BENGALLA Mining Company

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Air Quality and Greenhouse Gas Impact Assessment

AIR QUALITY AND GREENHOUSE GAS IMPACT ASSESSMENT

CONTINUATION OF BENGALLA MINE

Prepared for Hansen Bailey

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CONTINUATION OF BENGALLA MINE

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1 INTRODUCTION

Todoroski Air Sciences (TAS) was commissioned by Hansen Bailey, on behalf of Bengalla Mining Company (BMC), to undertake an Air Quality Impact and Greenhouse Gas assessment for the Continuation of Bengalla Mine Project (the Project). This assessment will form part of the Environmental Impact Statement (EIS) supporting an application for Development Consent under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project involves the continuation of mining to the west of the existing extraction limit at a rate of 15 million tonnes per annum (Mtpa) for 24 years. The mining will largely be conducted within current mining leases and extract coal from the Whittingham Coal Measures.

The Project consists of the following:

- Open cut mining at a rate of up to 15Mtpa run-of-mine (ROM) coal for 24 years continuing to utilise a dragline and truck and excavator fleet;
- Extending mining to the west of current operations;
- An out of pit Overburden Emplacement Area (OEA) to the west of Dry Creek which may be utilised for excess spoil material until it is intercepted by mining;
- Processing, handling and transportation of coal via the Coal Handling and Preparation Plant (CHPP) to be upgraded, and rail loop for export and domestic sale;
- An additional CHPP stockpile and ROM coal stockpile;
- Continued use, extension and upgrades to existing infrastructure;
- The construction of a radio tower;
- Relocation of the Explosives Magazine and Reload Facility;
- Relocation of a section of Bengalla Link Road near the existing mine access road to enable coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent re-alignment of Dry Creek through rehabilitation areas when emplacement areas are suitably advanced;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the Staged Discharge Dam);
- The construction of raw water dams and a clean water dam;
- A workforce of approximately 900 full time equivalent personnel at peak production; and,
- Supporting power and water reticulation infrastructure, other ancillary facilities, infrastructure including roads, co-disposal and temporary in pit coal reject emplacement along with earth handling facilities which enable construction activities.

2 BACKGROUND

BMC was granted Development Consent (DA 211/93) by the then Minister for Urban Affairs and Planning on 7 August 1995 for the construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and associated facilities. Bengalla was approved to operate for a 21 year period from 1996.

Since the granting of DA 211/93, there have been four approved modifications to ensure ongoing operations at Bengalla. Bengalla is currently approved to produce up to 10.7Mtpa ROM coal.

3 STUDY REQUIREMENTS

This air quality impact and greenhouse gas assessment has been prepared in general accordance with the Director-Generals Environmental Assessment Requirements (presented in **Table 3-1**), other agency comments (presented in **Table 3-2** and **Table 3-3**) and the New South Wales Office of Environment and Heritage (NSW OEH) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (**NSW DEC, 2005**).

Table 3-1: Director-General's Environmental Assessment Requirements

Specific matter	General Requirements	Section
Air Quality - including a quantitative assessment of potential:	Construction and operational impacts, with a particular focus on dust emissions (including $PM_{2.5}$ and PM_{10} emissions, and dust generation from coal transport), as well as diesel and blast fume emissions;	10 12 13 14 15
	Reasonable and feasible mitigation measures to minimise dust, diesel and blast fume emissions, including evidence that there are no such measures available other than those proposed; and	7.2
	Monitoring and management measures, in particular real-time air quality monitoring.	11
Greenhouse Gases - including:	A quantitative assessment of potential Scope 1, 2 and 3 greenhouse gas emissions;	17
	A quantitative assessment of the potential impacts of these emissions on the environment; and	17
	An assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.	17

Table 3-2: Environmental Protection Authority / Office of Environment and Heritage Recommended Director General's Requirements

Air Issues - Air Quality	Section
1. Assess the risk associated with potential discharges of fugitive and point source emissions for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human health and amenity.	10
2. Justify the level of assessment undertaken on the basis of risk factors, including but not limited to: a. proposal location; b. characteristics of the receiving environment; and c. type and quantity of pollutants emitted.	-
3. Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:	4 6

Air Issues - Air Quality	Section
a. meteorology and climate; b. topography; c. surrounding land-use; receptors; and d. ambient air quality.	
4. Include a detailed description of the proposal. All processes that could result in air emissions must be identified and described. Sufficient detail to accurately communicate the characteristics and quantity of all emissions must be provided.	7
5. Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.	7
6. Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment. This must include an assessment of cumulative 24-hour PM_{10} impacts.	10
7. Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the *Approved Methods for Modelling and Assessment of Air Pollutants in NSW.*	10
8. Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act 1997* (POEO Act) and the *Protection of the Environment Operations (Clean Air) Regulation 2010* (the Clean Air Regulation).	-
9. Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010 and its implementation plan 'Action for Air'.	-
10. Provide details of all emission control techniques/practices that will be employed to mitigate air emission impacts from the project.	7.2
Air Issues - Greenhouse Gas	
1. The EIS should include a comprehensive assessment of, and report on, the project's predicted greenhouse gas emissions (t CO_2-e). Emissions should be reported broken down by: a) direct emissions (Scope 1 as defined by the Greenhouse Gas Protocol) b) indirect emissions from electricity (Scope 2) and c) upstream and downstream emissions (Scope 3) both before and after implementation of the project, including annual emissions for each year of the project (construction, operation and commissioning).	17
2. The EIS should include an estimate of the greenhouse emissions intensity (per unit of production). Emissions intensity should be compared with best practice if possible.	17
3. The emissions should be estimated using an appropriate methodology, in accordance with NSW, Australian and international guidelines	17
4. The proponent should also evaluate and report on the feasibility of measures to reduce greenhouse gas emissions associated with the project. This could include a consideration of energy efficiency opportunities or undertaking an energy use audit for the site.	17

Table 3-3: Muswellbrook Shire Council - Director General Requirements

Air Quality	Section
Assessment of pre-mining and predicted operational maximum and minimum PM_1, $PM_{2.5}$ and PM_{10} particulate generation must be made for all particulate matter: (a) Leaving the proposed disturbance approval; (b) Leaving the Mining lease; (c) Affecting a township or village; and (d) Affecting any landholder, leasee, or licencee impacted upon by the Project. For both daytime and night time hours. Note: Air quality assessments should be undertaken with a high level of fidelity as Council is likely to seek conditions which bind the Project to its predictions.	This report, and Illustrated in App. E

3.1 Additional Study Requirements - Available New Data

Since the time of preparing this assessment report new data on a proposed modifications to three other nearby mine operations have become publically available. These data relate to the proposed Drayton South Coal Project (**Hansen Bailey, 2012**) and proposed modifications to the Mt Arthur Coal Mine (**Resource Strategies, 2013**) and Mangoola Coal Mine (**EMGAMM, 2013**).

This section considers the latest data available for these proposed operations in conjunction with the Project to determine the potential change in cumulative impacts that may arise if all of the proposed and modified other projects were to occur in conjunction with this Project.

The effect on cumulative air quality arising due to the new data available for these projects is considered in this section only.

The predicted cumulative levels presented in this assessment report are revised in this section on the basis of the new data on the annual TSP emissions from each operation.

3.1.1 Proposed Drayton South Coal Project

The proposed Drayton South Coal Project would be located approximately 16km south of the Project and shares a common boundary with the Mt Arthur Coal Mine. Due to its distant location and considering the predominant wind patterns, the proposed Drayton South Coal Project would be unlikely to make any significant contribution to the dust levels at local receivers assessed in this report.

As the Project is located north of Mt Arthur and is not aligned with the Proposed Drayton South Coal Project along the prevailing northwest and southeast wind axis, it is also concluded that there would not be any tangible contribution to dust levels from the Drayton South Coal Project at receptors of interest to this Project (around the Project), and that the Drayton South Coal Project would thus be unlikely to have any tangible effect on the cumulative dust levels presented in this assessment report. Therefore, the potential impact from the Drayton South Coal Project has not been considered further in this assessment.

3.1.2 Proposed modifications to the Mt Arthur Coal Mine

In order to present the potential cumulative impacts associated with the anticipated continuation of the Mt Arthur Coal mine, this assessment report originally included the modified Mt Arthur Coal mine operating beyond its current approved consent. However, the Mt Arthur Coal Mine is seeking only a four year continuation of the open cut mine life until 2026 at the approved maximum rate of 32Mtpa of ROM Coal. This is a shorter period than originally assumed in this assessment report.

Table 3-4 outlines the new data that affects the proposed changes to annual TSP emissions estimated for the Mt Arthur Coal Mine compared with the emissions originally assumed in this (Continuation of Bengalla Mine) assessment report. The proposed modifications to Mt Arthur Coal Mine indicate a decrease in the TSP emissions during 2016 and an increase in emissions in Year 2022 and 2026 relative to the emissions originally assumed in this assessment report. Therefore the results presented in this report are considered conservative as it has considered Mt Arthur Coal Mine operating further west than in its current modification.

Table 3-4: Comparison of TSP emissions modelled for Mt Arthur

Year	Year 1	Year 4	Year 8	Year 15	Year 24
Original Continuation of Bengalla Mine	22,996,561	25,708,373	24,809,310	24,809,310	24,809,310
Year	**-**	**2016**	**2022**	**2026**	**-**
Mt Arthur Coal Open Cut Modification	-	22,379,803	28,080,554	28,384,088	-
% variation	-	-15%	12%	13%	-

3.1.3 Proposed modifications to the Mangoola Coal Mine

The Mangoola Coal Mine is seeking an increase in maximum rate of ROM extraction to 13.5Mtpa which would see an increase in the annual TSP emissions from the mine. In a similar manner to Mt Arthur, this assessment report included Mangoola operating beyond its approved consent to capture any potential cumulative impacts arising as the Project operates. **Table 3-5** outlines the proposed changes to annual TSP emissions estimated for the Mangoola Coal Mine compared with the emissions originally assumed in this assessment report. Therefore the results presented in this report are considered conservative as it has considered Mangoola operating in excess of its current modification.

Table 3-5: Comparison of TSP emissions modelled for Mangoola

Year	Year 1	Year 4	Year 8	Year 15	Year 24
Original Continuation of Bengalla Mine	3,733,301	3,618,969	3,013,405	3,013,405	3,013,405
Year	**Year 2**	**Year 5**	**Year 10**	**-**	**-**
Mangoola Coal Modification 6	4,459,305	4,095,891	4,178,641	-	-
% variation	16%	12%	28%	-	-

3.2 Revision of Predicted Air Quality Impacts - New Data Available for Other Projects

To examine the effect that the new data available for the proposed modifications to the Mt Arthur and the Mangoola coal mines may have on the predicted impacts, the predictions were revised based on the estimated levels of dust emission presented by each proponent corresponding best to Year 1, 4, 8, and 15, as shown in **Table 3-4** and **Table 3-5**.

3.2.1 Effects in Year 1 of the Project

Figure 3-1 to **Figure 3-3** show the effect of the predicted total impact of annual average PM_{10}, TSP and dust deposition during Year 1 respectively, based on the proposed modifications to other mining operations. The pink contours are based on the revised assessment including the new data and the blue contours are those previously assessed in this report.

There is no change arising from any new data for the proposed modifications to the Mt Arthur Coal mine, but the new data indicate that 16% higher emissions may arise from the proposed modifications to Mangoola Coal mine.

Figure 3-1 to **Figure 3-3** show that should all the proposed other projects proceed; there would be no additional impacts at any of the privately-owned receptors of relevance to the Project in Year 1 when considering the new data.

The difference between the pink and the blue isopleths shows that consideration of the new data makes only a small difference close to the Mangoola Mine, and has insignificant effects near the Project. This situation is also noted in the Mangoola assessment report which considered the Bengalla Extension Project (i.e. the Project) and found that impacts at receptors closer to the Project and Mt Arthur would be affected by existing dust sources in the wider area.

This is likely as there is a reasonably large separation distance between the projects, and generally infrequent winds blowing from one project to the other.

3.2.2 Effects in Year 4 of the Project

Figure 3-4 to **Figure 3-6** show the predicted total impact of annual average PM_{10}, TSP and dust deposition during Year 4 respectively, based on the proposed modifications to other mining operations. The pink contours are based on the revised assessment including the new data and the blue contours are those previously assessed in this report.

The new data for the proposed modifications to the Mt Arthur Coal mine show that it's emissions would be 15% lower than originally estimated, and the new data for the proposed modifications to Mangoola Coal mine indicate that 12% higher emissions may arise, relative to the original estimates.

Figure 3-4 to **Figure 3-6** show that any increase in cumulative impact arising from the new data near Mangoola would be relatively minor, however a noticeable reduction in cumulative impact occurs near Mt Arthur as seen by the change between the pink and the blue isopleths to the southwest of the Project.

Overall, there is a reduction in cumulative impact as a result of the new data, and hence there would be no additional impact at any receptor in Year 4 should all proposed other projects proceed.

3.2.3 Effects in Year 8 of the Project

Figure 3-7 to **Figure 3-9** show the predicted total impact of annual average PM_{10}, TSP and dust deposition during Year 8 respectively, based on the proposed modifications to other mining operations. The pink contours are based on the revised assessment including the new data and the blue contours are those previously assessed in this report.

The increase in emissions estimated by Mt Arthur and Mangoola in their new data relative to the emissions originally assumed (12% and 28% respectively); indicate that cumulative impacts are likely to occur at one additional receptor, Receptor 118 in Year 8, should all proposed other projects proceed.

It is noted that Receptor 118 is already predicted to be impacted in other years and is currently entitled to acquisition by Mt Arthur.

3.2.4 Effects in Year 15 of the Project

Figure 3-10 to **Figure 3-12** show the predicted total impact of annual average PM_{10}, TSP and dust deposition during Year 15 respectively, based on the proposed modifications to other mining operations. The pink contours are based on the revised assessment including the new data and the blue contours are those previously assessed in this report.

The new data indicate that the Mangoola Mine does not seek to operate in Year 15 of the Project, hence there would be no emissions, whereas the original estimate included Mangoola operations in this Year.

The new data show a 13% increase in emissions estimated by Mt Arthur relative to the emissions originally assumed in this assessment report.

The results in **Figure 3-10** to **Figure 3-12** show that there are likely to be cumulative impacts at two additional receptors, Receptor 112N and Receptor 120 in Year 15 when considering the new data.

3.2.5 Effects in Year 24 of the Project

There could not be any additional cumulative impacts beyond those shown in the original assessment as the other proposed operations would not occur at this time. The original assessment assumed the proposed modifications to the Mt Arthur and the Mangoola coal mines would operate in Year 24, and thus overestimates the likely cumulative impacts that may arise.

3.3 Summary of Cumulative Effects - New Data Available for Other Projects

The latest available data in relation to the proposed modifications to Mt Arthur and Mangoola Coal mines have been considered and indicate there is potential for three additional receptors to be impacted if all currently proposed projects, in conjunction with this Project, were to operate simultaneously.

These receptors are Receptor 118 in Year 8, and Receptors 112N and 120 in Year 15 (all of which are presently entitled to acquisition upon request by Mt Arthur). Cumulative impacts beyond those previously assessed are not predicted in any other Year.

Modelling of cumulative impacts in this section is revised relative to the rest of this assessment report based on the emission estimates presented by the proponents of other projects, and approximations of plant locations, terrain and other such factors.

It is considered that the approximations that have been made are such that the predicted cumulative impacts in this section are likely to be a reliably accurate estimation of what may occur should all of the proposed projects proceed simultaneously.

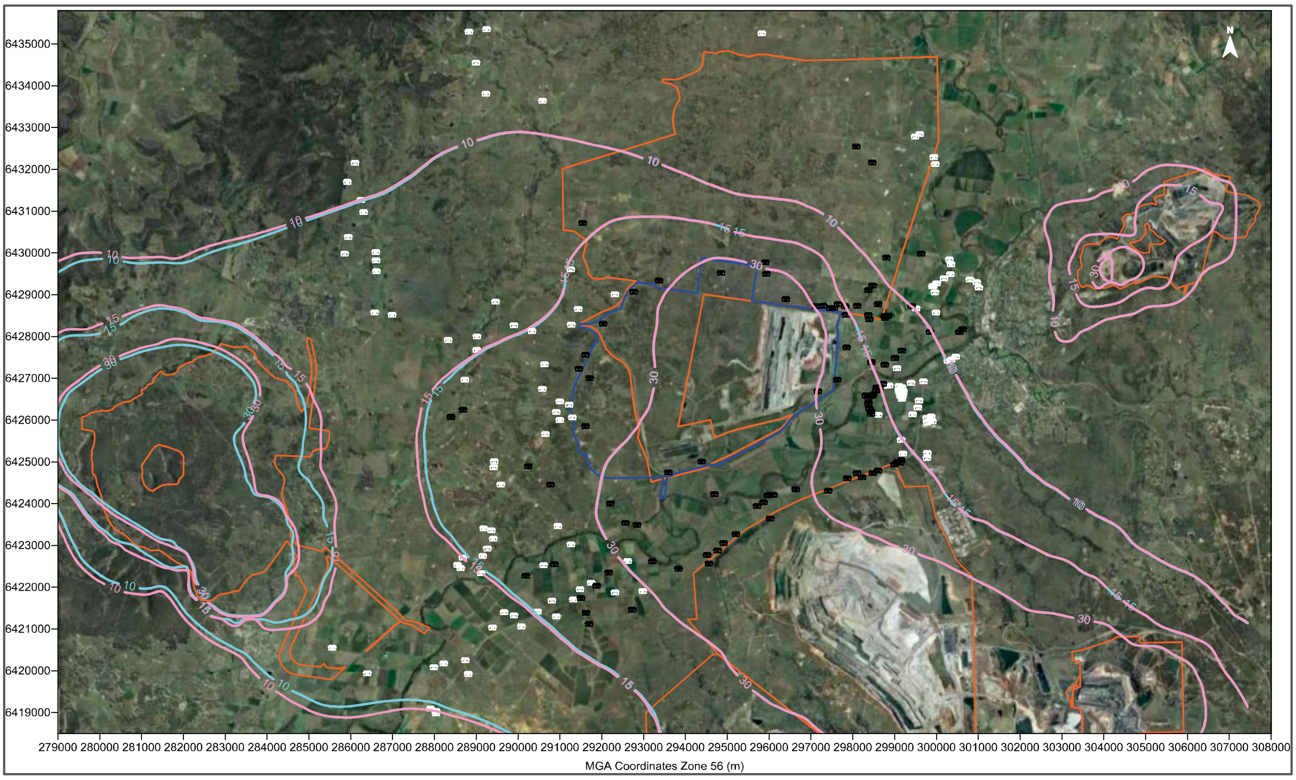

Figure 3-1: Comparison of predicted cumulative annual average PM_{10} concentrations due to other mine modifications in Year 1 (µg/m³)

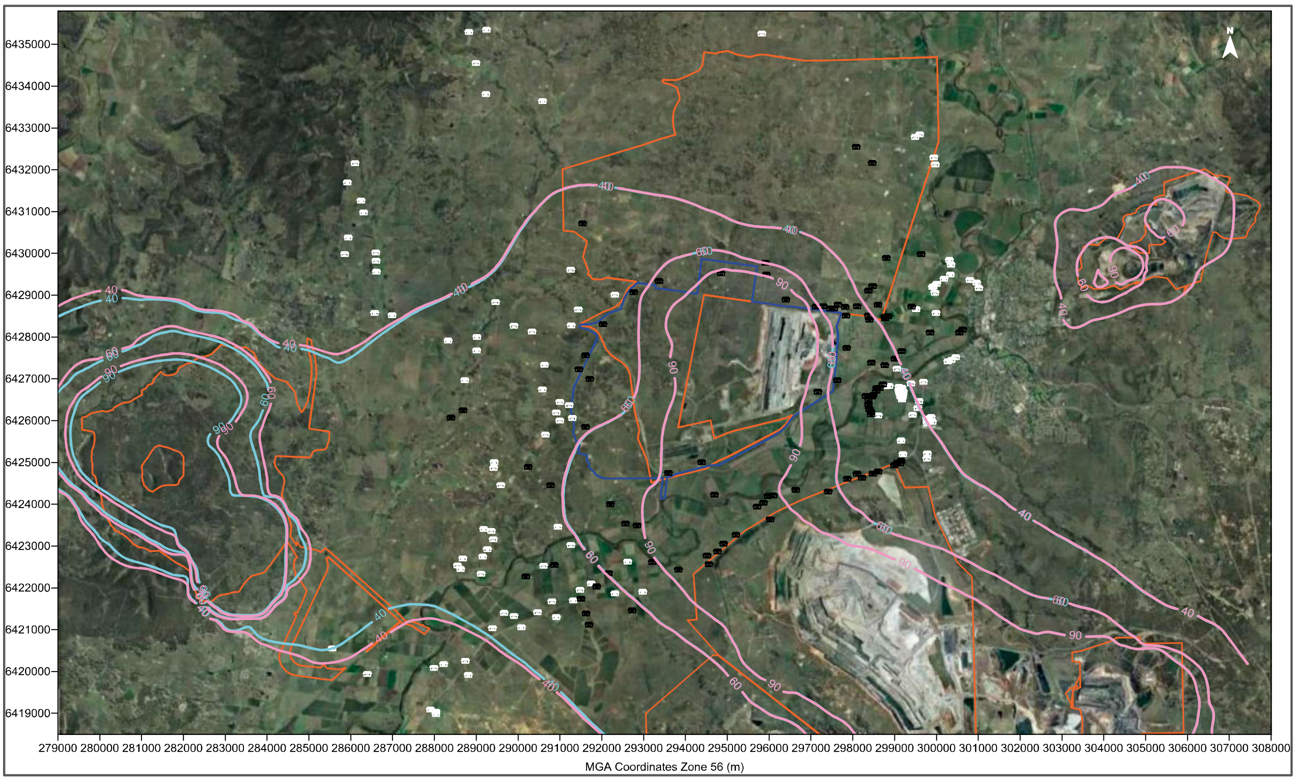

Figure 3-2: Comparison of predicted cumulative annual average TSP concentrations due to other mine modifications in Year 1 (µg/m³)

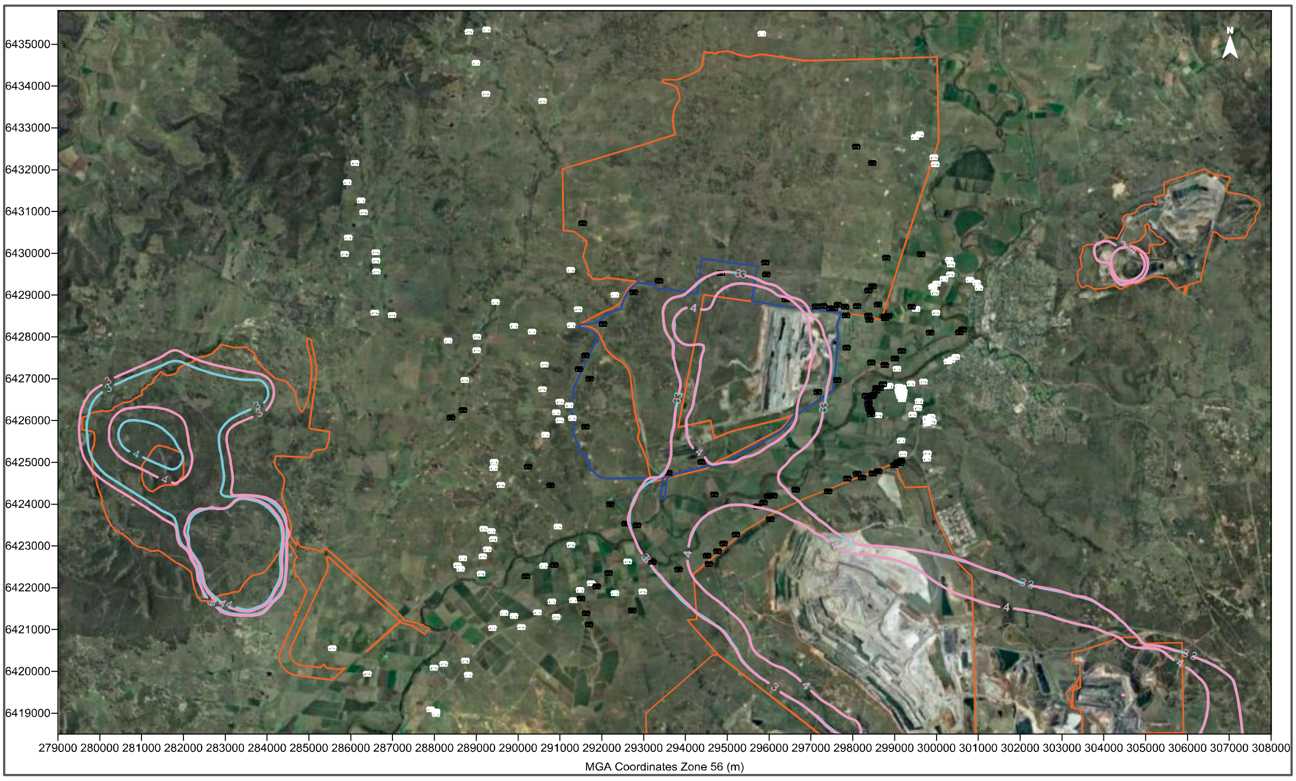

Figure 3-3: Comparison of predicted cumulative annual average dust deposition levels due to other mine modifications in Year 1 (g/m²/month)

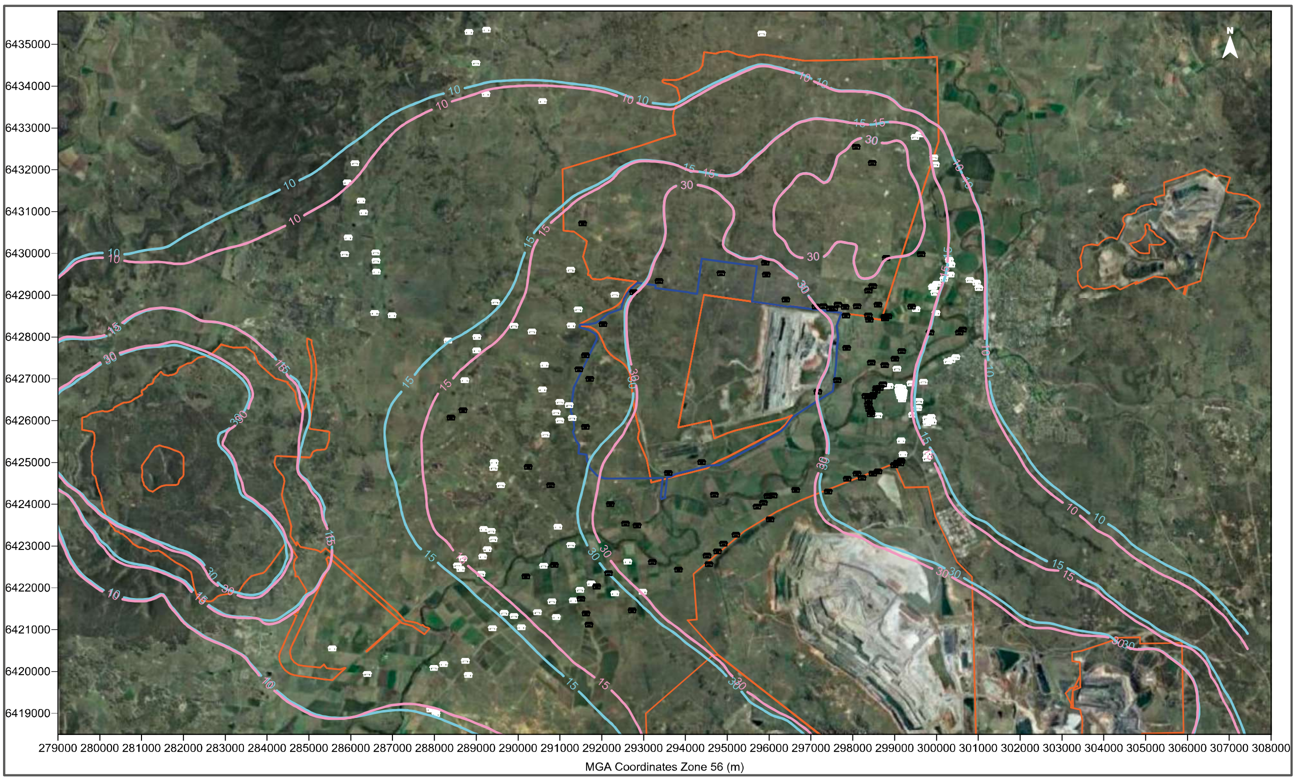

Figure 3-4: Comparison of predicted cumulative annual average PM_{10} concentrations due to other mine modifications in Year 4 (µg/m³)

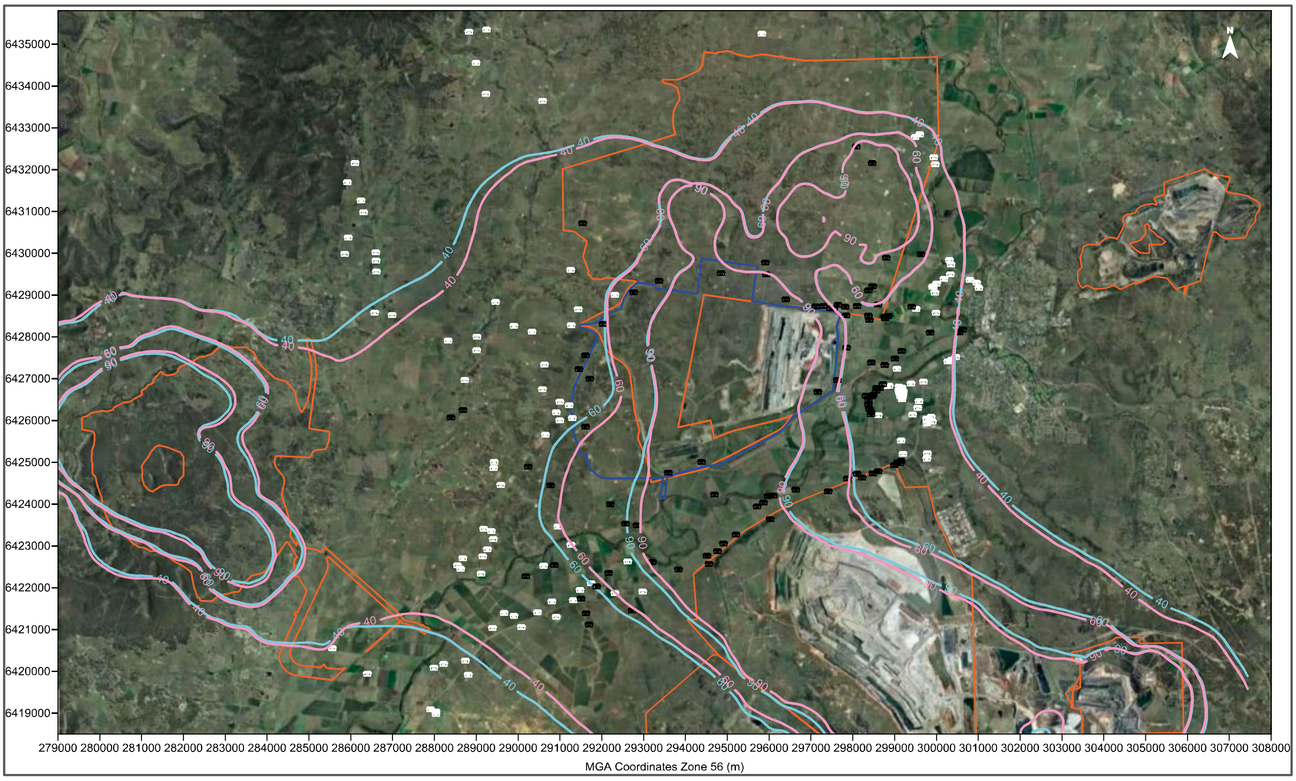

Figure 3-5: Comparison of predicted cumulative annual average TSP concentrations due to other mine modifications in Year 4 (µg/m³)

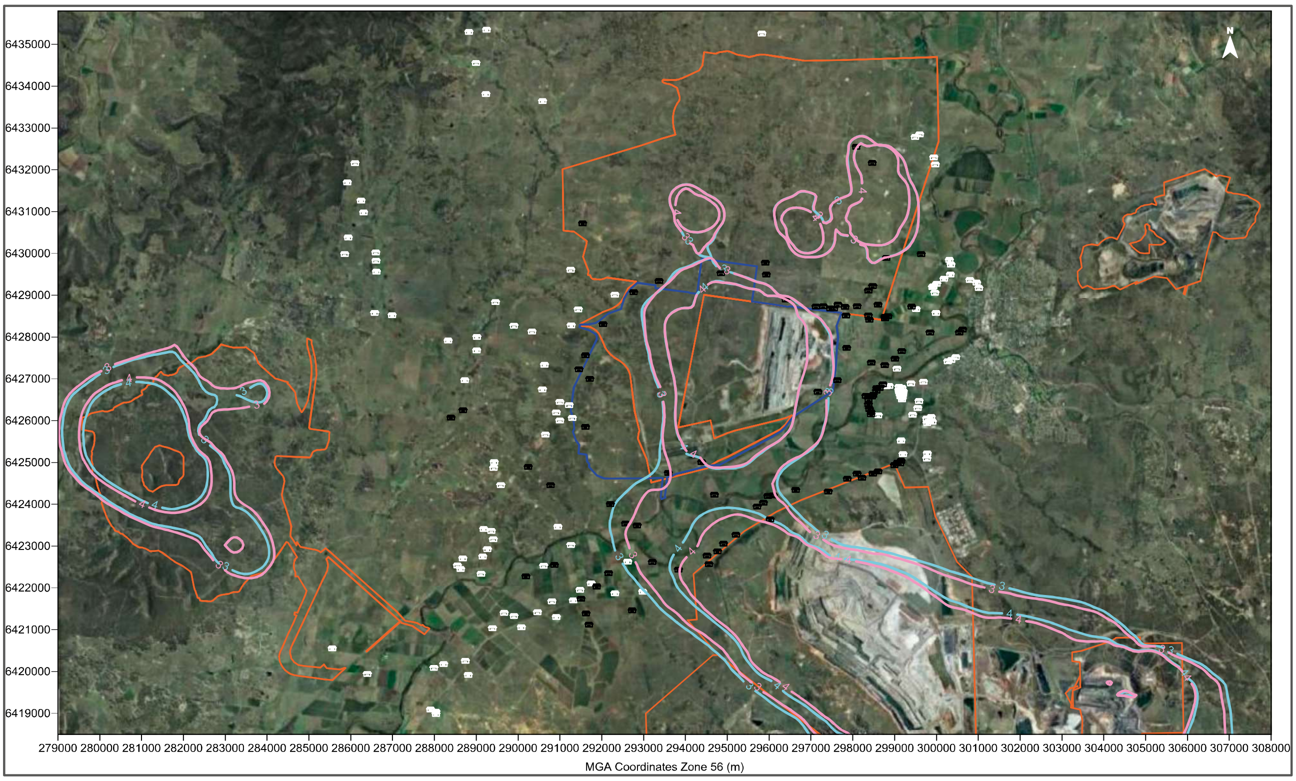

Figure 3-6: Comparison of predicted cumulative annual average dust deposition levels due to other mine modifications in Year 4 (g/m²/month)

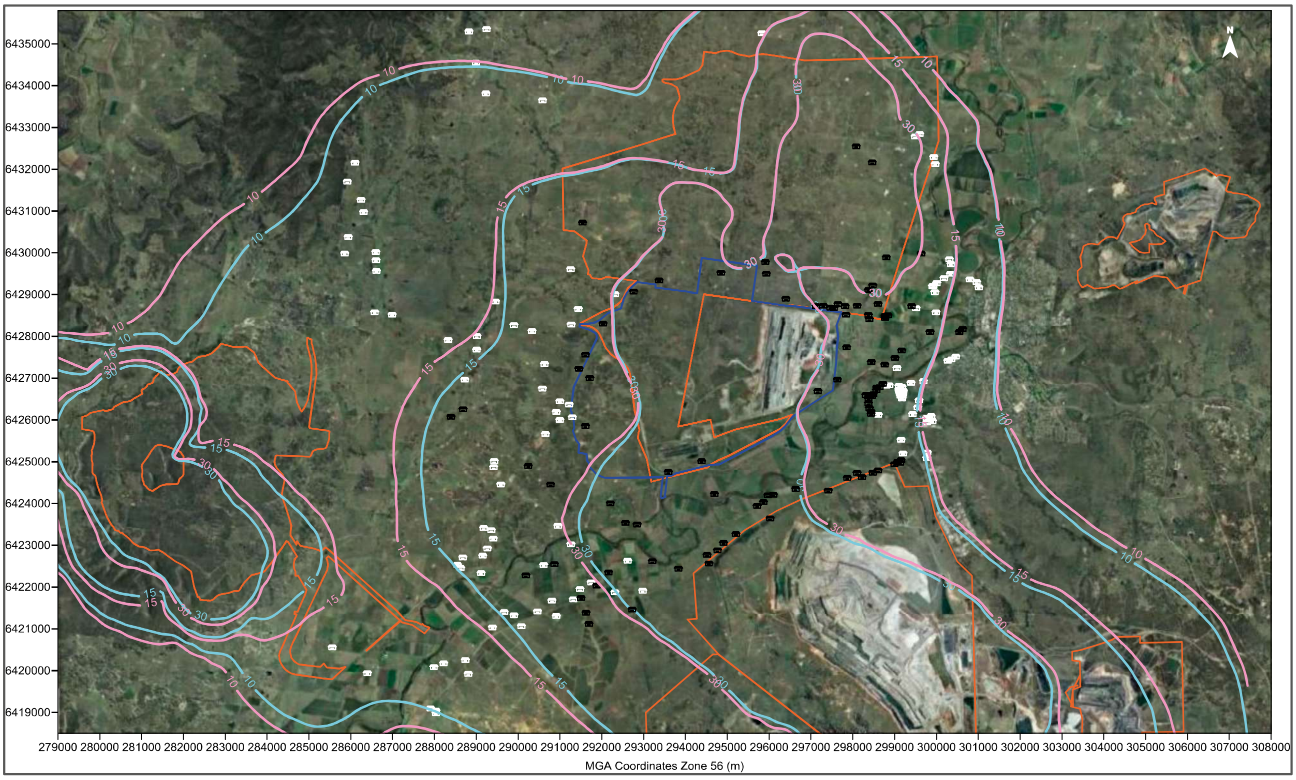

Figure 3-7: Comparison of predicted cumulative annual average PM_{10} concentrations due to other mine modifications in Year 8 (µg/m³)

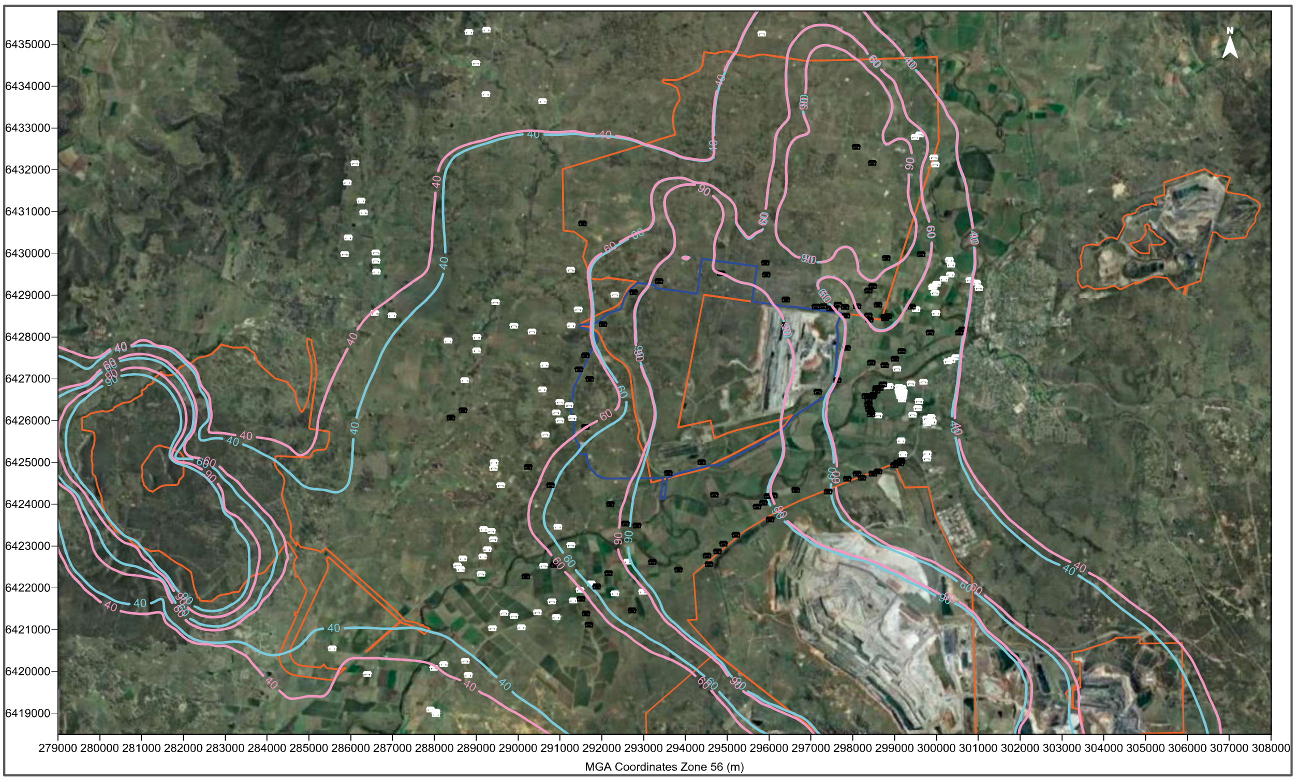

Figure 3-8: Comparison of predicted cumulative annual average TSP concentrations due to other mine modifications in Year 8 (µg/m³)

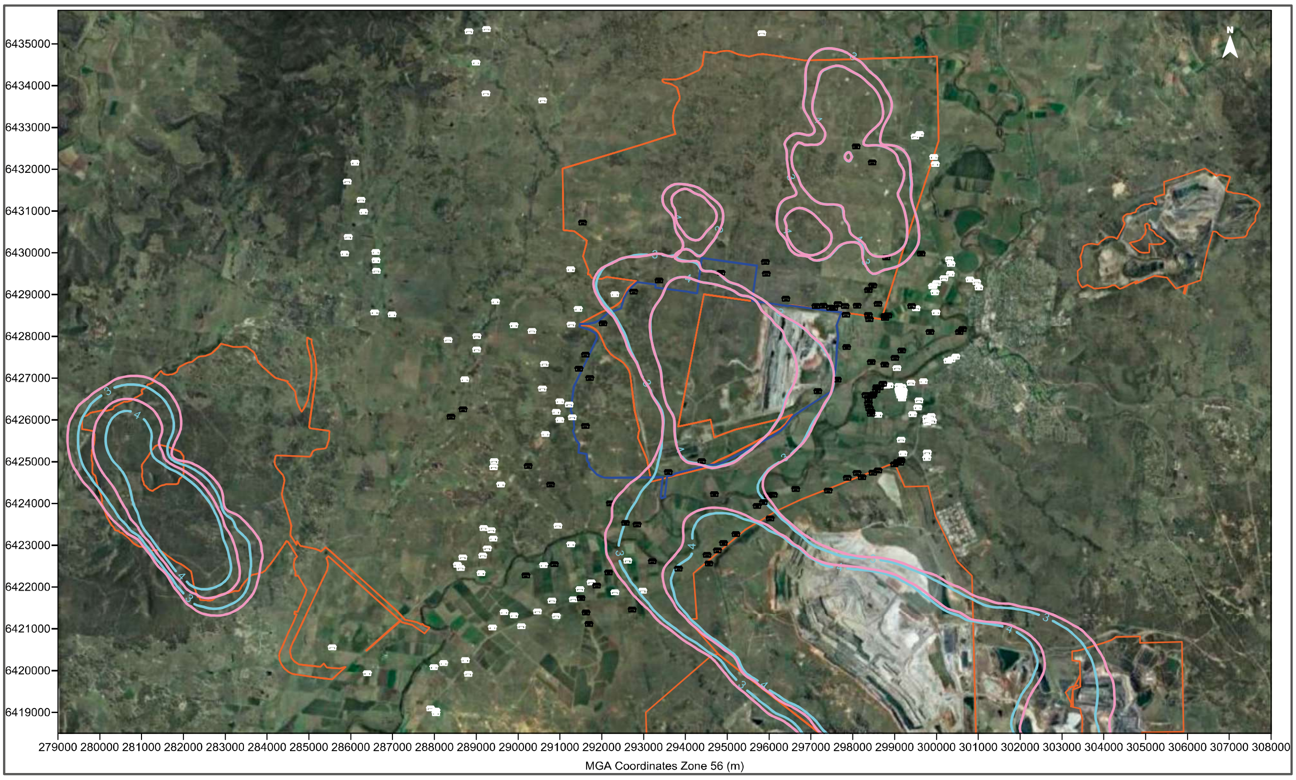

Figure 3-9: Comparison of predicted cumulative annual average dust deposition levels due to other mine modifications in Year 8 (g/m²/month)

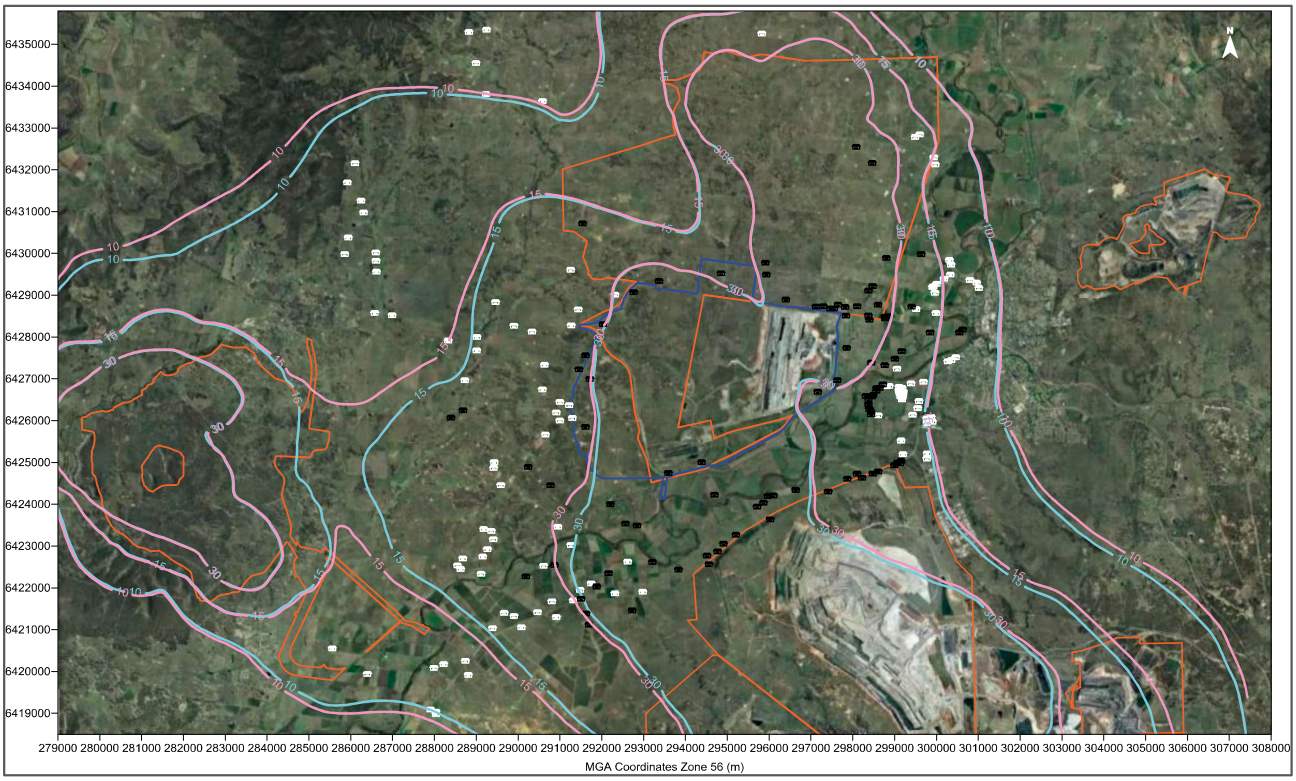

Figure 3-10: Comparison of predicted cumulative annual average PM_{10} concentrations due to other mine modifications in Year 15 (µg/m³)

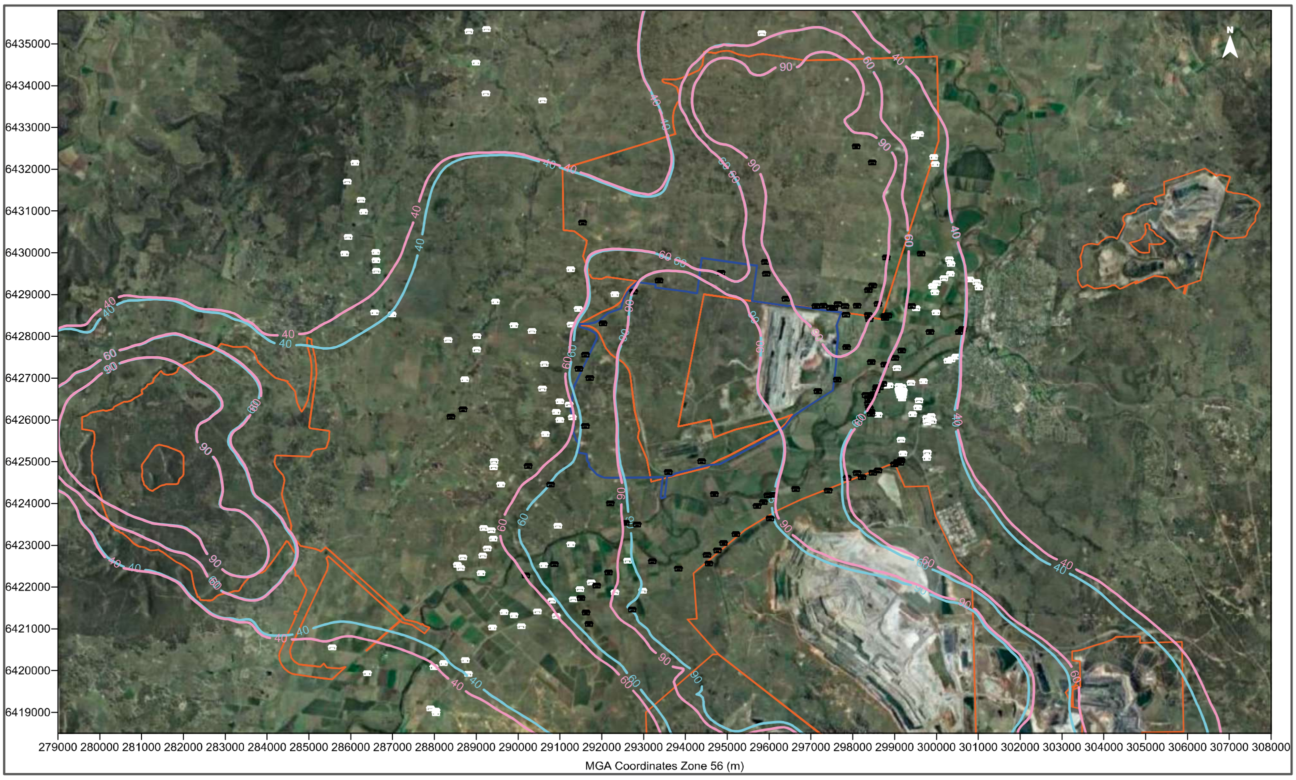

Figure 3-11: Comparison of predicted cumulative annual average TSP concentrations due to other mine modifications in Year 15 (µg/m³)

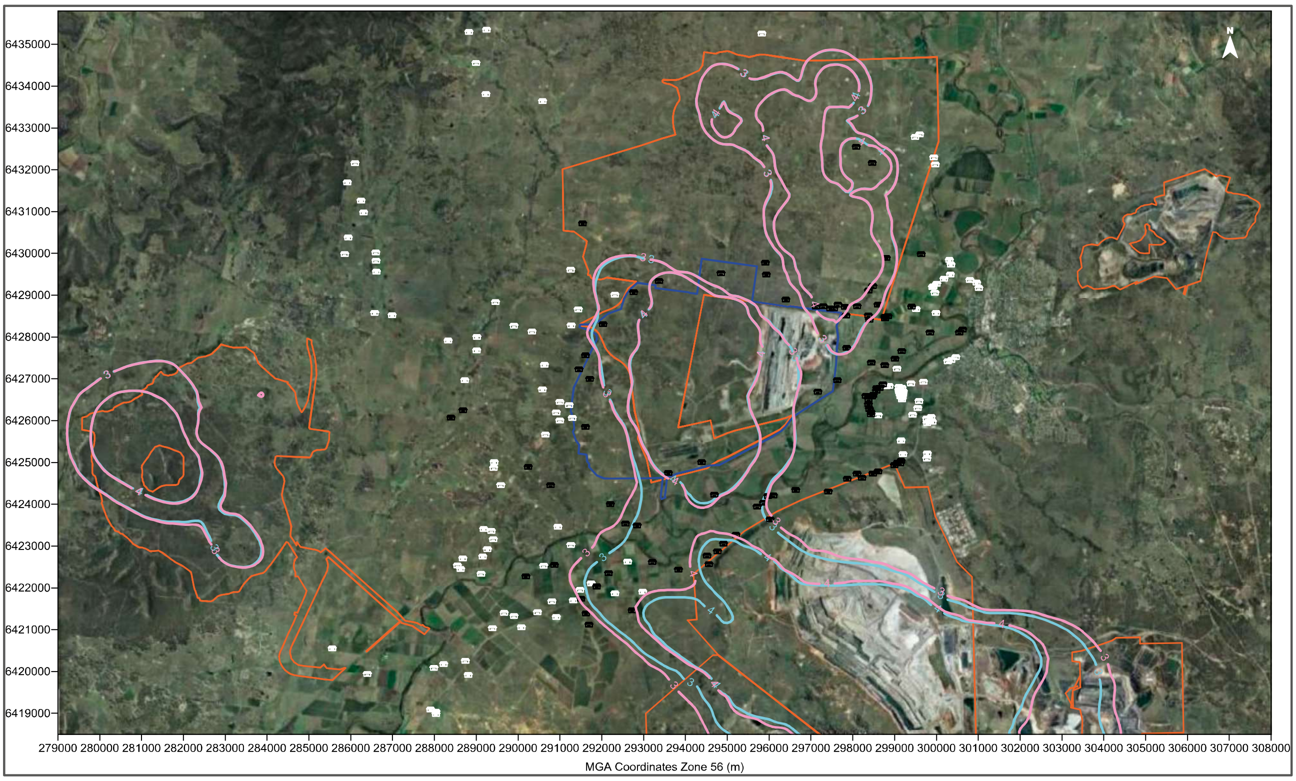

Figure 3-12: Comparison of predicted cumulative annual average dust deposition levels due to other mine modifications in Year 15 (g/m²/month)

4 LOCAL SETTING

Bengalla is located in the Upper Hunter Valley of NSW, approximately 130 kilometres (km) north-west of Newcastle and 4km west of Muswellbrook. The mine is bounded by Wybong Road to the north and the alluvial lands associated with the Hunter River to the south. Various open cut coal mining operations, agriculture and urban development dominate the land-use surrounding the project area.

Figure 4-1 presents the location of Bengalla in relation to the neighbouring coal mining operations and the privately-owned and mine-owned receptors of relevance to this assessment. **Appendix A** provides a detailed list of all the privately-owned and mine-owned sensitive receptors assessed in this report.

Figure 4-2 presents a representative three dimensional visualisation of the terrain in the wider vicinity of the Project area. The surrounding topography is characterised to the southeast of the Project area with the Hunter Valley dominating this area, separated by the mountainous features of the Barrington Tops National Park and Wollemi National Park. In the general vicinity of the Project area, the characteristic features of the local topography include Mount Pleasant to the north of the Project site. To the east and south, the terrain is generally open and essentially flat along the Hunter River floodplain before reaching Mount Arthur. These topographical features play a significant role in defining the local wind distribution patterns of the Project area.

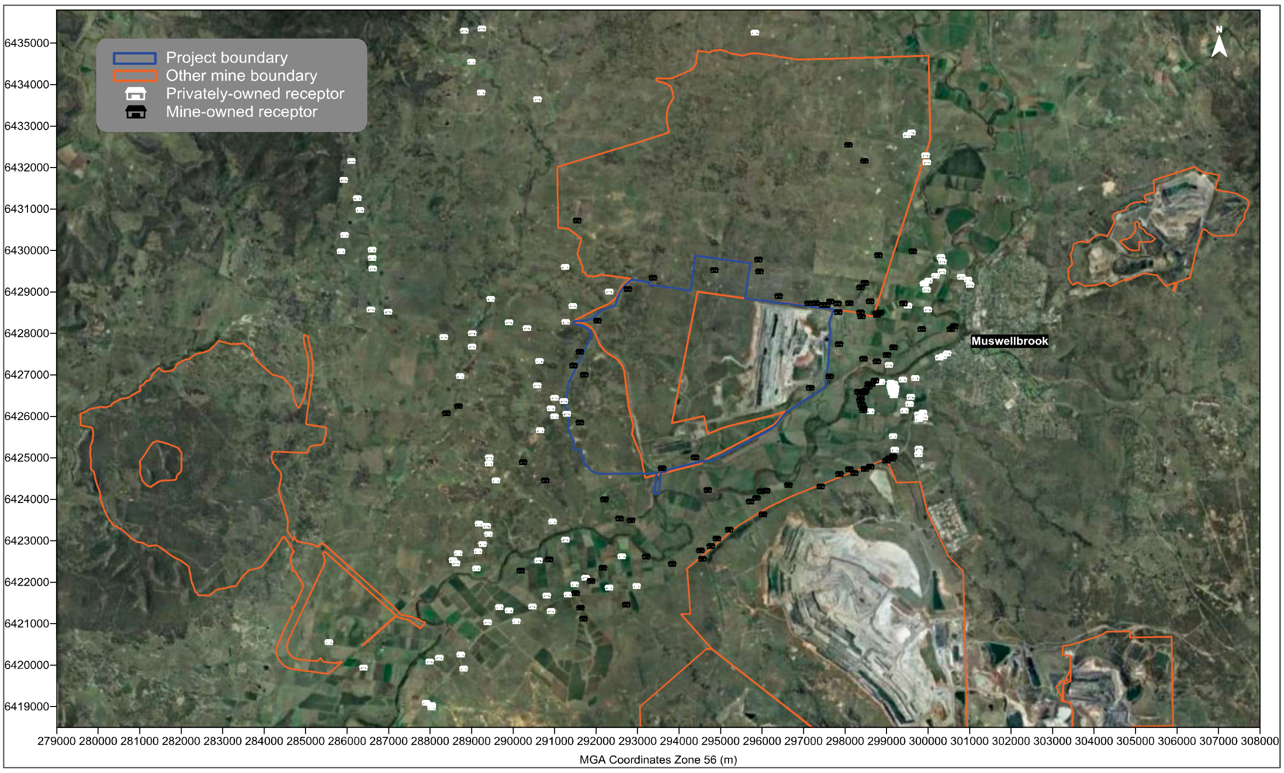

Figure 4-1: Project location

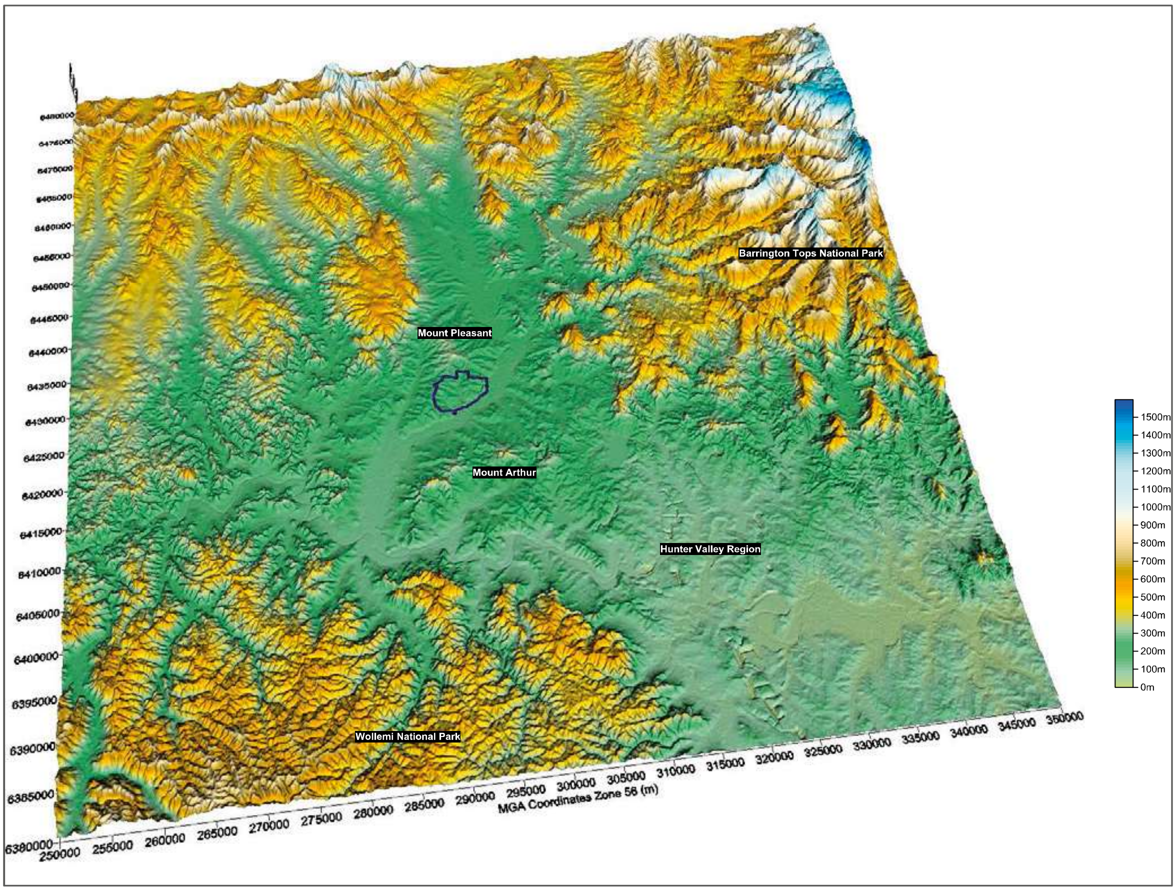

Figure 4-2: Representative three dimensional terrain view of Project location

5 AIR QUALITY ASSESSMENT CRITERIA

5.1 Preamble

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential air emissions generated by the Project and the applicable air quality criteria.

5.2 Particulate matter

Particulate matter consists of dust particles of varying size and composition. Air quality goals refer to measures of the total mass of all particles suspended in air defined as the Total Suspended Particulate matter (TSP). The upper size range for TSP is nominally taken to be 30 micrometres (μm) as in practice particles larger than 30 to 50μm will settle out of the atmosphere too quickly to be regarded as air pollutants.

The TSP is defined further into two sub-components. They are PM_{10} particles, particulate matter with aerodynamic diameters of 10μm or less, and $PM_{2.5}$, particulate matter with aerodynamic diameters of 2.5μm or less.

Mining activities generate particles in all the above size categories. The great majority of the particles generated are due to the abrasion or crushing of rock and coal and general disturbance of dusty material. These particulate emissions will be generally larger than 2.5μm as these fine particulates are often only generated through combustion processes.

Combustion particulates can be more harmful to human health as the particles have the ability to penetrate deep into the human respiratory system and generally include acidic and carcinogenic substances.

A study of the distribution of particle sizes near mining dust sources in 1986 conducted by the State Pollution Control Commission (SPCC) found that the average of approximately 120 samples showed $PM_{2.5}$ comprised 4.7% of the TSP, and PM_{10} comprised 39.1% of the TSP in the samples (**SPCC, 1986**). The emissions of $PM_{2.5}$ occurring from mining activities are small in comparison to the total dust emissions and in practice, the concentrations of $PM_{2.5}$ in the vicinity of mining dust sources are likely to be low.

5.2.1 Office of Environment and Heritage impact assessment criteria

Table 5-1 and **Table 5-2** summarise the air quality goals that are relevant to this study as outlined in the Office of Environment and Heritage (OEH) document "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (**NSW DEC, 2005**). The air quality goals for total impact relate to the total dust burden in the air and not just the dust from the Project. Consideration of background dust levels needs to be made when using these goals to assess potential impacts.

Table 5-1: OEH air quality impact assessment criteria for particulate matter

Pollutant	Averaging Period	Impact	Criterion
Total suspended particulates (TSP)	Annual	Total	90µg/m^3
Particulate Matter < 10µm (PM_{10})	Annual	Total	30µg/m^3
	24 hour	Total	50µg/m^3
Deposited dust	Annual	Incremental	2g/m^2/month
		Total	4g/m^2/month

Source: **NSW DEC, 2005**

The criteria for 24-hour average PM_{10} originate from the National Environment Protection Measure (NEPM) goals (**NEPC, 1988**). These goals apply to the population as a whole, and are not recommended to be applied to "hot spots" such as locations near industry, busy roads or mining. However, in the absence of alternative measures, OEH does apply the criteria to assess the potential for impacts to arise at such locations. The NEPM permits five days annually above the 24-hour average PM_{10} criterion to allow for bush fires and similar events. Similarly, it is normally the case that on days where ambient dust levels are affected by such events they are excluded from assessment as per the OEH criterion.

5.2.2 Department of Planning and Infrastructure acquisition criterion for particulate matter

While the OEH applies the maximum 24-hour average PM_{10} level in any year to assess the potential for impacts from the project, the Department of Planning and Infrastructure (DP&I) in contemporary project approvals (PA) have invoked requirements for acquisition and negotiated agreements if there are systemic exceedances of the OEH criterion. In the context of impact assessments for approval of new projects and modifications to existing projects, this is interpreted to mean where the OEH criterion is exceeded on more than five days in any year (a 98.6 percentile level of compliance). This DP&I criterion and other relevant criteria are outlined in **Table 5-2**.

Table 5-2: DP&I acquisition criteria for particulate matter

Pollutant	Averaging Period	Impact	Criterion
Total suspended particulates (TSP)	Annual	Total	90µg/m^3
Particulate Matter < 10µm (PM_{10})	Annual	Total	30µg/m^3
	24 hours	Incremental	50µg/m^3
Deposited dust	Annual	Incremental	2g/m^2/month
		Total	4g/m^2/month

5.2.3 Impacts on land

Recent DP&I PA conditions have identified that dust criteria should not be exceeded on more than 25% of privately owned land.

It is understood that the purpose of these conditions is to protect the capacity for vacant land to be built on for human habitation, where such a right would automatically exist.

Assessments of this nature can only be made by examination of the relevant dust isopleth (contour) to see the extent of any land that may be affected. Such contours are always approximate, and thus the assessment made can only be equally approximate.

It is understood that the land subject to assessment refers to all the land under a single ownership, which may comprise multiple lots. All land under a single ownership is treated as a single property when making such an assessment.

5.2.4 $PM_{2.5}$ concentrations

The OEH currently does not have impact assessment criteria for $PM_{2.5}$ concentrations; however the National Environment Protection Council (NEPC) has released a variation to the NEPM (**NEPC, 2003**) to include advisory reporting standards for $PM_{2.5}$ (see **Table 5-3**). The advisory reporting standards for $PM_{2.5}$ are a maximum 24-hour average of 25µg/m^3 and an annual average of 8µg/m^3, and as with the NEPM goals, apply to the average, or general exposure of a population, rather than to "hot spot" locations.

Predictions have been made as to the likely contribution that emissions from the Project would make to ambient $PM_{2.5}$ concentrations and are presented in **Section 10** of this assessment.

Table 5-3: Advisory reporting standard for $PM_{2.5}$ concentrations

Pollutant	Averaging Period	Concentration
Particulate Matter < 2.5µm ($PM_{2.5}$)	24 hours	25µg/m^3
	Annual	8µg/m^3

Source: **NEPC, 2003**

5.3 Other air pollutants

Emissions of other air pollutants will also potentially arise from mining operations with the source of these emissions generated from the diesel powered equipment used on-site. Emissions from diesel powered equipment generally include carbon monoxide (CO), nitrogen dioxide (NO_2) and other pollutants, such as sulfur dioxide (SO_2).

CO is colourless, odourless and tasteless and is generated from the incomplete combustion of fuels when carbon molecules are only partially oxidised. It can reduce the capacity of blood to transport oxygen in humans resulting in symptoms of headache, nausea and fatigue.

NO_2 is reddish-brown in colour (at high concentrations) with a characteristic odour and can irritate the lungs and lower resistance to respiratory infections such as influenza. NO_2 belongs to a family of reactive gases called nitrogen oxides (NOx). These gases form when fuel is burned at high temperatures, mainly from motor vehicles, power generators and industrial boilers (**USEPA 2011**). NO_x may also be generated by blasting activities. It is important to note that when formed, NO_2 is generally a small fraction of the total NO_x generated.

Sulfur dioxide (SO_2) is a colourless, toxic gas with a pungent and irritating smell. It commonly arises in industrial emissions due to the sulphur content of the fuel. SO_2 can have impacts upon human health and the habitability of the environment for flora and fauna. SO_2 emissions are a precursor to acid rain, which can be an issue in the northern hemisphere, however it is not known to have any widespread impact in NSW, and is generally only associated with large industrial activities. Due to its potential to impact on human health, sulfur is actively removed from fuel to prevent the release and formation of SO_2. The sulphur content of Australian diesel is controlled to a low level by national fuel standards and as such the emissions of SO_2 and other pollutants generated from diesel powered equipment at mine sites are generally considered to be too low to generate any significant off-site pollutant concentrations and have not been assessed further in this study.

Table 5-4 summarises the air quality goals for CO and NO_2 assessed in this report.

Table 5-4: OEH air quality impact assessment criteria for air toxics

Pollutant	Averaging period	Criterion
Carbon monoxide (CO)	15 minute	100mg/m^3
	1 hour	30mg/m^3
	8 hour	10mg/m^3
Nitrogen dioxide (NO_2)	1 hour	246µg/m^3
	Annual	62µg/m^3

Source: **NSW DEC, 2005**

6 EXISTING ENVIRONMENT

This section describes the existing environment including the climate and ambient air quality in the area surrounding the Project.

6.1 Local climate

Long-term climatic data from the Bureau of Meteorology weather stations at Jerrys Plains Post Office (Site No. 061086) and Scone SCS (Site No. 061089) are used to characterise the local climate in the proximity of the Project. The Jerrys Plains Post Office station is located approximately 25km southeast of the Project and the Scone SCS station is located approximately 25km north-northeast of the Project.

Table 6-1 and **Figure 6-1** present a summary of data from Jerrys Plains Post Office (Jerrys Plains) collected over an approximate 125-year period. **Table 6-2** and **Figure 6-2** present a summary of data from Scone SCS (Scone) collected over an approximate 51-year period.

The data indicate that January is the hottest month with mean maximum temperatures of 31.7ºC and 31.1ºC respectively at the Jerrys Plains and Scone stations. July is the coldest month with mean minimum temperatures of 3.8ºC and 4.7ºC.

Humidity levels exhibit variability and seasonal flux across the year. Mean 9am humidity levels range from 59% in October to 80% in June at Jerrys Plains and 59% in October to 78% in June at Scone. Mean 3pm humidity levels vary from 42% in the months of October, November and December to 54% in June at Jerrys Plains. Mean 3pm humidity levels at Scone vary from 39% in December to 58% in June.

Rainfall peaks during the summer months and declines during winter at both stations. The data indicates that January is the wettest month with an average rainfall of 76.8mm over 6.5 days at Jerrys Plains and 81.3mm over 6.5 days at Scone. August is the driest month at Jerrys Plains with an average rainfall of 36.5mm over 5.2 days and July is the direst month at Scone with an average rainfall of 36.1mm over 5.1 days.

As expected, wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the colder months. At Jerrys Plains, mean 9am wind speeds range from 8.6km/h in May to 11.7km/h in September and mean 3pm wind speeds range from 11.0km/h in May to 14.7km/h in September. At Scone, mean 9am wind speeds range from 6.7km/h in May to 10.0km/h in November and mean 3pm wind speeds range from 10.0km/h in May to 15.0km/h in November.

Table 6-1: Monthly climate statistics summary - Jerrys Plains Post Office

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Mean max. temperature (ºC)	31.7	30.9	28.9	25.3	21.3	18.0	17.4	19.4	22.9	26.2	29.1	31.3
Mean min. temperature (ºC)	17.1	17.1	15.0	11.0	7.5	5.3	3.8	4.4	7.0	10.3	13.2	15.7
Rainfall												
Rainfall (mm)	76.8	72.4	58.4	44.5	40.9	48.1	43.5	36.5	42.0	52.2	61.1	67.9
Mean No. of rain days (≥1mm)	6.5	6.0	5.7	4.9	4.9	5.5	5.2	5.2	5.2	5.9	6.2	6.4
9am conditions												
Mean temperature (ºC)	23.4	22.7	21.2	18.0	13.6	10.6	9.4	11.4	15.3	19.0	21.1	23.0
Mean relative humidity (%)	67	72	72	72	77	80	78	71	65	59	60	61
Mean wind speed (km/h)	9.6	9.0	8.8	8.6	9.0	9.4	10.6	11.0	11.7	10.9	10.5	9.9
3pm conditions												
Mean temperature (ºC)	29.8	28.9	27.2	24.1	20.1	17.1	16.4	18.2	21.2	24.2	26.9	29.0
Mean relative humidity (%)	47	50	49	49	52	54	51	45	43	42	42	42
Mean wind speed (km/h)	13.2	13.0	12.4	11.3	11.0	11.5	13.0	14.3	14.7	14.1	14.2	14.2

Source: **Bureau of Meteorology, 2012**

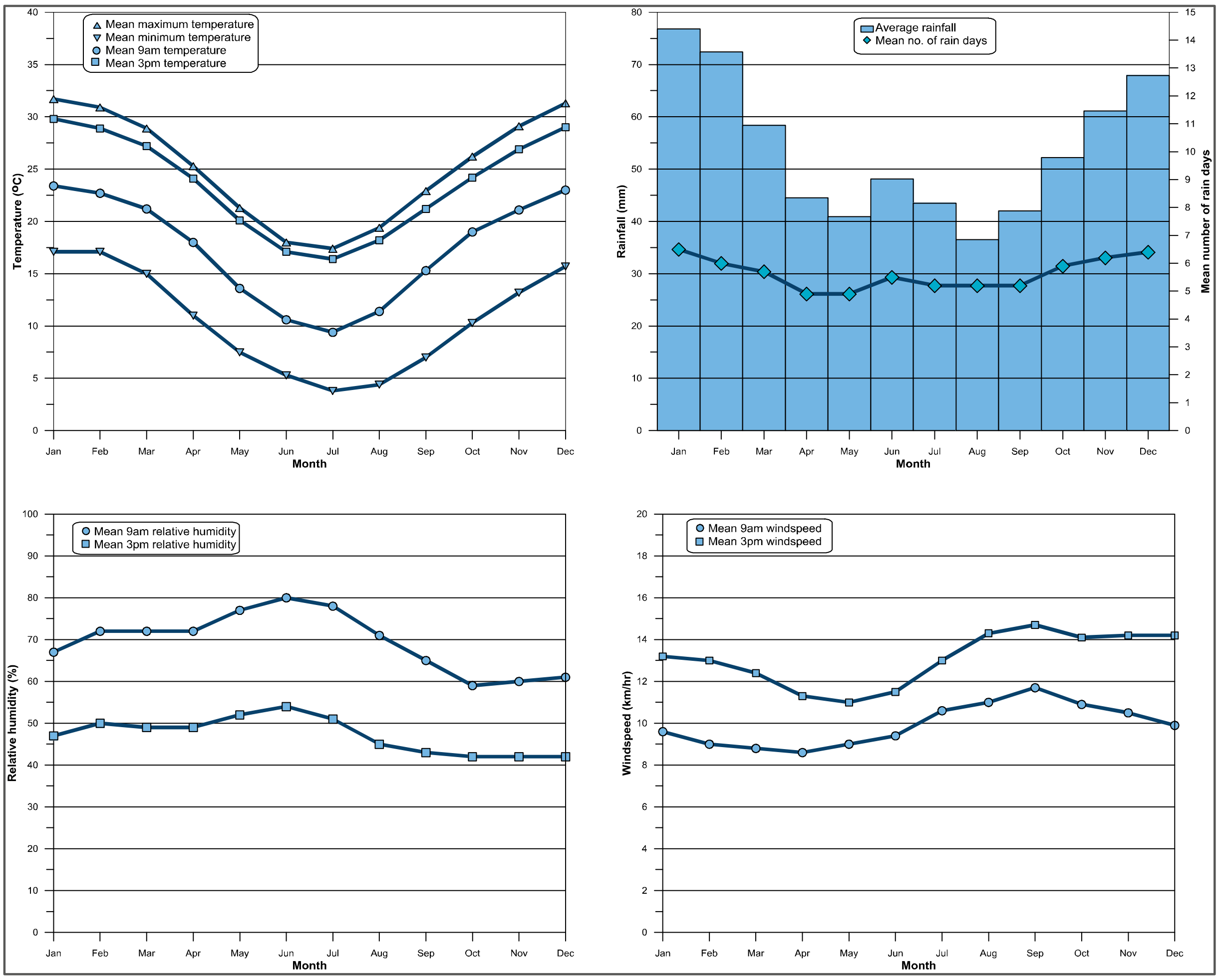

Figure 6-1: Monthly climate statistics summary - Jerrys Plains Post Office

Table 6-2: Monthly climate statistics summary - Scone SCS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Mean max. temperature (ºC)	31.1	29.9	27.9	24.5	20.1	16.9	16.3	18.3	21.4	24.9	27.6	30.3
Mean min. temperature (ºC)	16.9	16.9	14.6	11.4	8.1	6.0	4.7	5.6	7.9	10.9	13.3	15.8
Rainfall												
Rainfall (mm)	81.3	77.0	51.3	39.8	47.4	45.2	36.1	39.2	39.2	59.4	61.7	68.4
Mean No. of rain days (≥1mm)	6.5	5.9	5.1	4.5	5.3	6.0	5.1	5.3	5.3	6.3	6.5	6.7
9am conditions												
Mean temperature (ºC)	22.9	21.9	20.2	17.6	13.3	10.4	9.5	11.5	15.2	18.7	20.3	22.5
Mean relative humidity (%)	67	73	73	71	76	78	75	67	62	59	62	61
Mean wind speed (km/h)	8.2	7.8	7.4	6.9	6.7	7.2	7.7	9.2	9.6	9.8	10.0	8.9
3pm conditions												
Mean temperature (ºC)	29.3	28.5	26.4	23.0	19.0	15.6	14.9	17.1	20.1	23.3	25.8	28.5
Mean relative humidity (%)	43	47	47	47	56	58	54	46	43	42	41	39
Mean wind speed (km/h)	14.9	14.3	13.5	11.6	10.0	10.4	10.9	13.4	13.9	13.6	15.0	14.2

Source: **Bureau of Meteorology, 2012**

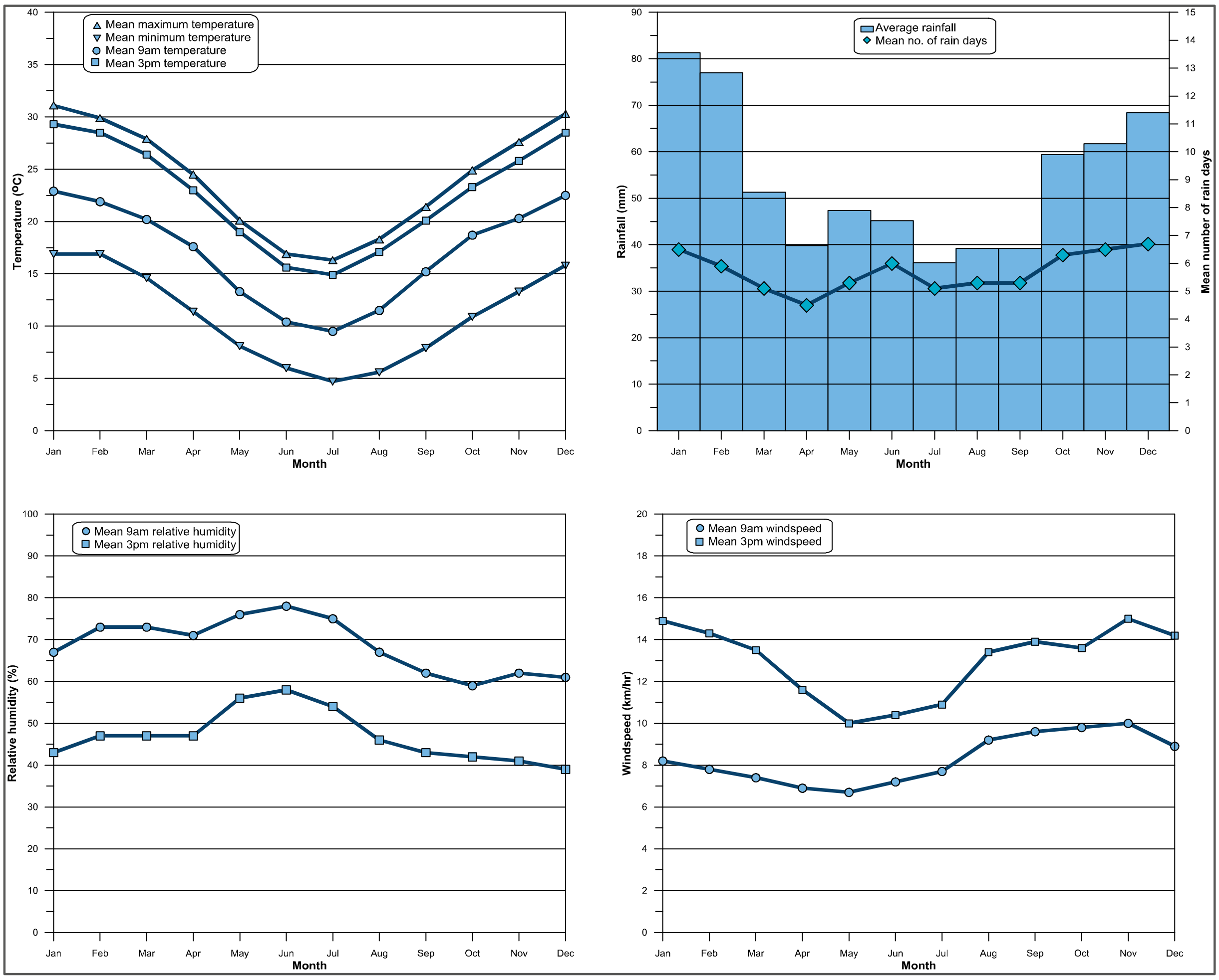

Figure 6-2: Monthly climate statistics summary - Scone SCS

6.2 Local meteorological conditions

BMC operate a 10m weather station and a 90m temperature inversion tower to assist with environmental management of site operations (see **Figure 6-3**).

Figure 6-3: Bengalla meteorological stations

Annual and seasonal windroses prepared from data collected for the 2010 period from the weather station and inversion tower are presented in **Figure 6-4** and **Figure 6-5** respectively. The wind distribution patterns of the two monitoring locations are similar, and are generally consistent with the expectation of only some small variation due to the different locations of these stations. It is important to note that approximately two months of data in Autumn are not available for either station, however this does not affect the reliability of the data used in the modelling which includes local data from Mt Arthur Coal mine, and many other weather stations in the wider area, as outlined in **Section 8.2.1**.

Analysis of the 10 m weather station windroses shows the most common winds on an annual basis are from the southeast, north-northeast and north. Very few winds originate from the east-northeast and west-southwest sectors. In the summertime the winds predominately occur from the southeast. During autumn and winter winds from the north-northeast sector occur most frequently. It can be seen that these are low speed winds that are attributable to drainage flows along the Hunter River floodplain. The spring distribution is similar to the annual distribution pattern.

On an annual basis the inversion tower windrose indicates winds from the southeast, east-southeast, east-northeast and west-northwest are most frequent. During summer, winds from the southeast and east-southeast are predominant. The autumn and winter seasons display a high proportion of light winds from the east-northeast attributable to drainage flows along the valley. Winter also experiences significant frequency of west-northwest winds, though at relatively higher wind speed. The spring distribution pattern is similar to the annual. Overall the 90m tower data shows a small skew in the wind direction relative to the 10m tower, attributable to the different valley axis angle at the sites.

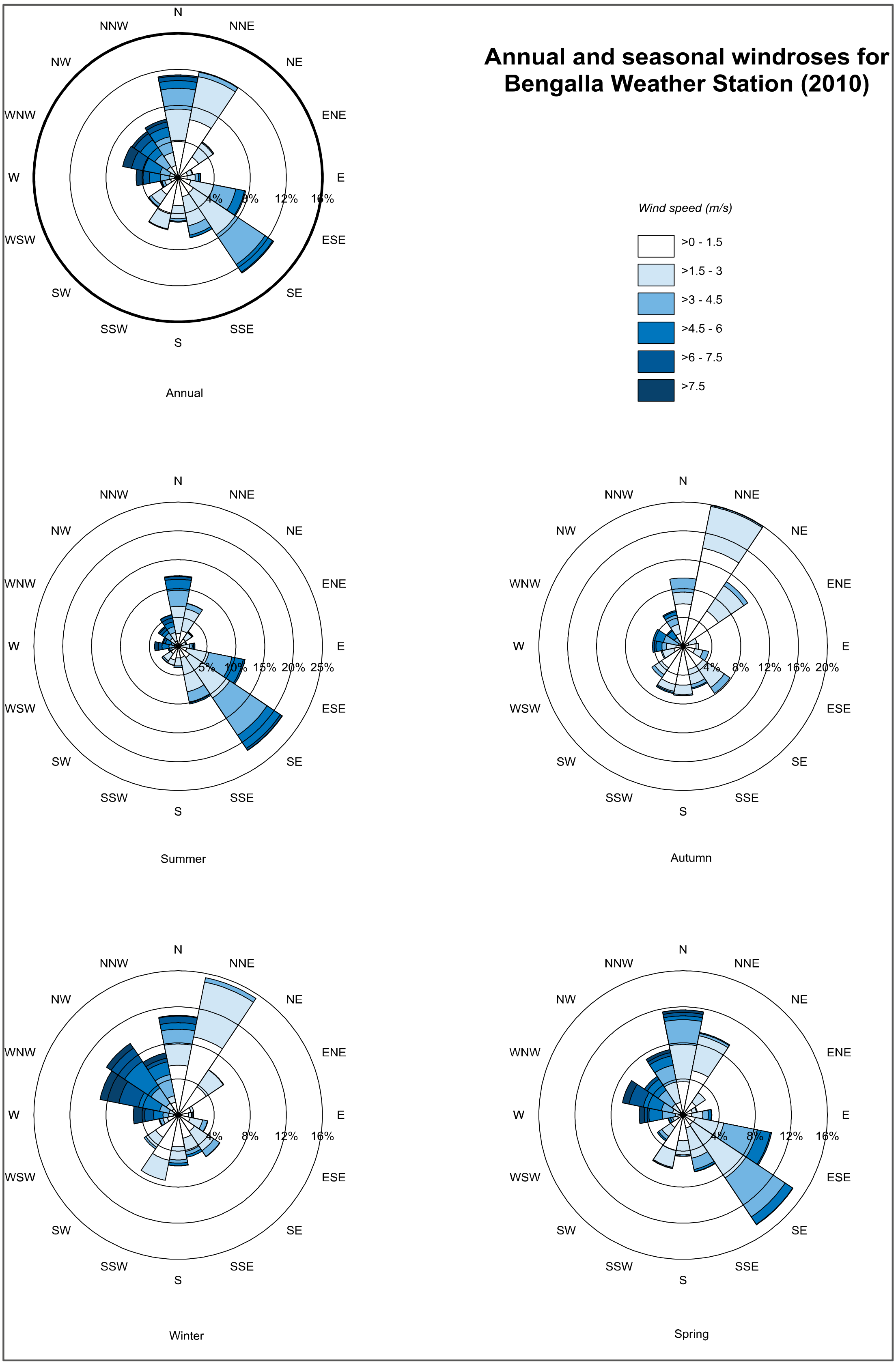

Figure 6-4: Annual and seasonal windroses for Bengalla weather station (2010)

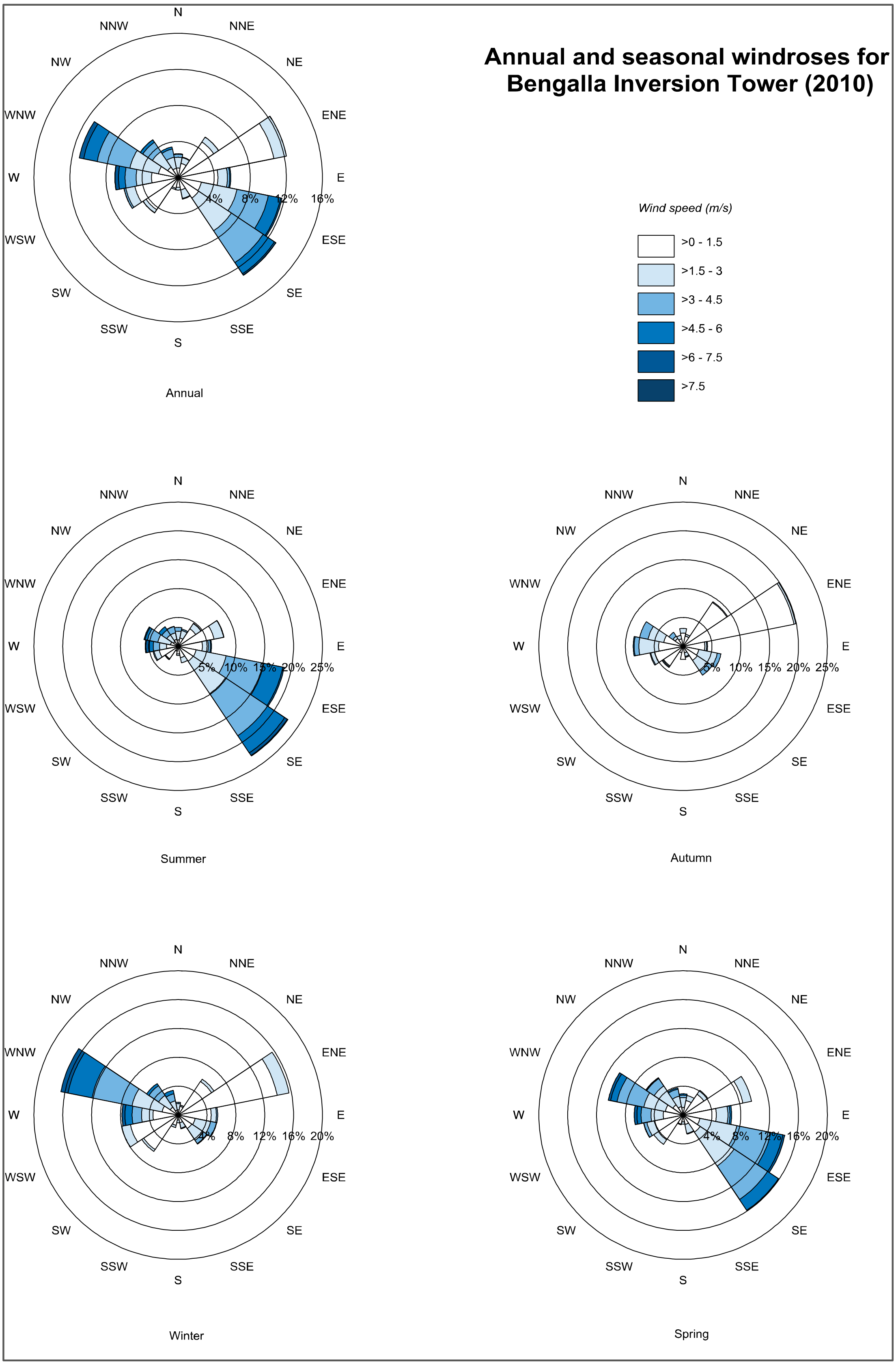

Figure 6-5: Annual and seasonal windroses for Bengalla inversion tower at 10m (2010)

6.3 Local air quality

The main sources of particulate matter in the wider area of the Project include active mining, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities. This section reviews the ambient monitoring data collected from a number of ambient monitoring locations in the vicinity of the Project.

The air quality monitors reviewed in this assessment include seven Tapered Element Oscillating Microbalances (TEOMs), 10 High Volume Air Samplers (HVAS) measuring either TSP or PM_{10}, and 29 dust deposition gauges sited in locations surrounding the Project.

Table 6-3 lists the monitoring stations reviewed in this section which includes data from surrounding mining operations and OEH. **Figure 6-6** shows the approximate location of each of the monitoring stations reviewed in this assessment. **Appendix B** provides a summary of all the monitoring data reviewed in this assessment.

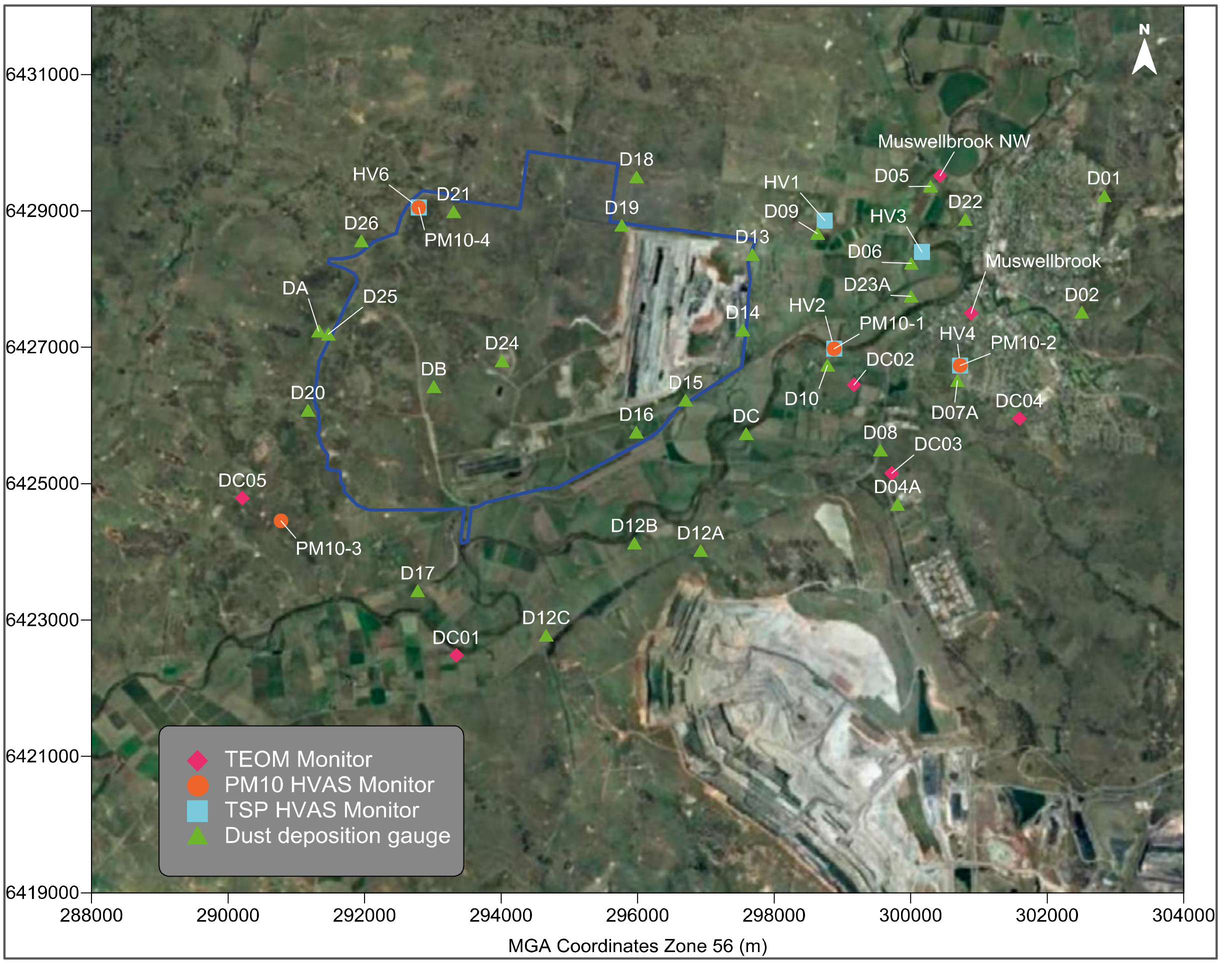

Figure 6-6: Air quality monitoring locations

Table 6-3: Summary of air quality monitors

Monitoring site ID	Type	Operator	Monitoring data availability
DC01	TEOM	MAC	January 2010 - December 2010
DC02	TEOM	MAC	January 2010 - December 2010
DC03	TEOM	MAC	January 2010 - December 2010
DC04	TEOM	MAC	January 2010 - December 2010
DC05	TEOM	MAC	June 2010 - December 2010
Muswellbrook	TEOM	NSW OEH	December 2010 - May 2012
Muswellbrook NW	TEOM	NSW OEH	December 2011 - May 2012
PM10-1	HVAS - PM_{10}	BMC	January 2007 - January 2011
PM10-2	HVAS - PM_{10}	BMC	January 2007 - January 2011
PM10-3	HVAS - PM_{10}	BMC	January 2007 - January 2011
PM10-4	HVAS - PM_{10}	BMC	September 2007 - January 2011
HV1	HVAS - TSP	BMC	January 2007 - January 2011
HV2	HVAS - TSP	BMC	January 2007 - January 2011
HV3	HVAS - TSP	BMC	January 2007 - January 2011
HV4	HVAS - TSP	BMC	January 2007 - January 2011
HV6	HVAS - TSP	BMC	September 2007 - January 2011
D01	Dust gauge	BMC	January 2007 - December 2010
D02	Dust gauge	BMC	January 2007 - December 2010
D04A	Dust gauge	BMC	January 2007 - December 2010
D05	Dust gauge	BMC	January 2007 - December 2010
D06	Dust gauge	BMC	January 2007 - December 2010
D07A	Dust gauge	BMC	November 2007 - December 2010
D08	Dust gauge	BMC	January 2007 - December 2010
D09	Dust gauge	BMC	January 2007 - December 2010
D10	Dust gauge	BMC	January 2007 - December 2010
D12A	Dust gauge	BMC	January 2007 - December 2010
D12B	Dust gauge	BMC	January 2007 - December 2010
D12C	Dust gauge	BMC	January 2007 - December 2010
D13	Dust gauge	BMC	January 2007 - December 2010
D14	Dust gauge	BMC	January 2007 - December 2010
D15	Dust gauge	BMC	January 2007 - December 2010
D16	Dust gauge	BMC	January 2007 - December 2010
D17	Dust gauge	BMC	January 2007 - December 2010
D18	Dust gauge	BMC	January 2007 - December 2010
D19	Dust gauge	BMC	January 2007 - December 2010
D20	Dust gauge	BMC	January 2007 - December 2010
D21	Dust gauge	BMC	January 2007 - December 2010
D22	Dust gauge	BMC	January 2007 - December 2010
D23A	Dust gauge	BMC	November 2007 - December 2010
D24	Dust gauge	BMC	January 2007 - December 2010
D25	Dust gauge	BMC	January 2007 - December 2010
DA	Dust gauge	BMC	January 2007 - December 2010
DB	Dust gauge	BMC	January 2007 - December 2010
DC	Dust gauge	BMC	January 2007 - December 2010
D26	Dust gauge	BMC	January 2007 - December 2010

BMC - Bengalla Mine MAC - Mt Arthur Coal NSW OEH - New South Wales Office of Environment and Heritage

6.3.1 PM_{10} monitoring

Ambient PM_{10} monitoring using TEOMs is conducted by Mt Arthur Coal Mine (MAC) and the NSW OEH at various locations surrounding the Project. The location of each of these monitors is shown in **Figure 6-6**. The monitoring data include all emission sources in the vicinity of the Project such as mining activities, traffic on unsealed roads, construction activities, farming and animal grazing, traffic from other local roads and other anthropogenic sources such as wood-fired heaters.

A summary of the data from the MAC TEOM monitoring stations collected during 2010 is presented in **Table 6-4** and **Figure 6-7**.

Table 6-4 indicates that the annual average PM_{10} concentrations for each monitoring station were below the NSW OEH criterion of 30µg/m^3, however, the maximum 24-hour average PM_{10} concentrations recorded at the DC01, DC02 and DC03 monitors were above 50µg/m^3 on some days during the monitoring period. An investigation into these days was unable to conclusively establish the specific cause of the elevated levels. The Mt Arthur Coal Annual Environmental Management Report for 2010 (**MAC, 2010**) indicates potential for dust emissions from mining activity to contribute to the elevated levels recorded on these days. Overall, based on the monitoring data recorded at the other surrounding stations during these periods, the indication is that a source close to the monitor was the most likely cause of the elevated levels on these days.

The maximum 24-hour average PM_{10} concentrations recorded at the DC04 and DC05 were below the 50µg/m^3 criterion during the monitoring period.

Table 6-4: Summary of PM_{10} levels from MAC TEOM monitoring (µg/m³)

Year	Annual average					
	DC01	DC02	DC03	DC04	DC05	Criteria
2010	13.7	16.1	15.7	14.2	3.3 (1)	30
Year	Maximum 24-hour average					
	DC01	DC02	DC03	DC04	DC05	Criteria
2010	**54.0**	**78.3**	**55.7**	47.4	12.5 (1)	50

(1) Data available from June 2010

Figure 6-7 shows measured 24-hour average PM_{10} levels. It can be seen that on some days only one monitor shows levels much higher than all the other monitors. This generally indicates that a localised source of dust close to the monitor is the likely cause of the elevated reading.

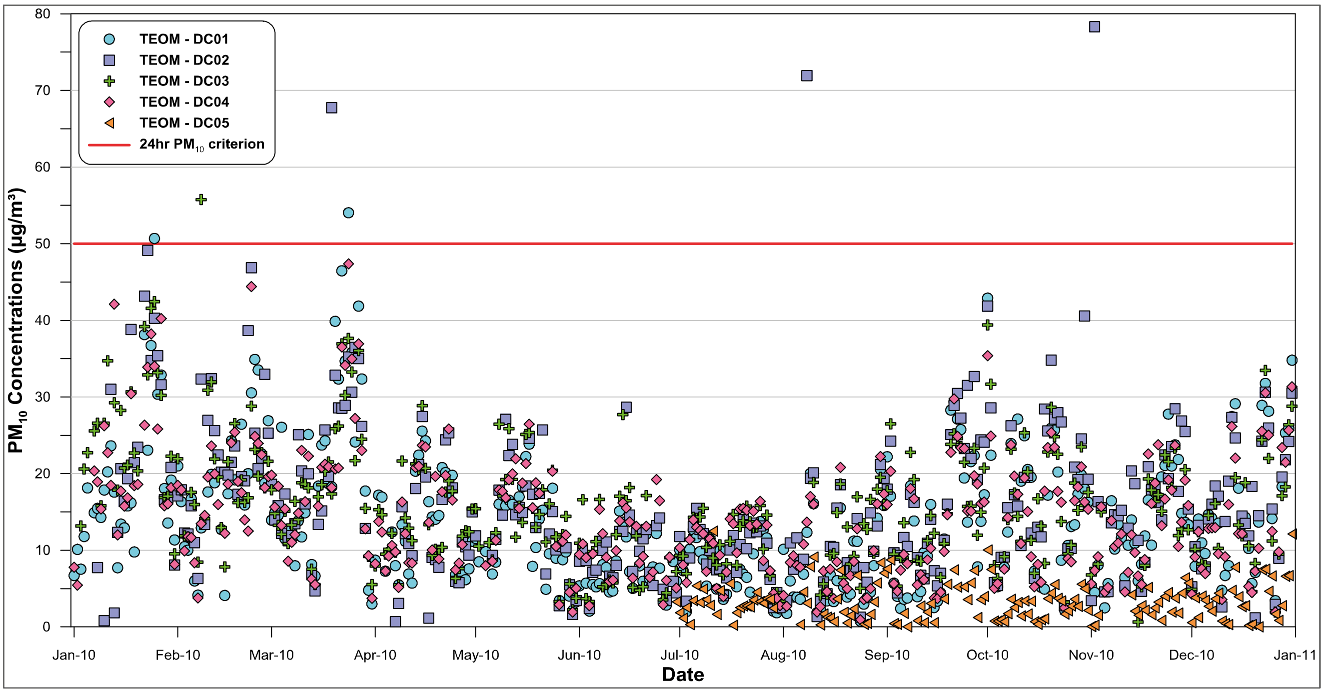

Figure 6-7: TEOM 24-hour average PM_{10} concentrations at MAC monitors

A summary of the data from the NSW OEH monitoring stations (located within the Muswellbrook Township) collected during the monitoring period is presented in **Table 6-5** and **Figure 6-8**.

A review of **Table 6-5** indicates that the annual average PM_{10} concentrations for each monitoring station were below the NSW OEH criterion of 30µg/m^3. The maximum 24-hour average PM_{10} concentrations recorded at these stations were also below the relevant criterion of 50µg/m^3 during the monitoring period.

Table 6-5: Summary of PM_{10} levels from NSW OEH TEOM monitoring (µg/m³)

Year	Annual average		
	Muswellbrook	Muswellbrook NW	Criteria
2010	20.1 (1)	ND	30
2011	19.3	17.0 (2)	30
2012 (3)	19.8	16.1	30
Year	**Maximum 24-hour average**		
	Muswellbrook	**Muswellbrook NW**	**Criteria**
2010	36.4 (1)	ND	50
2011	46.5	22.6 (2)	50
2012 (3)	38.7	35.2	50

ND - no data; (1) Data available from December 2010; (2) Data available from December 2011 (3) Data available till August 2012

Figure 6-8 shows a relatively similar trend to the MAC TEOM station data (shown in **Figure 6-7**) and overall indicates a higher level of recorded PM_{10} concentrations at these monitors. The reason for typically higher levels being recorded further away from mining activity is most likely to be the influence of urban sources located close to the OEH monitors.

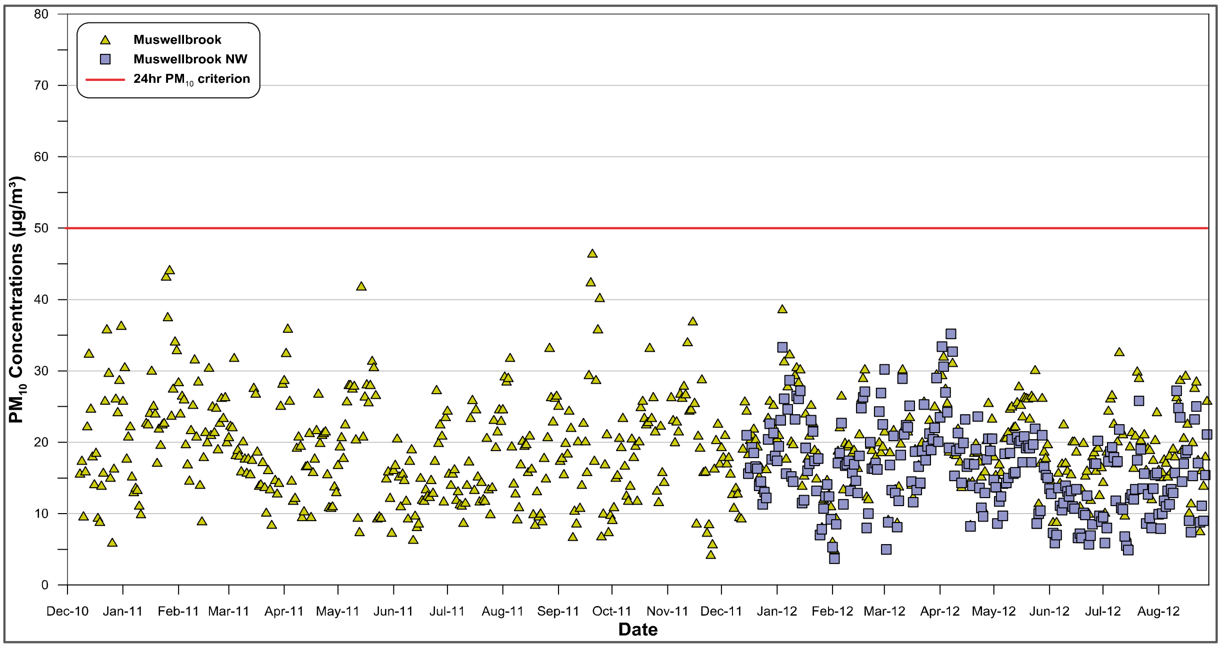

Figure 6-8: TEOM 24-hour average PM_{10} concentrations at NSW OEH monitors

BMC conduct PM_{10} monitoring using four HVAS stations, the locations of these stations are shown in **Figure 6-6**. A summary of the results from the HVAS monitoring stations collected between January 2007 and January 2011 are presented in **Table 6-6** and **Figure 6-9**.

The data in **Table 6-6** indicate that the annual average PM_{10} concentrations for each monitoring station were below the relevant criterion of 30µg/m³ for all years with the exception of 2009. During the 2009 period there were a number of notable regional dust storms that occurred which have significantly contributed to the annual average result. During 2008 dust levels were affected by drought and dust storm events. Further details regarding individual elevated days of dust concentrations are described in the annual environmental monitoring reports for the mine and surrounding mines. The data for 2011 are only available for one month and are not representative of the annual period.

Table 6-6: Summary of PM_{10} levels from HVAS monitoring (µg/m³)

Year	Annual average				
	PM10-1	PM10-2	PM10-3	PM10-4	Criteria
2007	26.5	23.3	17.2	24.8(1)	30
2008	22.6	19.0	16.1	17.5	30
2009	31.3	30.3	24.1	22.6	30
2010	18.9	19.0	16.3	17.2	30
2011(2)	32.8	29.6	25.8	29.6	30
Year	Maximum 24-hour average				
	PM10-1	PM10-2	PM10-3	PM10-4	Criteria
2007	78.1	55.0	49.3	57.7(1)	50
2008	83.6	62.4	45.9	57.1	50
2009	123.0	125.0	70.0	63.0	50
2010	52.0	42.0	56.0	52.0	50
2011(2)	44.0	44.0	39.0	44.0	50

(1) Data available from September 2010; (2) Data available till January 2011

The seasonal trends in PM_{10} concentrations are well represented in **Figure 6-9** along with the regional dust storm events that occurred during late 2009**.**

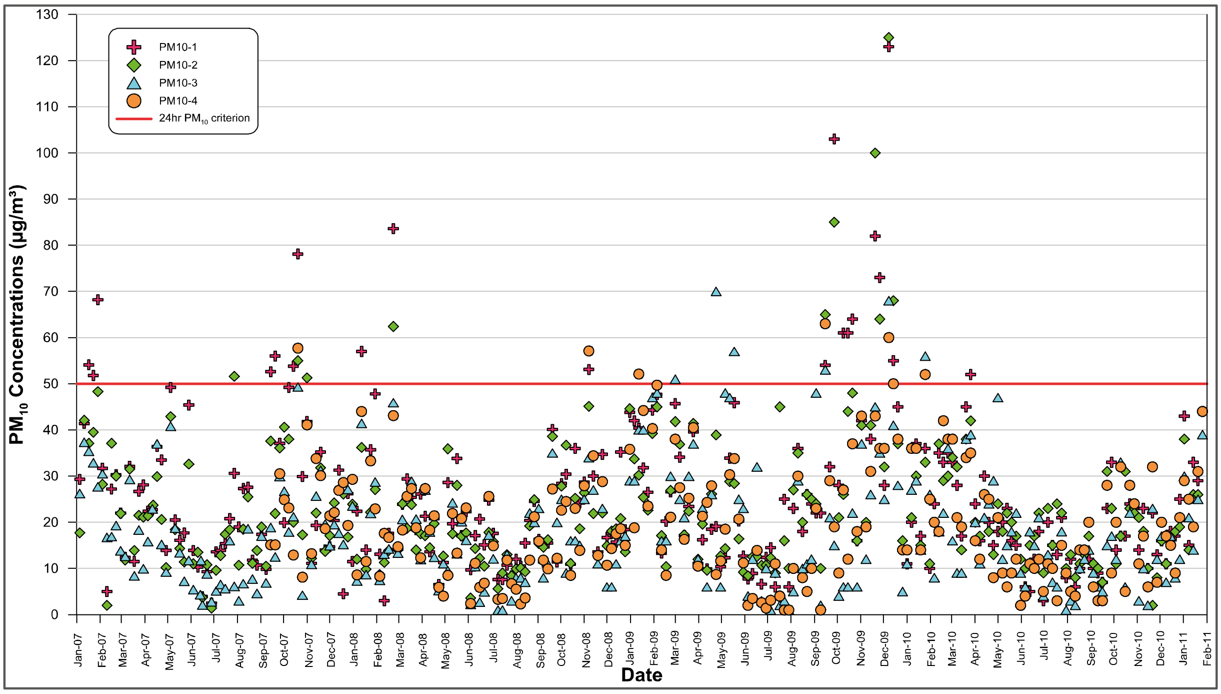

Figure 6-9: HVAS 24-hour average PM_{10} concentrations at BMC monitors

6.3.2 TSP monitoring

BMC conduct TSP monitoring using five HVAS stations, the location of these monitors are shown in **Figure 6-6**. A summary of the results from the HVAS stations collected between January 2007 and January 2011 are presented in **Table 6-7** and **Figure 6-10**.

The monitoring data presented in **Table 6-7** indicate that the annual average TSP concentrations for each monitoring station were below the OEH criteria of 90µg/m³ during the monitoring periods.

Table 6-7: Summary of TSP levels from HVAS monitoring (µg/m³)

Year	Annual average					
	HV1	HV2	HV3	HV4	HV6	Criteria
2007	49.0	63.8	42.1	48.9	69.6[(1)]	90
2008	40.0	51.1	39.7	44.4	50.7	90
2009	55.6	73.2	48.7	53.7	64.1	90
2010	41.9	50.0	35.3	39.3	48.4	90
2011[(2)]	66.4	60.4	58.8	69.4	81.4	90

[(1)] Data available from September 2010; [(2)] Data available till January 2011

It can be seen from **Figure 6-10** that TSP concentrations are nominally highest in the spring and summer months with the warmer weather raising the potential for drier ground elevating the windblown dust, the occurrence of bushfires and pollen levels.

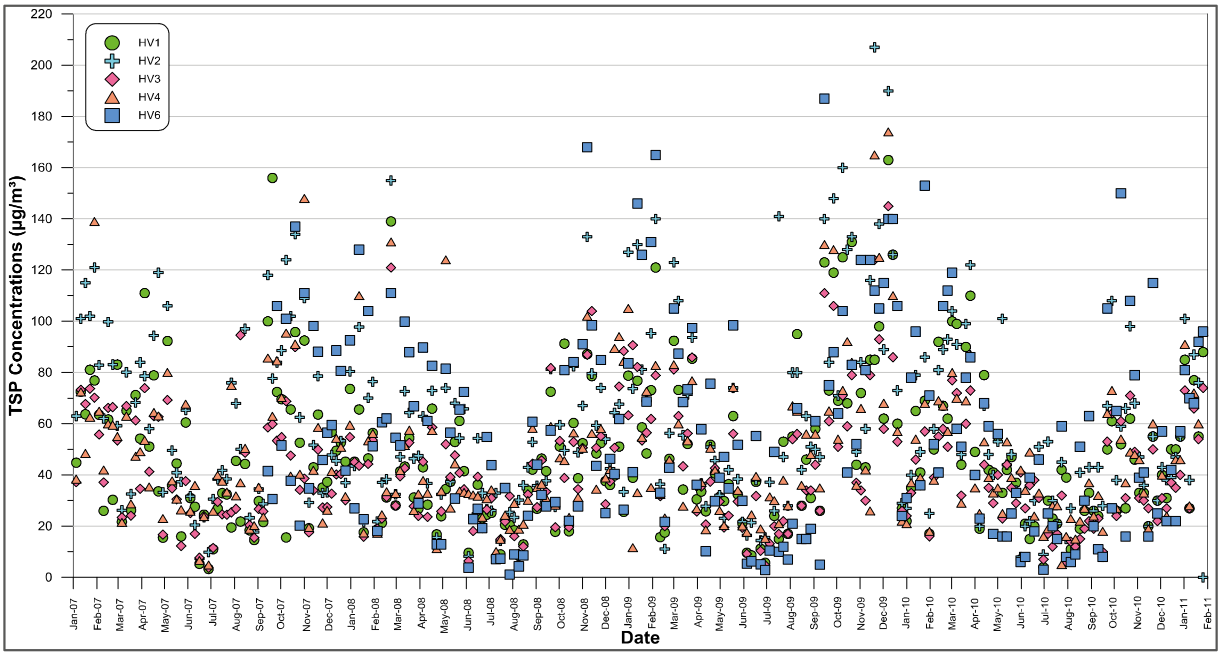

Figure 6-10: HVAS 24-hour average TSP concentrations at BMC monitors

6.3.3 Dust deposition monitoring

The location of each of the dust deposition monitoring sites operated by BMC is shown in **Figure 6-6**. **Table 6-8** shows the annual average deposition levels at each gauge from 2007 to 2010. Field notes accompanying the monitoring data indicate that some of the samples were contaminated with materials such as bird droppings, insects or plant matter. This is a relatively common occurrence for this type of monitoring, and accordingly, contaminated samples have been excluded from the reported annual average results.

All gauges located close to residential areas in Muswellbrook (with the exception of D23A) recorded an annual average insoluble deposition level below the OEH criteria of $4g/m^2$/month and in general, the air quality in terms of deposition can be considered good for these areas.

A review of the measurements taken at the D23A monitor, and presented in **Table 6-8**, indicate a potential exceedance of the OEH criteria of $4g/m^2$/month in 2007 and 2009. Nearby monitors D06, D09 and D10 all recorded lower levels of dust deposition during the same periods indicating the measurements at D23A are most likely most influenced by a localised source of dust.

The gauges located close to or within the existing mine boundary are not used for compliance purposes and are shown here only for completeness. These gauges are shown in grey shading in **Table 6-8**. The annual average insoluble deposition levels at these gauges are relatively high in comparison, which is expected for gauges located within or adjacent to the mining operations.

Table 6-8: Annual average dust deposition levels (g/m²/month)

Year	2007	2008	2009	2010	Criteria
D01	1.1	3.5	1.5	1.2	4.0
D02	1.2	1.1	1.5	1.2	4.0
D04A	2.1	1.9	2.7	2.0	4.0
D05	1.3	1.4	1.7	1.5	4.0
D06	1.3	1.4	2.1	1.5	4.0
D07A	1.8	1.4	1.7	1.2	4.0
D08	1.8	2.0	2.2	1.5	4.0
D09	1.4	1.4	1.7	1.4	4.0
D10	1.5	1.6	2.2	2.1	4.0
D17	2.2	2.3	3.2	2.4	4.0
D20	3.0	2.5	2.9	2.6	4.0
D21	2.8	2.9	3.9	3.4	4.0
D22	1.5	2.2	3.3	2.1	4.0
D23A	**11.3**	2.0	**4.2**	3.5	4.0
D25	2.7	2.4	2.5	3.9	4.0
D26	2.1	2.4	2.5	2.4	4.0
DA	3.3	2.6	3.5	2.8	4.0
DB	3.2	3.2	3.3	3.7	4.0
D12A	**4.3**	3.9	3.9	**6.3**	4.0
D12B	**5.7**	**4.5**	**5.7**	**6.5**	4.0
D12C	**4.5**	3.7	**4.8**	**5.1**	4.0
D13	**4.6**	2.9	3.4	2.8	4.0
D14	3.9	**4.1**	4.0	3.4	4.0
D15	**8.2**	**10.3**	**9.7**	**9.3**	4.0
D16	**6.5**	**10.2**	**9.1**	**10.4**	4.0
D18	**5.2**	**4.8**	**4.1**	3.6	4.0
D19	**12.1**	**10.2**	**11.2**	**12.9**	4.0
D24	**4.5**	3.2	4.0	**4.1**	4.0
DC	**4.2**	**4.9**	3.3	**4.5**	4.0

Figure 6-11 presents a visualisation of the annual average dust deposition levels for each of the years reviewed. The figure indicates that annual average dust deposition levels are generally contained to areas surrounding active mining and in areas to the east and south of Bengalla which indicate contributions from other activities (i.e. the town of Muswellbrook and MAC).

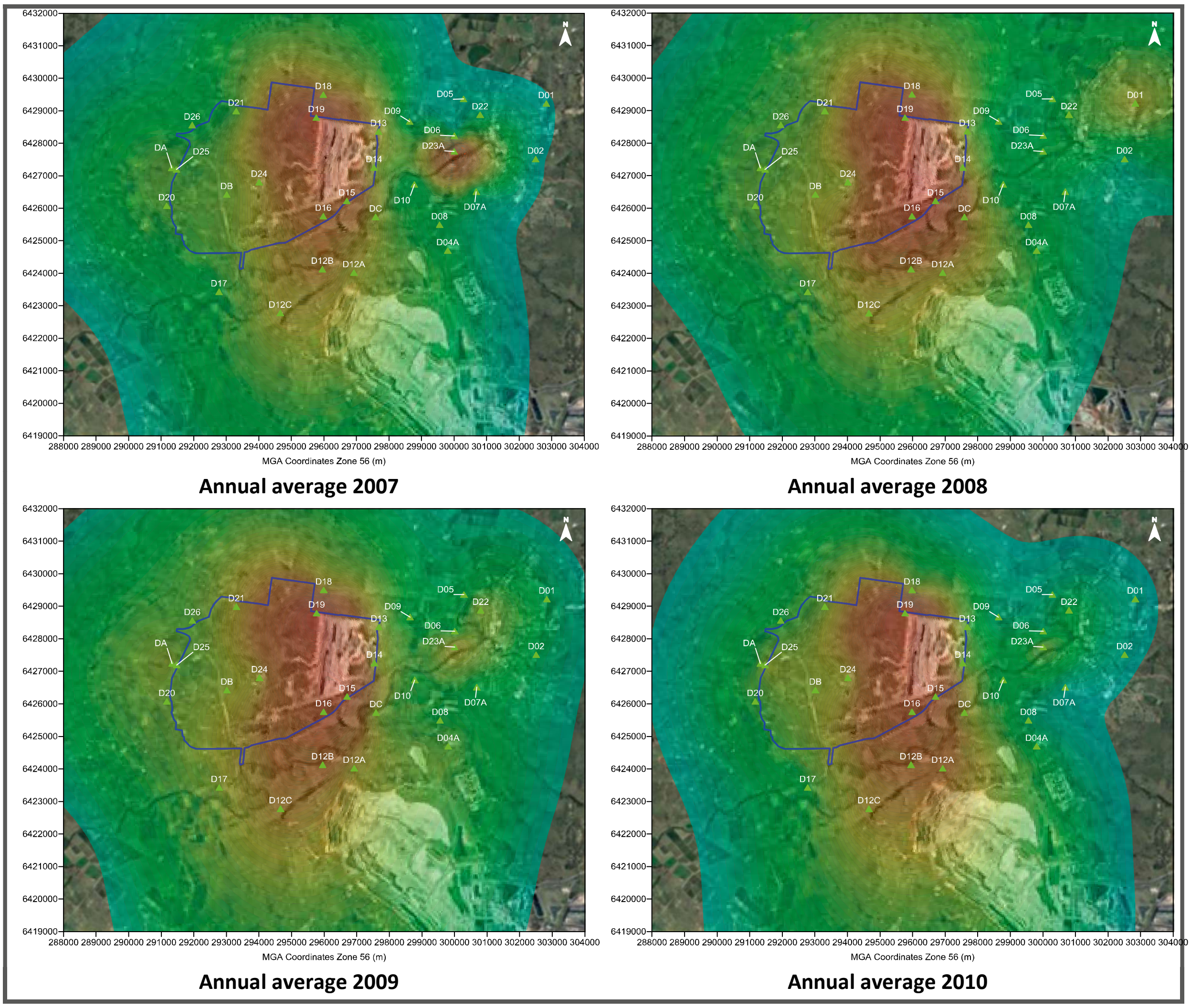

Figure 6-11: Visualisation of annual average dust deposition levels for BMC

6.3.4 Other air pollutants

Ambient monitoring data for other air pollutants are not collected as part of the Project's ambient monitoring program. Recently the NSW OEH has commissioned an ambient monitor in Muswellbrook as part of the Upper Hunter Valley Monitoring Network to monitor NO_2; however a complete year of data has not been captured at this time. Therefore monitoring data collected from the NSW OEH monitor at Beresfield have also been reviewed to characterise the background levels.

6.3.4.1 Nitrogen dioxide

A summary of the NO_2 monitoring data collected between 2010 and 2012 from the Beresfield and Muswellbrook monitors are presented in **Table 6-9**, **Figure 6-12** and **Figure 6-13**.

The data in **Table 6-9** indicate that there were no exceedances of the NSW OEH 1-hour average and annual average goals of 246µg/m³ and 62µg/m³ at these monitors respectively. **Figure 6-12** and **Figure 6-13** further indicates that the monitored levels of NO_2 are relatively low and the data trend with a seasonal fluctuation.

Table 6-9: Summary of 24-hour average NO_2 monitoring (µg/m³)

Year	Annual average		Criteria	Maximum 1-hour average		Criteria
	Beresfield	Muswellbrook		Beresfield	Muswellbrook	
2010	13.5	-	62	60.2	-	246
2011	16.9	13.4[1]	62	79.0	86.5[1]	246
2012[2]	17.9	18.2	62	62.0	79.0	246

[1] Data available from November 2011

[2] Data available till August 2012

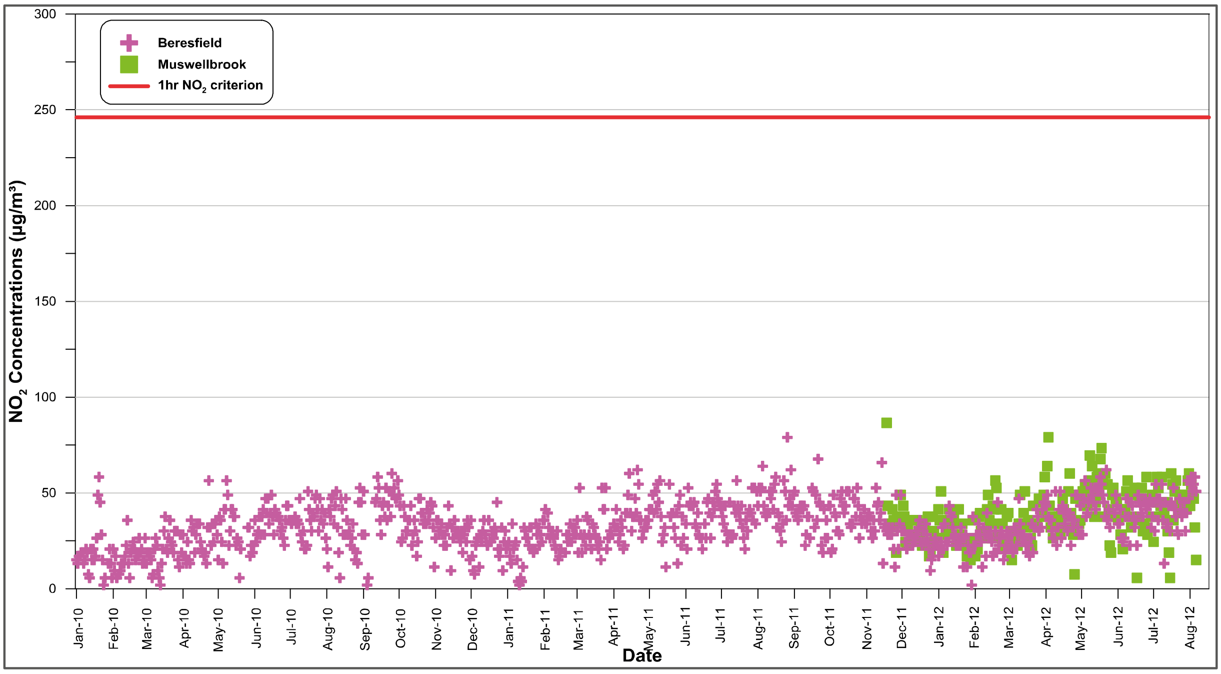

Figure 6-12: Maximum 1-hour average NO_2 concentrations

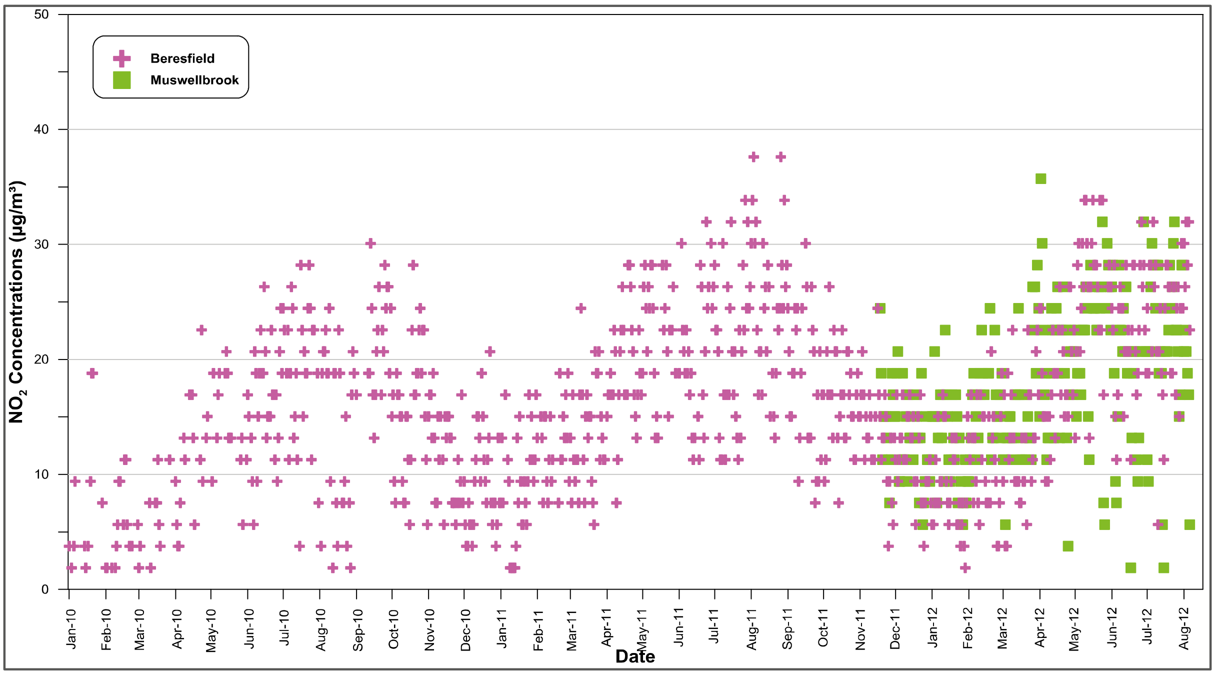

Figure 6-13: 24-hour average NO_2 concentrations

6.3.4.2 Carbon monoxide

The NSW OEH Beresfield and Muswellbrook monitors do not record ambient concentrations of CO.

Combustion activities are generally the main cause of CO emissions and spatially there is little such activity in the area apart from power generation, motor vehicles (including diesel powered mining equipment) and wood heaters.

Ambient air quality goals for CO are set at higher concentration levels than NO_2 goals. Based on the NO_2 monitoring data which is low compared to the goals, and consideration of the typical mix of ambient pollutant levels, the indication is that ambient levels of CO would similarly also be well below the air quality goals.

7 MODELLING SCENARIOS

This assessment considers Years 1, 4, 8, 15 and 24 to represent the progression of the Project. The scenarios modelled represent the years in which maximum impacts are likely to occur in reference to the location of operations and the potential to generate dust. Combined they represent the range of potential impacts over the life of the mine and are indicative of worst-case scenarios.

The modelled Year 1 represents the early stage of the Project as the mine progresses in a general westerly direction. Overburden is emplaced behind and to the east of the active mining operations. It is also proposed to establish an additional overburden emplacement area (OEA) to the west of the active mining area (see **Figure 7-1**). This would allow for greater flexibility with mine scheduling operations and the area is mined through in the later years of the mine plan. In modelled Year 4, a satellite pit (i.e. an individual mining area in advance of the main Bengalla pit), is established to the southwest of the main pit to assist with coal quality management (see **Figure 7-2**). The OEA to the west continues its service as its footprint increases. By Year 8 (see **Figure 7-3**), the main pit has progressed further west and reaches the limits of the western OEA. During this time operations have commenced to mine the western OEA to allow for the continued progression of the main pit. During Year 15 and Year 24 (**Figure 7-4** and **Figure 7-5**, respectively) the pit progression continues westerly towards the western open cut extraction limit. Rehabilitation of the overburden emplacement areas to the east of the main pit is well established and will continue progressively.

The ROM coal production in Year 1 remains at 10.7Mtpa consistent with existing approved limits, the production rate increases gradually to full production of 15Mtpa by approximately Year 5 and continues at this rate to Year 24.

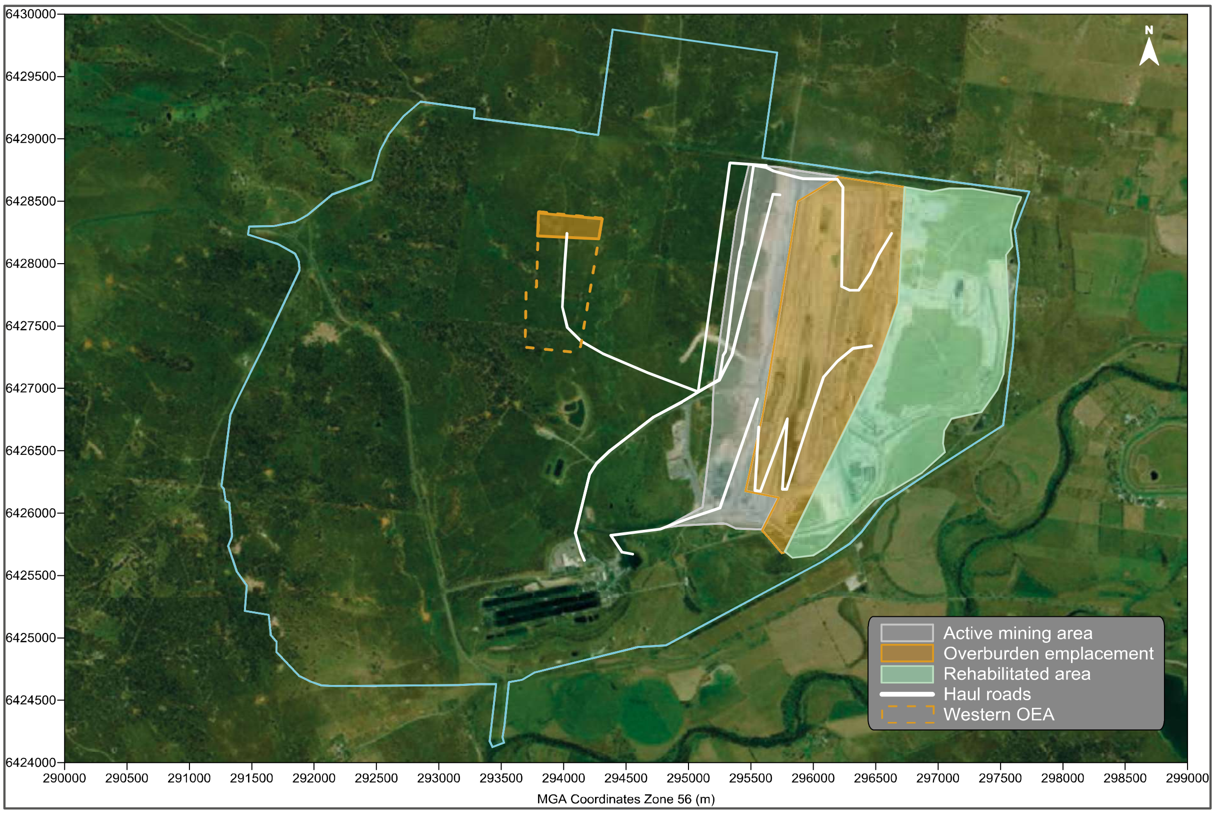

Figure 7-1: Year 1 mine plan

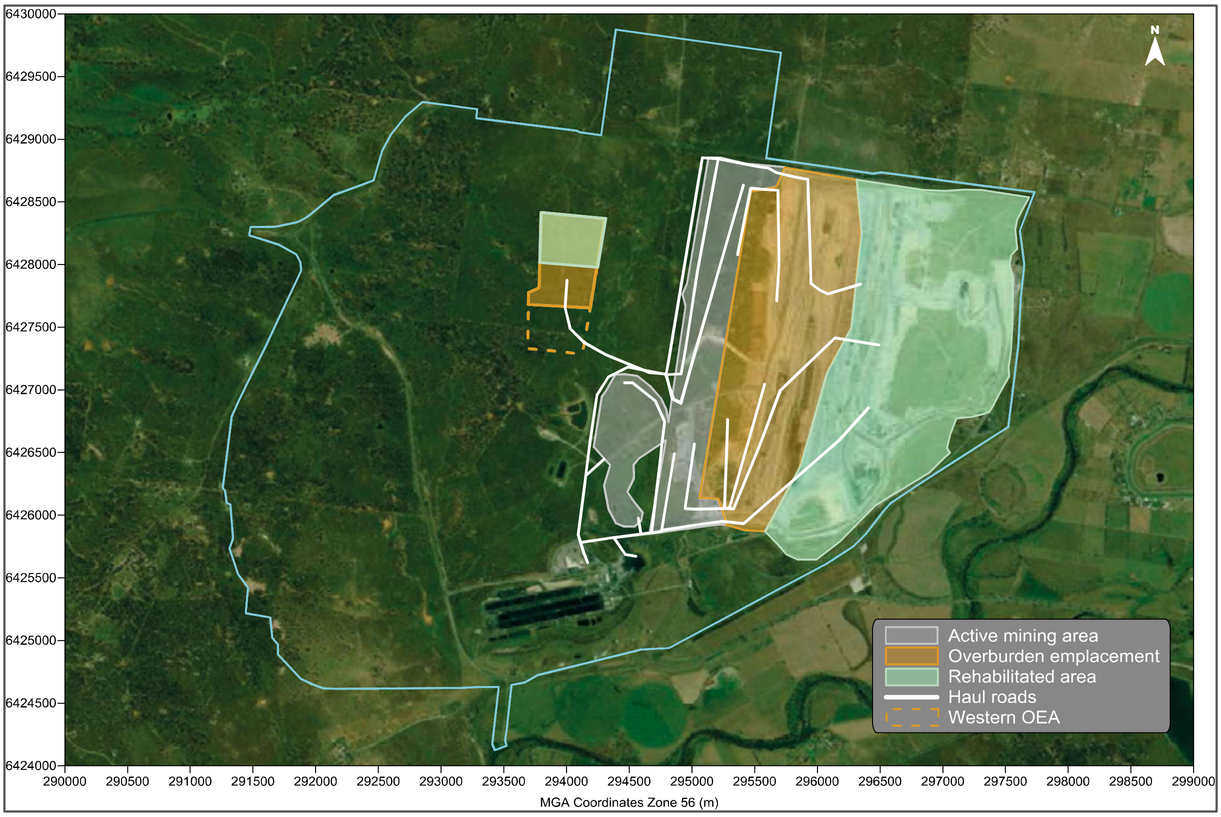

Figure 7-2: Year 4 mine plan

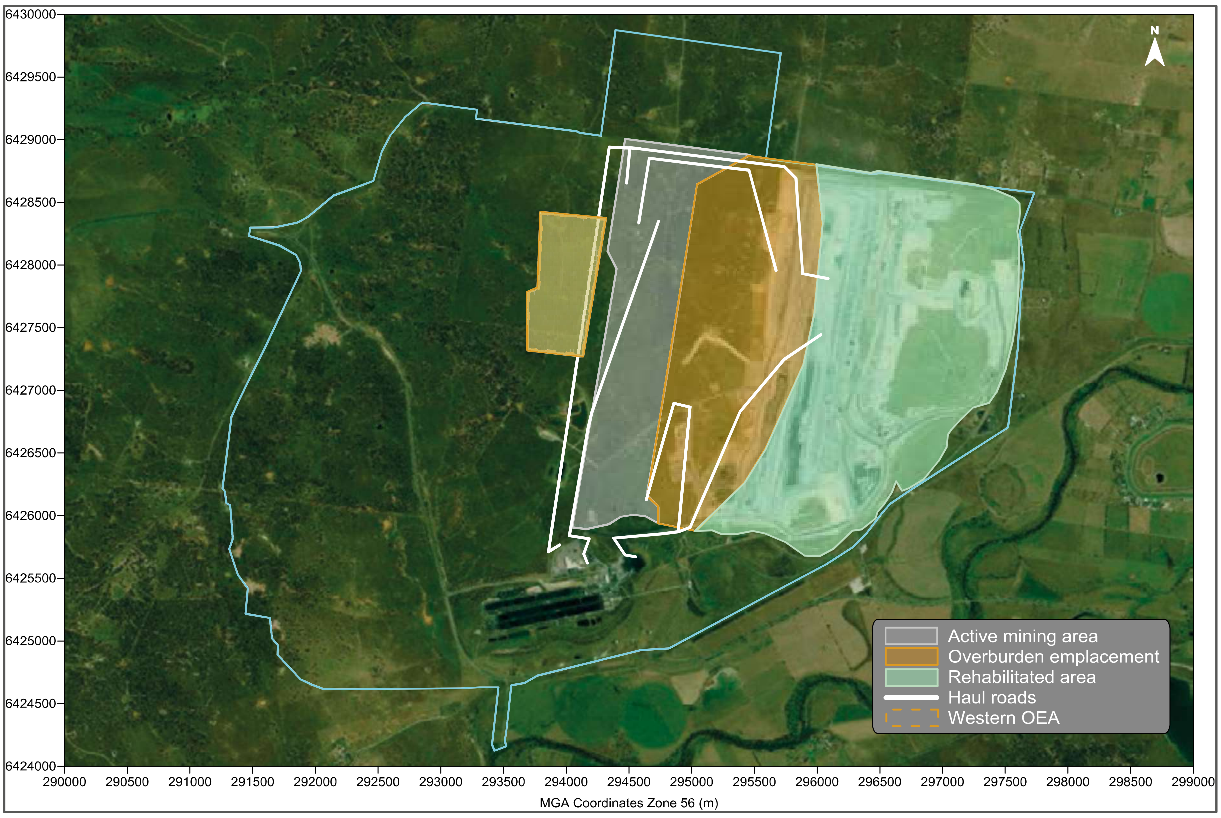

Figure 7-3: Year 8 mine plan

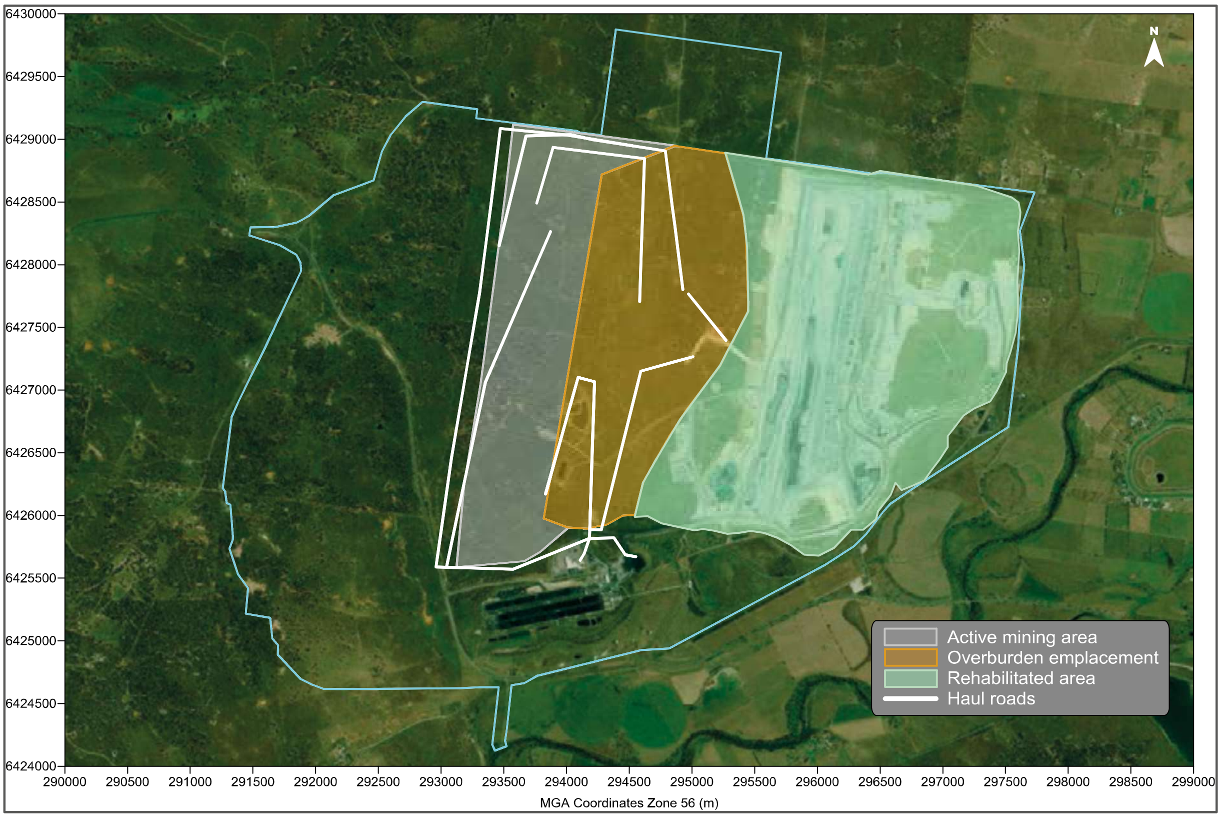

Figure 7-4: Year 15 mine plan

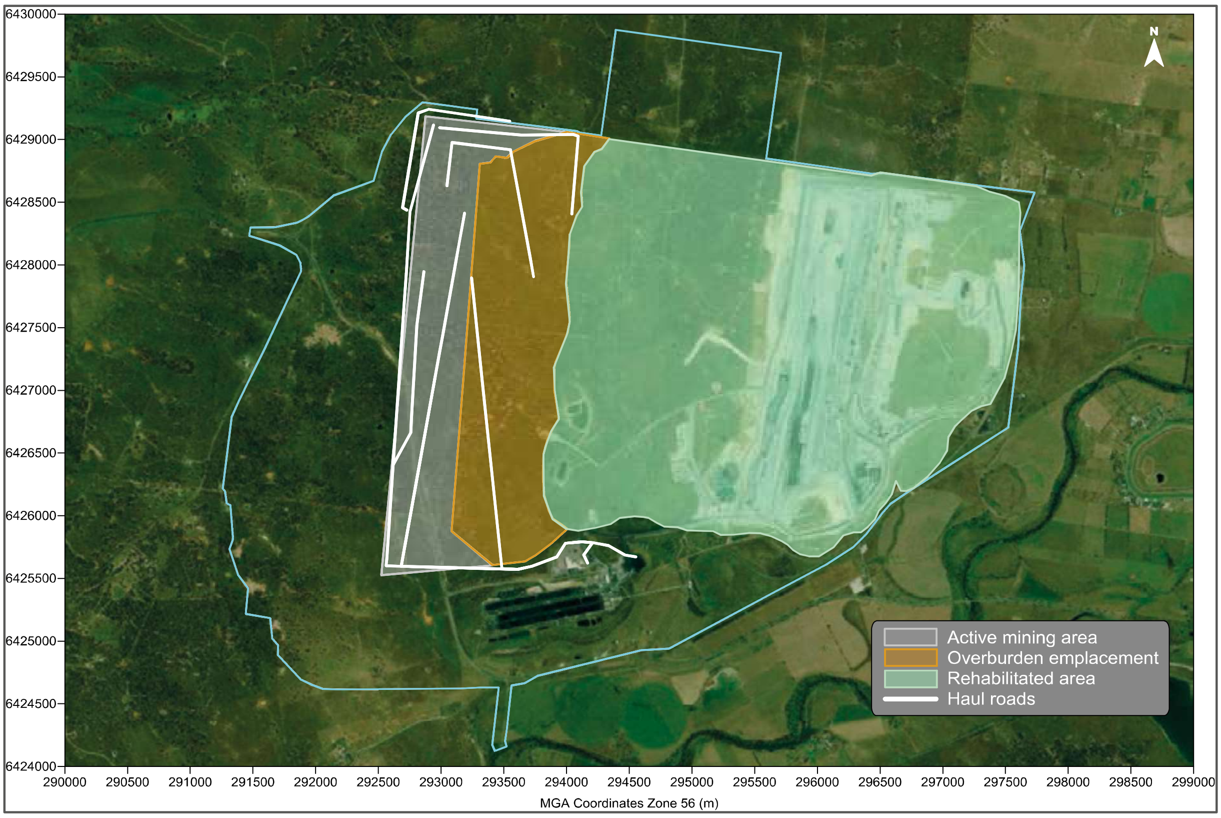

Figure 7-5: Year 24 mine plan

7.1 Emission estimation

For each of the representative years of the Project mine life, dust emission estimates have been calculated by analysing the various types of dust generating activities taking place and utilising suitable emission factors.

The emissions factors applied are considered the most applicable and representative for determining dust generation rates for the proposed activities. The emission factors were sourced from both locally developed and US EPA developed documentation. Total dust emissions from all significant dust generating activities for the Project are presented in **Table 7-1**. Detailed emission inventories and emission estimation calculations are presented in **Appendix C**.

The dust emissions presented in **Table 7-1** are commensurate with a best practice mining operation utilising reasonable and feasible best practice dust mitigation applied where applicable. Further details on the dust control measures applied at the Project are outlined in the following section.

Table 7-1: Estimated emissions for the Project (kg of TSP)

Activity	Year 1	Year 4	Year 8	Year 15	Year 24
OB - Topsoil Removal	4,184	4,184	4,184	4,184	4,184
OB - Drilling	9,776	12,469	12,469	14,695	16,920
OB - Blasting	42,621	53,589	53,589	63,065	72,541
OB - Loading OB to haul truck	94,634	128,650	128,650	158,157	187,665
OB - Loading OB to haul truck Sat-Pit	-	10,675	-	-	-
OB - Hauling to Emplacement	1,900,083	2,698,560	3,053,058	3,887,377	4,986,527
OB - Hauling to Emplacement WOEA	76,183	60,058	-	-	-
OB - Hauling to Emplacement Sat-Pit	-	150,162	-	-	-
OB - Emplacing at Dump	94,634	133,424	128,650	158,157	187,665
OB - Emplacing at Dump WOEA	5,901	5,901	-	-	-
OB - Loading OB to haul truck at WOEA	-	-	17,704	-	-
OB - Hauling to Emplacement from WOEA	-	-	283,400	-	-
OB - Emplacing at Dump from WOEA	-	-	17,704	-	-
OB - Rehandle Overburden	4,826	6,175	6,175	7,592	9,008
OB - Dozers on various OB Activities	683,567	677,876	677,876	677,876	677,876
OB - Dragline	289,777	362,222	250,169	250,169	362,222
CL - Drilling	967	1,233	1,233	1,453	1,673
CL - Blasting	4,736	5,954	5,954	7,007	8,060
CL - Dozers ripping/pushing/clean-up	248,912	246,855	246,855	246,855	246,855
CL - Loading ROM coal to haul truck	444,345	570,899	622,914	622,914	622,914
CL - Loading ROM coal to haul truck Sat-Pit	-	52,015	-	-	-
CL - Hauling to ROM hopper	233,599	282,226	295,294	451,063	511,623
CL - Hauling to ROM hopper Sat-Pit	-	16,347	-	-	-
CHPP - Unloading ROM to hopper	66,652	93,437	93,437	93,437	93,437
CHPP - Rehandle ROM at hopper	66,652	93,437	93,437	93,437	93,437
CHPP - Dozers at ROM hopper	706	706	706	706	706
CHPP - Unloading to product coal stockpile	391	548	548	548	548
CHPP - Loading Rejects	367	514	514	514	514
CHPP - Hauling Rejects	51,505	70,864	62,573	55,621	80,732
CHPP - Dumping Rejects	367	514	514	514	514
PC - Loading coal to train at Bengalla Rail loop	313	438	438	438	438
WE - Overburden emplacement areas	651,179	745,689	537,260	754,144	582,837
WE - Open pit	463,743	557,901	1,146,130	1,108,718	891,955
WE - ROM stockpiles	1,247	1,247	1,247	1,247	1,247
WE - Product stockpiles	7,156	7,156	7,156	7,156	7,156
Grading roads	62,778	62,778	62,778	62,778	62,778
Total TSP emissions (kg/yr)	**5,511,801**	**7,114,705**	**7,812,619**	**8,729,823**	**9,712,032**

OB - overburden, CL - coal, CHPP - coal handling preparation plant, WE - wind erosion

In addition to the estimated dust emissions from the Project, all nearby approved mining operation were modelled, to assess potential cumulative dust effects. Emissions estimates from these sources were derived from information provided in air quality assessments available in the public domain at the time of modelling. These estimates are likely to be conservative, as in many cases, mines do not operate at the maximum extraction rates assessed in their respective assessments.

Table 7-2 summarises the emissions for each of the nearby mining operations. Where there is no estimated annual TSP, it is assumed (as per their current consents) that the other mines no longer operate.

Table 7-2: Estimated emissions for nearby mining operations (kg of TSP)

Mining Operation	Development Consent -Expiry Year	Year 1	Year 4	Year 8	Year 15	Year 24
Mount Arthur Coal Mine(1)	2023	22,996,561	25,708,373	24,809,310	24,809,310	24,809,310
Mount Pleasant Project Coal Mine(2)	2020	-	2,362,500	4,250,000	5,250,000	6,300,000
Mangoola Coal Mine(3)	2028	3,733,301	3,618,969	3,013,405	3,013,405	3,013,405
Drayton Coal Mine(4)	2018	5,168,196	3,225,173	-	-	-
Muswellbrook Coal Company Coal Mine(5)	2015	972,967	-	-	-	-

(1)PAEHolmes (2009), (2)ERM Mitchell McCotter (1997), (3)Holmes Air Sciences (2006), (4)Holmes Air Sciences (2007), (5)Holmes Air Sciences (2002)

At the time of preparation of this assessment, Drayton Coal Mine's proposed South Coal Project had lodged a Preliminary Environmental Assessment (PEA) only, with no Environmental Assessment available to include in this cumulative assessment. However, in consideration of the mine plan presented in the PEA, with a separation distance of over approximately 16km from the Project and divided by MAC as well as being outside the predominant wind direction of the area, it would be unlikely to add any significant contribution to the predictions at local receivers in this report. Therefore the potential Drayton South Project has not been considered any further.

We note that the estimated emissions for the nearby mining operations in **Table 7-2** include considerations of the Mount Pleasant Project which has yet to commence mining operations since gaining Development Consent approval in December 1999. Due to this delay in commencement of mining, it is difficult to align the estimated emissions presented in the Mount Pleasant Environmental Impact Statement (MTP EIS) (**ERM Mitchell McCotter, 1997**) for the purposes of assessing potential cumulative dust effects. For the purposes of this assessment it has been conservatively assumed that construction of the Mount Pleasant Project commences by the end of 2015 and initial coal extraction from 2017. We note that the Mount Pleasant Project Development Consent is due to expire in 2020, however to assess potential cumulative worst case scenarios at the later stages of the Project we have assumed mining operations at the Mount Pleasant Project continue for a 21 year period in general accord with the approved mine plans presented in the EIS. Alternatively, we have also assessed impacts in the absence of the Mount Pleasant Project commencing.

In light of the current situation of high regulatory and community concern over dust from mining activities, which includes the recent regulatory pollution reduction programs seeking "best practise", it is reasonable to assume that a contemporary level of performance would be achieved at the Mount Pleasant Project in regard to controlling dust emissions, similar to that of neighbouring operations.

The dust mitigation measures noted in the MTP EIS include such things as minimising the extent of the exposed areas, watering of dusty surfaces, collection of fine dust from drilling, prevention of truck overloading, expediting the rehabilitation of mined land and overburden emplacements. A variety of control measures will also be used at the CHPP including water sprays on stockpiles, mist sprays at the ROM hopper, enclosures and control sprays to be used on conveyors, use of a luffing stacker and adequate bunding of product stockpiles. As these controls were not applied in the emissions estimation used for modelling in the MTP EIS, there is potential for further reduction in the emission estimation.

Considering the location of the Mount Pleasant project mining operations adjacent to the Project and the similar mining techniques used, it would be reasonable to assume that the Mount Pleasant Project would generate emissions at a similar rate (i.e. TSP to ROM ratio) as the Project. The estimated emissions for the Mount Pleasant project used in the modelling of cumulative impacts are shown in **Table 7-2** reflect the above considerations.

We also note that the Mount Arthur Coal Mine and Mangoola Coal Mine consents would expire approximately in the middle stages of the Project. To assess potential worst case cumulative dust effects we have assumed that these operations would continue until the end of the Project. In the absence of other publicly available information, the Mount Arthur Coal Mine was assumed to continue progression in a south-westerly direction within the approved mining boundary and the Mangoola Coal Mine to continue operations within the existing approved mining boundary.

The modelled source locations for each mining operation for each of the modelled years are shown in **Figure 7-6**. These source locations are based on assumed westerly progression of mining per the publically available information at the time of the modelling.

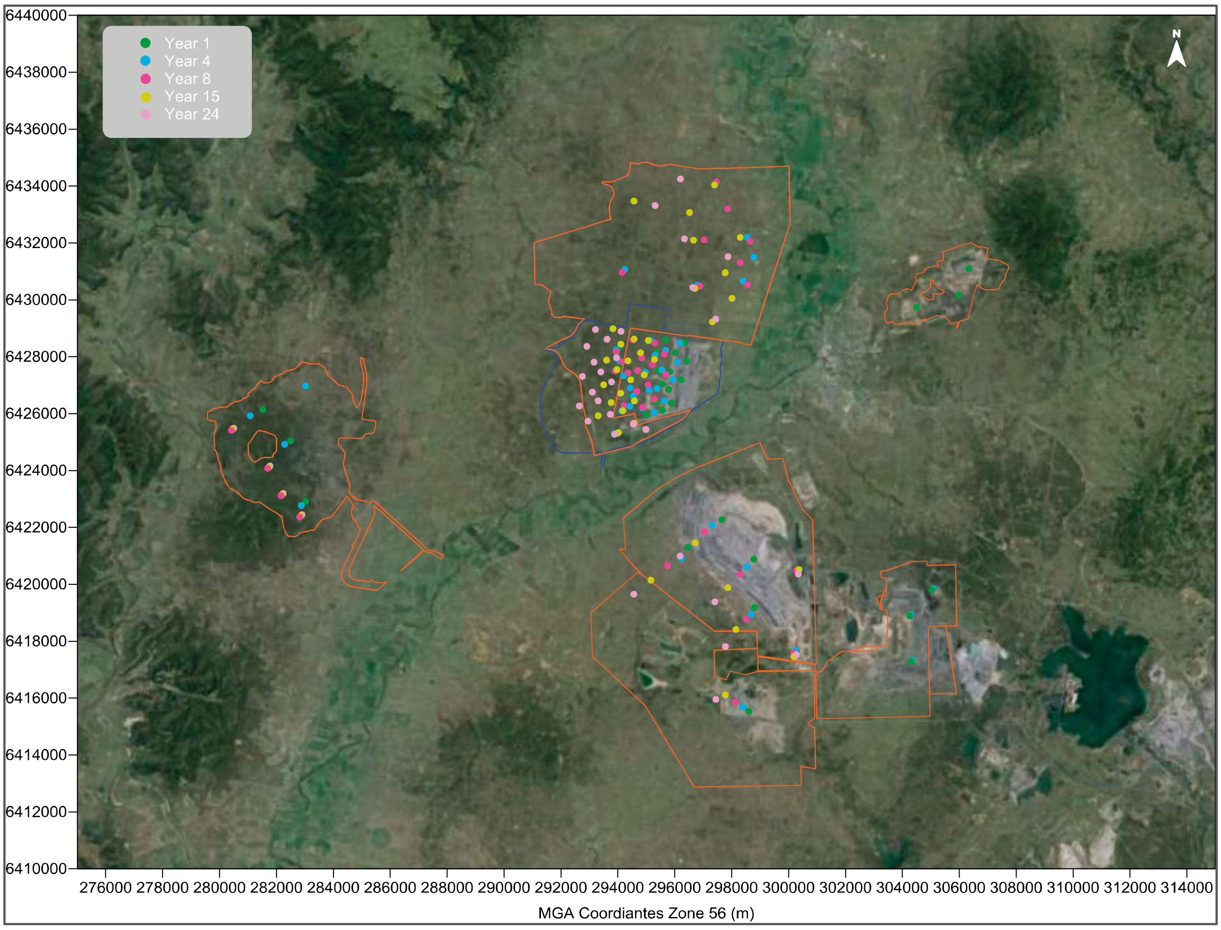

Figure 7-6: Modelled source locations

7.2 Best practice operational dust mitigation measures

BMC has taken into consideration the possible range of mitigation measures that can be applied collectively to achieve a standard of mine operation consistent with current best practice for the control of dust emissions from coal mines in NSW. The measures applied to the Project reflect those outlined in the recent OEH document, "*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*", prepared by Katestone Environmental (**Katestone, 2010**).

BMC has in place management measures to align and maximise dust management practices to respond to government and community concerns regarding the impacts of mining on regional air quality in the Hunter Valley. These measures include implementation of best practice dust management techniques and the implementation of controls and staff guidance for the visual identification of dust. Other measures include dust level alarms and wind speed alarms situated in and around active areas to monitor the potential for dust and assist with prevention and reduction of potential impacts. Operational measures such as enforcing a cessation of particular operations during periods of high dust provide additional assistance in reducing the potential dust impacts.

BMC was recently required to undertake a Pollution Reduction Program (PRP) in accordance with EPL 6538 under the POEO Act that included a Best Management Practice (BMP) determination of all dust generating activities. The top activities identified in the PRP were found to be wheel generated dust on unpaved surfaces, loading and unloading of overburden, bulldozing activities and wind erosion (**BMC, 2012**).

The PRP determined that all reasonable and feasible measures for reducing dust emissions from loading and unloading of overburden and bulldozing activities are currently implemented and the continued implementation of these measures would apply for the Project. Additional control measures including the use of chemical suppression on haul roads and interim stabilisation of exposed areas through vegetation and/or chemical suppression were identified for consideration for Bengalla to achieve best practice.

A summary of the key dust controls applied to current operations at the Project is shown in **Table 7-3**. Where applicable these controls have been reflected in the dust emission estimates shown in **Table 7-1**, and as detailed in **Appendix C.**

The dust mitigation measures listed in **Table 7-3** include all reasonable and feasible control measures applicable for Bengalla. These measures have been assessed in the PRP with strong consideration of the operational features and implications.

BMC would also investigate the application of site specific meteorological forecasting systems to assist with predicting the likelihood of potential adverse weather conditions and adverse dust impacts.

Table 7-3: Summary of best practice dust mitigation measures

Activity	Dust Control
Drilling	✦ Dust suppression systems (water sprays, vacuum systems and/or dust skirts). ✦ Prevent disturbance of drill cuttings. ✦ Application of water on dusty areas prior to drilling. ✦ Ceasing operations when visible dust is generated.
Blasting	✦ Watering blast areas to suppress dispersion of drill cuttings.
Hauling on unsealed roads	✦ Watering and/or chemical stabilisation of haul road surfaces. ✦ Prevent material being deposited on haul roads. ✦ Restrict general vehicle speed. ✦ Access roads with high volumes of light traffic to be paved. ✦ Trafficable areas clearly marked; vehicle movement restricted to these areas. ✦ Trafficable areas and vehicle manoeuvring areas maintained. ✦ Fleet optimisation to reduce vehicle kilometres travelled.
Material extraction/dumping	✦ Watering of extraction areas. ✦ Sheltered dumping during period of high winds. ✦ Minimise the distance fall of materials during loading and unloading. ✦ Ceasing operations during high dust periods.
Unloading ROM to hopper	✦ Enclosed dump hopper and water curtain. ✦ Slower tipping during adverse conditions. ✦ Drop heights reduced as far as practicable. ✦ Visual triggers for dust mitigation and safety purposes.
Conveyors and transfers	✦ Enclosed (3/4) and water sprays where applicable. ✦ Belt cleaning applied to remove debris. ✦ Enclosed chutes.
Dozer operation	✦ Avoid use during unfavourable conditions. ✦ Minimise travel speed in dusty conditions. ✦ Travel on watered routes between work areas.
Graders	✦ Travel on watered routes. ✦ Haul roads watered immediately following grading, where possible.
Exposed areas	✦ Minimise area of disturbance, rehabilitate areas as soon as feasible. ✦ Apply interim stabilisation on areas inactive for long periods with vegetation and/or chemical suppression.
Coal crushing and screening	✦ Crushing plant enclosed with internal water sprays.
Rehabilitation	✦ Rehabilitation expedited to achieve maximum coverage rate. ✦ Vegetation is actively managed.
Dragline	✦ Avoid over-dragging and overflowing of material in bucket. ✦ Lift bucket cleanly away from dig face with minimum spillage. ✦ Restrict drop height as far as practical. ✦ Consider placement of material to reduce material slippage. ✦ Suspension of operations during dry, windy conditions. ✦ Specific measures to limit dust, such as skilled modification of bucket movement, fill and placement of material.
ROM and product stockpiles	✦ Automated water sprays during high winds. ✦ Minimise drop heights when stacking. ✦ Automated stacker/reclaimer which can vary height. ✦ Manual implementation of water sprays and/or water cart during dusty periods. ✦ Visual surveillance of dust plumes during activity. ✦ Stockpiling and recovery of ROM coal is minimised as practical.

Activity	Dust Control
Rail operations	✦ Ensure streamlined and consistent profiled coal surface within rail wagons. ✦ Minimise spillage and parasitic loading. ✦ Coal spillage is collected and disposed of on regular basis.

BMC's Coal Mine Particulate Matter Control Best Practice Management Determination (PRP) (**BMC, 2012a**) estimated that the level of haul road dust control is 75% at the current BMC mine and that a control level of up to 80 to 85% could be achieved. The PRP also calculated that haul road emissions comprised between 91.8 to 95.0% of the total improvement over existing emissions that adoption of best practice controls could deliver at the current BMC mine. Whilst these calculations may not be accurate if applied directly to the Project, the key point is that haul road emissions represent a significant fraction of the controllable level of dust from coal mines is correct.

Clearly therefore, there is a need to consider haul road dust controls in detail.

A key concern with increasing haul road dust level control is the potential availability of sufficient resources, including haul trucks and water to achieve the required level of dust control. To address this issue, calculations were made to estimate the additional water and haul truck requirements to increase the level of dust control from 75 to 85% at this location. It needs to be pointed out that these are theoretical calculations of the control efficiency achieved by watering estimated based on the following empirical formula (**Buonicore and Davis, 1992**).

$$CE = 100 - \frac{0.8pdt}{i}$$

CE = average control efficiency (%)
p = potential average hourly daytime evaporation rate (mm/hr)
d = average hourly daytime traffic rate (/hr)
t = time between applications
i = application intensity (L/m²)

An example of the calculation made for Year 24 is shown in **Table 7-4**.

Table 7-4: Example of annual average water demand calculations for best practice haul dust control - Year 24

Application frequency per hr	Watering application rates (l/h)												Increase in water demand
	0.11	0.18	0.14	0.2	0.18	0.3	0.27	0.45	0.36	0.6	0.55	0.9	
5	75%	85%	80%	88%	85%	91%	90%	94%	-	-	-	-	64%
4	69%	81%	75%	85%	81%	89%	87%	92%	-	-	-	-	70%
3	59%	75%	67%	80%	75%	85%	83%	90%	87%	92%	-	-%	67%
2	-	-	49%	70%	62%	77%	75%	85%	81%	88%	88%	92%	67%
1.5			-	61%	50%	70%	67%	80%	75%	85%	84%	90%	64%
1				-	-	55%	49%	70%	62%	77%	75%	85%	64%
Average increase in water usage for change from 75% to 85% control													**66%**

The table shows that the likely increase in annual haul road water demand in moving from 75% to 85% control is approximately 66%. The level varies according to water application frequency (water cart pass-bys) per hour, but this is largely due to rounding of the low watering application rate values. On maximum evaporation days (see below), a greater watering application rate would be necessary than the annual average rates shown in the table.

Assuming an average water cart operating speed of 40km/hr, each cart can cover all haul roads 1.8 times in one hour. Therefore a minimum of 2.2 water carts would need to be available continually to achieve for 4 pass-bys per hour. This indicates that the required level of water cart pass by can be achieved with 3 water carts dedicated to the haul roads, which allows for reasonable down time, including re-filling.

It must be kept in context that these calculations are based on the theoretical level of control in relation to a hypothetical situation of no control, which does not occur at any known mine in the locality, and therefore cannot be quantified. It is perhaps more relevant to consider that the level of control assumed is commensurate with reducing uncontrolled dust emissions from approximately 4kg per vehicle kilometre travelled (VKT) down to approximately 1kg/ VKT for 75% control (current practice) and down to approximately 0.6kg/VKT for 85% control for proposed best practice.

The data from the water demand calculations was used by WRM Water & Environment Pty Ltd to determine the water required in each year in the Project life to achieve the nominal control level on average, and on days of peak demand/ peak daily evaporation. These peak demand days are characterised by hot dry winds that remove surface moisture rapidly. The results are shown in **Table 7-5**.

Table 7-5: Estimated haul road dust suppression peak and average water requirements

Mining Stage	Dust Suppression Area (ha)***	At 75% Control Application Rate		At 85% Control Application Rate	
		Maximum Daily Dust Suppression (kL/d)*	Yearly Average Dust Suppression (ML/a)**	Maximum Daily Dust Suppression (kL/d)*	Yearly Average Dust Suppression (ML/a)**
Existing	53.0	1,002	310	-	-
Y1	37.6	711	220	1,181	365
Y4	43.4	818	253	1,359	420
Y8	40.4	761	235	1,264	391
Y15	47.4	896	277	1,488	460
Y24	44.7	845	261	1,403	434

* For a non-rainfall (0mm) day.
** Based on long-term average including rainfall days.
*** Based on a 25m watered road width.

The results in the table show that a 48% increase in the current haul road water consumption rate would be required. The table also shows that the proposed mine would have a smaller haul road surface area than the current mine, which is a best practice design feature that inherently reduces dust emissions. Best practice dust controls are detailed further in **Section 11.2.**

8 DISPERSION MODELLING APPROACH

8.1 Introduction

The following sections are included to provide the reader with an understanding of the model and modelling approach combined with the dust emission estimates for each of the assessed scenarios.

Those familiar with the approach used in historical assessments for Hunter Valley coal mines in NSW will notice that a similar approach has been followed in this assessment however the CALPUFF modelling suite is applied to dispersion modelling rather than ISCMOD. The CALPUFF model is an advanced "puff" model that can deal with the effects of complex local terrain on the dispersion meteorology over the entire modelling domain in a three-dimensional (3D), hourly varying time step. CALPUFF is an air dispersion model approved by OEH for use in air quality impact assessments.

8.2 Modelling methodology

Modelling was undertaken using a combination of the CALPUFF Modelling System and TAPM. The CALPUFF Modelling System includes three main components: CALMET, CALPUFF and CALPOST and a large set of pre-processing programs designed to interface the model to standard, routinely available meteorological and geophysical datasets.

CALMET is a meteorological model that uses the geophysical information and observed/simulated surface and upper air data as inputs and develops wind and temperature fields on a three-dimensional gridded modelling domain.

CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion processes along the way. It typically uses the three dimensional meteorological field generated by CALMET.

CALPOST is a post processor used to process the output of the CALPUFF model and produce tabulations that summarise the results of the simulation.

TAPM is a prognostic air model used to simulate the upper air data for CALMET input. The meteorological component of TAPM is an incompressible, non-hydrostatic, primitive equation model with a terrain-following vertical coordinate for three-dimensional simulations. The model predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analysis.

8.2.1 Meteorological modelling

The TAPM model was applied to the available data to generate a three dimensional upper air data file for use in CALMET. The centre of analysis for the TAPM modelling used is 32deg15.5min south and 150deg47.5min east. The simulation involved four nesting grids of 30km, 10km, 3km and 1km with 35 vertical grid levels.

CALMET modelling used a nested approach where the 3D wind field from the coarser grid outer domain is used as the initial guess (or starting) field for the finer grid inner domain. This approach has several advantages over modelling a single domain. Observed surface wind field data from the near field as well as from far field monitoring sites can be included in the model to generate a more representative 3D wind field for the modelled area. Off domain terrain features for the finer grid domain can be allowed to take effect within the finer domain, as would occur in reality, also the coarse scale wind flow fields give a better set of starting conditions with which to operate the finer grid run.

The coarser grid domain was run on a 150 x 150km area with a 3km grid resolution. The available meteorological data for the 2010 calendar year from ten surrounding meteorological monitoring sites were included in this run.

Figure 8-1 presents the location of each of these sites and **Table 8-1** outlines the parameters used from each station. 3D upper air data were sourced from TAPM output. The finer grid domain was run on a 30 x 30km grid with a 0.3km grid resolution for each modelled year. Local land use and detailed topographical information including proposed mine topography for each modelled year was included to produce realistic fine scale flow fields (such as terrain forced flows) in surrounding areas, as shown in **Figure 8-2**. Further detail regarding the CALMET input variables are presented in **Appendix D**.

Table 8-1: Surface observations station parameters

Weather station	Parameters
Bengalla Weather Station	Wind speed, wind direction, temperature.
Bengalla Inversion Tower	Wind speed, wind direction, temperature.
Mt Arthur Coal Weather Station	Wind speed, wind direction, temperature, humidity.
Paterson (Tocal) Automatic Weather Station (BoM) (Station No. 061250)	Wind speed, wind direction, temperature, humidity.
Scone Airport Automatic Weather Station (BoM) (Station No. 061363)	Wind speed, wind direction, temperature, humidity, sea level pressure.
Cessnock Airport Automatic Weather Station (BoM) (Station No. 061260)	Wind speed, wind direction, temperature, humidity, sea level pressure.
Williamtown RAAF (BoM) (Station No. 061078)	Wind speed, wind direction, temperature, humidity, sea level pressure, cloud height, cloud amount.
Nullo Mountain Automatic Weather Station (BoM) (Station No. 062100)	Wind speed, wind direction, temperature, humidity.
Merriwa (Roscommon) Weather Station (BoM) (Station No, 061287)	Wind speed, wind direction, temperature, humidity, sea level pressure, cloud height, cloud amount.
Murrurundi Gap Automatic Weather Station (BoM) (Station No. 061392)	Wind speed, wind direction, temperature, humidity, sea level pressure, cloud height, cloud amount.

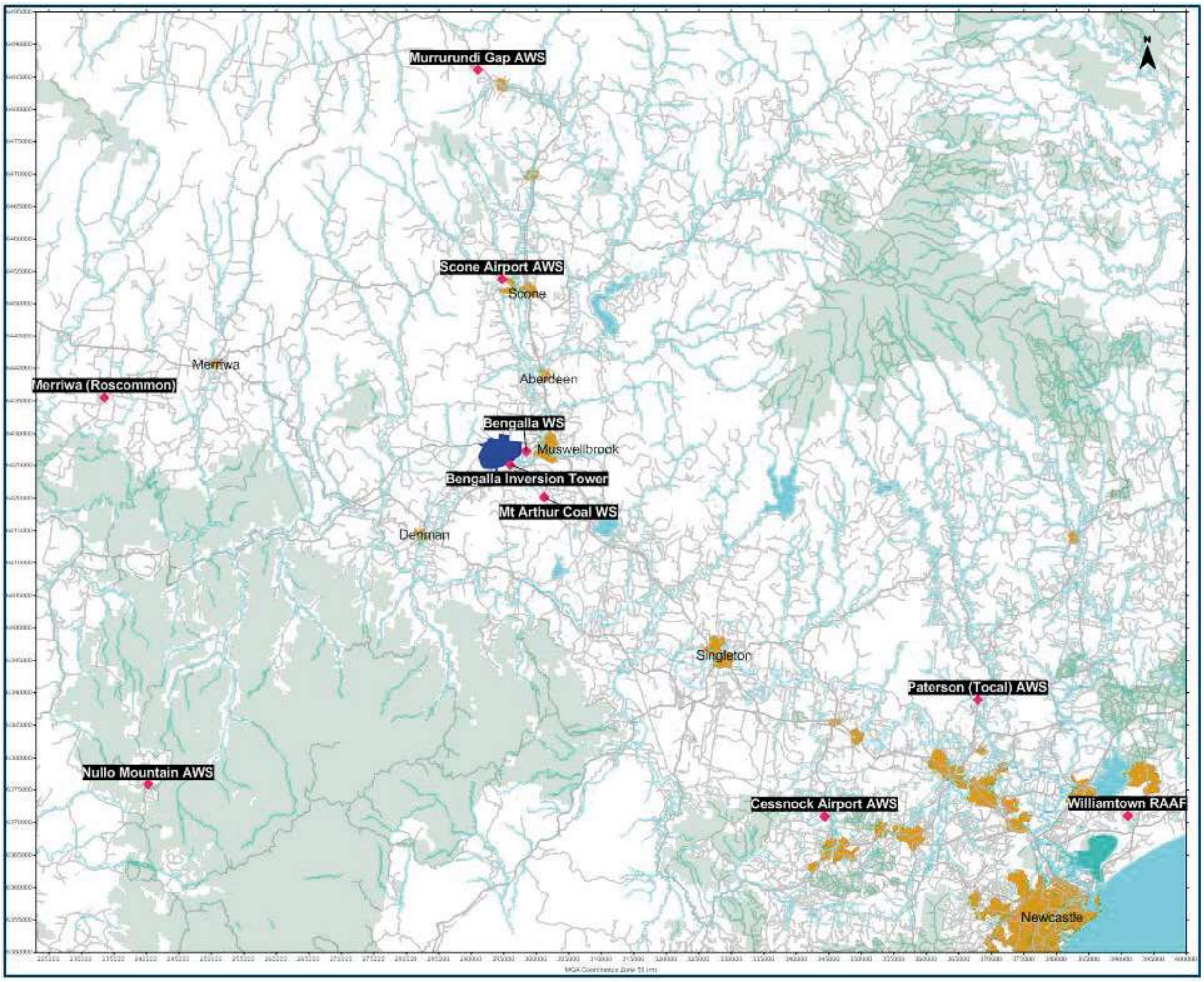

Figure 8-1: Surface observation station locations

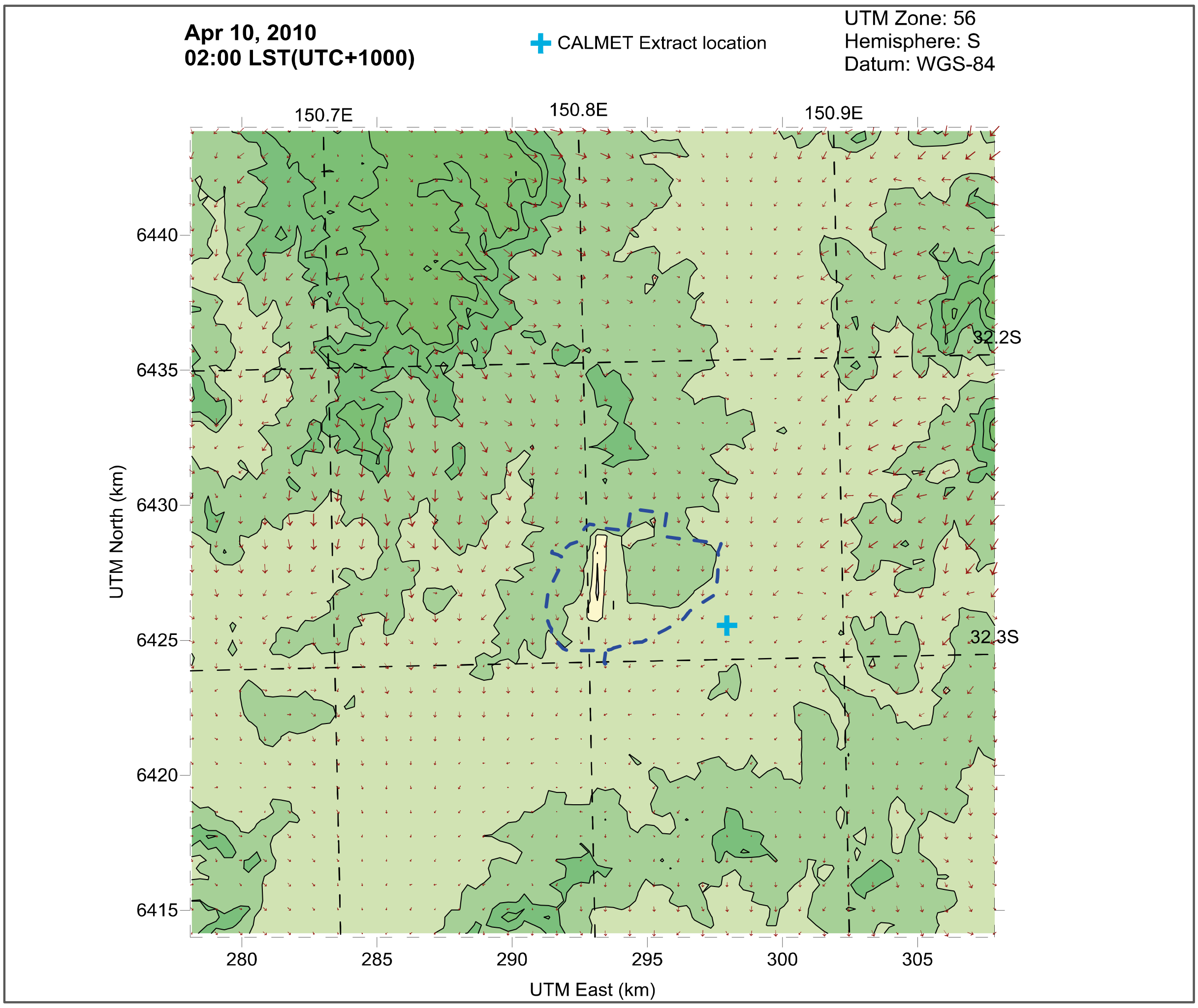

Figure 8-2: Representative snapshot of wind field for the Project

CALMET generated meteorological data were extracted from a point within the CALMET domain (see **Figure 8-2**) and are graphically represented in **Figure 8-3** and **Figure 8-4**.

Figure 8-3 presents the annual and seasonal windroses from the CALMET data. On an annual basis, winds from the southeast are most frequent with a lesser proportion of winds from the east-southeast and northeast. During summer, winds from the southeast and east-southeast are predominant. The autumn and spring seasons have a relatively similar wind distribution to the annual windrose. In winter, west and northeast winds dominate the wind distribution. Overall the windroses reflect the typical wind distributions patterns that would be expected in the area.

Figure 8-4 includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and show sensible trends considered to be representative of the area.

Figure 8-3: Windroses from CALMET extract (Cell Ref 6739)

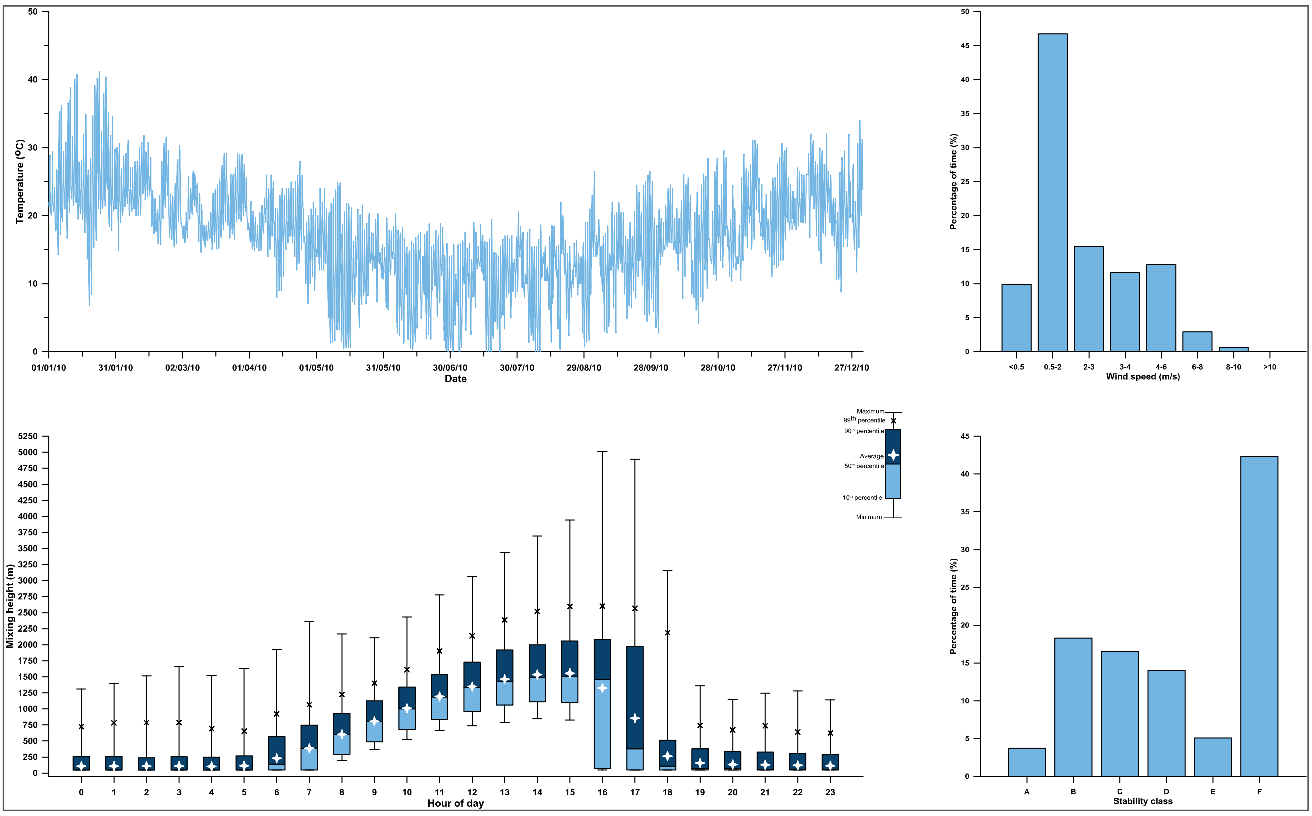

Figure 8-4: Meteorological analysis of CALMET extract (Cell Ref 6739)

8.2.2 Dispersion modelling

CALPUFF modelling is based on the application of three particle size categories Fine Particulates (FP), Coarse Matter (CM) and Rest (RE). The estimated emissions are presented in **Section 7.1**. The distribution of particles for each particle size category was derived from measurements in the **SPCC (1986)** study and is presented in **Table 8-2**.

Emissions from each activity in **Table 7-1** were represented by a series of volume sources and were included in the CALPUFF model via an hourly varying emission file. Meteorological conditions associated with dust generation (such as wind speed) and levels of dust generating activity were considered in calculating the hourly varying emission rate for each source. It should be noted that as a conservative measure, the effect of the precipitation rate (rainfall) in reducing dust emissions has not been considered in this assessment. Further detail regarding the CALPUFF input variables are presented in **Appendix D**.

Table 8-2: Distribution of particles

Particle category	Size range	Distribution
Fine particulates (FP)	0 to 2.5 µm	4.68% of TSP
Coarse matter (CM)	2.5 to 10 µm	34.4% of TSP
Rest (RE)	10 to 30 µm	60.92% of TSP

Each particle-size category is modelled separately and later combined to predict short-term and long-term average concentrations for $PM_{2.5}$, PM_{10}, and TSP. Dust deposition was predicted using the proven dry deposition algorithm within the CALPUFF model. Particle deposition is expressed in terms of atmospheric resistance through the surface layer, deposition layer resistance and gravitational settling (**Slinn and Slinn, 1980** and **Pleim et al., 1984**). Gravitational settling is a function of the particle size and density, simulated for spheres by the Stokes equation (**Gregory, 1973**).

CALPUFF is capable of tracking the mass balance of particles emitted into the modelling domain. For each hour CALPUFF tracks the mass emitted, the amount deposited, the amounts remaining in the surface mixed layer or the air above the mixed layer and the amount advected out of the modelling domain. The versatility to address both dispersion and deposition algorithms in CALPUFF, combined with the three-dimensional meteorological and land use field generally result in a more accurate model prediction compared to other Gaussian plume models (**Pfender et al 2006**).

9 ACCOUNTING FOR BACKGROUND DUST LEVELS

All significant dust generating mining operations surrounding the Project were included in the model, including Mt Arthur Coal Mine, Drayton Coal Mine, Mangoola Coal Mine, Muswellbrook Coal Company Coal Mine and the Mount Pleasant Project. These mining operations are the nearest significant operations and would have a significant contribution to air quality near the Project.

Other mining operations in the Hunter Valley would also have a small contribution to existing levels and an allowance for this contribution as well as contributions from other non-modelled dust sources is included in the assessment.

The contribution of other non-modelled dust sources to the prevailing background dust levels was estimated by modelling the existing mining activities during the 2010 calendar and comparing model predictions with the measured values from the monitoring stations near the Project. The difference between the measured and predicted PM_{10} and TSP concentrations is considered to be the contribution from other non-modelled dust sources, and is added to the future predicted values to fully account for the background dust levels (not already in the model).

This approach is preferable to modelling the mine alone and adding a single constant background level at all points across the modelling domain to estimate cumulative impacts. This is because the approach includes modelling of other major sources (i.e. mines) that more reliably represent the higher ambient dust levels near such sources, and also accounts for the seasonal and time varying changes in the background levels that arise from these major dust sources. Also, to account for any underestimation from not including every source (as it's not possible to do that reasonably), the relatively smaller contribution arising from other non-modelled dust sources, as determined above, is added to the results to obtain the most accurate predictions of future cumulative impacts across the modelled domain.

The estimated annual average contribution from other non-modelled dust sources for the area surrounding the Project was established to be:

- PM_{10} - 5.0µg/m^3;
- TSP - 28.0µg/m^3; and,
- Deposited dust - 1.7g/m^2/month.

It is important that the above values are not confused with measured background levels, or background levels (excluding the Project). The values above are not background levels in that sense, but are the residual portion of the background dust level that is not already included in the modelling.

To account for background levels when assessing total (cumulative) 24-hour average PM_{10} impacts, the mine only incremental levels are added to the total measured ambient dust levels (per the OEH contemporaneous assessment guidance). Further details regarding the total cumulative 24-hour average PM_{10} impacts are provided in **Section 10.7**.

Predicted incremental and total (cumulative) concentration and dust deposition levels for short and long term averaging periods are presented in tabular format as well as in contour plots in the following section of this report.

10 DISPERSION MODELLING RESULTS

The dispersion model predictions for each of the assessed years are presented in this section. The results show the estimated maximum 24-hour average $PM_{2.5}$ concentrations, annual average $PM_{2.5}$ concentrations, maximum 24-hour average PM_{10} concentrations, annual average PM_{10} concentrations, annual average TSP concentrations and annual average dust (insoluble solids) deposition (DD) rates for the Project operating in isolation (the incremental impact), with other sources including other nearby mining projects (the total (cumulative) impact.

It is important to note that when assessing impacts for a maximum 24-hour average concentration; the results shown in the figures present the highest predicted 24-hour average concentrations that occur at each point within the modelling domain for the one year modelling period. The maximum impact at a point will generally occur on a different day to other points, and thus the figures do not represent a single calendar day, and show the maximum 24-hour average impact at each of the many points in the domain over a full year.

When trying to assess the total (cumulative) 24-hour average impacts based on model predictions, challenges arise as the predicted impacts are often overestimated by the model's limitations in considering spatial and temporal variability in reality. Furthermore the difficulties associated with identification and quantification of emissions from non-modelled sources over any 24-hour period result in greater overestimations occurring. Due to these factors, the predicted total (cumulative) impacts for maximum 24-hour average PM_{10} concentrations are calculated differently to annual average impacts and have been addressed specifically in **Section 10.7**.

Each of the sensitive receptors shown in **Figure 4-1** and detailed in **Appendix A** were assessed individually as discrete receptors with the predicted results presented in tabular form for each of the assessed years.

Associated isopleth diagrams of the dispersion modelling results are presented in **Appendix E.**

For sources not explicitly included in the model, and to fully account for all cumulative dust levels, the unaccounted fractions of background dust levels (which arise from the other non-modelled sources), were added to the model predictions as described in **Section 9** with the results presented in the following sections for each of the assessed years.

10.1 Year 1

Table 10-1 presents the model predictions at each of the privately-owned receptors, the values presented in bold indicate predicted values above the relevant criteria. The receptors highlighted in grey have rights to acquisition upon request under other mining companies' development consents. **Table 10-2** presents the model predictions at each of the mine-owned receptors.

Figure E-1 to **Figure E-9** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 1.

Table 10-1: Modelling predictions for Year 1 (privately-owned receptors)

Receptor ID	Incremental Impact						Total Impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air Quality Impact Criteria						
	25*	8*	50	-	-	2	30	90	4
2	4	0	24	1	2	0.05	8	33	1.8
3	3	0	24	1	2	0.06	8	33	1.8
7	2	0	16	1	2	0.09	8	33	1.9
8	2	0	15	1	2	0.11	8	33	1.9
12	3	0	18	1	2	0.09	8	33	1.9
17	3	0	24	1	2	0.07	8	33	1.8
19	4	0	26	2	2	0.08	8	34	1.8
22	4	0	29	2	3	0.08	9	34	1.8
23	4	0	30	2	3	0.09	9	34	1.8
24	4	0	30	2	3	0.09	9	34	1.8
25	4	0	28	2	3	0.10	9	34	1.9
27W	5	0	34	3	5	0.16	10	36	1.9
27E	4	0	30	2	4	0.17	9	35	1.9
29	6	1	49	5	8	0.42	13	41	2.2
30	4	0	35	2	4	0.35	10	35	2.1
31	5	0	36	3	4	0.36	10	36	2.1
33	5	0	37	3	5	0.36	10	36	2.1
39	5	1	35	4	6	0.38	11	39	2.2
40	5	1	37	4	7	0.40	12	40	2.2
41	5	1	36	5	8	0.43	13	41	2.2
42	5	1	38	5	9	0.44	13	41	2.2
43	5	1	41	6	10	0.48	14	43	2.3
44	5	1	42	6	10	0.49	14	43	2.3
45	4	1	32	8	13	0.56	17	48	2.4
46	4	1	31	7	12	0.52	16	46	2.4
47	4	1	35	5	9	0.44	13	42	2.2
48	4	1	35	5	9	0.44	13	41	2.2
49	4	1	34	5	8	0.43	13	41	2.2
50	4	1	34	5	9	0.44	13	42	2.2
51	4	1	33	5	9	0.44	13	42	2.2
52	4	1	31	5	9	0.43	13	42	2.2
53	4	1	30	5	9	0.43	13	42	2.2
54	4	1	33	5	8	0.42	13	41	2.2
55	4	1	32	5	8	0.43	13	41	2.2
57	4	1	30	5	8	0.43	13	41	2.2
58	4	1	30	5	8	0.43	13	41	2.2
59	4	1	29	5	8	0.43	13	41	2.2
60	4	1	28	5	8	0.43	13	42	2.2
61	3	1	22	4	7	0.38	12	40	2.2
62	3	1	23	4	7	0.37	12	40	2.2
63	3	1	24	5	8	0.37	13	41	2.2
64	4	1	28	6	9	0.36	15	44	2.2
66	4	1	31	6	9	0.32	16	45	2.2

Receptor ID	Incremental Impact						Total Impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air Quality Impact Criteria						
	25*	8*	50	-	-	2	30	90	4
81	3	1	22	4	6	0.33	12	39	2.1
83	3	1	23	4	7	0.33	12	40	2.2
84	3	1	22	4	6	0.32	12	39	2.1
85	3	1	23	4	7	0.33	12	40	2.1
87N	3	1	26	4	7	0.28	14	43	2.2
87S	3	1	26	4	7	0.27	14	43	2.2
88W	1	0	4	0	1	0.01	10	35	1.8
88N	1	0	4	0	1	0.01	10	35	1.8
88S	1	0	4	0	1	0.01	10	35	1.8
90	1	0	4	0	1	0.01	11	37	1.9
92	1	0	5	1	1	0.01	11	38	1.9
93	1	0	4	1	1	0.01	11	38	1.9
96	1	0	3	0	0	0.00	11	38	1.9
97	0	0	3	0	0	0.00	13	40	1.9
98	1	0	5	1	1	0.01	12	38	1.9
102	1	0	6	1	1	0.01	13	41	2.0
103	1	0	7	1	1	0.01	14	42	2.0
105	1	0	7	1	1	0.01	14	42	2.0
106	1	0	9	1	2	0.02	16	45	2.1
107	1	0	7	1	1	0.01	14	42	2.0
108	1	0	8	1	1	0.01	15	44	2.1
110S	1	0	9	1	2	0.02	16	46	2.1
110N	2	0	10	1	2	0.02	18	49	2.2
112N	2	0	14	2	3	0.02	23	57	2.4
112S	2	0	11	1	2	0.02	18	48	2.2
113	2	0	12	2	2	0.02	19	51	2.3
114	2	0	15	2	3	0.03	21	54	2.3
117	2	0	17	2	3	0.03	23	57	2.4
118	4	0	27	3	5	0.04	**32**	72	2.7
119	3	0	20	3	4	0.04	28	65	2.6
120	2	0	14	2	3	0.02	23	58	2.4
126N	1	0	7	1	1	0.01	17	47	2.2
126W	1	0	7	1	1	0.01	16	46	2.1
126S	1	0	7	1	1	0.01	16	45	2.1
130	1	0	6	1	1	0.01	15	43	2.1
133N	1	0	6	1	1	0.01	15	43	2.1
133W	1	0	5	1	1	0.01	14	43	2.1
133S	1	0	6	1	1	0.01	14	43	2.1
145	1	0	7	1	1	0.01	17	47	2.2
146	1	0	7	1	1	0.01	17	48	2.2
149S	1	0	8	1	2	0.02	19	50	2.3
149W	1	0	8	1	2	0.02	18	50	2.4
149N	1	0	8	1	2	0.02	18	50	2.4
152	2	0	15	3	4	0.04	21	54	2.4

Receptor ID	Incremental Impact						Total Impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air Quality Impact Criteria						
	25*	8*	50	-	-	2	30	90	4
153	2	0	13	2	3	0.03	21	55	2.5
154	2	0	15	3	4	0.04	22	55	2.4
155	3	0	18	3	5	0.05	22	56	2.4
156S	3	0	18	3	5	0.06	21	54	2.4
156E	3	0	16	3	4	0.05	20	53	2.4
156W	2	0	13	2	4	0.05	19	50	2.4
158	3	1	20	4	6	0.11	18	49	2.3
161	2	0	14	3	4	0.08	17	47	2.3
166	3	1	24	5	8	0.22	16	46	2.3
168	5	1	37	10	17	0.54	19	52	2.4
169	3	1	24	6	9	0.30	16	46	2.3
171	3	1	27	6	10	0.36	15	45	2.3
180	2	0	13	2	4	0.10	13	41	2.1
184(1)	1	0	12	2	3	0.07	14	42	2.2
186N	1	0	11	2	3	0.05	14	43	2.2
186S	1	0	10	2	2	0.04	15	44	2.2
189	2	0	9	1	2	0.04	14	42	2.1
192	1	0	8	1	2	0.03	15	45	2.3
194	1	0	7	1	2	0.03	12	40	2.0
195	1	0	7	1	1	0.03	12	39	2.0
198	1	0	7	1	2	0.04	11	38	2.0
199	1	0	7	1	2	0.05	11	37	2.0
200	1	0	7	1	2	0.04	11	37	2.0
201	1	0	8	1	2	0.04	10	36	1.9
203	1	0	8	1	2	0.05	11	37	2.0
209S	1	0	9	1	2	0.06	10	36	1.9
209E	1	0	9	1	2	0.06	10	36	1.9
209W	1	0	9	1	2	0.06	10	35	1.9
209N	1	0	9	1	2	0.07	9	35	1.9
222	2	0	17	2	4	0.11	9	34	1.9
230	3	0	22	2	4	0.11	9	34	1.9
252	1	0	9	1	1	0.01	6	30	1.9
286	2	0	16	1	2	0.06	8	32	1.7
287	2	0	14	2	2	0.07	8	32	1.8
288	2	0	16	2	3	0.09	8	33	1.8
289N	2	0	10	1	1	0.01	7	31	1.8
289S	2	0	10	1	1	0.01	7	31	1.8
292W	2	0	12	1	1	0.01	7	31	1.8
292E	2	0	11	1	1	0.01	7	31	1.8

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**) (1) Estimated

Table 10-2: Modelling predictions for Year 1 (mine-owned receptors)

Receptor ID	Incremental Impact						Total Impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air Quality Impact Criteria						
	25*	8*	50	-	-	2	30	90	4
M1	4	1	31	6	11	0.41	14	43	2.2
M2	9	2	**66**	17	29	0.77	25	62	2.6
M3	**28**	5	**217**	39	66	1.24	**46**	**98**	3.0
M4	17	2	**130**	16	25	0.31	23	56	2.1
M5	**25**	4	**189**	27	42	0.55	**34**	74	2.3
M6	**59**	**8**	**466**	64	108	1.41	**71**	**140**	3.2
M7	24	2	**186**	17	27	0.52	24	58	2.3
M8	4	0	26	1	2	0.02	7	31	1.7
M9	3	0	24	1	2	0.02	7	31	1.7
M10	7	0	**52**	2	4	0.05	9	33	1.8
M11	5	0	34	2	2	0.04	8	32	1.8
M12	15	1	**116**	10	16	0.39	17	47	2.1
M13	9	1	**70**	4	6	0.12	10	36	1.9
M14	10	1	**74**	4	7	0.14	11	37	1.9
M15	7	1	**55**	4	7	0.19	11	37	1.9
M16	8	1	**65**	5	7	0.24	11	38	2.0
M17	7	1	**59**	5	7	0.35	12	38	2.1
M18	7	1	**55**	5	8	0.40	12	40	2.2
M94	3	1	20	4	6	0.11	18	49	2.3
M19	20	2	**152**	13	21	0.43	20	52	2.2
M20	17	1	**126**	11	17	0.41	18	49	2.2
M21	14	1	**108**	9	13	0.30	16	44	2.1
M22	12	1	**92**	8	12	0.30	15	43	2.1
M23	10	1	**76**	6	10	0.25	13	41	2.0
M24	12	1	**99**	8	13	0.40	15	44	2.2
M25	9	1	**73**	6	9	0.29	12	40	2.0
M26	10	1	**81**	6	9	0.31	13	40	2.1
M27	5	0	35	3	5	0.15	9	35	1.9
M28	8	1	**62**	4	7	0.23	11	38	2.0
M29	8	1	**68**	5	7	0.25	11	38	2.0
M30	6	0	48	3	5	0.26	9	35	2.0
M31	4	0	31	2	3	0.24	8	33	2.0
M32	4	0	34	2	3	0.26	8	33	2.0
M33	9	1	**72**	10	17	0.76	18	49	2.5
M34	7	1	**55**	7	11	0.55	15	43	2.3
M35	7	1	**53**	6	10	0.47	13	41	2.2
M36	8	2	**60**	13	21	1.00	21	55	2.8
M37	6	1	44	6	11	0.51	14	43	2.3
M38	5	1	43	7	11	0.53	15	44	2.3
M39	6	1	44	7	12	0.55	15	44	2.3
M40	5	1	43	7	12	0.55	15	45	2.3
M41	5	1	42	7	12	0.57	16	45	2.4
M42	5	1	41	8	13	0.57	16	46	2.4

Receptor ID	Incremental Impact						Total Impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air Quality Impact Criteria						
	25*	8*	50	-	-	2	30	90	4
M43	6	1	44	8	14	0.62	17	47	2.4
M44	5	1	41	8	13	0.59	16	47	2.4
M45	5	1	38	8	13	0.59	17	47	2.4
M46	11	2	**85**	19	31	1.35	28	66	3.2
M47	**41**	7	**317**	52	82	0.87	**77**	**143**	3.5
M48	15	2	**109**	17	25	0.22	**46**	**94**	3.0
M49	18	4	**136**	27	43	0.46	**64**	**126**	3.7
M50	6	1	42	5	7	0.07	**40**	86	3.1
M51	4	1	33	4	6	0.06	**36**	80	3.0
M52	4	1	28	4	6	0.05	**33**	74	2.8
M53	3	1	20	4	5	0.06	24	58	2.5
M54	4	1	23	4	7	0.11	19	51	2.3
M55	3	1	22	5	8	0.16	18	49	2.3
M56	4	1	34	7	12	0.32	18	50	2.3
M57	6	2	46	13	22	0.65	22	57	2.5
M94	3	1	20	4	6	0.11	18	49	2.3
M58	4	1	35	8	13	0.58	17	47	2.4
M59	4	1	32	8	13	0.56	17	47	2.4
M60	4	1	32	8	13	0.56	17	47	2.4
M61	4	1	31	6	9	0.31	16	46	2.2
M62	4	1	31	6	9	0.31	16	46	2.2
M63	4	1	32	6	10	0.32	16	47	2.2
M64	4	1	32	6	10	0.32	17	47	2.2
M65	4	1	34	7	11	0.36	18	50	2.3
M66	4	1	35	7	12	0.37	19	51	2.3
M67	5	1	37	8	13	0.37	21	54	2.4
M68	5	1	40	9	15	0.40	21	55	2.4
M69	6	1	46	10	16	0.38	23	57	2.4
M70	7	1	**54**	11	18	0.35	26	63	2.5
M71	10	2	**81**	16	27	0.45	**35**	77	2.8
M72	15	3	**120**	19	32	0.44	**45**	**95**	3.3
M73	16	3	**122**	20	34	0.44	**47**	**99**	3.4
M74	14	3	**111**	19	31	0.41	**52**	**107**	3.7
M75	13	2	**99**	19	31	0.39	**56**	**115**	3.9
M76	12	2	**93**	13	22	0.29	**62**	**125**	**4.5**
M77	7	2	**55**	12	19	0.22	**77**	**153**	**4.9**
M78	6	1	47	10	16	0.18	**74**	**148**	**4.8**
M79	6	1	43	9	14	0.15	**75**	**149**	**4.9**
M80	5	1	38	8	13	0.14	**70**	**140**	**4.8**
M81	5	1	37	7	11	0.12	**73**	**146**	**5.0**
M82	4	1	32	5	8	0.08	**49**	**103**	3.6
M83	5	1	35	4	7	0.06	**40**	86	3.1
M84	2	0	15	2	3	0.03	23	56	2.4
M85	1	0	10	1	2	0.02	17	47	2.2

Receptor ID	Incremental Impact						Total Impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air Quality Impact Criteria						
	25*	8*	50	-	-	2	30	90	4
M86	2	0	11	2	2	0.02	18	48	2.2
M87	2	0	12	2	2	0.02	19	50	2.2
M88	2	0	15	2	3	0.03	21	54	2.3
M89	3	0	19	2	3	0.03	25	61	2.5
M90	2	0	11	2	2	0.02	19	51	2.3
M91	1	0	9	1	2	0.01	17	46	2.1
M92	2	0	13	2	3	0.03	23	57	2.5
M93	2	0	10	2	2	0.02	21	54	2.5
M95	1	0	6	1	1	0.02	16	45	2.3
M96	1	0	7	1	2	0.02	16	46	2.3

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**)

10.1.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-1 and **Figure E-2** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 1 due to emissions from the Project. The results in **Table 10-1** indicate that all privately owned receptors are predicted to experience a maximum 24-hour average and annual average concentrations below the advisory reporting standards of 24µg/m³ and 8µg/m³, respectively in Year 1.

The results in **Table 10-2** indicate that four mine-owned receptors; Receptors M3, M5, M6 and M47, are predicted to experience levels above the maximum 24-hour average $PM_{2.5}$ advisory standard in Year 1. Receptor M6 is also predicted to experience levels above the annual average $PM_{2.5}$ advisory standard in Year 1.

10.1.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-3 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 1 due to emissions from the Project. The results in **Table 10-1** indicate that all privately owned receptors are predicted to experience maximum 24-hour average PM_{10} concentrations below the relevant criterion of 50µg/m³ in Year 1.

Results for the total (cumulative) impact for maximum 24-hour average PM_{10} concentrations are discussed in **Section 10.7**.

The results in **Table 10-2** indicate that the following mine-owned receptors; Receptors M2, M3, M4, M5, M6, M7, M10, M12, M13, M14, M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M28, M29, M33, M34, M35, M36, M46, M47, M48, M49, M70, M71, M72, M73, M74, M75, M76 and M77, are predicted to experience maximum 24-hour average PM_{10} concentrations above 50µg/m³ in Year 1.

10.1.3 Predicted annual average PM_{10} concentrations

Figure E-4 shows the predicted annual average PM_{10} concentrations for Year 1 due to emissions from the Project. **Figure E-5** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-1** indicate that one privately owned receptor; Receptor 118, is predicted to experience total annual average PM_{10} concentration above the relevant criterion of 30µg/m^3 in Year 1.

The results in **Table 10-2** indicate that the following mine-owned receptors; Receptors M3, M5, M6, M47, M48, M49, M50, M51, M52, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82 and M83, are predicted to experience annual average PM_{10} concentrations above 30µg/m^3 in Year 1.

10.1.4 Predicted annual average TSP concentrations

Figure E-6 shows the predicted annual average TSP concentrations for Year 1 due to emissions from the Project. **Figure E-7** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-1** indicate that all privately owned receptors are predicted to experience annual average TSP concentrations below the relevant criterion of 90µg/m^3 in Year 1.

The results in **Table 10-2** indicate that the following mine-owned receptors; Receptors M3, M6, M47, M48, M49, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81 and M82, are predicted to experience annual average TSP concentrations above 90µg/m^3 in Year 1.

10.1.5 Predicted annual average dust deposition levels

Figure E-8 shows the predicted annual average dust deposition levels for Year 1 due to emissions from the Project. **Figure E-7** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-1** indicate that all privately owned receptors are predicted to experience an incremental annual average dust deposition level below the relevant criterion of 2g/m^2/month in Year 1.

All privately owned receptors are also predicted to experience a total annual average deposition level below the relevant criterion of 4g/m^2/month due to emissions from the Project and other sources.

The results in **Table 10-2** indicate that all mine-owned receptors are predicted to experience incremental annual average dust deposition levels below the relevant criterion of 2g/m^2/month in Year 1. The following mine-owned receptors; Receptors M76, M77, M78, M79, M80 and M81, are predicted to experience total annual average deposition levels above the relevant criterion of 4g/m^2/month in Year 1.

10.2 Year 4

Table 10-3 presents the model predictions at each of the privately-owned receptors, the values presented in bold indicate predicted values above the relevant criteria. The receptors highlighted in grey have rights to acquisition upon request under other mining companies' development consents. **Table 10-4** presents the model predictions at each of the mine-owned receptors.

Figure E-10 to **Figure E-18** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 4.

Table 10-3: Modelling predictions for Year 4 (privately-owned receptors)

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
2	3	0	22	1	2	0.06	15	44	2.2
3	3	0	22	1	2	0.06	14	44	2.2
7	3	0	17	1	2	0.10	11	37	2.1
8	2	0	16	1	2	0.11	10	37	2.1
12	3	0	18	1	2	0.09	11	38	2.1
17	3	0	23	2	3	0.08	14	43	2.2
19	4	0	25	2	3	0.09	15	45	2.2
22	4	0	27	2	3	0.10	16	48	2.2
23	4	0	29	2	3	0.10	17	49	2.2
24	4	0	29	2	3	0.10	17	49	2.2
25	4	0	28	2	4	0.12	16	47	2.2
27W	5	0	40	3	5	0.18	18	51	2.3
27E	4	0	36	3	4	0.19	15	45	2.2
29	7	1	**53**	5	9	0.45	17	48	2.4
30	5	0	40	3	5	0.38	12	40	2.3
31	5	0	41	3	5	0.39	12	40	2.3
33	5	0	42	3	5	0.39	13	41	2.3
39	5	1	38	4	7	0.42	14	44	2.3
40	5	1	40	5	8	0.44	15	46	2.3
41	5	1	38	5	9	0.46	16	47	2.4
42	5	1	39	6	9	0.47	16	48	2.4
43	5	1	41	6	10	0.51	18	50	2.4
44	5	1	42	6	11	0.52	18	50	2.4
45	5	1	38	8	14	0.60	20	53	2.5
46	5	1	35	8	13	0.56	19	52	2.5
47	5	1	37	6	9	0.47	17	48	2.4
48	5	1	37	6	9	0.47	16	47	2.4
49	5	1	36	5	9	0.46	16	47	2.4
50	5	1	36	6	9	0.47	16	48	2.4
51	4	1	35	6	9	0.47	16	47	2.4
52	4	1	34	6	9	0.47	16	47	2.4

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
53	4	1	33	6	9	0.47	16	47	2.4
54	4	1	35	5	9	0.46	16	47	2.4
55	4	1	34	5	9	0.46	16	47	2.4
57	4	1	33	5	9	0.46	16	47	2.4
58	4	1	32	5	9	0.46	16	47	2.4
59	4	1	32	5	9	0.46	16	47	2.4
60	4	1	31	5	9	0.46	16	47	2.4
61	4	1	26	5	8	0.41	15	44	2.3
62	4	1	26	5	8	0.41	15	44	2.3
63	4	1	28	5	8	0.41	15	45	2.3
64	4	1	33	6	11	0.41	17	48	2.3
66	5	1	38	6	11	0.38	18	49	2.3
81	4	1	25	4	7	0.37	14	43	2.2
83	4	1	26	4	7	0.37	14	43	2.3
84	4	1	26	4	7	0.36	14	43	2.2
85	4	1	27	4	7	0.37	14	43	2.2
87N	4	1	30	5	8	0.33	16	46	2.2
87S	4	1	30	5	9	0.32	16	46	2.2
88W	1	0	5	1	1	0.01	10	36	1.9
88N	1	0	5	1	1	0.01	10	36	1.9
88S	1	0	5	1	1	0.01	10	36	1.9
90	1	0	6	1	1	0.01	12	38	1.9
92	1	0	7	1	1	0.01	12	39	1.9
93	1	0	6	1	1	0.01	12	39	1.9
96	1	0	4	0	1	0.01	11	38	1.9
97	1	0	4	0	1	0.01	12	40	1.9
98	1	0	7	1	1	0.01	12	39	2.0
102	1	0	8	1	1	0.01	14	42	2.0
103	1	0	9	1	2	0.02	15	44	2.1
105	2	0	10	1	2	0.02	15	44	2.1
106	2	0	12	2	2	0.02	18	48	2.2
107	2	0	10	1	2	0.02	16	44	2.1
108	2	0	11	1	2	0.02	17	47	2.2
110S	2	0	13	2	2	0.02	19	49	2.2
110N	2	0	14	2	3	0.02	21	54	2.3
112N	3	0	20	3	4	0.03	27	64	2.6
112S	2	0	16	2	3	0.03	20	53	2.3
113	2	0	18	2	3	0.03	22	56	2.4
114	3	0	21	3	4	0.03	25	60	2.5
117	3	0	22	3	4	0.04	27	63	2.6
118	5	1	37	4	6	0.06	**39**	84	3.1
119	4	1	28	4	6	0.06	**34**	75	3.0

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
120	3	0	19	2	4	0.03	27	64	2.6
126N	2	0	10	1	2	0.02	19	51	2.3
126W	1	0	9	1	2	0.02	18	49	2.2
126S	1	0	9	1	2	0.02	17	48	2.2
130	1	0	9	1	2	0.01	16	46	2.1
133N	1	0	8	1	1	0.01	16	46	2.2
133W	1	0	7	1	1	0.01	16	45	2.1
133S	1	0	7	1	1	0.01	16	45	2.1
145	1	0	9	1	2	0.02	19	50	2.3
146	1	0	10	1	2	0.02	19	51	2.3
149S	2	0	11	2	2	0.02	21	53	2.5
149W	2	0	10	2	2	0.02	20	53	2.5
149N	2	0	10	2	2	0.02	20	53	2.5
152	3	0	19	4	5	0.06	23	56	2.4
153	3	0	17	3	4	0.04	23	58	2.5
154	3	1	20	4	5	0.06	23	58	2.5
155	4	1	23	4	6	0.07	24	59	2.4
156S	4	1	23	4	6	0.08	23	56	2.4
156E	3	1	21	4	6	0.08	22	55	2.4
156W	3	0	19	3	5	0.08	20	52	2.4
158	4	1	31	6	9	0.18	21	53	2.3
161	3	1	21	4	6	0.12	19	50	2.3
166	5	1	38	8	13	0.40	19	51	2.4
168	7	2	**56**	16	27	0.90	26	64	2.8
169	5	1	37	9	15	0.51	19	52	2.5
171	5	1	39	9	16	0.57	19	51	2.4
180	3	0	21	4	6	0.16	15	44	2.2
184(1)	2	0	17	3	5	0.11	15	44	2.2
186N	2	0	14	2	4	0.08	15	44	2.2
186S	2	0	14	2	3	0.07	16	45	2.2
189	2	0	13	2	3	0.05	15	44	2.2
192	2	0	12	2	3	0.04	17	47	2.3
194	2	0	10	2	2	0.05	13	41	2.1
195	2	0	9	1	2	0.04	13	40	2.1
198	1	0	10	2	2	0.06	12	39	2.0
199	1	0	11	2	3	0.07	12	39	2.0
200	1	0	10	1	2	0.05	11	38	2.0
201	1	0	11	2	2	0.06	11	37	2.0
203	2	0	12	2	3	0.07	12	38	2.0
209S	2	0	12	2	3	0.09	11	37	2.0
209E	2	0	12	2	3	0.09	11	37	2.0
209W	1	0	11	2	3	0.09	10	36	1.9

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	24-hr ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($g/m^2/mth$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($g/m^2/mth$)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
209N	2	0	14	2	3	0.11	10	36	1.9
222	3	0	22	3	5	0.13	10	36	1.9
230	3	0	28	3	5	0.12	11	37	1.9
252	2	0	15	1	1	0.01	9	34	1.8
286	3	0	21	2	3	0.07	9	34	1.9
287	2	0	18	2	3	0.08	9	34	1.9
288	2	0	19	2	4	0.10	10	35	1.9
289N	2	0	11	1	1	0.01	14	42	2.0
289S	2	0	12	1	1	0.01	14	42	2.0
292W	2	0	13	1	1	0.01	19	53	2.0
292E	2	0	13	1	1	0.01	16	48	2.0

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**) (1) Estimated

Table 10-4: Modelling predictions for Year 4 (mine-owned receptors)

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	24-hr ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($g/m^2/mth$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($\mu g/m^3$)	Annual ave. ($g/m^2/mth$)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M1	5	1	39	8	14	0.53	17	47	2.4
M2	10	3	**80**	22	38	1.00	**35**	78	2.9
M3	**34**	5	**271**	37	65	1.15	**52**	**110**	3.1
M4	21	2	**163**	17	27	0.34	**32**	74	2.4
M5	**28**	3	**214**	25	41	0.53	**40**	88	2.5
M6	**40**	4	**313**	30	51	0.73	**47**	**102**	2.8
M7	22	2	**166**	13	21	0.47	30	73	2.6
M8	4	0	31	1	2	0.02	**37**	90	3.8
M9	4	0	27	1	2	0.02	**535**	**1308**	**23.5**
M10	7	0	48	2	4	0.06	29	74	2.9
M11	4	0	29	2	3	0.05	26	66	2.6
M12	15	1	**115**	9	15	0.39	23	59	2.4
M13	9	1	**64**	4	6	0.13	26	68	2.5
M14	9	1	**69**	4	7	0.15	25	66	2.4
M15	8	1	**57**	4	7	0.21	22	60	2.4
M16	9	1	**73**	5	8	0.26	21	58	2.4
M17	8	1	**67**	5	8	0.37	17	49	2.3
M18	8	1	**62**	5	9	0.42	17	49	2.4
M94	4	1	31	6	9	0.18	21	53	2.3
M19	19	1	**143**	11	18	0.41	26	66	2.5

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M20	16	1	**123**	10	16	0.41	24	62	2.5
M21	14	1	**106**	8	13	0.32	20	55	2.3
M22	12	1	**93**	7	12	0.31	20	54	2.3
M23	10	1	**78**	6	10	0.27	21	56	2.3
M24	14	1	**110**	8	13	0.41	21	57	2.4
M25	10	1	**83**	6	9	0.31	21	57	2.4
M26	11	1	**90**	6	10	0.33	21	57	2.4
M27	5	0	38	3	5	0.17	19	52	2.3
M28	9	1	**70**	5	8	0.25	21	57	2.3
M29	9	1	**76**	5	8	0.27	21	57	2.4
M30	7	0	**55**	3	5	0.28	15	45	2.3
M31	5	0	36	2	4	0.27	12	39	2.2
M32	5	0	39	2	4	0.28	12	40	2.3
M33	10	1	**77**	10	16	0.74	23	59	2.7
M34	7	1	**56**	7	12	0.57	20	54	2.5
M35	7	1	**55**	6	10	0.49	18	51	2.4
M36	8	2	**57**	12	21	0.98	24	61	2.9
M37	5	1	43	7	11	0.54	18	51	2.5
M38	5	1	43	7	12	0.56	19	52	2.5
M39	5	1	43	7	12	0.57	19	52	2.5
M40	5	1	43	7	12	0.57	19	52	2.5
M41	5	1	43	8	13	0.59	19	53	2.5
M42	5	1	43	8	13	0.60	20	53	2.5
M43	6	1	46	8	14	0.65	20	54	2.6
M44	6	1	45	8	14	0.63	20	54	2.5
M45	6	1	44	8	14	0.63	20	54	2.5
M46	10	2	**74**	18	30	1.30	29	68	3.2
M47	**49**	**9**	**379**	69	108	1.16	**94**	**169**	3.7
M48	**27**	4	**206**	27	38	0.35	**57**	**109**	3.1
M49	19	4	**144**	32	51	0.56	**70**	**135**	3.7
M50	9	1	**64**	7	10	0.09	**46**	**96**	3.3
M51	7	1	**54**	6	9	0.08	**42**	89	3.1
M52	6	1	44	6	8	0.07	**38**	81	3.0
M53	4	1	26	5	7	0.08	26	62	2.5
M54	5	1	33	7	10	0.17	22	55	2.3
M55	5	1	38	8	12	0.27	21	54	2.4
M56	6	2	49	12	21	0.57	24	59	2.5
M57	9	2	**74**	19	33	0.98	30	70	2.9
M94	4	1	31	6	9	0.18	21	53	2.3
M58	5	1	42	8	14	0.62	20	54	2.5
M59	5	1	40	8	14	0.60	20	53	2.5
M60	5	1	38	8	14	0.60	20	54	2.5

Receptor ID	Incremental impact						Total impact)		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M61	5	1	39	7	11	0.37	18	50	2.3
M62	5	1	39	7	11	0.37	18	50	2.3
M63	5	1	40	7	11	0.38	18	50	2.3
M64	5	1	40	7	12	0.38	19	51	2.3
M65	5	1	43	8	14	0.44	20	54	2.4
M66	6	1	45	8	14	0.45	21	55	2.4
M67	6	1	50	9	16	0.46	23	58	2.5
M68	7	1	**52**	10	17	0.50	24	59	2.5
M69	8	1	**55**	11	19	0.47	25	62	2.5
M70	9	2	**61**	12	20	0.41	28	66	2.6
M71	11	2	**87**	18	31	0.53	**37**	81	2.8
M72	19	3	**148**	24	39	0.58	**48**	**99**	3.1
M73	20	3	**159**	25	42	0.59	**51**	**104**	3.2
M74	20	3	**155**	23	39	0.54	**54**	**110**	3.4
M75	19	3	**146**	23	38	0.52	**59**	**118**	3.6
M76	17	2	**130**	16	27	0.40	**61**	**120**	3.9
M77	11	2	**86**	15	24	0.29	**89**	**170**	**5.2**
M78	8	2	**63**	13	20	0.23	**85**	**162**	**4.9**
M79	8	2	**57**	11	18	0.20	**82**	**159**	**4.8**
M80	7	1	**52**	10	16	0.17	**77**	**151**	**4.7**
M81	6	1	47	9	14	0.15	**82**	**160**	**5.1**
M82	6	1	46	7	11	0.11	**62**	**126**	**4.3**
M83	6	1	42	6	9	0.08	**50**	**103**	3.6
M84	3	0	24	3	5	0.05	27	63	2.6
M85	2	0	14	2	3	0.03	20	51	2.3
M86	2	0	15	2	3	0.03	21	53	2.3
M87	2	0	17	2	3	0.03	22	54	2.4
M88	3	0	21	3	4	0.04	25	61	2.5
M89	4	0	27	3	5	0.04	**30**	69	2.7
M90	2	0	16	2	3	0.03	22	56	2.4
M91	2	0	12	1	2	0.02	19	50	2.2
M92	2	0	17	3	4	0.04	25	61	2.6
M93	2	0	14	2	3	0.03	23	57	2.5
M95	1	0	8	1	2	0.02	17	47	2.4
M96	1	0	9	2	2	0.03	17	48	2.4

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**)

10.2.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-10 and **Figure E-11** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 4 due to emissions from the Project. The results in **Table 10-3** indicate that all privately owned receptors are predicted to experience a maximum 24-hour average and annual average concentrations below the advisory reporting standards of 25μg/m³ and 8μg/m³, respectively in Year 4.

The results in **Table 10-4** indicate that five mine-owned receptors; Receptors M3, M5, M6, M47 and M48, are predicted to experience levels above the maximum 24-hour average $PM_{2.5}$ advisory standard in Year 4. Receptor M47 is also predicted to experience levels above the annual average $PM_{2.5}$ advisory standard in Year 4.

10.2.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-12 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 4 due to emissions from the Project. The results in **Table 10-3** indicate that two privately owned receptors; Receptors 29 and 168, are predicted to experience maximum 24-hour average PM_{10} concentrations above the relevant criterion of 50μg/m³ in Year 4.

An analysis of the number of days that the DP&I acquisition criterion of 50μg/m³ would be exceeded at these receptors is presented in **Table 10-5**. The analysis indicates that only Receptor 168 would experience levels systemically above the criterion (e.g. on more than 5 days).

Table 10-5: Analysis of Year 4, maximum 24-hour average PM_{10} concentrations

Receptor ID	Number of days over 50μg/m³
29	1
168	13

Results for the total (cumulative) impact for maximum 24-hour average PM_{10} concentrations are discussed in **Section 10.7**.

The results in **Table 10-4** indicate that the following mine-owned receptors; Receptors M2, M3, M4, M5, M6, M7, M12, M13, M14, M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M28, M29, M30, M33, M34, M35, M36, M46, M47, M48, M49, M50, M51, M57, M68, M69, M70, M71, M72, M73, M74, M75, M76, M77, M78, M79 and M80, are predicted to experience maximum 24-hour average PM_{10} concentrations above 50μg/m³ in Year 4.

10.2.3 Predicted annual average PM_{10} concentrations

Figure E-13 shows the predicted annual average PM_{10} concentrations for Year 4 due to emissions from the Project. **Figure E-14** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-3** indicate that privately owned receptors; Receptor 118 and 119 are predicted to experience total annual average PM_{10} concentration above the relevant criterion of 30μg/m³ in Year 4.

The results in **Table 10-4** indicate that the following mine-owned receptors; Receptors M2, M3, M4, M5, M6, M8, M9, M47, M48, M49, M50, M51, M52, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83 and M89, are predicted to experience annual average PM_{10} concentrations above 30µg/m^3 in Year 4.

10.2.4 Predicted annual average TSP concentrations

Figure E-15 shows the predicted annual average TSP concentrations for Year 4 due to emissions from the Project. **Figure E-16** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-3** indicate that all privately owned receptors are predicted to experience annual average TSP concentrations below the relevant criterion of 90µg/m^3 in Year 4.

The results in **Table 10-4** indicate that the following mine-owned receptors; Receptors M3, M6, M9, M47, M48, M49, M50, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82 and M83, are predicted to experience annual average TSP concentrations above 90µg/m^3 in Year 4.

10.2.5 Predicted annual average dust deposition levels

Figure E-17 shows the predicted annual average dust deposition levels for Year 4 due to emissions from the Project. **Figure E-18** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-3** indicate that all privately owned receptors are predicted to experience an incremental annual average dust deposition level below the relevant criterion of 2g/m^2/month in Year 4.

All privately owned receptors are also predicted to experience a total annual average deposition level below the relevant criterion of 4g/m^2/month due to emissions from the Project and other sources.

The results in **Table 10-4** indicate that all mine-owned receptors are predicted to experience incremental annual average dust deposition levels below the relevant criterion of 2g/m^2/month in Year 4. The following mine-owned receptors; Receptors M9, M77, M78, M79, M80, M81 and M82, are predicted to experience total annual average deposition levels above the relevant criterion of 4g/m^2/month in Year 4.

10.3 Year 8

Table 10-6 presents the model predictions at each of the privately-owned receptors, the values presented in bold indicate predicted values above the relevant criteria. The receptors highlighted in grey have rights to acquisition upon request under other mining companies' development consents. **Table 10-7** presents the model predictions at each of the mine-owned receptors.

Figure E-19 to **Figure E-27** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 8.

Table 10-6: Modelling predictions for Year 8 (privately-owned receptors)

Receptor ID	Incremental impact						Total impact		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
2	2	0	17	1	2	0.06	16	47	2.3
3	2	0	17	1	2	0.07	16	46	2.3
7	2	0	14	1	2	0.11	12	39	2.2
8	2	0	14	1	2	0.13	11	39	2.2
12	2	0	15	1	2	0.11	12	40	2.2
17	2	0	17	1	2	0.09	16	46	2.3
19	2	0	18	1	2	0.09	17	48	2.3
22	3	0	20	2	3	0.10	18	51	2.3
23	3	0	20	2	3	0.11	19	52	2.3
24	3	0	21	2	3	0.11	19	52	2.3
25	3	0	21	2	3	0.13	18	50	2.3
27W	4	0	29	2	4	0.18	21	55	2.3
27E	3	0	26	2	4	0.20	16	47	2.3
29	7	1	**57**	4	7	0.45	18	50	2.4
30	4	0	35	2	4	0.40	13	41	2.4
31	5	0	37	2	4	0.41	13	41	2.4
33	5	0	38	3	4	0.41	13	42	2.4
39	5	0	41	3	6	0.43	15	45	2.4
40	5	1	43	4	7	0.45	16	46	2.4
41	5	1	39	4	8	0.48	17	47	2.4
42	5	1	40	5	8	0.48	17	48	2.4
43	5	1	41	5	9	0.52	18	50	2.4
44	5	1	41	5	9	0.54	18	51	2.5
45	6	1	45	7	12	0.64	20	53	2.5
46	6	1	43	7	12	0.60	19	51	2.5
47	5	1	37	5	8	0.49	17	48	2.4
48	5	1	37	5	8	0.49	17	48	2.4
49	5	1	36	5	8	0.48	17	48	2.4
50	5	1	36	5	8	0.49	17	48	2.4
51	5	1	34	5	8	0.49	17	48	2.4
52	5	1	34	5	8	0.49	17	48	2.4
53	5	1	35	5	8	0.49	17	47	2.4
54	5	1	36	4	8	0.48	16	47	2.4
55	5	1	34	5	8	0.48	16	47	2.4
57	5	1	34	5	8	0.48	16	47	2.4
58	5	1	34	5	8	0.48	16	47	2.4
59	5	1	35	5	8	0.49	16	47	2.4
60	5	1	35	5	8	0.49	16	47	2.4
61	5	1	32	4	7	0.44	15	44	2.3
62	5	1	33	4	7	0.43	15	44	2.3
63	5	1	35	5	8	0.44	15	45	2.3
64	5	1	41	6	10	0.43	16	47	2.3

Receptor ID	Incremental impact						Total impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
66	6	1	45	6	10	0.39	16	47	2.2
81	5	1	32	4	7	0.40	14	43	2.3
83	5	1	33	4	7	0.40	14	43	2.3
84	5	1	32	4	7	0.39	14	43	2.2
85	5	1	33	4	7	0.40	14	43	2.3
87N	5	1	38	5	8	0.35	15	44	2.2
87S	5	1	39	5	8	0.34	15	44	2.2
88W	1	0	4	0	1	0.01	10	36	1.9
88N	1	0	5	0	1	0.01	10	36	1.9
88S	1	0	5	0	1	0.01	10	36	1.9
90	1	0	5	1	1	0.01	12	38	1.9
92	1	0	6	1	1	0.01	12	39	2.0
93	1	0	5	1	1	0.01	12	39	2.0
96	1	0	4	0	1	0.01	11	37	1.9
97	1	0	3	0	1	0.01	12	39	1.9
98	1	0	6	1	1	0.01	12	39	2.0
102	1	0	8	1	1	0.01	14	42	2.1
103	1	0	9	1	1	0.02	15	44	2.1
105	1	0	9	1	2	0.02	15	44	2.1
106	2	0	13	1	2	0.02	18	48	2.2
107	1	0	9	1	2	0.02	16	44	2.1
108	2	0	11	1	2	0.02	17	46	2.2
110S	2	0	13	1	2	0.02	19	49	2.2
110N	2	0	14	2	2	0.03	21	53	2.3
112N	3	0	20	2	4	0.04	27	64	2.6
112S	2	0	16	2	3	0.03	21	53	2.3
113	2	0	18	2	3	0.03	23	56	2.4
114	3	0	21	2	4	0.04	26	61	2.5
117	3	0	27	3	5	0.05	29	66	2.6
118	5	1	37	5	7	0.08	**42**	88	3.1
119	5	1	44	4	7	0.07	**39**	81	3.1
120	3	0	19	2	3	0.03	27	63	2.5
126N	1	0	9	1	2	0.02	19	50	2.2
126W	1	0	9	1	2	0.02	18	48	2.2
126S	1	0	8	1	1	0.02	17	47	2.2
130	1	0	8	1	1	0.01	16	45	2.1
133N	1	0	7	1	1	0.01	16	45	2.1
133W	1	0	7	1	1	0.01	15	44	2.1
133S	1	0	7	1	1	0.01	15	44	2.1
145	1	0	8	1	2	0.02	18	49	2.2
146	1	0	9	1	2	0.02	19	50	2.2
149S	1	0	9	1	2	0.02	20	52	2.4
149W	1	0	9	1	2	0.02	19	50	2.4

Receptor ID	Incremental impact						Total impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
149N	1	0	9	1	2	0.02	19	50	2.4
152	3	0	19	3	5	0.06	20	52	2.3
153	2	0	14	2	4	0.04	21	54	2.4
154	3	0	18	3	5	0.06	21	54	2.3
155	3	0	21	4	5	0.07	21	54	2.3
156S	3	0	22	4	6	0.08	20	53	2.3
156E	3	0	20	3	5	0.08	20	52	2.3
156W	2	0	20	3	5	0.08	18	49	2.3
158	5	1	36	6	10	0.22	20	51	2.3
161	3	1	27	4	6	0.14	17	48	2.3
166	6	1	**52**	9	17	0.60	20	53	2.5
168	11	3	**90**	21	38	1.40	**31**	73	3.2
169	6	1	49	11	19	0.76	21	54	2.6
171	8	2	**60**	12	22	0.85	21	55	2.7
180	4	1	29	4	7	0.22	15	43	2.2
184(1)	3	0	25	3	5	0.15	14	43	2.1
186N	3	0	22	3	4	0.10	14	43	2.1
186S	3	0	22	2	4	0.08	15	43	2.2
189	3	0	19	2	3	0.06	14	42	2.1
192	2	0	15	2	3	0.04	15	44	2.2
194	3	0	14	2	3	0.06	12	39	2.0
195	3	0	13	1	2	0.05	12	39	2.0
198	2	0	14	2	3	0.08	11	38	2.0
199	2	0	15	2	3	0.09	11	38	2.0
200	2	0	12	2	3	0.07	11	37	2.0
201	2	0	15	2	3	0.08	11	37	2.0
203	2	0	16	2	3	0.10	11	38	2.0
209S	2	0	16	2	4	0.12	11	37	2.0
209E	2	0	16	2	4	0.13	11	37	2.0
209W	2	0	16	2	4	0.13	10	36	1.9
209N	3	0	20	3	5	0.15	10	36	2.0
222	4	0	34	3	6	0.17	11	37	2.0
230	5	0	40	3	5	0.14	11	38	2.0
252	2	0	15	0	1	0.01	14	42	2.1
286	3	0	28	2	3	0.08	9	34	1.9
287	3	0	26	2	3	0.09	9	35	1.9
288	3	0	26	3	5	0.13	10	36	1.9
289N	2	0	13	1	1	0.01	19	51	2.2
289S	2	0	14	1	1	0.01	17	48	2.2
292W	1	0	9	0	1	0.01	**32**	71	2.4
292E	1	0	9	0	1	0.01	28	65	2.3

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**) (1) Estimated

Table 10-7: Modelling predictions for Year 8 (mine-owned receptors)

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M1	8	1	**66**	11	19	0.80	19	52	2.6
M2	18	4	**149**	32	60	1.79	**46**	**101**	3.6
M3	**27**	3	**215**	21	36	0.64	**37**	83	2.7
M4	12	1	**91**	7	11	0.15	**30**	67	2.2
M5	19	1	**143**	11	17	0.22	**31**	69	2.2
M6	24	2	**179**	12	20	0.39	**33**	75	2.4
M7	11	1	**83**	7	12	0.35	30	71	2.5
M8	2	0	14	1	1	0.01	**83**	**154**	**4.2**
M9	2	0	11	1	1	0.01	**235**	**508**	**14.8**
M10	4	0	27	2	3	0.05	**53**	**116**	3.6
M11	3	0	20	1	2	0.05	29	69	2.7
M12	8	1	**58**	5	9	0.31	23	59	2.4
M13	4	0	32	3	4	0.12	**34**	81	2.6
M14	5	0	35	3	5	0.14	**32**	76	2.5
M15	4	0	36	3	5	0.20	28	68	2.5
M16	6	0	46	3	6	0.25	26	64	2.4
M17	8	1	**62**	4	6	0.38	19	52	2.4
M18	8	1	**64**	4	7	0.42	19	52	2.4
M94	5	1	36	6	10	0.22	20	51	2.3
M19	10	1	**71**	6	10	0.32	26	65	2.4
M20	8	1	**61**	6	9	0.32	25	61	2.4
M21	7	1	**53**	5	8	0.26	21	56	2.3
M22	6	1	49	4	8	0.27	21	55	2.3
M23	6	1	45	4	7	0.24	23	59	2.3
M24	8	1	**62**	5	9	0.34	22	57	2.4
M25	6	1	**51**	4	7	0.28	24	61	2.4
M26	7	1	**56**	4	7	0.30	24	61	2.4
M27	4	0	28	2	4	0.17	22	58	2.4
M28	5	0	44	3	6	0.24	26	64	2.4
M29	6	0	47	3	6	0.26	25	64	2.4
M30	5	0	39	3	4	0.29	17	47	2.4
M31	3	0	27	2	3	0.29	12	40	2.3
M32	4	0	29	2	3	0.30	13	41	2.3
M33	11	1	**87**	7	12	0.66	23	58	2.6
M34	8	1	**64**	5	9	0.55	21	55	2.5
M35	8	1	**62**	5	8	0.48	19	53	2.5
M36	8	1	**60**	10	17	1.05	23	59	3.0
M37	5	1	42	5	10	0.55	19	51	2.5
M38	6	1	39	6	10	0.58	19	52	2.5
M39	6	1	41	6	11	0.60	20	53	2.5
M40	6	1	41	6	11	0.61	19	53	2.5

Receptor ID	Incremental impact						Total impact)		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M41	6	1	43	7	11	0.63	20	53	2.5
M42	6	1	44	7	12	0.65	20	53	2.6
M43	7	1	46	7	13	0.69	20	54	2.6
M44	6	1	46	7	12	0.67	20	54	2.6
M45	6	1	46	7	13	0.67	20	53	2.6
M46	10	2	**74**	13	24	1.36	25	63	3.2
M47	**42**	**10**	**323**	80	135	1.68	**101**	**189**	4.0
M48	**30**	5	**231**	35	56	0.58	**63**	**121**	3.2
M49	22	4	**173**	31	53	0.67	**64**	**127**	3.5
M50	8	1	**65**	8	12	0.12	**46**	**94**	3.1
M51	7	1	**53**	6	9	0.10	**41**	87	3.0
M52	5	1	40	5	8	0.08	**37**	79	2.8
M53	3	1	25	4	6	0.07	23	57	2.4
M54	5	1	37	6	11	0.21	20	53	2.3
M55	6	1	48	9	15	0.38	21	54	2.4
M56	8	2	**64**	15	28	0.88	26	64	2.8
M57	15	3	**118**	26	48	1.56	**37**	84	3.4
M94	5	1	36	6	10	0.22	20	51	2.3
M58	6	1	46	7	13	0.66	20	53	2.5
M59	6	1	45	7	12	0.64	20	53	2.5
M60	6	1	45	7	12	0.64	20	53	2.5
M61	6	1	45	6	10	0.38	17	47	2.2
M62	6	1	45	6	10	0.38	17	47	2.2
M63	6	1	45	6	10	0.39	17	47	2.2
M64	6	1	45	6	10	0.39	17	48	2.2
M65	6	1	47	7	12	0.45	18	50	2.3
M66	6	1	**51**	7	13	0.47	19	51	2.3
M67	7	1	**57**	8	14	0.49	20	53	2.4
M68	7	1	**60**	9	15	0.52	21	55	2.4
M69	8	1	**64**	9	16	0.50	22	57	2.4
M70	10	1	**78**	10	18	0.44	25	60	2.4
M71	10	2	**84**	15	26	0.54	**31**	71	2.6
M72	13	2	**96**	19	33	0.57	**39**	85	2.8
M73	14	3	**110**	20	36	0.59	**41**	89	2.9
M74	16	3	**127**	20	34	0.55	**44**	**94**	3.0
M75	17	3	**139**	20	34	0.54	**48**	**101**	3.2
M76	14	2	**114**	14	24	0.42	**48**	**100**	3.2
M77	11	2	**86**	14	23	0.32	**82**	**163**	**5.1**
M78	11	2	**85**	12	21	0.27	**83**	**163**	**5.1**
M79	9	1	**74**	11	19	0.24	**81**	**156**	**4.8**
M80	9	1	**62**	10	17	0.21	**74**	**142**	**4.3**
M81	8	1	**54**	9	15	0.18	**78**	**148**	**4.4**

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M82	5	1	39	7	12	0.13	**65**	**126**	**4.1**
M83	8	1	**64**	6	10	0.11	**53**	**107**	3.5
M84	4	0	36	3	5	0.06	30	66	2.6
M85	2	0	16	2	3	0.03	21	52	2.3
M86	2	0	17	2	3	0.03	22	54	2.3
M87	2	0	17	2	3	0.03	22	55	2.4
M88	3	0	21	3	4	0.04	27	62	2.5
M89	4	0	27	3	5	0.05	**32**	71	2.8
M90	2	0	15	2	3	0.03	23	56	2.4
M91	2	0	12	1	2	0.02	19	49	2.2
M92	2	0	16	2	3	0.03	25	59	2.5
M93	2	0	11	2	3	0.03	22	54	2.4
M95	1	0	8	1	2	0.02	16	45	2.2
M96	1	0	9	1	2	0.03	16	45	2.3

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**)

10.3.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-19 and **Figure E-20** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 8 due to emissions from the Project. The results in **Table 10-6** indicate that all privately owned receptors are predicted to experience a maximum 24-hour average and annual average concentrations below the advisory reporting standards of 25µg/m^3 and 8µg/m^3, respectively in Year 8.

The results in **Table 10-7** indicate that three mine-owned receptors; Receptors M3, M47 and M48, are predicted to experience levels above the maximum 24-hour average $PM_{2.5}$ advisory standard in Year 8. Receptor M47 is also predicted to experience levels above the annual average $PM_{2.5}$ advisory standard in Year 8.

10.3.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-21 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 8 due to emissions from the Project. The results in **Table 10-6** indicate that privately owned receptors; Receptors 29, 166, 168 and 171 are predicted to experience maximum 24-hour average PM_{10} concentrations above the relevant criterion of 50µg/m^3 in Year 8.

An analysis of the number of days that the DP&I acquisition criterion of 50µg/m^3 would be exceeded at these receptors is presented in **Table 10-8**. The analysis indicates that Receptors 168 and 171 would experience levels systemically above the criterion (e.g. on more than 5 days.)

Table 10-8: Analysis of Year 8, maximum 24-hour average PM_{10} concentrations

Receptor ID	Number of days over 50µg/m^3
29	1
166	1
168	46
171	10

Results for the total (cumulative) impact for maximum 24-hour average PM_{10} concentrations are discussed in **Section 10.7**.

The results in **Table 10-7** indicate that the following mine-owned receptors; Receptors M1, M2, M3, M4, M5, M6, M7, M12, M17, M18, M19, M20, M21, M24, M25, M26, M33, M34, M35, M36, M46, M47, M48, M49, M50, M51, M56, M57, M66, M67, M68, M69, M70, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81 and M83 are predicted to experience maximum 24-hour average PM_{10} concentrations above 50µg/m^3 in Year 8.

10.3.3 Predicted annual average PM_{10} concentrations

Figure E-22 shows the predicted annual average PM_{10} concentrations for Year 8 due to emissions from the Project. **Figure E-23** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-6** indicate that privately owned receptors; Receptor 118, 119, 168, and 292W are predicted to experience total annual average PM_{10} concentration above the relevant criterion of 30µg/m^3 in Year 8.

It is noted for Receptor 292W, that this receptor is located well away from the Project and are generally unaffected by activity from the Project. This receptor is affected by other dust sources in the area.

The results in **Table 10-7** indicate that the following mine-owned receptors; Receptors M1, M2, M3, M4, M5, M6, M8, M9, M10, M13, M14, M47, M48, M49, M50, M51, M52, M57, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83 and M89 are predicted to experience annual average PM_{10} concentrations above 30µg/m^3 in Year 8.

10.3.4 Predicted annual average TSP concentrations

Figure E-24 shows the predicted annual average TSP concentrations for Year 8 due to emissions from the Project. **Figure E-25** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-6** indicate that all privately owned receptors are predicted to experience annual average TSP concentrations below the relevant criterion of 90µg/m^3 in Year 8.

The results in **Table 10-7** indicate that the following mine-owned receptors; Receptors M2, M8, M9, M10, M47, M48, M49, M50, M74, M75, M76, M77, M78, M79, M80, M81, M82 and M83 are predicted to experience annual average TSP concentrations above 90µg/m^3 in Year 8.

10.3.5 Predicted annual average dust deposition levels

Figure E-26 shows the predicted annual average dust deposition levels for Year 8 due to emissions from the Project. **Figure E-27** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-6** indicate that all privately owned receptors are predicted to experience an incremental annual average dust deposition level below the relevant criterion of 2g/m^2/month in Year 8.

All privately owned receptors are also predicted to experience a total annual average deposition level below the relevant criterion of 4g/m^2/month due to emissions from the Project and other sources.

The results in **Table 10-7** indicate that all mine-owned receptors are predicted to experience incremental annual average dust deposition levels below the relevant criterion of 2g/m^2/month in Year 8. The following mine-owned receptors; Receptors M8, M9, M77, M78, M79, M80, M81 and M82, are predicted to experience total annual average deposition levels above the relevant criterion of 4g/m^2/month in Year 8.

10.4 Year 15

Table 10-9 presents the model predictions at each of the privately-owned receptors, the values presented in bold indicate predicted values above the relevant criteria. The receptors highlighted in grey have rights to acquisition upon request under other mining companies' development consents. **Table 10-10** presents the model predictions at each of the mine-owned receptors.

Figure E-28 to **Figure E-36** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 15.

Table 10-9: Modelling predictions for Year 15 (privately-owned receptors)

Receptor ID	Incremental impact						Total impact		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
2	2	0	13	1	1	0.06	14	42	2.2
3	2	0	13	1	1	0.07	14	42	2.3
7	2	0	11	1	2	0.10	11	38	2.2
8	2	0	11	1	2	0.12	11	38	2.2
12	2	0	11	1	2	0.10	12	39	2.2
17	2	0	13	1	2	0.08	14	43	2.3
19	2	0	14	1	2	0.09	15	45	2.3
22	2	0	15	1	2	0.09	16	47	2.3
23	2	0	15	1	2	0.10	17	48	2.3
24	2	0	15	1	2	0.10	17	48	2.3
25	2	0	15	1	2	0.11	16	47	2.3
27W	2	0	19	2	3	0.15	20	54	2.4
27E	2	0	17	2	3	0.17	16	46	2.3
29	4	0	31	3	6	0.32	21	54	2.4
30	3	0	23	2	3	0.31	13	41	2.4
31	3	0	23	2	3	0.32	13	41	2.4
33	3	0	24	2	3	0.32	13	42	2.4
39	3	0	27	3	5	0.32	16	46	2.3
40	4	0	28	3	5	0.33	17	48	2.4
41	4	0	28	4	6	0.35	19	50	2.4
42	4	0	29	4	6	0.35	19	52	2.4
43	4	1	29	4	7	0.37	22	56	2.4
44	4	1	29	4	7	0.38	22	56	2.4
45	4	1	32	6	10	0.47	23	58	2.5
46	4	1	30	5	9	0.44	22	56	2.4
47	4	0	28	4	6	0.35	19	52	2.4
48	4	0	28	4	6	0.35	19	51	2.4
49	4	0	28	4	6	0.35	19	51	2.4
50	4	0	28	4	6	0.36	19	51	2.4
51	4	1	28	4	6	0.36	19	51	2.4
52	3	1	27	4	6	0.36	19	51	2.4
53	3	1	27	4	6	0.36	19	51	2.4
54	3	0	28	4	6	0.35	18	50	2.4
55	3	0	27	4	6	0.35	18	50	2.4
57	3	0	27	4	6	0.35	18	50	2.4
58	3	0	27	4	6	0.35	18	50	2.4
59	3	1	27	4	6	0.36	18	50	2.4
60	3	1	26	4	6	0.36	18	50	2.3

Receptor ID	Incremental impact						Total impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
61	3	0	23	3	5	0.33	16	46	2.3
62	3	0	23	3	6	0.33	16	46	2.3
63	3	0	24	4	6	0.34	16	47	2.3
64	4	1	30	5	8	0.36	18	49	2.3
66	4	1	34	5	8	0.35	17	48	2.3
81	3	0	22	3	5	0.32	14	43	2.2
83	3	0	23	3	6	0.32	15	44	2.2
84	3	0	23	3	5	0.31	14	43	2.2
85	3	0	24	3	6	0.32	15	44	2.2
87N	4	1	29	4	7	0.31	15	45	2.2
87S	4	1	30	4	7	0.31	16	45	2.2
88W	1	0	6	1	1	0.01	10	36	1.9
88N	1	0	6	1	1	0.01	10	36	1.9
88S	1	0	6	1	1	0.01	10	36	1.9
90	1	0	6	1	1	0.01	12	39	1.9
92	1	0	8	1	1	0.01	12	40	2.0
93	1	0	6	1	1	0.01	12	40	2.0
96	1	0	4	0	1	0.01	11	37	1.9
97	1	0	4	0	1	0.01	12	39	1.9
98	1	0	8	1	1	0.01	13	41	2.0
102	1	0	9	1	2	0.02	15	45	2.1
103	2	0	10	1	2	0.02	17	48	2.2
105	2	0	13	1	2	0.02	17	48	2.2
106	2	0	17	2	3	0.03	22	57	2.5
107	2	0	11	1	2	0.02	17	48	2.2
108	2	0	14	2	2	0.02	20	53	2.4
110S	2	0	16	2	3	0.03	23	58	2.5
110N	3	0	17	2	3	0.03	26	63	2.6
112N	4	1	26	4	5	0.04	29	69	2.8
112S	3	0	21	3	4	0.04	27	65	2.8
113	3	0	24	3	5	0.04	30	71	2.9
114	4	1	30	4	6	0.05	**34**	77	3.1
117	6	1	45	5	7	0.07	**37**	84	3.4
118	8	1	**62**	9	13	0.12	**41**	88	3.2
119	5	1	40	7	10	0.10	**42**	90	3.6
120	4	0	26	3	5	0.04	29	67	2.7
126N	2	0	11	2	2	0.02	22	56	2.4
126W	2	0	10	1	2	0.02	21	54	2.4
126S	2	0	10	1	2	0.02	20	53	2.4
130	1	0	9	1	2	0.02	18	50	2.3
133N	1	0	8	1	2	0.02	18	50	2.3
133W	1	0	8	1	1	0.01	17	48	2.2

Receptor ID	Incremental impact						Total impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
133S	1	0	8	1	1	0.01	17	48	2.2
145	2	0	10	1	2	0.02	21	55	2.4
146	2	0	10	2	2	0.02	22	56	2.4
149S	2	0	12	2	3	0.03	21	54	2.5
149W	2	0	14	2	3	0.03	20	52	2.5
149N	2	0	15	2	3	0.03	20	52	2.5
152	4	1	30	6	9	0.15	21	54	2.3
153	3	1	24	4	6	0.08	21	54	2.3
154	4	1	32	6	9	0.13	22	55	2.3
155	5	1	36	7	12	0.18	23	57	2.3
156S	5	1	37	8	13	0.25	23	57	2.4
156E	4	1	33	7	12	0.22	22	55	2.4
156W	4	1	30	6	10	0.25	20	53	2.4
158	7	2	**54**	14	24	0.72	26	63	2.7
161	4	1	35	8	14	0.47	20	53	2.5
166	6	2	**52**	13	23	0.95	23	59	2.9
168	10	3	**83**	22	40	1.43	**31**	74	3.3
169	7	2	**52**	13	23	0.98	22	58	2.9
171	7	2	**54**	13	23	0.88	21	56	2.7
180	3	1	26	6	11	0.38	16	46	2.3
184(1)	3	1	24	5	9	0.29	15	45	2.2
186N	3	1	23	4	7	0.21	15	44	2.2
186S	3	1	21	4	6	0.18	15	45	2.2
189	3	0	18	3	5	0.12	14	43	2.1
192	2	0	16	3	4	0.09	15	45	2.2
194	3	0	16	2	4	0.10	13	40	2.0
195	3	0	14	2	3	0.08	12	40	2.0
198	2	0	16	3	4	0.13	12	39	2.0
199	2	0	16	3	4	0.14	12	39	2.0
200	2	0	14	2	4	0.11	11	38	2.0
201	2	0	13	2	4	0.12	11	38	2.0
203	2	0	14	3	5	0.15	12	38	2.0
209S	2	0	17	3	5	0.17	11	38	2.0
209E	2	0	19	3	5	0.17	11	37	2.0
209W	2	0	19	3	5	0.16	11	37	2.0
209N	2	0	19	3	5	0.18	11	37	2.0
222	5	0	38	3	4	0.14	10	36	1.9
230	5	0	40	2	3	0.10	10	35	1.9
252	2	0	11	0	1	0.01	19	52	2.2
286	3	0	26	1	2	0.06	9	34	1.8
287	3	0	24	2	2	0.07	9	34	1.9
288	4	0	31	2	3	0.10	9	35	1.9

Receptor ID	Incremental impact						Total impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
289N	2	0	12	0	1	0.01	15	43	2.1
289S	2	0	13	0	1	0.01	14	42	2.1
292W	2	0	10	0	1	0.01	19	49	2.1
292E	2	0	10	0	1	0.01	18	47	2.1

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**) (1) Estimated

Table 10-10: Modelling predictions for Year 15 (mine-owned receptors)

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M1	9	1	**77**	10	18	0.73	18	50	2.5
M2	25	5	**199**	43	84	**3.06**	**53**	**119**	**4.9**
M3	16	1	**123**	10	17	0.30	22	56	2.1
M4	8	0	**54**	3	5	0.09	**39**	82	2.5
M5	9	1	**68**	5	7	0.14	**34**	75	2.4
M6	7	1	**55**	6	10	0.33	**37**	83	2.6
M7	5	1	39	4	7	0.29	**65**	**134**	3.4
M8	1	0	8	0	1	0.01	**70**	**146**	**5.2**
M9	2	0	11	1	1	0.01	**371**	**798**	**23.4**
M10	3	0	17	1	2	0.05	**41**	**92**	3.5
M11	2	0	14	1	2	0.05	18	50	2.4
M12	4	0	34	4	6	0.26	**152**	**303**	**6.0**
M13	3	0	22	2	3	0.12	**63**	**131**	3.8
M14	3	0	24	2	4	0.13	**75**	**149**	**4.0**
M15	3	0	24	2	4	0.17	**40**	89	3.1
M16	3	0	27	3	4	0.20	**34**	77	2.8
M17	4	0	29	3	5	0.28	22	56	2.4
M18	4	0	31	3	5	0.31	22	57	2.5
M94	7	2	**54**	14	24	0.72	26	63	2.7
M19	5	1	36	4	7	0.27	**118**	**238**	**4.9**
M20	4	0	35	4	6	0.26	**147**	**294**	**5.8**
M21	4	0	31	3	5	0.23	**138**	**278**	**5.9**
M22	4	0	31	3	5	0.22	**86**	**172**	**4.3**
M23	4	0	29	3	5	0.20	**60**	**121**	3.6
M24	4	0	33	3	6	0.27	**85**	**168**	**4.0**
M25	4	0	29	3	5	0.22	**43**	**92**	3.1
M26	4	0	30	3	5	0.23	**41**	89	3.0

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M27	2	0	19	2	3	0.15	21	56	2.4
M28	3	0	26	2	4	0.19	**32**	74	2.7
M29	3	0	27	3	4	0.20	**33**	76	2.8
M30	3	0	22	2	3	0.23	16	47	2.4
M31	2	0	18	2	3	0.23	12	40	2.4
M32	2	0	19	2	3	0.24	13	40	2.4
M33	5	1	39	5	8	0.44	**49**	**102**	3.1
M34	4	1	34	4	7	0.38	**30**	70	2.7
M35	4	0	32	4	6	0.34	25	61	2.5
M36	5	1	37	7	11	0.62	**33**	74	2.8
M37	4	1	30	4	7	0.38	23	59	2.5
M38	4	1	29	4	8	0.40	24	60	2.5
M39	4	1	29	5	8	0.41	25	61	2.5
M40	4	1	29	5	8	0.41	25	61	2.5
M41	4	1	29	5	8	0.43	25	61	2.5
M42	4	1	29	5	9	0.44	25	61	2.5
M43	4	1	29	5	9	0.46	26	63	2.6
M44	4	1	29	5	9	0.46	25	61	2.5
M45	4	1	31	6	9	0.47	25	61	2.5
M46	6	1	48	9	16	0.80	27	64	2.8
M47	**134**	**41**	**1025**	314	537	**7.54**	**331**	**586**	**9.7**
M48	**64**	**14**	**485**	109	168	1.77	**129**	**223**	**4.1**
M49	**48**	**12**	**367**	91	144	1.74	**114**	**202**	**4.1**
M50	15	2	**112**	17	24	0.22	**47**	**95**	3.0
M51	11	2	**82**	12	17	0.16	**41**	87	2.9
M52	9	1	**67**	10	14	0.12	**37**	79	2.8
M53	6	1	45	9	14	0.19	26	61	2.4
M54	8	2	**64**	16	29	0.79	29	69	2.8
M55	7	2	**56**	15	27	0.90	27	65	2.8
M56	9	2	**73**	19	33	1.16	29	69	3.0
M57	16	4	**123**	30	56	1.61	**39**	**91**	3.4
M94	7	2	**54**	14	24	0.72	26	63	2.7
M58	4	1	32	6	10	0.47	24	60	2.5
M59	4	1	32	6	10	0.46	24	59	2.5
M60	4	1	32	6	10	0.47	23	58	2.5
M61	5	1	37	5	8	0.35	18	48	2.2
M62	5	1	38	5	9	0.35	18	49	2.3
M63	5	1	39	5	9	0.36	18	49	2.3
M64	5	1	40	5	9	0.37	18	49	2.3
M65	6	1	48	6	11	0.44	19	52	2.3
M66	6	1	50	7	11	0.46	20	53	2.4
M67	6	1	**53**	8	13	0.50	22	55	2.4

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M68	7	1	**57**	8	14	0.52	23	57	2.5
M69	7	1	**58**	9	16	0.54	24	59	2.5
M70	8	1	**68**	11	19	0.53	26	63	2.6
M71	10	2	**82**	18	30	0.66	**34**	75	2.7
M72	15	3	**120**	26	42	0.72	**43**	**91**	2.9
M73	17	4	**133**	29	47	0.77	**47**	**96**	2.9
M74	17	4	**125**	29	47	0.74	**48**	**99**	3.0
M75	20	4	**149**	30	49	0.76	**51**	**104**	3.1
M76	12	2	**94**	19	30	0.52	**44**	**91**	2.9
M77	18	3	**136**	23	36	0.51	**60**	**119**	3.7
M78	15	3	**120**	22	34	0.45	**64**	**127**	**4.1**
M79	14	3	**108**	20	31	0.39	**67**	**133**	**4.4**
M80	12	3	**92**	19	30	0.35	**65**	**129**	**4.3**
M81	11	2	**85**	16	25	0.29	**66**	**131**	**4.4**
M82	11	2	**79**	14	21	0.21	**52**	**107**	3.5
M83	9	2	**70**	13	18	0.18	**48**	**99**	3.3
M84	5	1	32	5	7	0.07	**42**	**92**	3.7
M85	3	0	27	3	4	0.04	26	64	2.7
M86	3	0	26	3	4	0.04	29	68	2.8
M87	3	0	24	3	4	0.04	30	70	2.9
M88	4	1	31	4	6	0.06	**34**	78	3.1
M89	5	1	40	6	8	0.08	**37**	81	3.2
M90	3	0	19	3	4	0.03	28	66	2.7
M91	2	0	14	2	3	0.02	23	57	2.5
M92	3	0	21	3	5	0.04	25	60	2.5
M93	3	0	16	3	4	0.04	22	56	2.5
M95	2	0	12	2	3	0.04	16	46	2.3
M96	2	0	14	2	3	0.05	16	46	2.3

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**)

10.4.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-28 and **Figure E-29** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 15 due to emissions from the Project. The results in **Table 10-9** indicate that all privately owned receptors are predicted to experience a maximum 24-hour average and annual average concentrations below the advisory reporting standards of 25µg/m³ and 8µg/m³, respectively in Year 15.

The results in **Table 10-10** indicate that three mine-owned receptors; Receptors M47, M48 and M49, are predicted to experience levels above the maximum 24-hour average $PM_{2.5}$ advisory standard in Year 15. These receptors are also predicted to experience levels above the annual average $PM_{2.5}$ advisory standard in Year 15.

10.4.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-30 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 15 due to emissions from the Project. The results in **Table 10-9** indicate that six privately owned receptors; Receptors 118, 158, 166, 168, 169 and 171 are predicted to experience maximum 24-hour average PM_{10} concentrations above the relevant criterion of 50µg/m³ in Year 15.

An analysis of the number of days that the DP&I acquisition criterion of 50µg/m³ would be exceeded at these receptors is presented in **Table 10-11**. The analysis indicates that only Receptor 168 would experience levels systemically above the criterion (e.g. on more than 5 days).

Table 10-11: Analysis of Year 15, maximum 24-hour average PM_{10} concentrations

Receptor ID	Number of days over 50µg/m³
118	4
158	2
166	1
168	55
169	1
171	3

Results for the total (cumulative) impact for maximum 24-hour average PM_{10} concentrations are discussed in **Section 10.7**.

The results in **Table 10-10** indicate that the following mine-owned receptors; Receptors M1, M2, M3, M4, M5, M6, M47, M48, M49, M50, M51, M52, M54, M55, M56, M57, M67, M68, M69, M70, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83 and M94 are predicted to experience maximum 24-hour average PM_{10} concentrations above 50µg/m³ in Year 15.

10.4.3 Predicted annual average PM_{10} concentrations

Figure E-31 shows the predicted annual average PM_{10} concentrations for Year 15 due to emissions from the Project. **Figure E-32** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-9** indicate that privately owned receptors; Receptor 114, 117, 118, 119 and 168 are predicted to experience total annual average PM_{10} concentration above the relevant criterion of 30µg/m³ in Year 15.

The results in **Table 10-10** indicate that the following mine-owned receptors; Receptors M2, M4, M5, M6, M7, M8, M9, M10, M12, M13, M14, M15, M16, M19, M20, M21, M22, M23, M24, M25, M26, M28, M29, M33, M34, M36, M47, M48, M49, M50, M51, M52, M53, M57, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83, M84, M88 and M89 are predicted to experience annual average PM_{10} concentrations above 30µg/m^3 in Year 15.

10.4.4 Predicted annual average TSP concentrations

Figure E-33 shows the predicted annual average TSP concentrations for Year 15 due to emissions from the Project. **Figure E-34** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-9** indicate that all privately owned receptors are predicted to experience annual average TSP concentrations below the relevant criterion of 90µg/m^3 in Year 15.

The results in **Table 10-10** indicate that the following mine-owned receptors; Receptors M2, M7, M8, M9, M10, M12, M13, M14, M19, M20, M21, M22, M23, M24, M25, M33, M47, M48, M49, M50, M57, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83 and M84, are predicted to experience annual average TSP concentrations above 90µg/m^3 in Year 15.

10.4.5 Predicted annual average dust deposition levels

Figure E-35 shows the predicted annual average dust deposition levels for Year 15 due to emissions from the Project. **Figure E-36** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-9** indicate that all privately owned receptors are predicted to experience an incremental annual average dust deposition level below the relevant criterion of 2g/m^2/month in Year 15.

All privately owned receptors are also predicted to experience a total annual average deposition level below the relevant criterion of 4g/m^2/month due to emissions from the Project and other sources.

The results in **Table 10-10** indicate that the following mine-owned receptors; Receptors M2 and M47, are predicted to experience incremental annual average dust deposition levels above the relevant criterion of 2g/m^2/month in Year 15. The following mine-owned receptors; Receptors M2, M8, M9, M12, M14, M19, M20, M21, M22, M24, M47, M48, M49, M78, M79, M80 and M81, are predicted to experience total annual average deposition levels above the relevant criterion of 4g/m^2/month in Year 15.

10.5 Year 24

Table 10-12 presents the model predictions at each of the privately-owned receptors, the values presented in bold indicate predicted values above the relevant criteria. The receptors highlighted in grey have rights to acquisition upon request under other mining companies' development consents. **Table 10-13** presents the model predictions at each of the mine-owned receptors.

Figure E-37 to **Figure E-45** in **Appendix E** present isopleth diagrams of the predicted modelling results for each of the assessed pollutants in Year 24.

Table 10-12: Modelling predictions for Year 24 (privately-owned receptors)

Receptor ID	Incremental impact						Total impact		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
2	2	0	12	1	2	0.08	14	43	2.3
3	2	0	12	1	2	0.09	14	43	2.3
7	2	0	11	1	2	0.14	12	39	2.3
8	2	0	11	1	2	0.15	11	39	2.3
12	2	0	11	1	2	0.13	12	40	2.3
17	2	0	12	1	2	0.11	14	43	2.3
19	2	0	13	1	2	0.12	15	45	2.3
22	2	0	14	1	2	0.12	16	47	2.3
23	2	0	15	1	2	0.13	17	48	2.3
24	2	0	15	1	2	0.13	17	48	2.3
25	2	0	15	1	3	0.15	17	47	2.3
27W	3	0	21	2	3	0.19	21	54	2.5
27E	3	0	19	2	3	0.20	16	47	2.4
29	4	0	32	3	5	0.35	20	53	2.4
30	3	0	23	2	3	0.34	13	41	2.4
31	3	0	23	2	3	0.35	14	42	2.4
33	3	0	24	2	4	0.35	14	43	2.4
39	3	0	27	3	5	0.35	16	46	2.4
40	4	0	29	3	5	0.35	17	48	2.4
41	4	0	30	3	6	0.37	18	50	2.4
42	4	0	31	3	6	0.37	19	51	2.4
43	4	0	32	4	6	0.39	21	55	2.5
44	4	1	33	4	7	0.39	22	56	2.5
45	6	1	40	5	9	0.47	23	58	2.5
46	5	1	38	5	8	0.45	22	56	2.5
47	4	0	30	3	6	0.37	19	51	2.4
48	4	0	30	3	6	0.37	19	51	2.4
49	4	0	30	3	6	0.37	19	50	2.4
50	4	0	30	3	6	0.37	19	51	2.4
51	4	0	30	4	6	0.38	19	50	2.4
52	4	0	30	4	6	0.38	19	50	2.4
53	4	0	29	4	6	0.38	19	50	2.4
54	4	0	29	3	6	0.37	18	49	2.4
55	4	0	29	3	6	0.37	18	49	2.4
57	4	0	29	3	6	0.37	18	50	2.4
58	4	0	29	3	6	0.37	18	49	2.4
59	4	0	29	4	6	0.37	18	50	2.4
60	4	0	29	4	6	0.38	18	49	2.4
61	4	0	26	3	5	0.35	16	46	2.3
62	4	0	28	3	6	0.35	16	46	2.3
63	4	0	31	4	6	0.36	16	47	2.3

Receptor ID	Incremental impact						Total impact		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
64	5	1	39	5	8	0.38	18	49	2.3
66	6	1	41	5	8	0.37	17	48	2.3
81	4	0	28	3	5	0.34	15	43	2.3
83	4	0	30	3	6	0.34	15	44	2.3
84	4	0	29	3	5	0.34	14	43	2.3
85	4	0	31	3	6	0.34	15	44	2.3
87N	5	1	36	4	7	0.33	15	45	2.2
87S	5	1	37	4	7	0.33	15	45	2.2
88W	1	0	7	1	1	0.01	11	37	1.9
88N	1	0	7	1	1	0.01	11	37	1.9
88S	1	0	7	1	1	0.01	10	37	1.9
90	1	0	8	1	1	0.01	13	40	2.0
92	1	0	9	1	2	0.02	14	42	2.1
93	1	0	9	1	1	0.02	13	42	2.0
96	1	0	5	1	1	0.01	11	38	1.9
97	1	0	4	0	1	0.01	12	40	2.0
98	1	0	10	1	2	0.02	14	43	2.1
102	2	0	15	1	2	0.03	18	50	2.3
103	2	0	18	2	3	0.03	21	54	2.4
105	2	0	15	2	3	0.03	21	55	2.4
106	3	0	26	3	5	0.05	**31**	72	3.0
107	2	0	17	2	3	0.03	22	56	2.5
108	2	0	18	2	4	0.04	26	64	2.7
110S	3	0	22	3	5	0.05	**32**	74	3.0
110N	3	0	27	3	5	0.05	**31**	72	2.8
112N	5	1	38	5	8	0.09	**31**	72	2.8
112S	5	0	39	4	6	0.07	**39**	86	3.3
113	6	1	45	4	7	0.09	**40**	88	3.3
114	7	1	**58**	5	9	0.11	**41**	89	3.3
117	5	1	41	6	10	0.12	**44**	**94**	3.4
118	9	1	**67**	11	18	0.22	**44**	**93**	3.2
119	8	1	**51**	8	13	0.15	**43**	**92**	3.3
120	5	1	38	4	7	0.08	29	68	2.7
126N	2	0	14	2	3	0.03	24	60	2.5
126W	2	0	13	2	3	0.03	24	59	2.5
126S	2	0	12	2	2	0.03	23	58	2.5
130	2	0	12	1	2	0.03	22	56	2.4
133N	2	0	10	1	2	0.02	21	54	2.4
133W	1	0	9	1	2	0.02	20	53	2.4
133S	1	0	10	1	2	0.02	20	53	2.4
145	2	0	12	2	3	0.03	23	57	2.5
146	2	0	14	2	3	0.03	23	59	2.5

Receptor ID	Incremental impact						Total impact		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
149S	2	0	16	2	3	0.04	21	55	2.5
149W	2	0	16	2	3	0.04	20	52	2.4
149N	2	0	16	2	4	0.04	19	52	2.4
152	6	1	47	8	13	0.24	22	55	2.3
153	4	1	34	5	8	0.10	21	53	2.3
154	6	1	48	7	12	0.20	22	56	2.3
155	7	1	**59**	10	17	0.30	24	60	2.4
156S	8	2	**60**	12	21	0.46	25	62	2.5
156E	7	1	**52**	10	17	0.39	23	58	2.4
156W	5	1	38	8	14	0.38	21	54	2.4
158	16	3	**131**	25	46	1.64	**36**	84	3.6
161	8	1	**63**	12	21	0.85	23	58	2.8
166	12	3	**92**	22	40	1.78	**32**	75	3.7
168	**26**	7	**211**	59	113	**3.68**	**68**	**147**	**5.5**
169	11	3	**88**	23	43	1.87	**32**	77	3.7
171	13	3	**109**	26	48	1.74	**34**	81	3.5
180	6	1	46	10	17	0.65	19	52	2.5
184(1)	5	1	40	8	13	0.40	17	49	2.4
186N	4	1	35	6	10	0.33	16	46	2.3
186S	3	1	27	5	8	0.26	16	45	2.2
189	4	1	25	4	7	0.18	15	44	2.1
192	3	0	21	3	5	0.11	15	44	2.2
194	4	0	20	3	5	0.14	13	41	2.1
195	4	0	19	3	4	0.11	13	40	2.0
198	3	0	22	4	6	0.21	13	40	2.1
199	3	1	22	4	6	0.23	13	40	2.1
200	3	0	20	3	5	0.16	12	39	2.0
201	2	0	20	4	6	0.19	12	39	2.0
203	3	1	22	4	7	0.24	13	40	2.1
209S	4	1	28	4	8	0.27	12	40	2.1
209E	4	1	29	5	8	0.27	12	40	2.1
209W	4	1	29	4	7	0.25	12	39	2.1
209N	4	1	29	5	8	0.29	12	40	2.1
222	7	0	**55**	3	5	0.16	11	37	1.9
230	10	0	**80**	2	4	0.10	10	37	1.9
252	2	0	14	0	1	0.01	**36**	81	2.7
286	7	0	**55**	2	3	0.07	9	35	1.9
287	5	0	42	2	3	0.08	9	35	1.9
288	5	0	38	2	4	0.11	10	36	1.9
289N	2	0	14	0	1	0.01	13	41	2.0
289S	3	0	14	0	1	0.01	13	41	2.0
292W	2	0	13	0	1	0.01	14	43	2.0

Receptor ID	Incremental impact						Total impact		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	24-hr ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)	Ann. ave. (µg/m³)	Ann. ave. (µg/m³)	Ann. ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
292E	2	0	13	0	1	0.01	14	42	2.0

*Advisory reporting standard for PM2.5 concentrations (refer to **Section 5.3**) (1) Estimated

Table 10-13: Modelling predictions for Year 24 (mine-owned receptors)

Receptor ID	Incremental impact						Total impact)		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M1	18	2	**151**	14	25	0.96	22	58	2.7
M2	**120**	**12**	**979**	94	180	**3.30**	**104**	**216**	**5.1**
M3	18	2	**139**	13	21	0.32	27	63	2.2
M4	7	0	47	3	5	0.11	**57**	**117**	2.9
M5	6	1	48	4	7	0.18	**48**	**102**	2.7
M6	6	1	44	5	9	0.38	**51**	**113**	3.1
M7	5	1	35	4	7	0.33	**103**	**200**	**4.2**
M8	2	0	12	1	1	0.01	29	68	2.5
M9	2	0	15	1	1	0.02	**43**	**96**	2.8
M10	2	0	17	1	2	0.08	**33**	75	2.8
M11	2	0	14	1	2	0.07	19	52	2.4
M12	4	0	32	3	6	0.29	**237**	**450**	**7.8**
M13	3	0	21	2	3	0.15	**42**	87	3.3
M14	3	0	22	2	4	0.17	**52**	**103**	3.6
M15	3	0	24	2	4	0.20	**33**	74	3.0
M16	4	0	29	2	4	0.23	29	67	2.7
M17	4	0	32	3	5	0.31	21	53	2.5
M18	4	0	33	3	5	0.33	21	55	2.5
M94	16	3	**131**	25	46	1.64	**36**	84	3.6
M19	4	0	33	4	6	0.30	**183**	**347**	**6.0**
M20	4	0	33	4	6	0.30	**235**	**446**	**7.6**
M21	4	0	30	3	5	0.26	**218**	**413**	**7.7**
M22	4	0	30	3	5	0.26	**128**	**240**	**5.2**
M23	4	0	28	3	5	0.24	**67**	**130**	3.9
M24	4	0	34	3	6	0.30	**122**	**229**	**4.9**
M25	4	0	30	3	5	0.25	**39**	83	3.1
M26	4	0	32	3	5	0.26	**38**	81	3.0
M27	3	0	21	2	3	0.18	22	56	2.5
M28	3	0	28	2	4	0.22	28	65	2.7
M29	4	0	29	3	4	0.23	29	66	2.7

Receptor ID	Incremental impact						Total impact)		
	PM2.5		PM10		TSP	DD	PM10	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M30	3	0	25	2	3	0.26	17	48	2.5
M31	3	0	20	2	3	0.27	13	41	2.4
M32	3	0	21	2	3	0.28	13	41	2.4
M33	5	1	41	4	8	0.44	**58**	**117**	3.3
M34	5	1	37	4	7	0.39	**30**	69	2.7
M35	4	0	34	3	6	0.36	24	59	2.5
M36	6	1	46	6	10	0.60	**35**	78	2.9
M37	4	1	33	4	7	0.40	23	57	2.5
M38	4	1	34	4	7	0.42	24	59	2.5
M39	4	1	35	4	7	0.42	25	60	2.5
M40	4	1	35	4	7	0.43	24	60	2.5
M41	5	1	35	4	8	0.44	25	60	2.5
M42	5	1	36	5	8	0.45	25	60	2.5
M43	5	1	37	5	8	0.47	26	63	2.6
M44	5	1	37	5	8	0.47	25	61	2.6
M45	5	1	38	5	9	0.47	25	60	2.5
M46	7	1	**50**	7	13	0.75	27	64	2.8
M47	**31**	**10**	**243**	80	141	**2.87**	**95**	**184**	**4.9**
M48	**49**	**9**	**392**	70	124	**2.00**	**87**	**171**	**4.1**
M49	17	5	**129**	36	62	1.08	**54**	**111**	3.2
M50	14	3	**112**	22	38	0.50	**51**	**106**	3.2
M51	15	2	**123**	18	31	0.39	**46**	**97**	3.1
M52	13	2	**104**	16	28	0.33	**40**	88	2.9
M53	9	2	**73**	13	22	0.34	28	66	2.4
M54	20	4	**164**	34	63	**2.06**	**45**	**101**	4.0
M55	12	3	**99**	26	49	1.79	**37**	86	3.7
M56	20	5	**164**	38	72	**2.45**	**48**	**107**	**4.3**
M57	**82**	**18**	**669**	148	299	**6.53**	**158**	**334**	**8.3**
M94	16	3	**131**	25	46	1.64	**36**	84	3.6
M58	5	1	39	5	9	0.47	24	59	2.5
M59	5	1	39	5	9	0.47	23	58	2.5
M60	6	1	40	5	9	0.47	23	58	2.5
M61	6	1	45	5	9	0.37	17	48	2.3
M62	6	1	46	5	9	0.38	18	49	2.3
M63	6	1	46	5	9	0.39	18	49	2.3
M64	6	1	47	5	9	0.39	18	49	2.3
M65	7	1	**52**	6	10	0.45	19	51	2.4
M66	7	1	**54**	6	11	0.47	20	52	2.4
M67	7	1	**56**	7	12	0.50	21	54	2.4
M68	7	1	**59**	7	13	0.51	21	55	2.4
M69	7	1	**59**	8	14	0.52	22	57	2.5
M70	8	1	**65**	9	16	0.50	24	59	2.5

Receptor ID	Incremental impact						Total impact)		
	$PM_{2.5}$		PM_{10}		TSP	DD	PM_{10}	TSP	DD
	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	24-hr ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)	Annual ave. (µg/m³)	Annual ave. (µg/m³)	Annual ave. (g/m²/mth)
	Advisory		Air quality impact criteria						
	25*	8*	50	-	-	2	30	90	4
M71	9	2	**76**	12	22	0.59	27	66	2.6
M72	11	2	**92**	15	27	0.61	**32**	73	2.7
M73	12	2	**98**	16	29	0.63	**33**	75	2.7
M74	13	2	**107**	16	29	0.59	**34**	77	2.7
M75	14	2	**110**	17	29	0.59	**35**	79	2.7
M76	10	2	**84**	12	21	0.46	**33**	75	2.7
M77	9	2	**72**	15	25	0.48	**40**	87	2.9
M78	10	2	**82**	15	26	0.45	**47**	**99**	3.2
M79	12	2	**91**	14	24	0.42	**54**	**112**	3.6
M80	12	2	**96**	14	25	0.39	**59**	**122**	3.9
M81	11	2	**84**	13	22	0.34	**66**	**135**	**4.4**
M82	11	2	**80**	13	22	0.30	**58**	**119**	4.0
M83	14	2	**103**	14	24	0.29	**51**	**107**	3.5
M84	5	1	39	5	9	0.10	**52**	**108**	3.8
M85	5	0	39	3	6	0.07	**42**	**91**	3.5
M86	6	1	45	4	7	0.08	**44**	**95**	3.6
M87	6	1	47	4	7	0.08	**42**	**92**	3.5
M88	7	1	**60**	6	10	0.11	**42**	**91**	3.3
M89	9	1	**70**	7	13	0.15	**40**	87	3.1
M90	4	0	28	3	5	0.06	**32**	74	2.9
M91	3	0	24	2	4	0.04	28	67	2.7
M92	5	1	35	4	6	0.07	24	60	2.5
M93	3	0	22	3	5	0.06	21	55	2.4
M95	2	0	16	2	3	0.05	16	46	2.3
M96	3	0	21	2	4	0.06	16	46	2.3

*Advisory reporting standard for $PM_{2.5}$ concentrations (refer to **Section 5.3**)

10.5.1 Predicted maximum 24-hour and annual average $PM_{2.5}$ concentrations

Figure E-37 and **Figure E-38** show the predicted maximum 24-hour average and annual average $PM_{2.5}$ concentrations for Year 24 due to emissions from the Project. The results in **Table 10-12** indicate that one privately owned receptor; Receptor 168, is predicted to experience a maximum 24-hour average $PM_{2.5}$ concentration above the advisory reporting standard of 25µg/m³.

For annual average $PM_{2.5}$ concentrations, all privately owned receptors are predicted to be below the advisory reporting standard of 8µg/m³ in Year 24.

The results in **Table 10-13** indicate that four mine-owned receptors; Receptors M2, M47, M48 and M57, are predicted to experience levels above the maximum 24-hour average $PM_{2.5}$ advisory standard in Year 24. These receptors are also predicted to experience levels above the annual average $PM_{2.5}$ advisory standard in Year 24.

10.5.2 Predicted maximum 24-hour average PM_{10} concentrations

Figure E-39 shows the predicted maximum 24-hour average PM_{10} concentrations for Year 24 due to emissions from the Project. The results in **Table 10-12** indicate that Receptors 114, 118, 119, 155, 156S, 156E, 158, 161, 166, 168, 169 and 171 are predicted to experience maximum 24-hour average PM_{10} concentrations above the relevant criterion of 50µg/m³ in Year 24. It is noted that in the northwest corner of the modelling domain, the isopleth for Year 24 shows a significant variation to the tabled, calculated values at receptor locations. This arises due to the combined effect of a number of individually small factors related to generating the isopleth, including large terrain variations and an unrealistic alignment of mine dust sources along the axis of the essentially constant wind direction on the worst case day of impact. The tabulated results are considered conservative and the assessment is based on the conservative (overestimated impact) values shown in the tables.

An analysis of the number of days that the DP&I acquisition criterion of 50µg/m³ would be exceeded at these receptors is presented in **Table 10-14**. The analysis indicates that Receptors 118, 155, 156S, 158, 166, 168, 169 and 171 would experience levels systemically above the criterion (e.g. on more than 5 days).

Table 10-14: Analysis of Year 24, maximum 24-hour average PM_{10} concentrations

Receptor ID	Number of days over 50µg/m³
114	1
118	8
119	3
155	6
156S	9
156E	2
158	56
161	2
166	44
168	166
169	57
171	83
222	1
230	3
286	1

Results for the total (cumulative) impact for maximum 24-hour average PM_{10} concentrations are discussed in **Section 10.7**.

The results in **Table 10-13** indicate that the following mine-owned receptors; Receptors M1, M2, M3, M46, M47, M48, M49, M50, M51, M52, M54, M55, M56, M57, M65, M66, M67, M68, M69, M70, M71, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83, M88, M89 and M94 are predicted to experience maximum 24-hour average PM_{10} concentrations above 50µg/m³ in Year 24.

10.5.3 Predicted annual average PM_{10} concentrations

Figure E-40 shows the predicted annual average PM_{10} concentrations for Year 24 due to emissions from the Project. **Figure E-41** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-12** indicate that the following privately owned receptors; Receptor 106, 110S, 110N, 112N, 112S, 113, 114, 117, 118, 119, 158, 166, 168, 169, 171, and 252 are predicted to experience total annual average PM_{10} concentrations above the relevant criterion of 30µg/m^3 in Year 24.

It is noted for Receptor 252, that this receptor is located well away from the Project and is generally unaffected by activity from the Project. This receptor is affected by other dust sources in the area.

The results in **Table 10-13** indicate that the following mine-owned receptors; Receptors M2, M4, M5, M6, M7, M9, M10, M12, M13, M14, M15, M19, M20, M21, M22, M23, M24, M25, M26, M33, M34, M36, M47, M48, M49, M50, M51, M52, M54, M55, M56, M57, M72, M73, M74, M75, M76, M77, M78, M79, M80, M81, M82, M83, M84, M85, M86, M87, M88, M89, M90 and M94 are predicted to experience annual average PM_{10} concentrations above 30µg/m^3 in Year 24.

10.5.4 Predicted annual average TSP concentrations

Figure E-42 shows the predicted annual average TSP concentrations for Year 24 due to emissions from the Project. **Figure E-43** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-12** indicate that privately owned receptors; Receptor 117, 118, 119 and 168, are predicted to experience annual average TSP concentrations above the relevant criterion of 90µg/m^3 in Year 24.

The results in **Table 10-13** indicate that the following mine-owned receptors; Receptors M2, M4, M5, M6, M7, M9, M12, M14, M19, M20, M21, M22, M23, M24, M33, M47, M48, M49, M50, M51, M54, M56, M57, M78, M79, M80, M81, M82, M83, M84, M85, M86, M87 and M88, are predicted to experience annual average TSP concentrations above 90µg/m^3 in Year 24.

10.5.5 Predicted annual average dust deposition levels

Figure E-44 shows the predicted annual average dust deposition levels for Year 24 due to emissions from the Project. **Figure E-45** shows the predicted total impact from the proposed Project and other sources.

The results in **Table 10-12** indicate that one privately owned receptor, Receptor 168, is predicted to experience an incremental annual average dust deposition level above the relevant criterion of 2g/m^2/month in Year 24.

There is one privately owned receptor, Receptor 168, predicted to experience a total annual average deposition level above the relevant criterion of 4g/m^2/month due to emissions from the Project and other sources.

The results in **Table 10-13** indicate that the following mine-owned receptors; Receptors M2, M47, M48, M54, M56 and M57, are predicted to experience incremental annual average dust deposition levels above the relevant criterion of 2g/m²/month in Year 24. The following mine-owned receptors; Receptors M2, M7, M12, M19, M20, M21, M22, M24, M47, M48, M56, M57, M81 and M82, are predicted to experience total annual average deposition levels above the relevant criterion of 4g/m²/month in Year 24.

10.6 Dust impacts on more than 25% of privately owned land

An assessment was made to ascertain the areas where the potential impacts due to the Project may extend over more than 25% of any land that is privately owned. This assessment can only be conducted approximately, based on predicted pollutant dispersion contours.

The contours used for the assessment are presented in **Figure E-46** to **E-60** for each year assessed and represent the limiting air quality isopleths overlayed on a cadastre plot of property boundaries. In all cases, the area of PM_{10} impact area was greater than the TSP and deposited dust impact area, hence the most impacting isopleth (i.e. the PM_{10} isopleth) was used as the basis of the assessment.

The results of the assessment are presented in **Table 10-15**. By examination of **Figure E-46** to **E-60**, it is clear that properties to the far northeast and many to the southwest of the Project site would be only marginally influenced by the Project.

Table 10-15: Land with dust impacts on more than > 25% of the land, by year.

Year	Land with dust impacts on more than > 25% of the lot
All land (lots)	
1	118, 119
4	117, 118, 119
8	117, 117, 118, 289, 290, 291
15	113, 114, 117, 118, 119, 248, 249, 250, 264
24	106, 109, 110, 111, 112, 113, 114, 117, 118, 119, 158, 166, 168, 169, 171, 248, 249, 250, 252, 253, 259, 260, 263, 264
All land (lots) not otherwise predicted to exceed criteria (i.e. not included in Table 10-16)	
1	-
4	-
8	289
15	248, 249, 250, 264
24	109, 111, 248, 249, 250, 252, 253, 259, 260, 263, 264

A summary of the land with a common owner (contiguous property) where one or more lots on the land may experience dust levels on more than 25% of the land is shown in **Table 10-17**.

10.7 Summary of results

Table 10-16 summarises the privately-owned sensitive receptors where impacts are predicted to exceed relevant assessment criteria. The receptors highlighted in grey have rights to acquisition upon request under other mining companies' development consents as indicted in the note below the table.

Table 10-16: Summary of modelled predictions where predicted impacts exceed assessment criteria

Receptor ID	PM_{10}			TSP	DD	
	Incremental 24-hr average		Total annual average	Total annual average	Incremental annual average	Total annual average)
	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 2g/m²/mth	Criterion 4g/m²/mth
	Year of impact (level)	No. of days above 50µg/m³	Year of impact (level of impact)			
29	Year 4 (53) Year 8 (57)	1 1	-	-	-	-
106	-	-	Year 24 (31+)	-	-	-
110S	-	-	Year 24 (32)	-	-	-
110N	-	-	Year 24 (31)	-	-	-
112N(2)	-	-	Year 24 (31)	-	-	-
112S(2)	-	-	Year 24 (39)	-	-	-
113(2)	-	-	Year 24 (40)	-	-	-
114(2)	Year 24 (58)	1	Year 15 (34) Year 24 (41)	-	-	-
117(2)	-	-	Year 15 (37) Year 24 (44)	Year 24 (94)	-	-
118(2)	Year 15 (62) Year 24 (67)	4 8	Year 1 (32) Year 4 (39) Year 8 (42) Year 15 (41) Year 24 (44)	Year 24 (93)	-	-
119(2)	Year 24 (51)	3	Year 4 (34) Year 8 (39) Year 15 (42) Year 24 (43)	Year 24 (92)	-	-
155(2)	Year 24 (59)	6	-	-	-	-
156S	Year 24 (60)	9	-	-	-	-
156E	Year 24 (52)	2	-	-	-	-
158(1)	Year 15 (54) Year 24 (131)	4 56	Year 24 (36)	-	-	-
161	Year 24 (63)	2	-	-	-	-
166(1)	Year 8 (52) Year 15 (52) Year 24 (92)	1 1 44	Year 24 (32)	-	-	-
168(1)	Year 4 (56) Year 8 (90) Year 15 (83) Year 24 (211)	13 46 55 166	Year 8 (31) Year 15 (31) Year 24 (68)	Year 24 (147)	-	Year 24 (5.5)
169(1)	Year 15 (52) Year 24 (88)	1 57	Year 24 (32)	-	-	-
171(1)	Year 8 (60)	10	Year 24 (34)	-	-	-

Receptor ID	PM10			TSP	DD	
	Incremental 24-hr average		Total annual average	Total annual average	Incremental annual average	Total annual average)
	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 2g/m²/mth	Criterion 4g/m²/mth
	Year of impact (level)	No. of days above 50µg/m³	Year of impact (level of impact)			
	Year 15 (54) Year 24 (109)	3 83				
222	Year 24 (55)	1	-	-	-	-
230	Year 24 (80)	3	-	-	-	-
252(1)	-	-	Year 24 (36)	-	-	-
286	Year 24 (55)	1	-	-	-	-
292W(1)	-	-	Year 8 (32)	-	-	-

Entitled to acquisition by: (1) Mount Pleasant, (2) Mount Arthur

Based on the results presented in **Table 10-16**, and the figures in **Appendix E** many privately owned receptors are entitled to acquisition by others or would not be greatly influenced by the Project.

Table 10-17 summarises the contiguous properties (lots with a common owner), not already included in **Table 10-16**, where it was predicted that more than 25% of any lot which is part of the contiguous land may be affected by annual average PM_{10} levels above criteria.

The contiguous property ID's are denoted with a capital alphanumeric (i.e. A, B, C, etc.). Lots comprising the contiguous property are shown in brackets. The lots that appear in **bold** indicate that more than 25% of the land may experience dust levels above criteria.

Table 10-17: Summary of land where more than 25% of the land may be impacted by dust, by land

Contiguous property ID (Lot ID)	Year
A(**109**)	Year 24
B(247, **248**, 251, 252, **253**, 256, **259**, **260**, **263**, **264**)*	Year 15 Year 24
C(245, 246, **249**, **250**)	Year 15 Year 24
D(**289**)*	Year 8

* Entitled to acquisition by Mount Pleasant

Based on the results presented in **Table 10-17** and examination of **Figure E-46** to **Figure E-50**, the impacts occurring on more than 25% of land (shown in **Table 10-17**) are only influenced by the activities from the Project to a minor degree.

10.8 Assessment of total (cumulative) 24-hour average PM_{10} concentrations

10.8.1 Introduction

The NSW OEH contemporaneous assessment method was applied to examine the potential maximum total (cumulative) 24-hour average PM_{10} impacts for the Project.

The first stage of the analysis described in this section focused on six locations that were chosen to represent the sensitive receptors surrounding the Project. The chosen locations are located at of each of the monitoring stations where accurate ambient monitoring data is available. The monitoring data collected at these sites cover the contemporaneous modelling period.

Figure 10-1 shows the location of each of these monitors in relation to the Project and the nearby sensitive receptors. The shaded regions around each monitoring location shown in the figure represent the approximate areas where that monitor's data was used in the assessment of cumulative impacts.

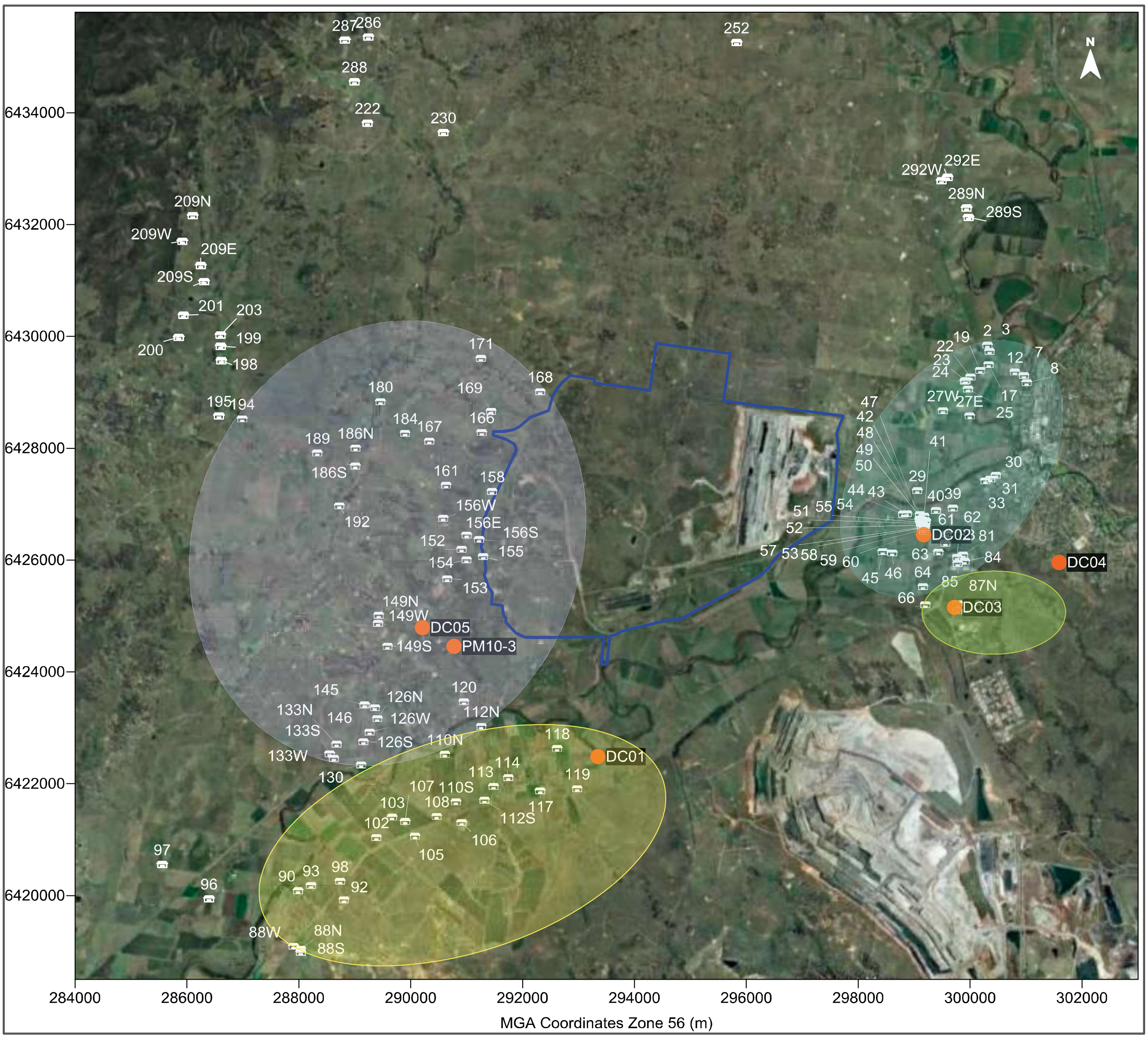

Figure 10-1: Locations available for contemporaneous cumulative impact assessment

The monitors tend to be located closer to mining than the majority of receptors (and almost exclusively in areas with higher impacts from mining activity than the majority of the receptors), and thus the underlying background data at these monitoring locations, which includes dust from existing mining activities, would tend to be higher than might actually occur at the majority of the receptors.

Where there was potential for higher impacts to occur than those presented in the first stage of the assessment, each individual receptor where this may potentially arise was examined further in detail and was individually assessed using the contemporaneous method. This further detailed assessment is detailed in the second stage of the assessment of cumulative 24-hour average impacts.

10.8.2 Assessment per NSW OEH Approved Methods

An assessment of cumulative 24-hour average PM_{10} impacts was undertaken in general accordance with the methods outlined in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW DEC**, **2005**).

As shown in **Section 6.2**, maximum background levels have in the past reached levels above or very near to the 24-hour average PM_{10} criterion level (depending on the monitoring location and time). As a result, the first pass OEH approach of adding maximum background levels to maximum predicted mine only levels will show levels above the criterion.

In such situations, the OEH approach applies a contemporaneous assessment of measured background levels added to that day's corresponding predicted mine only level. Ambient (background) dust concentration data for January 2010 to December 2010 from five TEOM stations and one HVAS station have been applied in such an assessment and represent the prevailing background levels in the vicinity of the Project and surrounding sensitive receptors. The HVAS station (PM10-3) data was included in this assessment to compensate for periods of unavailable data at TEOM monitoring station DC05.

As the existing mine was operational during this period, it would have contributed to the measured levels of dust in the area on some occasions. It is important to account for the existing Bengalla activities in the cumulative assessment. Modelling of the actual mining scenario for Bengalla for the 2010 period was conducted to determine the existing contribution to the measured levels of dust in the vicinity. This information allows the cumulative assessment to avoid double counting of Bengalla emissions in the measured data and in the predicted levels, and to make a more reliable prediction of the likely cumulative total dust level.

A contemporaneous assessment of cumulative 24-hour average PM_{10} impacts was conducted for receptors that may be subject to such impacts. To minimise unnecessary assessment, receptors that would have to be acquired due to the project impacts on cumulative annual average PM_{10} levels or its incremental PM_{10} were not assessed further.

The remaining receptors were included in this cumulative 24-hour PM_{10} impact assessment on the basis of likely risk of impact, for example receptors to the west have more risk of impact as the project approaches, whereas receptors to the east have reduced risks as the project moves away, and as other mines move further away also.

The review of the risk of impact commenced with a contemporaneous assessment of cumulative 24-hour PM_{10} impact.

Table 10-18 provides a summary of the findings of the contemporaneous assessment at each monitoring location. Detailed tables of the full assessment results are provided in **Appendix F**.

Table 10-18: NSW OEH contemporaneous assessment - maximum number of additional days above 24-hour average criterion depending on background level at monitoring sites - first stage assessment

Location	Year 1	Year 4	Year 8	Year 15	Year 24
DC01	0	0	0	7	13
DC02	0	0	0	0	0
DC03	0	0	0	0	0
DC04	0	0	0	0	0
DC05	0	0	0	0	0
PM10-3	0	0	0	0	0

The results in **Table 10-18** indicate that in almost every case, there would not be any additional day of impact arising at any representative location. As the assessment locations are generally in positions where maximum impacts are most likely to occur, it follows that there is also no further risk of impacts at the receptors, except in the vicinity of monitoring location DC01 in Year 15 and 24, and potentially receptors to the west of the Project where there is no available monitoring data.

Due to this, a further second stage detailed assessment of the potential cumulative 24-hour average impacts was therefore conducted at each receptor in the vicinity of monitoring location DC01, as shown in the results in **Appendix F**. These results are summarised in **Table 10-19**.

The assessment in the vicinity of monitoring station DC01 used the measured background level at the nearest monitoring station (DC01) added with the predicted mine only incremental dust level at each receptor to determine the cumulative impact.

Table 10-19: Further contemporaneous assessment - additional receptors in the vicinity of monitoring station DC01 - maximum number of additional days above 24-hour average criterion - second stage assessment

Location	Year 15	Year 24
Receptor 106	0	0
Receptor 110S	0	0
Receptor 110N	0	0

The results in **Table 10-19** indicate that it is unlikely that cumulative impacts would arise at the receptors near monitoring location DC01 in Year 15 and Year 24.

The results infer that the predicted impacts would be lower at all receptor locations further from the mine than the locations assessed.

Further review of the potential risk of impact was also conducted. Examination of **Figure 10-1** shows that there is no monitoring station to the west of the Project, which makes it difficult to provide a precise assessment of cumulative 24-hour average impacts in that area. An analysis of the isopleth diagrams presented in **Appendix E** indicates the mine only incremental PM_{10} level would be close to 50μg/m^3 in this area in the final stages of the project, largely as it is proposed that the mine would move towards this area. Therefore there would be some risk that impacts may occur at receptors in this area in the later years of the Project, and accordingly, this potential issue was investigated further.

Receptors in this area that may be affected were individually assessed for potential cumulative impacts based on monitoring data collected at the nearest monitor, either the DC05 or PM10-3 monitor as closest to the individual receptor. The detailed results are presented in **Appendix F** and a summary is presented in **Table 10-20**.

Table 10-20: Further contemporaneous assessment - additional receptors to the west of the Project, based on monitoring station DC05/PM10-3 data - maximum number of additional days above 24-hour average criterion - second stage assessment

Location	Year 15	Year 24
Receptor 152	0	5
Receptor 153	0	3
Receptor 154	0	5
Receptor 156E	0	4
Receptor 156W	0	3
Receptor 161	2	6
Receptor 180	0	5
Receptor 184 (1)	0	3
Receptor 186N	0	2
Receptor 186S	0	0

(1) Estimated

The results in **Table 10-20** indicate that there is potential for exceedances of the maximum 24-hour average PM_{10} criterion at Receptor 161 in Year 15 and at Receptors 152, 153, 154, 156E, 156W, 161, 180, 184 and 186N in year 24.

Systemic exceedances (greater than 5 days of exceedance) of the maximum 24-hour average PM_{10} criterion at Receptor 161 are predicted to occur in Year 24.

10.8.3 Statistical assessment of total (cumulative) 24-hour average PM_{10} concentrations

Further assessment of the potential for cumulative 24-hour PM_{10} impacts has been conducted using a statistical approach. Statistical assessments do not provide an accurate representation of the likely impacts as it is assumed that the prevailing background levels of dust are not correlated with the wind patterns or the levels of dust from new projects. For example, it is readily apparent that a location near a mine would experience higher dust levels when wind blows dust from the mine to that location than at other times and therefore that there is a correlation between wind patterns and existing dust levels. A similar situation arises when considering the potential effects from a new project.

The cumulative air dispersion modelling assessment is conducted specifically to address the spatial and time varying effects of the background dust levels and also the addition of new emissions from proposed projects, and provides a realistic assessment of the potential cumulative impacts that may arise.

However a statistical assessment can provide a theoretical upper limit of potential cumulative impact, assuming that the maximum incremental impact of a project can coincide with the maximum measured background levels of existing dust.

The approach applied in this case considers the entire range of possible combinations of predicted impacts and existing local ambient dust levels over the modelling period and assumes that any combination is possible. This will overestimate the potential impacts, as the space and time varying effects of dust dispersion in air are ignored.

Ambient dust concentration data from five TEOM and one HVAS station operating in the area were used as reference locations for assessing the cumulative impact.

The probability of an observed background concentration occurring on a given day was calculated and weighted by the number of values in the dataset. The probability distribution of observed and predicted PM_{10} concentrations are merged using an integral equation expressed as:

$$[f * g](t) \equiv \int_0^\tau f(\tau)g(t-\tau)d\tau$$

Where f(τ) is the probability of observing a background concentration of τ and g(τ) is the probability of predicting concentration τ.

The result is a distribution of all possible combinations of background and predicted levels and the probability of these combinations occurring is akin to an infinite number of iterations of the Monte-Carlo method.

On the basis of these data, the number of days per annum above the 24-hour average PM_{10} criterion of 50μg/m^3 at the representative receptor locations, and corresponding with background data from each of the existing monitoring sites, was calculated.

The results for each of the modelled years at each of the reference locations are presented in **Table 10-21**.

Table 10-21: Statistically probable number of days above 24-hour average criterion

Location	Year 1	Year 4	Year 8	Year 15	Year 24
DC01	0.1	0.1	0.2	4.3	22.3
DC02	0.3	0.3	0.3	0.3	0.3
DC03	0.1	0.1	0.1	0.1	0.1
DC04	0.0	0.0	0.0	0.0	0.0
DC05	0.0	0.0	0.0	0.0	0.0
PM10-3	5.0	5.0	5.0	5.2	6.0

Note that monitor DC05 has only limited data for the year, and similarly PM_{10}-3 uses a Hi Volume Air sampler with data available only every 6th day.

The results show that the probability of exceedance days at the reference locations largely depends on the location of the monitor relative to the mining activities. Much of the predicted impact arises due to an over prediction of 24-hour average levels that is inherent in modelling generally.

When applying 100 percentile (maximum) cumulative criteria to assess maximum short term impacts, it is important to recognise that the inaccuracy inherent in modelling generally and in the actual measurement of dust levels in the natural environment will combine and make it difficult to see any real trend or pattern. This is because a 100 percentile short term criteria is not a stable criteria target as the happenstance of elevated, sporadic natural or modelled events will determine impacts assessed per such criteria, rather than any significant actual underlying trend in the data.

This statistical approach is not without limitations and is likely to overestimate impacts as it:

- Uses the dust levels measured at locations that are close to mines (i.e. significant sources of dust), and therefore are likely to be higher than levels at the majority of receptors;
- Combines the measured levels with modelled 24-hour levels that are known to over-estimate short-term impacts;
- Ignores negative impacts (reductions in the existing level of impact) that arise for receptors to the east as a result of the Project moving westwardly; and,
- Assumes that the maximum existing ambient levels and the maximum incremental impacts from the project coincide, whereas this is unlikely to actually occur. For example, given the prevailing winds, at times when other mine impacts are high the Project would be downwind and would be a low contributor (and vice-versa). This means that coincidental high ambient and low incremental effects are more likely to occur than coincidental high ambient and high incremental effects.

It is also important to note that there is a variation in the measured ambient background level across the monitoring sites and that there are no currently known impact assessment approaches that can deal with this effectively.

Overall, the assessment indicates conservatively, zero and six days of additional exceedance at the assessed locations with the exception of DC01 where up to 22 days of additional exceedance may arise. The statistically predicted impacts at the DC01 monitor arise largely as a result of the short-term modelling predictions as the mine progresses to the west in the later years.

This assessment indicates a generally similar result to the NSW OEH contemporaneous assessment method as shown in **Section 10.8.2,** noting that the statistical assessment shows a greater number of potential exceedance days due to the overly conservative nature of the statistical assessment method.

It needs to be noted that the predicted impacts would be lower at all receptor locations further from the mine than the locations assessed. For an accurate assessment of the likely cumulative effects, please refer to the results of the contemporaneous assessment at **Section 10.8.2**.

10.9 Consideration of cumulative $PM_{2.5}$ impacts

There are currently no criteria applicable for $PM_{2.5}$ particulate impact assessment in NSW, however there are NEPM advisory reporting standards that apply to the exposure of the population as a whole, as assessed by monitoring at suitable NEPM "performance monitoring sites". Therefore the NEPM criteria would not generally apply in the near proximity to coal mines, or near to other potentially large sources of particulate emissions.

Despite the absence of suitable criteria, this assessment quantifies the approximate levels of $PM_{2.5}$ that may arise as a result of the Project.

There are two ways the situation may be considered, a simple approximate technical assessment, (as shown below), or a more pragmatic observation that the proposed change in the dust emissions due to the Project would be proportional to the difference between current operations and the proposed extension, meaning the Project might therefore add approximately 40% of the predicted incremental $PM_{2.5}$ levels to the current levels of $PM_{2.5}$ in the area.

An examination of the predicted levels for the Project (see the tables in **Section 10**) shows the total predicted contributions from the Project are small and generally only a few micrograms per cubic metre of air. The proposed modification might therefore comprise approximately 2/5th of the levels shown. This would be the Project's addition to the existing environment, and would be too small to discern in any practical sense.

There are no reliable $PM_{2.5}$ background monitoring data collected by the Project with which to conduct an accurate technical assessment of impacts and therefore it is necessary to make an approximate assessment to consider 24-hour average $PM_{2.5}$ levels.

The lack of reliable $PM_{2.5}$ data is not unusual, but it is an impediment to making an accurate calculation of the likely total $PM_{2.5}$ level in the area. This is especially so in this case as it is known that particulate levels from coal mine emissions contain a relatively small fraction of $PM_{2.5}$ material (approximately 4.7% of TSP from mining). This means that in the modelling, where we account for all major mine sources of dust, the residual, unaccounted portion of $PM_{2.5}$, for example due to non-mining sources such as wood smoke and other such sources may comprise a significant portion of total $PM_{2.5}$ levels in the environment.

In other words ambient $PM_{2.5}$ levels are likely to be governed by many minor non-mining background sources such as wood heaters and motor vehicles which cannot be reasonably modelled in small populations and rural areas, and there is little $PM_{2.5}$ monitoring data available for a detailed assessment.

The available $PM_{2.5}$ data collected at Upper Hunter Air Quality Monitoring Network station at Muswellbrook was examined in the absence of Project specific data.

The data show a trend of increasing $PM_{2.5}$ levels in the winter and reduced levels in the summer, whereas the PM_{10} levels do not show such a distinct seasonal trend. The trends are illustrated in **Figure 10-2** which shows a moving average trend line on the same 25 point basis for each data set.

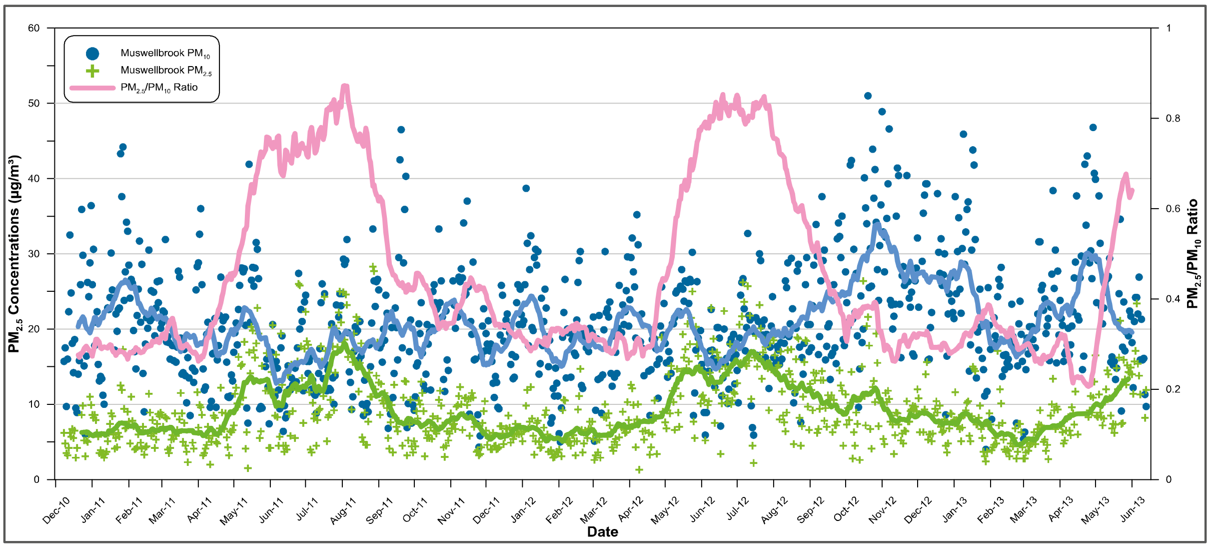

Figure 10-2: Comparison of measured PM_{10} and $PM_{2.5}$ levels in Muswellbrook

Whilst we see a peak in wintertime $PM_{2.5}$ levels in Muswellbrook, it is unlikely that this arises from mining activity as mining produces a relatively steady level of particulate emissions over the year. An analysis of the ratio of $PM_{2.5}$ to PM_{10} levels recorded at Muswellbrook during the period of the review indicates a ratio of 0.41 which tends to signify a high proportion of fine particulate matter in the area. The ratio in the wintertime is consistently high at approximately 0.75. It can thus be reasonably inferred that the increased winter levels of $PM_{2.5}$ may be largely due to urban sources of fine particulate matter such as wood heaters, and that these sources appear to govern the population exposure to $PM_{2.5}$ in this area.

Examination of the available $PM_{2.5}$ measurement data for Muswellbrook shows that the annual average $PM_{2.5}$ levels are approximately 9µg/m^3 and the 70th percentile 24-hour average maximum levels are approximately 10.5µg/m^3.

However, the $PM_{2.5}$ levels in Muswellbrook would be influenced by urban sources of fine particle emissions such as wood heaters, motor vehicles and other combustion sources potentially to a larger extent than the sparsely populated rural receptors located to the west of the Project which may experience increased impacts as the Project moves west. Therefore it would be reasonable to assume that the underlying background levels of $PM_{2.5}$ at Project receptors might be significantly lower and therefore the likely level has been estimated to be approximately 5µg/m^3 on an annual average basis and 10µg/m^3 on a 70th percentile 24-hour basis.

Examination of the incremental (mine alone) results for annual and 24-hour average $PM_{2.5}$ shown in the tables in **Section 10**, reveals that if they were added to the assumed annual average background levels or the 70th percentile 24-hour maximum levels, then no privately owned receptor (predicted to comply with the criteria for other pollutants) would experience $PM_{2.5}$ levels above the NEPM advisory reporting standards. A number of mine owned receptors may also be impacted, but these receptors would also have significant impacts for other pollutants, as assessed previously.

Therefore, the indication is that $PM_{2.5}$ would not appear to be a limiting issue for air quality impacts from the Project, and that air quality impacts, including $PM_{2.5}$, would be effectively managed through the existing air quality impact assessment framework.

The recently released Upper Hunter Air Particles Action Plan (**NSW EPA, 2013**) by the NSW EPA provides additional information about air quality and the actions underway to improve air quality in the Upper Hunter. The action plan has a strong focus on reducing $PM_{2.5}$ levels in the region and outlines 18 actions of which include a dust stop program for coal mining operations, reducing emissions from diesel powered equipment and improving wood smoke management in the area. BMC is actively partaking in these relevant actions to assist with the reduction in $PM_{2.5}$ levels in the area.

11 DUST MANAGEMENT

The mining activities at the Project site will generate dust. To ensure these activities have a minimal affect on the surrounding environment and sensitive receptors, it is required that all reasonable and practicable dust mitigation measures are utilised in the operation of the project

11.1 Existing dust mitigation

The existing dust mitigation measures utilised at BMC are outlined in the Air Quality and Greenhouse Gas Management Plan (AQMP) for Bengalla (**BMC, 2012b**).

The objectives of the AQMP are to ensure relevant statutory requirements and standards relating to air quality are met through the use of applicable best practice and air quality tools. The BMC Environmental Management System (EMS) is comprised of environmental procedures and standards for the site and features an advanced Real Time Environmental Monitoring System (RTEMS) which combines with a comprehensive set of proactive and reactive control measures to ensure dust emanating from the site is minimised.

Some of the types of proactive and reactive control measures currently utilised at BMC include dust alarms and wind speed alarms to alert relevant staff regarding the potential for dust impacts, ceasing operations during high dust periods, modifying activities depending on weather conditions and forecasting adverse weather conditions. These air quality control measures are summarised in **Table 11-1** and complement the mitigation measures outlined in **Section 7** of this report.

Table 11-1: Air quality control measures summary

Operation	Control Measures
General Dust Mitigation	✦ Dust alarms and wind speed alarms alert the Open Cut Examiner (OCE) and environmental staff about potential dust impacts. ✦ Bengalla ceases operations during high dust periods (as informed by the site's real-time air quality monitoring system). When hourly average wind speeds are above 5.6 m/s the site does not operate on the elevated areas of its overburden emplacement area, pre-strip area or the run of mine infill area. ✦ Forecasting is utilised to predict the likelihood of potential adverse weather conditions. When adverse conditions are anticipated operations are modified where practicable to reduce excess emissions leaving site. Modification of operations may include but are not limited to: additional frequency and use of water carts targeting specific areas, no blasting when winds exceed 10m/s.
Blasting	✦ Blasting at restricted times. In accordance with DA 211/93 Condition 10, all blasting is conducted on site between 7 am and 5 pm Monday to Saturday inclusive. No blasting occurs on Sundays, public holidays, or at any other time without written approval of the Director-General. ✦ Individual blasts are designed to limit the potential for environmental impacts taking into account the size of individual charges, their proximity to roads and neighbouring residences, the nature of the stemming material and weather conditions. ✦ Public roads within 500 m of blast site closed during the blast and until they are clear of dust and fumes. ✦ Blasting operations are assisted by the Blasting Permission System which integrates real-time meteorology (wind speed, inversion strength, wind direction). In addition during scheduling consideration is given to the size and design of the blast pattern relative to extremities of the mining areas and neighbours, material type, expected dust and or blast fume generation potential, sleep time and hot or reactive ground.

Operation	Control Measures
	✦ On the morning prior to a scheduled blast time, Bengalla Environmental Services' staff check the real-time meteorological information for wind speed and direction before the blast is fired. Blasts are avoided under adverse meteorological conditions. ✦ Neighbours are notified by phone, and a 'Blasting Hotline' (02 6542 9591) provides the community with daily blast times and locations. This 'Blasting Hotline' is also advertised regularly in the local paper. ✦ In relation to fume generation: ○ Blasts in weathered material not permitted to be slept > 48 hours without approval, and no other blasts are permitted to be planned to be slept > 5 days without approval. ○ Use of blast fume scale and logging of fume incidences. ○ Trialling of different explosives. ○ Blasts filmed where practicable to provide a library of reference data.
Bulldozing coal	✦ Dozers travel on watered routes between work areas
Bulldozing overburden	✦ Dozers travel on watered routes between work areas. ✦ No operations at exposed areas during high dust periods (as informed by the site's real-time air quality monitoring system).
Coal crushing and screening	✦ Crushing plant enclosed within internal water sprays.
Loading/ unloading coal stockpiles	✦ Automated initiation of coal stockpile sprays when the wind exceeds 5.6m/s. Coal stockpile spray systems are informed by on-line meteorological data. ✦ Monitoring of the stacking machine and stockpile height to minimise drop heights. ✦ Visual surveillance of dust plumes visible dust not to rise above the boom height of the stacker or reclaimer or leave the bounds of the stockpile being worked. ✦ Close monitoring of reclaim operations where the machine is working raw coal or performing final cut reclaiming. ✦ Use of stockpile sprays and/or water carts where dust cannot be controlled within the confines of the stockpile. ✦ Automated stacker/reclaimers which vary their height by sensor. ✦ Stockpiling and recovery of ROM coal is minimised as practical. ✦ ROM coal is usually trucked from the pit to the ROM hopper, with a limited ROM stockpile maintained in case of poor weather.
Dragline operations	✦ Avoiding over-dragging and overflowing the material in the bucket. ✦ Lift bucket cleanly away from the dig face-hoist up with minimum spillage. ✦ Restrict the drop height as far as practical, particularly during windy conditions. ✦ Placement of material in a manner which avoids large rocks rolling down the spoils. ✦ Regular assessment of dust from dragline operations throughout the shift by the dragline operator and mine supervisor / team leader (or nominated representative). ✦ Implementation of measures to ensure that visible dust from active work areas does not leave the mine site and encroach on private property. ✦ Specific measures to limit dust from dragline operations include modifying dragline bucket movement, material placement, skilled modification of bucket movement, fill and placement of material decreases dust impact. ✦ Dust-related dragline stoppages are logged.
Drilling	✦ All drill rigs equipped with dust suppression systems (vacuum systems). ✦ Inspection of drill dust suppression systems to ensure they are fully operational at the start of each shift (water sprays, vacuum equipment, dust skirts to be fully operational). ✦ Ceasing operations if systems are not operating properly resulting in visible dust. The drill is stood down pending repairs being carried out. ✦ When moving off a drill hole, operators are required to take care not to disturb drill cuttings. ✦ Blast crew must ensure disturbance to the crust on the drill cuttings is kept to a minimum

Operation	Control Measures
	when loading the shot. ✦ All drill sites are watered down post drilling to ensure adequate crusting of drill cuttings. ✦ Visible dust triggers for suspending operations (visible dust cloud rising above drill deck is unacceptable). ✦ Operators can call for a water cart if the drill bench is dusty (a small water cart is available for this purpose).
Graders	✦ All haul roads are watered prior to grading. ✦ Where possible haul roads are watered immediately following grading prior to any heavy vehicle traffic.
Hauling on unsealed roads	✦ Access roads with high light vehicle traffic volumes are paved including around the administration and CHPP areas ✦ Trafficable areas are clearly demarcated and vehicle movements largely restricted to these areas. ✦ All trafficable areas and vehicle manoeuvring areas are maintained. ✦ Fleet optimisation to reduce vehicle kilometres travelled. ✦ Wet suppression is applied using water carts. ✦ Levels of visible dust are assessed regularly by operators and the mine supervisor. ✦ Additional water suppression is called for by operators when observed elevated dust levels occur. ✦ Interim measures that are taken to reduce dust levels (pending additional wet suppression) may include reduced vehicle speed or suspension of operations.
Trucks unloading overburden	✦ Ceasing of operations during high dust periods. ✦ In general Maximum overburden dump heights are restricted to 7m lifts.
Material transfer of coal	✦ Enclosure or partial enclosure of conveyors. ✦ Skirting fitted to conveyors at transfer points. ✦ Use of belt cleaning. ✦ Enclosed chutes.
Scrapers	✦ Scrapers travel on watered or chemically suppressed haul roads. ✦ Suspension of topsoil stripping operations during dry, windy conditions. ✦ Haul roads used by scrapers during their loading and unloading cycle will be watered.
Train loading	✦ Automated loading systems, with provision made for telescopic chutes and load profiling. ✦ Provision for rail loading facilities to be closely monitored for the spillage of coal fines and material in the vicinity of the loading bin and rail siding. Coal spillage is required to be collected and disposed of on a regular basis to eliminate the potential for wind-blown dust.
Loading/ unloading of ROM coal	✦ Drop heights reduced as far as practicable by excavator operators. ✦ ROM hopper is equipped with a roof and is enclosed on 3-sides with automated water curtain. ✦ Visual triggers for safety purposes (visible dust should not rise above the operator cabin to ensure visibility is not compromised). ✦ Visual trigger for dust mitigation. Dust mitigation measures are called for (e.g. water cart) if dust is observed to rise half way above the wheel height. ✦ Application of wind speed thresholds (5.6 m/s) for defining moderate to strong winds for dust management purposes. ✦ Dust suppression sprays (or water cart) availability for use at all times during coal handling or dumping. ✦ Modification of operations (e.g. slower tipping) if dust cannot be controlled in the manner specified. ✦ Ceasing of operations when visible dust leaves the mine site.
Wind erosion of exposed areas/ stockpiles	✦ Topsoil Stripping Areas are limited to two strips ahead of mining to minimise the amount of disturbed area. All site disturbances are managed via the ground disturbance permit system.

Operation	Control Measures
	✦ Topsoil stripping and topsoil stockpile volumes are tracked (and mapped) on an ongoing basis (topsoil stockpiled register). ✦ Topsoil stockpiles in place for longer than 3 months are vegetated to minimise dust generation. ✦ Topsoil stockpiles have gently battered slopes with heights limited to 3m. ✦ Topsoil stripping is not undertaken during high winds. ✦ Bengalla has no tailings dam (fine material is thickened, dewatered and then combined with other reject streams for emplacement within the spoil area and capped with a minimum of 5 m of inert overburden material.)
Wind erosion of overburden	✦ Permanent rehabilitation in line with Mining Operation Plan (MOP) targets. ✦ Rehabilitation methods and procedures are undertaken in accordance with the Bengalla procedures. ✦ As rehabilitation progresses the vegetation is actively managed. ✦ Rehabilitation is completed opportunistically to ensure plant establishment occurs reducing dust generation from uncovered areas. Bengalla undertakes rehabilitation of areas as soon as they become available (including grass cover on windrows and temporary slopes at the outer edges of the mine). Rehabilitation monitoring is undertaken to assess the long term viability of rehabilitation. ✦ Annual audit of rehabilitated areas to assess ongoing success of rehabilitation and identify areas that need remedial work. ✦ Alternative rehabilitation techniques and soil improvement options maybe trialled at Bengalla to improve the rehabilitation success of both pasture species and native tree species. ✦ Interim stabilisation of inactive spoil through vegetation and/or chemical suppression. Interim stabilisation techniques are applied on temporarily inactive open spoils.
Spontaneous combustion	✦ Minimise quantity of combustible material disposed of with overburden and minimise quantity of air that can reach material that is disposed. ✦ Manage the raw and clean coal stockpiles to prevent spontaneous combustion of the stockpiled coal.
Vehicle exhaust emissions	✦ All vehicles to comply with appropriate emission guidelines and equipment will be properly maintained to minimise emissions.

Source: BMC, 2012b

Supplementary monitoring includes video camera surveillance to address performance in real time, to assist in making decisions to minimise offsite air quality impacts, target the dust producing activities, and improve response times to dust events.

Air quality performance indicators currently utilised by Bengalla include measures of:

- Compliance with relevant air quality standards at monitoring locations, in particular those which are representative of sensitive receiver locations; and,
- Compliance with the Bengalla EMP and the AQMP, as indicated by internal and statutory reporting.

Further improvement to the AQMP and dust mitigation measures which would be incorporated by the site for the purposes of this Project relate to ensuring best practice operation is achieved, as outlined in the following sections.

11.2 Best practice dust mitigation

Best practice dust mitigation for the Project comprises of three core elements.

1. Best practice design of the mine to eliminate unnecessary dust occurring in the first place;
2. Best practice dust mitigation of the dust that is produced during operations, and,
3. Best practice dust management to systematically measure dust levels, coordinate the mitigation measures that are applied and to reactively and proactively control operational activity to ameliorate or eliminate impacts.

The emissions inventory used in the study (see **Appendix C**) reflects the reductions that are achieved by the first two core elements. Modelling of a specific situation, where exact equipment locations and actual data are available, can be done to test the effectiveness of real time reactive management, or predictive management controls that are a component of the third core of best management. However, in a general EA study covering many years of operation, it is not practical to assess the range of possible effects that predictive controls and reactive management strategies have on potential impacts, other than to note that such strategies would limit the impacts of peak events that may otherwise occur from time to time.

11.2.1 Best practice mine design

The Project has been designed to minimise the emissions from haul roads, overburden dumps, unnecessary hauling or double handling of materials. This is done inherently in the design and is separate to add-on controls such as watering. The effectiveness of the mine design in reducing emissions is reflected in the low net total dust emissions generated by the project relative to the quantity of material being moved and coal produced.

Relative to Greenfield sites, projects that extend an existing mine will generally have limited scope for wholesale design changes in order to mitigate impacts. However it is the case that the BMC pit has evolved over time to a more efficient, lower dust emitting design. Progressive improvements in the mine's operational efficiency, for example by reducing haul road distances, straightening pit shells and positioning plant in central locations, goes hand-in hand with reducing emissions from the mine also.

11.2.2 Best practice operational dust mitigation

BMC proposes to implement best practice dust management at its operations to further reduce and manage any dust impacts. These practices are based on the currently available best practice measures that would be implemented for this Project as detailed in **Section 7** of this report, and as have been factored into the modelling.

The proposed dust management measures that would be employed at Bengalla are considered appropriate for managing dust emissions from the Project and would form an integral component of the Project, for reducing the potential for any dust impacts.

Key controls include watering or chemical dust suppression of haul road emissions.

11.2.3 Best practice dust management

Bengalla currently operates a comprehensive air quality monitoring network and mining activities operate per well developed dust emissions management and control procedures in place. This section provides comments and recommendations to supplement the existing procedures based on the results presented in this assessment.

The Bengalla air quality management program covers a variety of aspects to ensure effective dust mitigation and management occurs at the operation. Aspects of the management system include the provision of guidance to employees on dust management measures for specific sources and activities and the use of automated monitoring systems that detect adverse dust and meteorological conditions.

11.2.3.1 Monitoring network

The location of the current air quality monitoring network at Bengalla is shown in **Figure 6-6**. This monitoring network surrounds Project boundary and is generally representative of the nearby sensitive receptors for the current BMC mine.

However, based on the predicted impacts presented in this assessment, some improvements to the existing network are recommended to enhance BMC's ability to manage dust impacts and to verify the environmental performance of the Project.

The recommended modifications are:

- Investigate the use of TEOM monitors to largely replace or augment the HVAS monitoring network;
- Investigate the potential for an ambient air quality monitoring data sharing arrangement with neighbouring operations;
- Commissioning of additional dust monitors to the west, northwest and southwest of the Project; and,
- Investigate the use of advanced dust management systems which combine meteorological forecasting with real-time meteorological and dust data. These systems may provide suitable information to allow for proactive and reactive operational measures to be applied more effectively.

11.2.3.2 Advanced dust management systems

There are a number of different advanced dust management systems available on the market today. These systems vary in complexity and capability, and are typically bespoke systems developed for specific mine locations, or for certain activities. The systems can incorporate various features such as monitoring instruments, cameras and SMS alert/ alarm features to prompt a response from the responsible mine staff to certain conditions.

The use of such systems will generally provide mine staff with a better understanding of potential dust problems and allow for better decision making in regard to taking the appropriate mitigating actions. It is noted that BMC currently has visual monitors as well as dust and wind speed alarms in operation.

Advanced forecasting or predictive systems have recently been become available through developments in international weather forecasting systems. These systems can be coupled with air dispersion models to forecast potential air quality impact risks and allow sufficient for mine operators to pre-emptively act to manage potential impacts before they occur.

The forecasting systems are typically included as part of the documented procedures and systems for operational dust management. Such systems represent best practice and if the investigations show such systems to be feasible and useful at this location, they would be applied in the Project.

12 ASSESSMENT OF POTENTIAL CONSTRUCTION IMPACTS

As part of the Project, BMC have proposed new infrastructure to augment the efficient operation of Project. This involves the construction of a number of buildings and related infrastructure, including the following:

- Additional car parking areas;
- Maintenance bay extension;
- Tyre change facility;
- Storage building;
- Heavy vehicle truck wash;
- CHPP upgrade and ROM hopper relocation;
- Extension to stockpile area; and
- Bengalla Link Road relocation

The construction process will temporarily generate dust. It is proposed that the construction process would be completed by Year 4 of the Project (excepting the Bengalla Link Road relocation around Year 20).

The impact due to these activities is difficult to accurately quantify due to the short, sporadic periods of dust generating activity that may occur over the construction time frame. However the total amount of dust generated from such activities would be minor and given the construction activity would be located relatively close to the main dust generating activities of the mine, the additional sporadic impact due to construction activities would not be discernible beyond the existing levels of dust that occur at any off-site receptor.

The majority of the construction activities are scheduled for completion in three months blocks through the construction period. Several construction activities are scheduled to take up to a year, however these are for linear infrastructure activities such as re-alignment of roads, creek diversions and construction of conveyors. Whilst the total construction duration may be up to a year, the actual activity in any one location would only occur for a short period, and therefore the localised dust levels from such activity would also only occur in the one place for a short period.

To ensure dust generation from construction is controlled; the site would utilise the Air Quality Management Plan (AQMP) which would be updated for the Project and applied to control potentially unwarranted construction dust emissions. The AQMP would apply to the construction activities with the most potential for dust impacts and would be based on prevention of any significant visible dust emissions.

The aim of the AQMP would be to minimise dust as far as practicable and to ensure that all applicable best practice measures are being taken to minimise dust during construction. The major dust emissions during the construction phase are identified as vehicles travelling on temporary access roads, handling of materials and wind erosion of exposed areas.

Potential mitigation measures to control dust from the construction activities would include:

- Maintaining sufficient levels of moisture on the surface of trafficked surfaces;
- Limit vehicle speeds on construction areas; and,
- Rehabilitate completed sections of the site as soon as practicable.

Relative to the mining operations, the scale of emissions generated during construction would be small, and therefore, provided that reasonable construction dust controls are implemented and managed via a construction dust management plan, there would not be any discernible effect at any off-site receptors above that predicted for ongoing operations.

13 ASSESSMENT OF DIESEL EMISSIONS

13.1 Preamble

It is generally considered that the quantity of emissions generated from the diesel powered equipment used for mining activity is too low to generate any significant off-site concentrations. This is due to considerations of the relatively small individual sources, the generally large distance between the sources and the locations of the sensitive receptors, and the generally widely spread distribution of sources across the mine site.

However, recent analysis by NSW OEH indicates that a large amount of diesel fuel is used in mining, and consequently there may be potential for impacts to arise due to the emissions from diesel powered equipment used in mining.

13.2 Approach to assessment

13.2.1 Emission estimation

Emissions from the diesel powered equipment were estimated on the basis of manufacturer's data. It is noted that manufacturer's equipment performance specifications were typically categorised on the basis of the US EPA federal tier standards of emissions for diesel equipment (**Dieselnet, 2012**).

Emissions for certain plant included non-methane-hydrocarbon (NMHC) and NO_x emissions as a single value. For the purpose of this assessment it has been conservatively assumed that the total emission (NHMC and NO_x) comprises NO_2.

The various types of diesel powered mining equipment used at the Project were identified in the mine production schedule (see **Table 13-1**). Plant hours of operation were based on plant availability and utilisation rates for the specific equipment type, conservatively assuming that all operational plant operates at full power for 20% of the time.

Table 13-1: Summary of diesel powered equipment and associated emissions

Equipment type	Number of Equipment					CO (g/KWh)	NMHC +NOx / NOx (g/KWh)
	Year 1	Year 4	Year 8	Year 15	Year 24		
Hitachi EX5500 Excavator	5	5	5	6	7	3.5	6.4
Hitachi EX3600 Excavator	2	2	2	2	2	3.5	6.4
LeTourneau 1800 Loader	1	1	2	1	1	3.5	6.4
Komatus 830E Haul Truck	21	33	39	46	53	3.5	6.4
Hitachi EH4500 Haul Truck	9	6	1	0	0	0.72	8.10
CAT 789 Haul Truck	0	0	4	0	0	11.4	9.2
Cat D11 Dozer	10	11	11	11	11	3.5	3.5
Cat 854G Dozer	1	1	1	1	1	3.5	6.4
Reedrill SK50 Drill	4	5	5	6	7	3.5	6.4
Euclid R90 Water Cart	4	4	4	4	4	1.3	9.2
Cat 16M Grader	2	2	2	2	2	3.5	4
Cat 24M Grader	1	1	1	1	1	3.5	4

13.2.2 Dispersion modelling

Dispersion modelling of the diesel powered equipment was conducted for each mine plan year assessed. The air dispersion model was setup essentially as discussed in **Section 8**. Incremental additional impacts due to the Project were added to the calculated ambient background level to assess potential impacts.

The NO_2 monitoring data presented in **Section 6.3.4** show that the maximum measured 24-hour average NO_2 background level would be 37.6µg/m³ and the annual average background level would be 16.9µg/m³. The maximum 1-hour NO_2 level measured at Muswellbrook was 86.5µg/m³, (between November 2011 and August 2012) and 79µg/m³ at Beresfield. Per the Victorian EPA approach, the 70th percentile level of 39.5µg/m³ obtained from the Beresfield data was used as a constant background level contributing to the total cumulative impact predictions as the Muswellbrook data does not contain a full year of measurements.

13.3 Modelling predictions

Figure G-1 to **Figure G-10** in **Appendix G** present isopleth diagrams of the predicted modelling results for the assessed 1-hour average and annual average NO_2 concentrations.

Table 13-2 presents the model predictions at each of the privately-owned receptors with background levels included. The values presented in bold indicate predicted values above the relevant criteria.

Table 13-2: Predicted NO_2 concentrations at privately-owned receptors

Receptor ID	Year 1		Year 4		Year 8		Year 15		Year 24	
	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average
2	69.4	29.0	70.6	29.0	63.3	29.0	60.1	28.9	58.5	28.9
3	68.8	29.0	70.1	29.0	63.1	29.0	59.9	29.0	58.6	28.9
7	59.9	28.9	62.0	29.0	59.0	28.9	58.7	28.9	60.1	28.9
8	58.8	28.9	61.1	29.0	59.8	29.0	60.0	28.9	61.4	28.9
12	61.8	28.9	63.5	29.0	60.0	29.0	58.4	28.9	60.1	28.9
17	68.0	29.0	69.6	29.0	63.2	29.0	60.0	29.0	58.9	29.0
19	69.1	29.0	71.0	29.0	64.2	29.0	60.9	29.0	60.0	29.0
22	69.9	29.0	72.1	29.1	65.1	29.0	61.7	29.0	61.4	29.0
23	70.1	29.1	72.5	29.1	65.5	29.1	62.1	29.0	62.1	29.0
24	70.2	29.1	72.6	29.1	65.5	29.1	62.2	29.0	62.2	29.0
25	67.4	29.1	70.5	29.1	64.7	29.1	61.6	29.0	64.9	29.0
27W	66.1	29.2	70.3	29.3	65.5	29.2	64.5	29.1	68.7	29.1
27E	61.5	29.1	65.6	29.2	66.9	29.1	69.3	29.1	71.7	29.1
29	62.4	29.5	68.9	29.6	71.3	29.4	71.3	29.4	78.1	29.3
30	62.1	29.1	68.8	29.2	73.5	29.1	71.5	29.1	74.7	29.1
31	61.8	29.1	68.8	29.2	73.1	29.1	71.3	29.1	75.0	29.1
33	61.8	29.1	69.0	29.2	73.1	29.1	71.5	29.1	75.2	29.1
39	62.4	29.3	72.2	29.4	74.3	29.3	72.0	29.2	78.1	29.2
40	62.0	29.4	72.4	29.5	72.2	29.4	73.2	29.3	80.4	29.3
41	60.1	29.5	69.7	29.6	69.1	29.5	72.3	29.4	80.7	29.3
42	60.0	29.5	69.3	29.6	68.7	29.5	72.1	29.4	80.6	29.3
43	62.9	29.7	67.5	29.7	69.0	29.6	70.3	29.4	79.4	29.4
44	63.9	29.7	67.0	29.8	69.2	29.6	69.6	29.5	78.9	29.4
45	73.8	30.0	73.6	30.1	72.0	29.9	72.9	29.7	77.9	29.7

Receptor ID	Year 1		Year 4		Year 8		Year 15		Year 24	
	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average
46	70.7	29.9	72.0	30.0	71.3	29.8	72.4	29.6	77.2	29.6
47	60.4	29.6	68.3	29.6	68.6	29.5	71.4	29.4	80.3	29.4
48	60.2	29.5	68.4	29.6	68.5	29.5	71.4	29.4	80.3	29.4
49	59.9	29.5	68.5	29.6	68.4	29.5	71.5	29.4	80.3	29.3
50	60.5	29.5	67.9	29.6	68.6	29.5	71.1	29.4	80.2	29.4
51	60.7	29.5	67.3	29.6	68.7	29.5	70.7	29.4	79.9	29.4
52	60.7	29.5	66.8	29.6	68.7	29.5	70.3	29.4	79.6	29.4
53	61.0	29.5	66.1	29.6	68.7	29.5	69.7	29.4	79.2	29.4
54	59.4	29.5	68.7	29.6	68.1	29.5	71.6	29.3	80.3	29.3
55	59.6	29.5	68.2	29.6	68.3	29.5	71.2	29.4	80.1	29.3
57	60.2	29.5	67.0	29.6	68.4	29.5	70.3	29.4	79.5	29.3
58	60.3	29.5	66.5	29.6	68.4	29.5	69.9	29.4	79.2	29.4
59	60.7	29.5	65.7	29.6	68.6	29.5	69.3	29.4	78.8	29.4
60	60.9	29.5	64.9	29.6	68.6	29.5	68.7	29.4	78.3	29.4
61	57.5	29.4	66.6	29.4	66.1	29.4	68.5	29.3	77.1	29.3
62	56.9	29.4	63.5	29.5	66.4	29.4	67.1	29.3	74.8	29.3
63	58.3	29.4	65.0	29.5	67.1	29.4	68.3	29.3	71.7	29.4
64	73.3	29.6	82.0	29.7	84.3	29.6	75.9	29.5	76.5	29.5
66	84.8	29.6	97.4	29.8	94.2	29.6	83.2	29.5	84.0	29.6
81	55.5	29.3	62.3	29.4	64.4	29.3	65.7	29.3	69.5	29.3
83	55.7	29.3	63.2	29.4	65.0	29.4	66.4	29.3	69.9	29.3
84	55.2	29.3	62.7	29.4	64.2	29.3	65.7	29.3	69.3	29.3
85	55.4	29.3	63.6	29.4	64.9	29.4	66.5	29.3	70.3	29.3
87N	60.7	29.4	66.6	29.5	64.9	29.4	65.6	29.4	70.8	29.4
87S	63.5	29.4	70.6	29.5	67.8	29.5	65.1	29.4	70.5	29.4
88W	50.4	28.8	55.0	28.8	57.5	28.8	59.7	28.9	65.8	28.9
88N	50.4	28.8	55.0	28.8	57.5	28.8	59.6	28.9	65.7	29.0
88S	50.4	28.8	54.9	28.8	57.4	28.8	59.5	28.9	65.6	29.0
90	51.1	28.8	55.8	28.9	58.2	28.9	59.9	28.9	65.7	29.0
92	51.8	28.8	56.6	28.9	59.0	28.9	60.3	28.9	66.7	29.1
93	51.3	28.8	56.1	28.9	58.4	28.9	59.9	28.9	65.8	29.0
96	48.7	28.8	52.6	28.8	54.8	28.8	57.1	28.8	61.9	28.9
97	48.4	28.8	52.2	28.8	54.3	28.8	56.3	28.8	60.8	28.9
98	51.8	28.8	56.6	28.9	58.9	28.9	60.1	28.9	66.3	29.1
102	51.9	28.9	56.4	28.9	58.7	29.0	65.4	29.0	75.2	29.2
103	51.5	28.9	57.5	29.0	61.4	29.0	69.1	29.0	80.7	29.3
105	52.2	28.9	58.6	29.0	62.2	29.0	69.3	29.0	77.4	29.3
106	55.2	29.0	63.1	29.1	67.0	29.1	73.9	29.2	78.9	29.7
107	51.9	28.9	58.6	29.0	62.6	29.0	70.3	29.0	81.0	29.3
108	54.1	29.0	61.9	29.1	66.2	29.1	74.2	29.1	83.5	29.5
110S	56.2	29.0	65.1	29.1	69.9	29.2	78.8	29.2	88.6	29.7
110N	55.5	29.0	64.5	29.2	70.8	29.2	82.8	29.2	105.3	29.8
112N	59.0	29.2	70.9	29.4	78.8	29.4	95.7	29.5	127.6	30.4
112S	58.3	29.1	67.9	29.2	72.5	29.3	80.1	29.3	84.4	30.0
113	60.2	29.1	70.9	29.3	76.2	29.3	85.0	29.4	90.0	30.2
114	62.3	29.2	74.0	29.4	79.6	29.4	87.8	29.5	95.7	30.5
117	61.2	29.2	70.2	29.5	73.1	29.6	86.5	29.7	132.1	30.7
118	71.1	29.5	85.4	29.9	96.5	30.1	89.6	30.3	141.4	32.3

Receptor ID	Year 1		Year 4		Year 8		Year 15		Year 24	
	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average
119	66.9	29.4	81.8	29.7	89.5	29.9	108.8	29.9	154.2	31.2
120	56.8	29.2	65.3	29.3	70.1	29.4	82.0	29.5	119.1	30.2
126N	49.9	28.9	54.8	29.0	55.3	29.1	59.1	29.1	71.8	29.4
126W	50.4	28.9	55.0	29.0	56.2	29.0	60.4	29.1	72.9	29.3
126S	50.7	28.9	55.0	29.0	56.7	29.0	60.8	29.0	73.1	29.3
130	51.3	28.9	55.6	29.0	58.0	29.0	63.1	29.0	75.8	29.2
133N	50.1	28.9	54.4	29.0	55.8	29.0	56.6	29.0	66.1	29.2
133W	50.3	28.9	54.3	28.9	56.2	29.0	57.1	29.0	66.1	29.2
133S	50.5	28.9	54.6	28.9	56.6	29.0	57.8	29.0	67.9	29.2
145	49.7	28.9	54.1	29.0	54.1	29.1	57.2	29.1	69.2	29.3
146	49.8	28.9	54.4	29.0	55.0	29.1	58.7	29.1	71.9	29.4
149S	50.3	29.0	55.6	29.1	55.6	29.1	59.9	29.2	72.8	29.5
149W	51.7	29.0	57.0	29.1	57.4	29.1	61.3	29.2	76.6	29.5
149N	52.2	29.0	57.6	29.1	58.2	29.1	62.6	29.2	78.7	29.5
152	61.5	29.3	76.4	29.6	78.3	29.6	98.0	30.0	165.4	31.1
153	57.3	29.2	69.1	29.4	69.3	29.5	82.7	29.7	120.3	30.4
154	61.9	29.3	77.3	29.6	78.6	29.7	98.4	30.0	172.8	31.1
155	65.6	29.4	84.2	29.8	86.2	29.8	109.0	30.3	217.2	31.9
156S	65.0	29.4	83.9	29.8	86.6	29.8	103.3	30.3	200.6	32.1
156E	62.7	29.3	82.0	29.7	81.4	29.7	99.5	30.1	177.3	31.5
156W	60.3	29.2	77.4	29.5	76.9	29.6	86.3	29.9	133.8	30.9
158	70.1	29.6	90.4	30.1	107.0	30.3	110.0	31.1	216.2	33.9
161	60.5	29.3	73.0	29.6	80.6	29.7	83.6	30.1	118.2	31.3
166	64.5	29.7	79.1	30.4	100.2	30.5	96.6	30.9	146.0	33.0
168	82.2	30.7	119.2	31.9	164.1	32.7	152.5	33.3	**272.8**	40.7
169	65.2	29.8	84.7	30.6	94.0	30.8	93.8	31.1	138.2	33.3
171	62.7	29.9	81.4	30.5	94.4	30.8	95.5	31.1	131.1	33.5
180	64.9	29.2	73.3	29.5	82.0	29.6	80.7	29.8	106.5	30.6
184(1)	64.4	29.1	75.0	29.4	79.5	29.4	80.3	28.6	106.6	30.3
186N	64.0	29.1	76.4	29.3	76.5	29.3	80.0	29.5	106.7	30.0
186S	57.8	29.0	67.7	29.2	74.1	29.3	77.9	29.4	101.1	29.9
189	68.4	29.0	82.8	29.2	83.8	29.2	81.5	29.3	106.3	29.7
192	55.1	29.0	62.3	29.1	70.2	29.2	74.0	29.3	86.4	29.6
194	69.0	28.9	82.0	29.1	88.5	29.1	90.4	29.2	108.0	29.4
195	65.9	28.9	77.4	29.0	85.0	29.0	88.7	29.1	109.6	29.3
198	57.7	28.9	64.5	29.1	71.2	29.1	73.8	29.2	89.0	29.5
199	55.1	28.9	60.8	29.1	66.5	29.1	69.1	29.2	82.3	29.5
200	50.7	28.9	54.7	29.0	58.8	29.0	61.1	29.1	70.8	29.3
201	49.0	28.9	52.3	29.0	55.7	29.1	57.7	29.1	65.9	29.4
203	53.3	28.9	58.2	29.1	63.2	29.1	65.7	29.2	77.3	29.5
209S	47.8	29.0	52.3	29.1	54.4	29.1	57.0	29.2	66.9	29.5
209E	47.7	29.0	52.2	29.1	54.6	29.1	56.9	29.2	66.7	29.5
209W	47.1	28.9	50.9	29.1	52.9	29.1	54.8	29.2	63.2	29.5
209N	47.1	29.0	50.7	29.1	53.1	29.2	54.9	29.3	62.2	29.5
222	53.6	29.1	56.4	29.2	60.7	29.3	61.7	29.3	64.4	29.4
230	49.9	29.1	55.2	29.2	57.6	29.3	67.0	29.2	89.0	29.3
252	47.7	28.8	50.3	28.8	51.5	28.8	51.6	28.8	56.3	28.9
286	48.3	29.0	50.3	29.0	52.5	29.0	59.0	29.0	69.5	29.1

Receptor ID	Year 1		Year 4		Year 8		Year 15		Year 24	
	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average	1-hour average	Annual average
287	49.5	29.0	50.6	29.0	52.2	29.1	54.1	29.1	62.7	29.1
288	51.6	29.0	52.9	29.1	56.2	29.2	56.3	29.2	61.1	29.2
289N	52.4	28.8	58.0	28.9	61.2	28.9	64.5	28.8	68.7	28.9
289S	52.9	28.8	58.3	28.9	64.4	28.9	66.7	28.8	69.1	28.9
292W	48.8	28.8	54.9	28.9	56.5	28.8	55.2	28.8	64.8	28.8
292E	48.9	28.8	54.7	28.9	55.9	28.8	55.2	28.8	64.3	28.8

(1) Estimated

13.4 Analysis of NO_2 modelling results

The modelling predictions in **Table 13-2** indicate that all privately-owned receptors are predicted to experience a maximum 1-hour average and annual average NO_2 concentrations below the relevant criterion of 246µg/m³ and 63µg/m³ in Year 1, 4, 8 and 15 respectively.

The modelling predictions for Year 24 indicate that Receptor 168 may experience levels above the criterion in a 1-hour average period. Total annual average impacts are below the relevant criterion.

It may be the case that no actual impact occurs at Receptor 168 in practice, given the total cumulative impact predicted is relatively close to the criterion and the modelling predictions are considered to be conservative.

13.4.1 Other diesel powered plant impacts

The ambient air quality goals for CO are set at higher concentration levels than the NO_2 goals. Based on the NO_2 monitoring data which is low compared to the goals, and considerations of the typical mix of ambient pollutant levels and associated emissions of CO, the indication is that predictions of CO would be well below the air quality goals and does not require further consideration.

14 ASSESSMENT OF RAIL TRANSPORT COAL DUST EMISSIONS

14.1 Introduction

The product coal produced at the Project will predominately be transported off-site via rail to the Port of Newcastle for export to customers. During this transportation activity, there is potential to generate coal dust emissions from rail wagons. The scale of the potential emissions would depend on various factors including the material properties of the product coal, meteorological factors and train/wagon specific factors.

14.2 Potential coal dust emissions from train wagons

Coal dust emissions from train wagons have the potential to originate from the coal surface of loaded wagons, leakage from wagon doors, re-suspension and wind erosion of coal spilled in the rail corridor, residual coal in unloaded wagons, and parasitic load on sills, shear plates and bogies of wagons.
The surface of loaded wagons provides a significant exposed area which is subject to wind erosion and air movement during transport. The amount of dust potentially generated during transport is related to the inherent dustiness of the coal material and the interactions of the air with the exposed coal surface (**Connell Hatch, 2008**).

Coal dust can potentially leak from the bottom doors of train wagons and fall into the ballast of the train line. This occurs when the doors of the wagon are not completely sealed. The amount of material released will depend on the material properties of the coal, and the vibrational forces experienced by the coal in the wagons that potentially break down the coal material. Dust impacts from this source are considered to be low as the ballast would provide a sufficient shielding effect to prevent particle lift-off (**Connell Hatch, 2008**).

During the loading process and in transit, there is potential for coal material to be spilled into the train corridor and cause parasitic loading on the sills, shear plates and bogies. These sources of emissions are easily prevented by careful loading of the material and profiling the shape of the load (**Connell Hatch, 2008**).

Residual coal remaining in an unloaded wagon can dry and become airborne during travel back to the site. This source is dependent on meteorological conditions, the train travel speed and the extent of any turbulent air generated in the unloaded wagon space causing the residual coal particles to become airborne.

14.3 Approach to assessment

14.3.1 Emission estimation

The study conducted by Katestone Environmental on behalf of Connell Hatch for Queensland Rail Limited (**Connell Hatch, 2008**) completed a review of a study by **Ferreira et al. (2003)** which focused on the release of coal dust from train wagons. The **Ferreira et al. (2003)** study conducted full-scale measurements of coal dust emissions from coal wagons over a 350km journey with an average train speed of between 55 and 60km/hr. The findings of this study determined that the total emission for an uncovered rail wagon was found to be 9.6 grams of TSP per kilometre.

The Katestone Environmental study applied this emission factor with dispersion modelling and found that the resulting predicted concentration compared well with actual air quality monitoring conducted. This suggests that the findings of the **Ferreria et al. (2003)** study are sensible and therefore have been applied to estimate emissions for this Project.

When considering the maximum product coal yield of 11.8Mtpa, an average train payload of 7,700t and 24-hour rail load out operation, the calculated train movements required for the Project are 9.8 train movements per day (including empty inbound trains), (**DC Traffic Engineering, 2012**). Based on this forecast and assuming that each wagon would hold approximately 96t of coal, an emission rate of 770g of TSP per km is calculated for the train.

14.3.2 Dispersion modelling

The transportation model CAL3QHCR, developed by the US EPA, has been used to assess potential impacts from this source. CAL3QHCR was designed for use in dispersion modelling of road transport emissions, however given the similar linear nature of the potential train wagon emissions compared to road transport emissions it is considered to be a suitable model for this situation also.

To consider the range of varying land use between the Project site and the Port of Newcastle, and the varying orientation of the rail line relative to the prevailing winds, the dispersion model has been setup to assess theoretical sections of the rail line over a distance of 3km with two varying alignments (north/south and east/west) and two different land use categories. Dust level calculation points were applied at a 10m spacing, perpendicular from the centre of the rail line source alignment out to a distance to 200m either side of the rail line.

14.4 Modelling predictions

Figure 14-1 presents the model predictions for each scenario. The modelling predictions indicate that at distances of 50m and beyond from the rail track centreline, the maximum 24-hour average TSP concentration for all assessed scenarios would be approximately 3µg/m^3 for the Project.

For urban areas, the predicted the maximum 24-hour average TSP level at 50m from the rail line centre would be approximately 1.5µg/m^3.

By assuming that 40% of the TSP is PM_{10} (**NSW Minerals Council, 2000**), the predicted maximum 24-hour average PM_{10} concentration would be approximately 1.2µg/m^3.

For urban areas the predicted the maximum 24-hour average PM_{10} level at 50m from the rail line centre would be approximately 0.6µg/m^3.

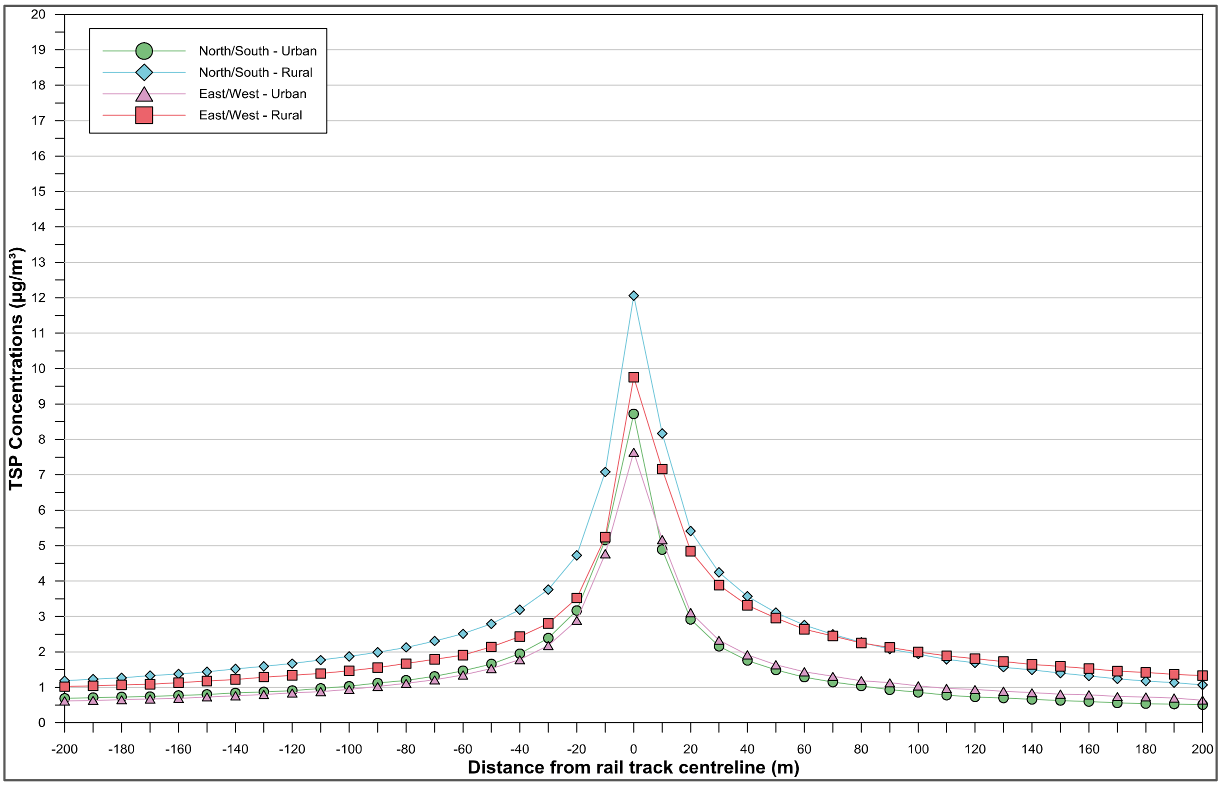

Figure 14-1: Maximum 24-hour average TSP concentrations based on train wagon emissions from Bengalla

14.5 Summary

The detailed study of dust emissions generated during rail transport of coal conducted by Katestone Environmental for Queensland Rail Limited (**Connell Hatch, 2008**) found that based on monitoring and modelling of the emissions and impacts of coal train wagons, there appears to be a minimal risk of adverse impact on human health. The study found that concentrations of coal dust at the edge of the rail corridor are below levels known to cause adverse impacts on amenity. This assessment is consistent with findings in the QR study and also indicates that the potential for any adverse air quality impacts would be low.

The predicted level of 24-hour average PM_{10} impact at locations 50m from the centre of the rail line would be approximately 1µg/m^3 or lower in urban areas and would not make any appreciable difference to air quality.

Nevertheless, BMC proposes to trial the use of spray bars to wet the surface of departing coal wagons as an additional measure to minimise potential emissions.

15 ASSESSMENT OF BLAST FUME EMISSIONS

15.1 Preamble

Air quality impacts of blast operations are managed under Environmental Work Instruction CNA-10-EWI-SITE-E6-016. The purpose of the work instruction is to ensure that blasting operations comply with all relevant requirements particularly noise, overpressure, vibration, blast fume and dust effects.

BMC also utilise a blasting permissions flowchart to guide operators on the suitability of current weather conditions for blasting. The permissions take into consideration a number of meteorological factors such as wind speed, inversion strength and wind direction which can affect the scale of potential blast impacts at receptors.

The current blast management measures applied at Bengalla appear to be adequate, as to date blasting appears to have been managed within acceptable bounds in regards to air quality.

15.2 Approach to assessment

15.2.1 Emission estimation

Blast fume emissions (NO_2) were based on emissions presented in a CSIRO study into Hunter Valley Blasts **(Attala et al., 2008)**. Blast fume emissions can vary greatly depending on a number of factors but largely depend on the tendency of a particular blast to generate NO_2 emissions. The assessment is based on the measured level of emissions from the CSIRO study.

15.2.2 Dispersion modelling

Dispersion modelling of the potential blast fume emissions was conducted for each mine plan year assessed. The model setup was generally in accordance with the setup discussed in **Section 8**. Blast emission sources where modelled in the centre of the active pit location during each year.

It is noted that the source location would vary, however for the purposes of this assessment it is considered that the centre of the pit would provide a suitable indication of the potential impacts.

The model was set up to generate a blast during each hour of the day when blasting is permitted, and considering the existing blast permissions. In other words the model was programmed to halt a blast based on the weather condition if that is what the blasting permissions would require.

As a comparison, modelling of blasts during each hour of the day without consideration of the blasting permissions was also conducted to determine the suitability of these permissions.

15.3 Modelling predictions

Figure H-1 to **Figure H-55** in **Appendix H** present isopleth diagrams of the predicted modelling results for the assessed maximum 1-hour average NO_2 concentrations during each potential blast hour of each year.

It should be noted that the isopleth diagrams show the maximum hourly extent of all potential blasts let of per the blast permissions on the hour for all daytime hours a full year, and do not represent a single blast event.

The isopleth diagrams indicate that based on the potential blast hours in each day, blasts occurring at 7:00am, 4:00pm and 5:00pm have potential to result in blast fume impacts. This indicates that the meteorological conditions during these periods may be unfavourable for blasting at times and should be accounted for prior to blasting.

It is noted that the Bengalla blasting permissions warn of potential fume impacts for blasts during wind speeds less than 2 m/s, but do not explicitly exclude blasting under such conditions. The decision to blast under such conditions is based on skilled operator judgement of the prevailing conditions, including weather data measured between the site and Muswellbrook and the alignment of the blast with the nearest sensitive receptors. This has successfully been employed at BMC for over 10 years.

As it is not reasonably possible to incorporate the human decision making element of the blast permissions into a computer model, all such low wind speed blasts were included in the modelling of potential blast impacts. It is considered likely that with the benefit of the actual human intervention that occurs, the potential early morning and late evening impacts that are predicted may not arise in practice. This is supported by the fact that blasting at 7:00am, 4:00pm and 5:00pm is not routinely conducted for any major blasts.

An examination of the blast impact isopleth diagrams shown in **Figure H-1** to **Figure H-55** in **Appendix H** was conducted to analyse any potential issues of compliance with the NO_2 criterion of 246 $\mu g/m^3$, 1-hour average. The isopleths in red show the impact that would occur if blasting occurred without any regard to the blast permissions and the light blue isopleths show the potential impact if the blast permissions are adhered to (but ignoring the human decision making component that applies when wind speeds are less than 2m/s). The results indicate the following:

- The current blast permissions need to be revised to minimise the risk for potential impact. The predictions show potential impacts at receptors that appear to be due to permissible blasts when winds are towards receptors (in the early morning and late afternoon);
- The blast permissions that would apply in Years 8 and beyond need to be revised at that time to recognise that as the mine progresses to the west the receptors to the west may come within the reach of blast plume impacts. At the same time the blast permissions that protect receptors to the east should be relaxed, as these receptors would be beyond the reach of the blast impacts as the mine moves west. Overall, there is a need to revise the blast permissions regularly as the mine progresses.

15.4 Summary

Overall, it is noticeable that during the middle daytime hours no impacts due to blasting fume emissions are predicted to occur. During these times, the blast permissions have a relatively small effect in mitigating impacts (largely as there would not be any appreciable impact to mitigate).

However in the morning and late evening, when potential impacts may occur off site (for uncontrolled blasting at such times), the results show that application of the blasting permissions would avert such potential impacts for most receptors. The available evidence shows that presently skilled operator judgement is also being used, and in conjunction with the blast permissions BMC has been able to effectively prevent potential impacts at all receptors to date.

However, the Project is moving west, and as it does so the potential for blast fume impacts to the west would increase. This means that potential impacts at receptors on either side of the mine will need to be managed simultaneously in later years, and it would become increasingly more complicated and restrictive to apply only simple blast permissions to prevent impacts in this situation.

However there is scope to improve upon the current controls methods for blasting at BMC and to do this the Project would implement a blast fume forecasting system to better manage its blasting operations.

Such a system uses actual conditions for each blast to predict the potential impact that may occur. The prediction can be made on the basis of forecast weather data, allowing operators to schedule a blast to the time of least impact over the course of the upcoming day. In effect such a system updates the blasting permissions for each individual blast on the basis of predicted impact. The system thus deals with the spatially and time varying weather and terrain influences and is generally more reliable than relying on a fixed set of wind speed, wind direction and inversion restrictions.

16 PARTICULATE MATTER HEALTH EFFECTS

The following section is a summarised excerpt of correspondence from Environmental Risk Sciences Pty Ltd to TAS.

Detailed reviews of the available studies that relate to health effects associated with exposure to particulates are available from various sources **(NEPC 2010, USEPA 2009**, **Anderson et al. 2004, WHO 2003, OEHHA 2002)**. Particulate matter is comprised of a diverse range of substances, with varying morphological, chemical, physical and thermodynamic properties, across a large size range. Particulates can be derived from natural sources such as crustal dust, pollen, sea salts and moulds, and anthropogenic activities including combustion and industrial processes. Secondary particulate matter is formed via atmospheric reactions of primary gaseous emissions. The most significant contributors to secondary particulates include nitrogen oxides, ammonia, sulfur oxides, and certain organic gases (emitted from vehicles, combustion, agriculture, industry and biogenic sources).

Particulate matter (PM) comprises particles that can remain suspended in the air for extended periods, and is typically classified by particle size.

16.1 Particulate size

The size of particulates is important as it determines how far from an emission source the particulates may be present in air (with larger particulates settling out first and smaller particles remaining airborne for greater distances) but also the potential for adverse effects to occur as a result of exposure.

The common measures of particulate matter that are considered in the assessment of air quality and health risks are:

- TSP (total suspended particulate) – this refers to all particulate with an equivalent aerodynamic particle size below approximately 50μm diameter. Larger particles (termed "inspirable", comprise particles around 10 microns (μm) and larger) that may cause nuisance and would deposit out of the air (measured as deposited dust) closer to the source. Such particles, if inhaled are mostly trapped in the upper respiratory system[1] and do not reach the lungs. Finer particles (smaller than 10 μm, termed "respirable") tend to be transported further from the source and are of more concern with respect to human health as these particles can penetrate into the lungs. As only a fraction of TSP material is harmful to human health, it is a measure of nuisance impact, not health impact.

- PM_{10}, particulate matter below 10 μm in diameter, $PM_{2.5}$, particulate matter below 2.5 μm in diameter and PM_1, particulate matter below 1 μm in diameter – these particles are small and have the potential to penetrate beyond the body's natural clearance mechanisms of cilia and mucous of the nose and upper respiratory system, with the smaller particles able to further penetrate into the lower respiratory tract[2] and lungs which may result in adverse health effects **(OEHHA 2002)**.

[1] The upper respiratory tract comprises the mouth, nose, throat and trachea. Larger particles are mostly trapped by the cilia and mucosa and swept to the back of the throat and swallowed.
[2] The lower respiratory tract comprises the smaller bronchioles and alveoli, the area of the lungs where gaseous exchange takes place. The alveoli have a very large surface area and absorption of gases occurs rapidly with subsequent transport to the blood and the rest of the body. Small particles can reach these areas, be dissolved by fluids and absorbed.

Monitoring for PM_{10} is a good method of determining the community's exposure to potentially harmful particulate matter and is the most commonly applied metric in local and regional air quality monitoring programs. Smaller particulates such as $PM_{2.5}$ and PM_1 are generally of most significance with respect to evaluating health effects as a higher proportion of these particles penetrate deep into the lungs, however monitoring for such particulate matter is not widely established and PM_{10} monitoring serves as a defacto method of measuring $PM_{2.5}$ **(WHO, 2005).**

Apart from small aerodynamic diameter the hygroscopicity, electrostatic charge, and characteristics of the human respiratory system including airway structure and geometry, as well as depth, rate and mode of breathing (e.g., nasal vs. oral/nasal) affect the extent of particulate penetration and deposition into the lung.

A significant amount of research has been conducted on the health effects of particulates with causal effects relationships identified for exposure to $PM_{2.5}$ (acting alone or in conjunction with other pollutants). A more limited body of evidence suggests an association between exposure to larger particles, PM_{10} and adverse effects **(USEPA 2009, WHO 2003).**

16.2 Particulates composition

Evaluation of size alone in regard to particle toxicity is difficult as particle size may not be independent of chemical composition. Certain particulate size fractions tend to contain certain chemical components, such as metals in fine particulates (<$PM_{2.5}$) or crustal materials in the coarse particle fraction (PM_{10} or larger). In addition different sources of particulates may emit other pollutants in addition to particulate matter. For example combustion sources, the dominant particulate source in urban areas, emit predominantly fine particulates as well as gaseous pollutants such as ozone, nitrogen dioxide, carbon monoxide and sulfur dioxide, all of which have independent health effects.

There is strong evidence to conclude that fine particles (< 2.5 µm, $PM_{2.5}$) are more hazardous than coarse particles **(WHO 2003)**, primarily on the basis of studies conducted in urban air environments where there is a higher proportion of fine particulates present from fuel combustion sources, rather than from crustal origins. Toxicological and controlled human exposure studies indicate that particles generated from fossil fuel combustion may be a significant contributor to adverse health outcomes Amongst the characteristics found to be contributing to toxicity in epidemiological and controlled exposure studies are high organic carbon content, metal content, presence of PAHs, other organic components, endotoxin and both small (< 2.5 µm) and extremely small size (< 100 nm) particulate **((USEPA 2009, WHO 2006a**, **WHO 2003).**

This does not mean that the coarse fraction of PM_{10} is not harmful, however relative to dust of crustal origin it appears to be a less critical (toxicological) source **(WHO 2003, USEPA 2009).**

The observed health effects are derived from studies conducted in urban areas, whereas the actual health impacts from particulate matter in a specific location would be affected by the specific characteristics of the mix of particulate matter at the location.

There are neither studies available nor any specific evidence that dust primarily derived from mining operations results in the same adverse effects.

Reviews of the currently available information have not been able to identify any single physical or chemical property of particles that is responsible for the array of adverse health outcomes reported in epidemiological studies **(USEPA 2009**, **WHO 2003).** Hence, WHO **(WHO 2006b)** and NEPC **(NEPC 2010)** concluded that the evidence cannot support an indicator for a standard that is more specific than size fraction alone.

As a consequence, the potential for adverse health effects is assumed to apply equally for all sources and composition of particulates at this time.

16.3 Health effects

Adverse health effects associated with exposure to particulate matter have been primarily derived from population-based epidemiological studies in urban areas, where health effects have been determined in relation to exposure to either PM_{10} or $PM_{2.5}$ (or both). It is noted that it is more difficult to obtain reliable measures of $PM_{2.5}$, hence much of the ambient air data available, and considered in the population studies is based on PM_{10}, as that was the more commonly used metric.

Short-term exposure (days to weeks) and long-term exposure (years) to PM_{10} has been linked to adverse health effects. The health effects associated with exposure to particulate matter vary widely (with the respiratory and cardiovascular systems most affected) and include mortality and morbidity effects.

Mortality effects relate to the increase in the number of deaths due to existing (underlying) respiratory or cardiovascular diseases that have been associated with exposure to PM_{10} or $PM_{2.5}$ in population-based epidemiological studies.

Morbidity effects relate to a wide range of health indicators used to define illness or the severity of illness associated with exposure to PM_{10} or $PM_{2.5}$, primarily related to the respiratory and cardiovascular system and include **(USEPA 2009, Morawska et al. 2004):**

- Aggravation of existing respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days);
- Changes in cardiovascular risk factors such as blood pressure;
- Changes in lung function and increased respiratory symptoms (including asthma);
- Changes to lung tissues and structure; and
- Altered respiratory defence mechanisms.

These effects are commonly used as measures of population exposure to particulate matter in community epidemiological studies.

Further toxicological studies on the characteristics of inhaled particles, have enabled the biological plausibility of the observed associations to be supported **(NEPC 2010)**. While the mechanisms by which particulates result in the range of adverse health effects are not fully understood, inflammation is considered central to producing many of the health effects attributed to particles **(USEPA 2009**, **WHO 2006a, WHO 2006b, OEHHA 2002).**

Controlled exposure studies of humans and animals have shown that particles, may have direct effects on the respiratory tract, mainly an inflammatory response. In particular, fine particulate matter ($PM_{2.5}$) has been shown to elicit DNA damage, mutations and carcinogenicity, primarily in the lung **(NEPC 2010).**

A summary of the available evidence, primarily derived from population-based epidemiology studies, relating to health effects that have been associated with exposure to particulate matter is outlined below.

While there is general agreement on the mortality effects associated with exposure to particulate matter, it is noted that there is less agreement on the wide range of morbidity indicators.

16.3.1 Short-term effects

Most of the evidence of an association between short-term exposure and adverse health outcomes comes from time-series epidemiological studies looking at daily increases in mortality and hospital admissions and emergency room attendances linked to ambient particle concentrations. These are presented and reviewed in a number of published reports **(NEPC 2010, USEPA 2009, Anderson et al. 2004**, **OEHHA 2002)**, as summarised below.

16.3.1.1 Mortality

The association between exposure to PM_{10} and $PM_{2.5}$ and increases in daily mortality has been the subject of extensive research showing that particles are linked to increases in all causes of mortality as well as specific mortality causes such as such cardiovascular and respiratory.

The results of multicity studies, including Australian studies **((Simpson et al. 2005a, Simpson et al. 2005b)** have identified positive associations between exposure to PM_{10} and $PM_{2.5}$ and an increase in all-cause mortality, respiratory and cardiovascular related mortality.

16.3.1.2 Cardiovascular effects

The recent evidence for an association between short-term exposure to PM_{10} and cardiovascular health effects is derived from epidemiological studies of hospital admissions and emergency department visits which show a positive association between PM_{10} and increases in hospital admissions and emergency department visits for cardiovascular diseases. Ischemic heart disease and chronic heart failure are responsible for the majority of such hospital admissions. Recent studies conducted in cities in the U.S., Europe and Australia and New Zealand have confirmed these findings for PM_{10}, and have also observed consistent associations between $PM_{2.5}$ and cardiovascular hospitalisations.

16.3.1.3 Respiratory effects

Recent studies have found a positive association between $PM_{2.5}$ and hospital admissions and emergency department visits for respiratory disease. The majority of the studies found a consistent relationship for asthmatic children; however less consistent evidence for a relationship is available for asthmatic adults.

Epidemiological studies that examined the association between short-term exposure to PM_{10} and respiratory morbidity found consistent positive effects in asthmatic children and adults, but no evidence of an association in healthy individuals.

Several lines of evidence suggest that fine particles ($PM_{2.5}$) promote and exacerbate allergic disease, which often underlies asthma.

16.3.2 Long-term effects

Long-term effects of exposure to particulate matter is primarily derived from chronic epidemiological studies looking at annual increases in mortality and other morbidity indicators including hospital admissions linked to long-term (annual average) ambient particle concentrations.

Long-term exposure to $PM_{2.5}$ has been associated with health outcomes similar to those found in the short-term exposure studies, specifically for respiratory and cardiovascular morbidity and mortality. The evidence indicates that a causal relationship exists between long-term $PM_{2.5}$ exposure and cardiovascular effects and is likely to exist between long-term $PM_{2.5}$ exposure and effects on the respiratory system **(USEPA 2009, WHO 2006b)**.

Multiple epidemiological studies have shown a consistent positive association between $PM_{2.5}$ and lung cancer mortality, but studies have generally not reported associations between $PM_{2.5}$ and lung cancer incidence. These findings are consistent with earlier studies that concluded that ambient particles and particles from specific combustion sources are mutagenic and genotoxic and provide biological plausibility for the results observed in the epidemiological studies. Collectively, the results from epidemiological studies, primarily those of lung cancer mortality, along with the toxicological studies that show some evidence of the mutagenic and genotoxic effects of particles has led the USEPA **(USEPA 2009)** to conclude that the evidence is suggestive of a causal relationship between long-term exposures to $PM_{2.5}$ and cancer.

Children may be at greater risk from long-term exposures to particles or other air pollutants because the growth and development of the respiratory system may be permanently affected by early environmental exposures **(NEPC 2010).**

16.4 Summary of health effects

The following table presents a summary of the adverse effects associated with exposure to particulate matter and the susceptible populations identified (relevant to the health endpoint).

Table 16-1: Summary of Potential Adverse Health Effects from Exposure to Particulate Matter

Health Effect	Susceptible Groups	Comments
Short-Term		
Mortality	Elderly, infants, persons with chronic cardiopulmonary disease, influenza or asthma	Causal relationship has been identified for exposure to PM10 and PM2.5.
Hospitalisation rates (respiratory and cardiovascular effects)	Elderly, infants, persons with chronic cardiopulmonary disease, pneumonia, influenza or asthma	Reflects substantive health impacts in terms of illness, discomfort, treatment costs, work or school time lost.
Increased respiratory symptoms	Most consistently observed in people with asthma, and children	For most, effects are transient with minimal overall health consequences. May result in some short-term absence from work or school due to illness.
Decreased lung function	Observed in both children and adults	For most, effects seem to be small and transient.
Long-Term		
Increased mortality rates, reduced survival times, chronic cardiopulmonary disease, reduced lung function, lung cancer	Observed in population-wide epidemiological studies, including adults, children and infants. All chronically exposed are potentially affected	Long-term repeated exposure appears to increase the risk of cardiopulmonary disease and mortality. May also result in lower lung function.

Table 16-1 relates to studies of human exposure to particulate matter in generally large cities, where a larger portion of the particulates are in the fine fraction that would penetrate more deeply into the lung, and also where a greater portion of the particulate matter is from combustion sources, and thus carries with it other individually toxic substances that are damaging to human health.

It is import to understand that the majority of particulate emissions from mining are dust which originates from the soil. Due to the extreme forces required at the micro level to break down a particle of dust into smaller particle sin the fine fraction, mining techniques used at coal mines generally cannot breakdown rock, coal or soil material into these very fine fractions. As a result emissions from mines are predominantly in the coarse size fraction that would not penetrate as deeply into the lung, or carry additional toxic combustion substances. On average it has been measured that approximately 95% of the total dust (TSP) from mining is larger than $PM_{2.5}$ in terms of size fraction, and approximately 88% of PM_{10} from mining is larger than $PM_{2.5}$ (SPCC, 1986).

It also needs to be understood that rural populations are simply too small for conclusive epidemiological studies to be conducted in rural areas, and insufficient alternative data is available for rural areas to identify specific issues that health experts can agree on. Therefore, as a matter of precaution, the findings for urban areas (as shown in **Table 16-1**) are extrapolated to cover rural areas in order to have a basis for managing rural population exposure to particulate matter.

This is not to say that particulate emissions from mining are harmless, mining emissions do include a significant component of particles in the PM_{10} and $PM_{2.5}$ range and this would include fine combustion particles from diesel equipment.

In the context of health impacts in rural areas, it needs to be noted that in many rural areas, domestic wood smoke is a key issue of health impact. Wood smoke warrants close attention in any evaluation of health impact as it can be a significant, highly localised source of toxic pollution in the winter period for rural communities and individuals.

In this regard it is also important to interpret emission inventory data, such as National Pollutant Inventory (NPI) data and data from NSW EPA's air emissions inventory for the greater metropolitan region in NSW in the correct context. For example, if one compares mine dust emissions with those from wood heaters based on only the inventory data, one would see that the two produce roughly the same amount of $PM_{2.5}$ emissions. However it would be wrong to conclude that mines and wood heaters have similar health impacts on the residential population. Unlike coal mines, wood heaters are located inside living rooms and their chimneys are closer to residents than coal mines, which means the air that the population breathes will be affected by wood heater emissions to a much greater degree.

17 GREENHOUSE GAS ASSESSMENT

17.1 Introduction

Dynamic interactions between the atmosphere and surface of the earth create the unique climate that enables life on earth. Solar radiation from the sun provides the heat energy necessary for this interaction to take place, with the atmosphere acting to regulate the complex equilibrium. A large part of this regulation occurs from the "greenhouse effect" with the absorption and reflection of the solar radiation dependent on the composition of specific greenhouse gases in the atmosphere.

Over the last century, the composition and concentration of greenhouse gases in the atmosphere has increased due to increased anthropogenic activity. Climatic observations indicate that the average pattern of global weather is changing as a result. The measured increase in global average surface temperatures indicate an unfavourable and unknown outcome if the rate of release of greenhouse gas emissions remain at the current rate.

This assessment aims to estimate the predicted emissions of greenhouse gases emitted to the atmosphere due to significant activity associated with the Project and to provide a comparison of the direct emissions from the Project at the national level.

17.2 Greenhouse gas inventories

The National Greenhouse Accounts (NGA) Factors document published by the Department of Climate Change and Energy Efficiency (DCCEE) defines three scopes (Scope 1, 2 and 3) for different emission categories based on whether the emissions generated are from "direct" or "indirect" sources.

Scope 1 and 2 emissions encompass the direct sources from the Project defined as:

"...*from sources within the boundary of an organisation as a result of that organisation's activities*" (**DCCEE, 2011a**).

Scope 3 emissions occur due to the indirect sources from the Project as:

"...*emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation*" (**DCCEE, 2011a**).

For the purpose of this assessment, emissions generated in all three scopes defined above provide a suitable approximation of the total GHG emissions generated from the Project.

Scope 3 emissions can often result in a significant component of the total emissions inventory; however these emissions are often not directly controlled by the Project. These emissions are understood to be considered in the Scope 1 and 2 emissions from other various organisations related to the Project. The primary contribution of the Scope 3 emissions occurs from the transportation of the product coal and from the end use of the product coal.

Scope 3 emissions also have the potential to arise from a greater number of sources associated with the operation of Project, but as these are often difficult to quantify due to the diversity of sources and relatively minor individual contributions, they have not been considered further.

17.2.1 Emission sources

Scope 1 and 2 GHG emission sources identified from the operation of the Project are the on-site combustion of diesel fuel, emissions of methane from the exposed coal seams, emissions from the use of explosives and on-site consumption of electricity. Scope 3 emissions have been identified as resulting from the purchase of diesel and electricity for use on-site, the transport of product to its final destination and the final use of the product.

Estimated quantities of materials that have the potential to emit GHG emissions associated with Scope 1 and 2 emissions for the Project have been summarised in **Table 17-1** below. These estimates are based on information obtained from the projected production schedule provided by the Proponent and provide a reasonable approximation for the purpose of this assessment.

Table 17-1: Summary of quantities of materials estimated for the Project

Year	ROM Coal (tonnes)	Product Coal (tonnes)	Diesel usage (kL)	Electricity usage (MWh)	Explosives Usage - ANFO (tonnes)	Explosives Usage - Heavy ANFO (tonnes)	Explosives Usage - Emulsion (tonnes)
1	10,700,000	8,453,000	56,126	67,730	13,694	4,340	177
2	11,043,725	8,927,160	57,928	72,810	14,721	4,666	190
3	13,000,000	9,464,224	53,700	76,196	15,406	4,883	199
4	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
5	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
6	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
7	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
8	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
9	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
10	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
11	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
12	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
13	15,000,000	11,850,000	78,681	93,129	18,830	5,968	243
14	15,000,000	11,850,000	78,681	110,061	22,253	7,053	287
15	15,000,000	11,850,000	78,681	110,061	22,253	7,053	287
16	15,000,000	11,850,000	78,681	110,061	22,253	7,053	287
17	15,000,000	11,850,000	78,681	110,061	22,253	7,053	287
18	15,000,000	11,850,000	78,681	126,994	25,677	8,138	331
19	15,000,000	11,850,000	78,681	126,994	25,677	8,138	331
20	15,000,000	11,850,000	78,681	126,994	25,677	8,138	331
21	15,000,000	11,850,000	78,681	126,994	25,677	8,138	331

Scope 3 emissions for the transport and final use of the coal may have the potential to vary in the future depending on the market situation at the time. These assumptions include emission factors for the transport modes of rail and shipping and the associated average weighted distance travelled for the export coal.

17.2.2 Emission factors

To quantify the amount of carbon dioxide equivalent (CO_2-e) material generated from the Project, emission factors obtained from the National Greenhouse Accounts (NGA) Factors (**DCCEE, 2011a**) and other sources are required and summarised in **Table 17-2.**

Table 17-2: Summary of emission factors

Type		Energy content factor	Emission Factor			Units	Scope	Source
			CO_2	CH_4	N_20			
Diesel oil		38.6 (GJ/kL)	69.2	0.2	0.5	(kg CO2-e/GJ)	1	Table 4 (DCCEE, 2011a)
		-	5.3	-	-		3	Table 38 (DCCEE, 2011a)
Electricity usage		-	0.89	-	-	(kg CO2-e/GJ)	2	Table 5 (DCCEE, 2011a)
		-	0.17	-	-		3	Table 39 (DCCEE, 2011a)
Explosives*	ANFO	-	0.17	-	-	(t CO2-e/GJ)	1	Table 4 (DCC, 2008)
	Heavy ANFO	-	0.18	-	-		1	Table 4 (DCC, 2008)
	Emulsion	-	0.17	-	-		1	Table 4 (DCC, 2008)
Fugitive emissions		-	0.0324	-	-	(kg CO2-e/t (ROM))	1	Coal Bed Energy Consultants (2012)
Rail		-	0.0123	-	-	(kg CO2-e/t-km)	3	QR Network Access, 2022
Ship		-	3.3	-	-	(t CO2-e/Mt-km)	3	PAEHolmes, 2010
Thermal coal		27.0 (GJ/t)	88.2	0.03	0.2	(kg CO2-e/GJ)	3	Table 1 (DCCEE, 2011a)

* The emission factor for explosives has been taken from the NGA factors published in February 2008 (**DCC, 2008**) as the current NGA factors document does not include a factor for explosives

The emission factor based on the release of methane from the coal seams at the Project is taken to be 0.0324 tonnes of CO_2-e per tonnes of ROM. This emission factor has been calculated based on actual testing of the methane gas from the coal seam provided by Bengalla (**Coal Bed Energy Consultants, 2012**). This emission factor is lower than the default factor provided in the National Greenhouse Accounts (NGA) Factors document and should provide a more accurate estimate of emissions generated for the site.

Emissions associated with the transport of coal to customers will occur via rail and shipping. The emission factor associated with the rail transport activity is taken to be 0.0123 kg CO_2-e/tonne-km (**QR Network Access, 2002**). Product coal is transported to the Port of Newcastle by rail and then transferred before being shipped to its final destination. The approximate rail distance is taken to be 300km (return distance). The emission factor associated with the shipping transport activity is taken to be 3.3 tonnes of CO_2-e/Mt-km (**PAEHolmes, 2010**) and assumes an approximate return distance of 16,000km based predominately on destinations in the Asian market.

The emissions generated from the end use of coal produced by the Project have assumed that all product coal is consumed as thermal coal in power stations. As it is difficult to estimate emissions from power stations in other countries, this assessment has assumed the emissions generated would be equivalent to those generated from a power station in NSW. The emission factor provided in the National Greenhouse Accounts (NGA) Factors document used is 88.43kg CO_2-e/GJ and energy content factor 27GJ/t (**DCCEE, 2011a**).

17.3 Summary of greenhouse gas emissions

Table 17-3 summarises the estimated annual CO_2-e emissions due to the operation of the Project.

Table 17-3: Summary of CO_2-e emissions for the Project (t CO_2-e)

Year	Fugitive Emissions	Diesel Fuel		Electricity		Explosives	Transport via Rail		Transport via Ship	Final use of product
							Export	Domestic		
	Scope 1	Scope 1	Scope 3	Scope 2	Scope 3	Scope 1	Scope 3	Scope 3	Scope 3	Scope 3
1	346,680	151,435	11,482	60,280	11,514	2,358	29,944	166	429,920	20,182,467
2	357,817	156,299	11,851	64,801	12,378	3,375	31,624	176	454,036	21,314,576
3	421,200	144,889	10,986	67,815	12,953	3,532	33,526	186	481,351	22,596,875
4	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
5	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
6	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
7	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
8	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
9	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
10	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
11	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
12	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
13	486,000	212,291	16,096	82,885	15,832	4,317	41,977	233	602,691	28,293,178
14	486,000	212,291	16,096	97,955	18,710	5,101	41,977	233	602,691	28,293,178
15	486,000	212,291	16,096	97,955	18,710	5,101	41,977	233	602,691	28,293,178
16	486,000	212,291	16,096	97,955	18,710	5,101	41,977	233	602,691	28,293,178
17	486,000	212,291	16,096	97,955	18,710	5,101	41,977	233	602,691	28,293,178
18	486,000	212,291	16,096	113,024	21,589	5,886	41,977	233	602,691	28,293,178
19	486,000	212,291	16,096	113,024	21,589	5,886	41,977	233	602,691	28,293,178
20	486,000	212,291	16,096	113,024	21,589	5,886	41,977	233	602,691	28,293,178
21	486,000	212,291	16,096	113,024	21,589	5,886	41,977	233	602,691	28,293,178
TOTAL	**9,873,697**	**4,273,868**	**324,056**	**1,865,658**	**356,363**	**96,382**	**850,687**	**4,726**	**12,213,751**	**573,371,131**

17.4 Contribution of greenhouse gas emissions

Table 17-4 summarises the emissions associated with the Project based on Scopes 1, 2 and 3.

Table 17-4: Summary of CO_2-e emissions per scope (t CO_2-e)

Year	Scope 1	Scope 2	Scope 3	Scope 1+2
1	500,473	60,280	20,663,884	560,752
2	517,491	64,801	21,824,640	582,291
3	569,621	67,815	23,135,877	637,436
4	702,608	82,885	28,970,009	785,493
5	702,608	82,885	28,970,009	785,493
6	702,608	82,885	28,970,009	785,493
7	702,608	82,885	28,970,009	785,493
8	702,608	82,885	28,970,009	785,493
9	702,608	82,885	28,970,009	785,493
10	702,608	82,885	28,970,009	785,493
11	702,608	82,885	28,970,009	785,493
12	702,608	82,885	28,970,009	785,493
13	702,608	82,885	28,970,009	785,493
14	703,393	97,955	28,972,887	801,347
15	703,393	97,955	28,972,887	801,347
16	703,393	97,955	28,972,887	801,347
17	703,393	97,955	28,972,887	801,347
18	704,178	113,024	28,975,766	817,202
19	704,178	113,024	28,975,766	817,202
20	704,178	113,024	28,975,766	817,202
21	704,178	113,024	28,975,766	817,202
TOTAL	**14,243,946**	**1,865,658**	**587,120,713**	**16,109,604**

In 2010, the estimated greenhouse emissions for Australia were 543 Mt CO_2-e (**DCCEE, 2011b**). In comparison, the estimated annual average greenhouse emission for the life of the Project is 0.77Mt CO_2-e (Scopes 1 and 2). Therefore, the annual contribution of greenhouse emissions from the Project in comparison to the Australian greenhouse emissions in 2010 is estimated to be approximately 0.14%.

The estimated Greenhouse gas emissions generated in all three scopes defined are based on approximated qualities of materials and where applicable generic emission factors. Therefore the estimated emissions for the Project are considered conservative.

17.5 Greenhouse gas management

BMC intends to continue to utilise various mitigation measures to help reduce the overall greenhouse gas emissions generated from the Project.

BMC considers ways to improve energy efficiency with use of B2 biodiesel and completion of the first five year cycle of the Energy Efficiency Opportunity project, with an approximate saving of 41,000 gigajoules per annum.

An Energy Savings Action Plan will also be established in accordance with the NSW Department of Energy, Utilities and Sustainability (DEUS) guidelines (**DEUS, 2005**).

The Greenhouse gas management system will provide the basis for identifying and implementing mitigation measures in various activities on-site. Examples of where energy efficiency opportunities are likely to occur include:

- Monitoring fuel efficiency of diesel equipment;
- Optimising conditions for fleet operations;
- Consideration and potential use of high efficiency electric motors;
- Energy efficient lighting systems; and
- A review of alternative renewable energy sources for new developments.

18 CONCLUSIONS AND SUMMARY OF IMPACTS

The study has identified the potential air quality impacts that may arise from the Project operated with best practice design and mitigation measures that are reasonable and feasible to implement. Best practice proactive or reactive measures that may operate are not included in the modelling results, but implementation of such measures would limit the impacts of peak events shown in the results. The best practice controls are detailed in **Section 7.2** and **Section 11**. The assessment of air quality focuses on potential dust impacts from the mine and cumulatively, but has also investigated potential impacts from blasting, diesel fuel combustion and transport of coal by rail.

Subsequent to this assessment, several other mines in the area made available new data in relation to their proposed modifications. This new information was used to make a revised assessment of cumulative impacts, described in **Section 3.1** to **3.3** . The effect of the new data in relation to the predicted impacts based on the assumed data used in this assessment is that three other receptors may experience cumulative impacts that are not shown in the summary table below. These are Receptor 118 in Year 8, and Receptors 112N and 120 in Year 15 (all of which are presently entitled to acquisition upon request by Mt Arthur Coal at present). No other cumulative impacts were predicted to arise should the other proposed projects proceed.

The assessment also quantified the effect of the Project on greenhouse gas emissions.

The potential air quality impacts at each privately-owned receptor that may be adversely impacted by the Project are presented in **Table 18-1**. The receptors that are highlighted in grey have existing property acquisition rights upon request per the conditions in other mining companies' development consents, as noted in the footnotes to the table.

Impacts that are shown in bold exceed acquisition criteria (but not necessarily as a result of the Project), please refer to the detailed assessment in **Section 10** for information in this regard.

Table 18-1: Summary of predicted impacts

Receptor ID	NO_2	PM_{10}			TSP	DD
	1-hour max	24-hour average (increment)	24-hour average (cumulative)	Annual average	Annual average	Annual average
	Criterion 246 µg/m³	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 4g/m²/mth
	Year (impact)	Year (# of days above criteria)		Year of impact (impact level)		
29	-	Year 4 (1) Year 8 (1)	-	-	-	-
106	-	-	-	**Year 24 (31)**	-	-
110S	-	-	na	**Year 24 (32)**	-	-
110N	-	-	-	**Year 24 (31)**	-	-
112N(2)	-	-	na	**Year 24 (31)**	-	-
112S(2)	-	-	na	**Year 24 (39)**	-	-
113(2)	-	-	na	**Year 24 (40)**	-	-
114(2)	-	Year 24 (1)	na	**Year 15 (34)** **Year 24 (41)**	-	-
117(2)	-	-	na	**Year 15 (37)** **Year 24 (44)**	Year 24 (94)	-
118(2)	-	Year 15 (4)	na	**Year 1 (32)**	Year 24 (93)	-

Receptor ID	NO_2	PM_{10}			TSP	DD
	1-hour max	24-hour average (increment)	24-hour average (cumulative)	Annual average	Annual average	Annual average
	Criterion 246 µg/m³	Criterion 50µg/m³		Criterion 30µg/m³	Criterion 90µg/m³	Criterion 4g/m²/mth
	Year (impact)	Year (# of days above criteria)		Year of impact (impact level)		
		Year 24 (8)		**Year 4 (39)** **Year 8 (42)** **Year 15 (41)** **Year 24 (44)**		
119 (2)	-	Year 24 (3)	na	**Year 4 (34)** **Year 8 (39)** **Year 15 (42)** **Year 24 (43)**	Year 24 (92)	-
152	-	-	Year 24 (5)	-	-	-
153	-	-	Year 24 (3)	-	-	-
154	-	-	Year 24 (5)	-	-	-
155 (2)	-	**Year 24 (6)**	-	-	-	-
156E	-	-	Year 24 (4)	-	-	-
156S	-	**Year 24 (9)**	-	-	-	-
156E	-	Year 24 (2)	Year 24 (4)	-	-	-
156W	-	-	Year 24 (3)	-	-	-
158 (1)	-	Year 15 (4) **Year 24 (56)**	na	**Year 24 (36)**	-	-
161	-	Year 24 (2)	**Year 24 (6)**	**-**	-	-
166 (1)	-	Year 8 (1) Year 15 (1) **Year 24 (44)**	-	**Year 24 (32)**	-	-
168 (1)	Year 24 (277)	**Year 4 (13)** **Year 8 (46)** **Year 15 (55)** **Year 24 (166)**	na	**Year 8 (31)** **Year 15 (31)** **Year 24 (68)**	Year 24 (147)	Year 24 (5.5)
169 (1)	-	Year 15 (1) **Year 24 (57)**	na	**Year 24 (32)**	-	-
171 (1)	-	**Year 8 (10)** Year 15 (3) **Year 24 (83)**	na	**Year 24 (34)**	-	-
180	-	-	Year 24 (5)	**-**	-	-
186N	-	-	Year 24 (2)	**-**	-	-
222	-	Year 24 (1)	-	**-**	-	-
230	-	Year 24 (3)	-	**-**	-	-
252 (1)	-	-	-	**Year 24 (36)**	-	-
286	-	Year 24 (1)	-	**-**	-	-
292W (1)	-	-	-	**Year 8 (32)**	-	-

Entitled to acquisition by: (1) Mount Pleasant, (2) Mount Arthur. na - not assessed as acquisition is required due to other criteria impacts

Note that further detailed cumulative 24-hour PM_{10} or $PM_{2.5}$ impact assessment was generally not conducted for receptors that were already predicted to be subject to acquisition due to exceedance of other criteria (e.g. cumulative annual average PM_{10}).

The investigation into potential blast impacts found that the area of risk would shift from receptors east of the Project to receptors in the west over time. Whilst the current blast management system has proven to be adequate to mitigate the risk of blast impacts, the Project should investigate, and if viable implement, an advanced blast forecasting systems as part of an improved blast management system.

The assessment of diesel fuel combustion emission impacts found that Receptor 168 may be impacted by NO_2 emissions in Year 24. The assessment conducted in this regard is conservative and the predicted level of impact may not actually occur in practice, however it is also noted that this receptor would be impacted significantly by dust levels in the final years of the Project, and would not be suitable for habitation.

The assessment of the potential impact from rail transport of coal from the Project found only minor emissions would be likely to arise within 50m of the centre of the rail line, and the likely level of impact would not have any discernible effect on air quality.

The greenhouse gas assessment estimated that the total Scope 1 and Scope 2 emissions over the life of the Project would be 16.1 Mt CO_2-e, or an average of 0.77 Mt CO_2-e annually. Scope 3 emissions over the life of the Project would be 587.1 Mt CO_2-e, or an average of 28 Mt CO_2-e annually. Relative to the total estimated greenhouse emissions for Australia of 543 Mt CO_2-e in 2010, the combined Scope 1 and 2 annually represents 0.14% of the Australian total.

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Appendix A
Sensitive Receptors

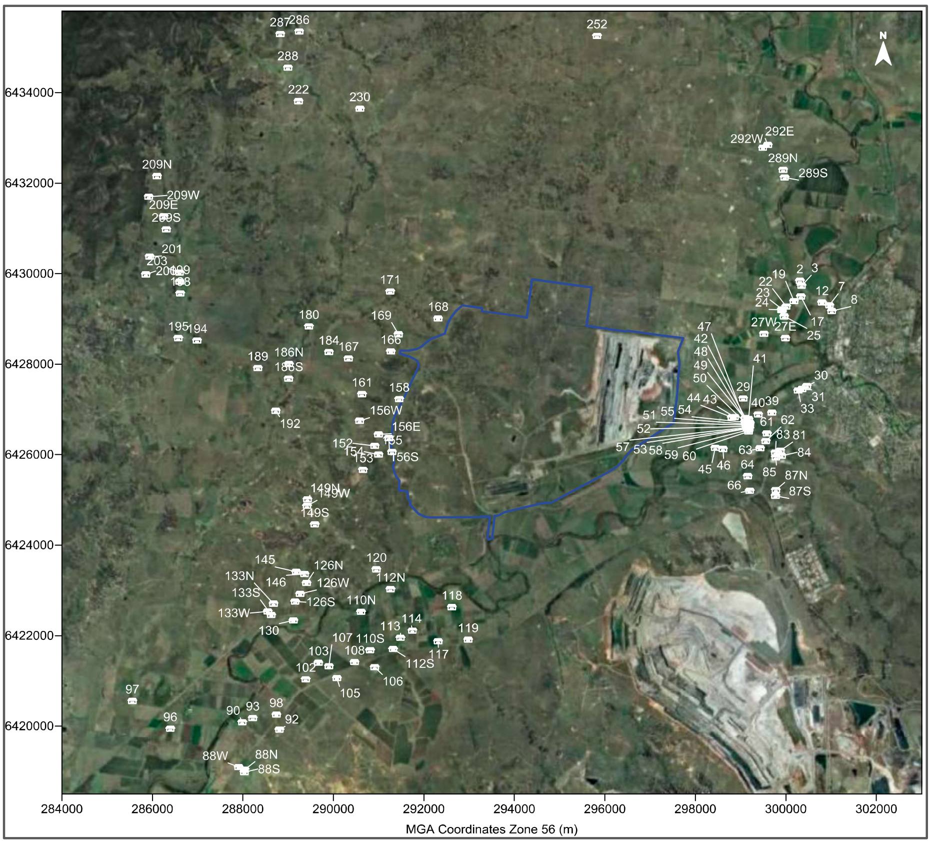

Figure A-1: Location of privately-owned receptors assessed in the study

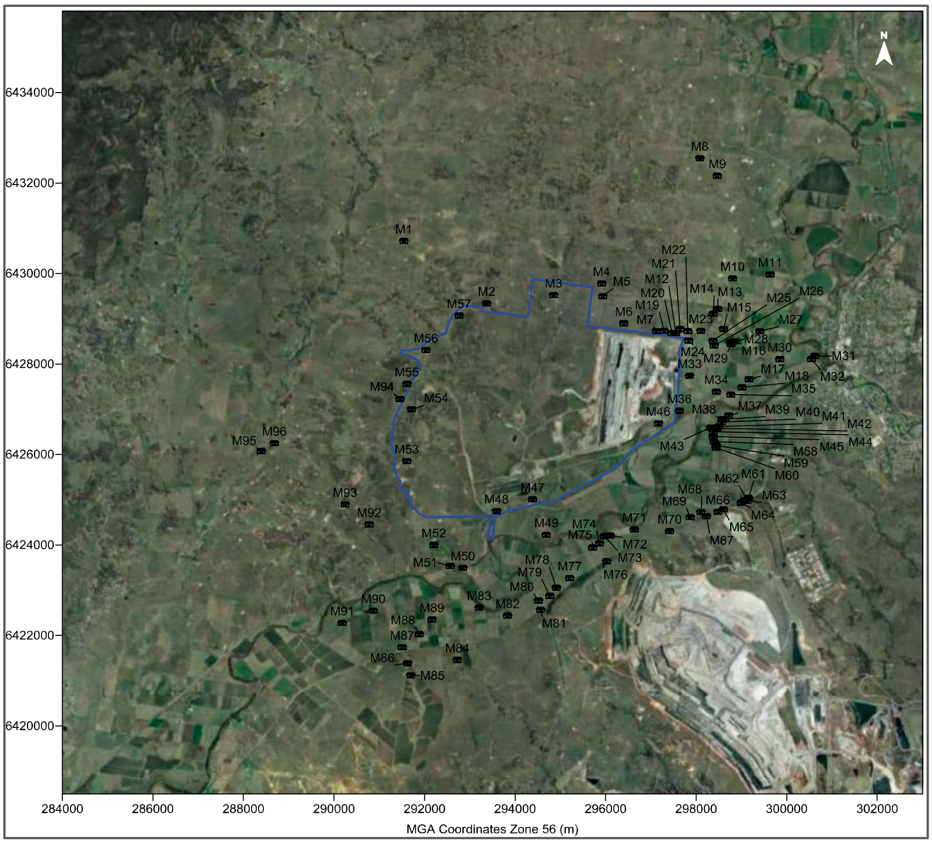

Figure A-1: Location of mine-owned receptors assessed in the study

Table A-1: List of all sensitive receptors assessed in the study

ID	Easting (m)	Northing (m)	Name
			PRIVATELY-OWNED RECEPTORS
2	300311	6429843	COWTIME INVESTMENTS PTY LIMITED
3	300346	6429733	COWTIME INVESTMENTS PTY LIMITED
7	300961	6429300	LG & CM KELMAN
8	301012	6429172	CK BIRCH
12	300798	6429363	WJ PITMAN
17	300332	6429496	LJ PURSER
19	300179	6429392	RK & NV GOOGE
22	300007	6429274	N & M SORMAZ
23	299924	6429210	RB PARKINSON
24	299904	6429199	JM SIMPSON
25	299961	6429057	RK & NV GOOGE
27W	299515	6428671	C HORNE
27E	299991	6428577	
29	299057	6427242	JABETIN PTY LIMITED
30	300461	6427519	TELSTRA CORPORATION LIMITED
31	300359	6427450	THE COUNCIL OF THE MUNICIPALITY OF MUSWELLBROOK
33	300271	6427418	THE NEW SOUTH WALES GREYHOUND BREEDERS OWNERS & TRAINERS
39	299691	6426930	WJ HARDES
40	299390	6426889	SW & KL BARKLEY
41	299176	6426787	FK & WDG ALMOND & PW HUME
42	299104	6426812	DP ENGLEBRECHT
43	298868	6426831	KB & JA BARNETT
44	298805	6426823	MJ MCGOLDRICK
45	298438	6426150	HUNTER VALLEY ENERGY COAL PTY LTD (formerly BD & JN ENGLEBRECHT)
46	298607	6426127	MUSWELLBROOK RACE CLUB LIMITED
47	299098	6426730	DL ROBINSON
48	299125	6426722	MC & LJ DOBIE
49	299153	6426716	ML & EA SWEENEY
50	299111	6426699	TD BARRON
51	299122	6426655	RA BYRNES & MA MOLLER
52	299137	6426622	GL & IL ANDREWS
53	299136	6426585	SY JOHNSON
54	299205	6426702	JR GLEESON & MR CRANFIELD
55	299197	6426672	SM BREDDEN
57	299188	6426608	AC GOOD
58	299192	6426582	RS & JT CRIDLAND
59	299173	6426549	ENGLEBRECHT RACING STABLES PTY LIMITED
60	299174	6426512	RH ENGLEBRECHT
61	299581	6426469	JR GLEESON & MR CRANFIELD
62	299555	6426302	DR & CJ TUBB
63	299432	6426142	JP DRAKE
64	299156	6425526	MJ DRAKE
66	299200	6425201	JR SCRIVEN
81	299874	6426090	JR & JA BUCKLEY
83	299769	6426047	JR & JA BUCKLEY
84	299902	6425975	SRP & RF RAY
85	299778	6425939	DJ & SE & TP & MV HALLETT & KL & J CAMPBELL & JE ANDERSON
87N	299779	6425218	F & IR WEBBER

ID	Easting (m)	Northing (m)	Name
87S	299770	6425091	
88W	287905	6419094	PR & M BURGMANN
88N	288037	6419039	
88S	288034	6418984	
90	287987	6420086	RW JONES
92	288807	6419921	TR & KM PAULSEN
93	288219	6420180	DJ PHILLIPS
96	286396	6419942	RJ & AM HORDERN
97	285558	6420556	GR COLE
98	288739	6420255	RL WILKS
102	289387	6421036	LA & CA MACPHERSON
103	289668	6421401	BD EGLINGTON & SR & L FULLER & SM & RD GOODCHILD
105	290078	6421062	RW TURNER
106	290911	6421305	MJ & MJ DUNCAN
107	289901	6421325	BD EGLINGTON & SR & L FULLER & SM & RD GOODCHILD
108	290465	6421416	MJ & MJ DUNCAN
110S	290810	6421676	GR & MK WALSH
110N	290611	6422527	
112N	291262	6423026	MG & LJ LATHAM
112S	291319	6421705	
113	291481	6421952	MG & LJ LATHAM
114	291745	6422110	JM WILD
117	292313	6421874	E RANKIN
118	292618	6422630	E & WJ RANKIN
119	292977	6421911	E & WJ RANKIN
120	290950	6423466	TW ROOTS
126N	289405	6423164	JDM MARKHAM
126W	289265	6422923	
126S	289154	6422752	
130	289114	6422336	AA & BT MEYER
133N	288677	6422708	S.R. & J. W. LAWSON (LINDISFARNE) PTY LIMITED
133W	288549	6422537	
133S	288625	6422455	
145	289176	6423412	PJ BROWN
146	289361	6423361	JI & PJ BROWN
149S	289587	6424458	RM & KF MERRICK
149W	289416	6424868	
149N	289427	6425012	
152	290911	6426194	MR PEEL
153	290653	6425665	PR ELLIS
154	290998	6426004	PSJ MURRAY
155	291295	6426062	PG & CM LANE
156S	291223	6426368	NJ & RY ELLIS
156E	290999	6426447	
156W	290581	6426749	
158	291454	6427227	RR & JM HAMILTON
161	290632	6427338	RB & SA PARKINSON
166	291269	6428281	BA & TE STRACHAN
168	292315	6429011	JB MOORE
169	291438	6428661	JONATHAN BUCHANAN MOORE

ID	Easting (m)	Northing (m)	Name
171	291256	6429607	BL & ML BATES
180	289458	6428835	JE & JL LONERGAN
184	289045	6428273	JL SMITH & KL BALMER
186N	289014	6428004	RB & SA PARKINSON
186S	289011	6427682	
189	288329	6427915	FN & WL GOOGE
192	288725	6426970	GT MCNEILL
194	286988	6428524	DMA CAREY
195	286572	6428577	AH & JA THIECKE
198	286615	6429565	IV & CA INGOLD
199	286604	6429824	SH JENNAR
200	285853	6429984	MA PERKINS
201	285938	6430379	DG PEACE
203	286600	6430024	RG GOWING
209S	286306	6430981	RG GOWING
209E	286248	6431266	
209W	285918	6431702	
209N	286103	6432158	
222	289229	6433814	JOHN DOUGLAS VANDENBERGH
230	290586	6433646	GRAEME CARL SPARRE
252	295826	6435256	GAVIN MICHAEL CASEY
286	289245	6435354	IAN JAMES RICHARDS & CHRISTINE MAREE RICHARDS
287	288825	6435299	MUSWELLBROOK COAL COMPANY LIMITED
288	288995	6434553	DONALD SCOTT MACDONALD & DIANNE ELIZABETH KILGANNON
289N	299937	6432297	KEITH JOSEPH YORE & GEORGINA MASKERY YORE
289S	299972	6432128	
292W	299491	6432783	DHH MACINTYRE
292E	299599	6432846	
MINE-OWNED RECEPTORS			
M1	291543	6430721	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M2	293369	6429342	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M3	294851	6429525	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M4	295911	6429780	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M5	295934	6429498	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M6	296402	6428900	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M7	297119	6428729	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M8	298081	6432549	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M9	298467	6432163	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M10	298804	6429893	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M11	299634	6429983	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M12	297550	6428684	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M13	298477	6429217	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M14	298375	6429112	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M15	298605	6428778	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M16	298770	6428487	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M17	299168	6427664	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M18	299011	6427485	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M94	291454	6427227	COAL & ALLIED OPERATIONS PTY LTD (MT PLEASANT)
M19	297294	6428736	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M20	297466	6428685	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)

ID	Easting (m)	Northing (m)	Name
M21	297644	6428772	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M22	297817	6428725	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M23	298103	6428736	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M24	297836	6428518	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M25	298371	6428513	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M26	298396	6428412	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M27	299408	6428726	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M28	298838	6428501	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M29	298772	6428445	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M30	299847	6428107	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M31	300626	6428178	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M32	300548	6428110	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M33	297855	6427743	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M34	298445	6427389	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M35	298765	6427328	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M36	297632	6426969	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M37	298720	6426868	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M38	298639	6426783	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M39	298570	6426778	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M40	298568	6426715	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M41	298490	6426617	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M42	298457	6426579	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M43	298315	6426596	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M44	298377	6426508	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M45	298373	6426398	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M46	297163	6426691	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M47	294386	6425011	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M48	293590	6424751	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M49	294691	6424228	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M50	292845	6423496	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M51	292566	6423537	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M52	292204	6424003	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M53	291608	6425854	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M54	291714	6427002	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M55	291609	6427562	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M56	292031	6428310	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M57	292762	6429070	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M94	291454	6427227	COAL & ALLIED OPERATIONS PTY LTD (BENGALLA)
M58	298394	6426283	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M59	298437	6426203	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M60	298438	6426150	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M61	299156	6425037	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M62	299129	6424978	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M63	299067	6424992	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M64	298997	6424936	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M65	298603	6424790	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M66	298478	6424736	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M67	298223	6424634	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M68	298102	6424730	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M69	297868	6424613	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)

ID	Easting (m)	Northing (m)	Name
M70	297414	6424309	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M71	296634	6424345	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M72	296099	6424210	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M73	295969	6424194	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M74	295865	6424036	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M75	295715	6423945	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M76	296022	6423642	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M77	295207	6423271	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M78	294911	6423056	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M79	294766	6422877	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M80	294517	6422771	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M81	294560	6422567	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M82	293833	6422440	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M83	293207	6422618	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M84	292724	6421461	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M85	291692	6421120	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M86	291622	6421389	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M87	291506	6421741	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M88	291881	6422035	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M89	292164	6422353	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M90	290870	6422549	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M91	290184	6422278	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M92	290776	6424455	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M93	290243	6424896	HUNTER VALLEY ENERGY COAL PTY LTD (MT ARTHUR)
M95	288394	6426076	MUSWELLBROOK COAL
M96	288684	6426251	MUSWELLBROOK COAL

Appendix B
Monitoring Data

Table B-1: MAC TEOM monitoring data

Date	DC01	DC02	DC03	DC04	DC05	Date	DC01	DC02	DC03	DC04	DC05
1/01/2010	6.7	-	-	7.8	-	3/07/2010	2.0	3.4	6.9	5.8	2.5
2/01/2010	10.1	-	-	5.4	-	4/07/2010	10.1	9.0	11.4	11.4	0.3
3/01/2010	7.5	-	13.2	-	-	5/07/2010	12.7	13.1	14.3	14.0	3.4
4/01/2010	11.8	-	20.6	-	-	6/07/2010	11.6	15.5	14.2	13.0	5.4
5/01/2010	18.1	-	22.7	-	-	7/07/2010	9.8	12.7	14.3	12.6	3.2
6/01/2010	-	-	-	-	-	8/07/2010	8.7	12.2	15.5	12.2	4.9
7/01/2010	14.9	-	25.6	20.4	-	9/07/2010	5.3	8.2	10.4	7.2	3.6
8/01/2010	15.5	7.8	26.6	18.9	-	10/07/2010	11.5	10.0	11.7	11.5	2.8
9/01/2010	14.3	-	15.8	15.4	-	11/07/2010	8.1	8.3	9.0	10.9	12.5
10/01/2010	17.9	0.8	26.6	26.2	-	12/07/2010	4.9	7.4	8.1	5.0	1.6
11/01/2010	20.2	-	34.7	22.7	-	13/07/2010	10.0	7.6	10.7	9.4	4.7
12/01/2010	23.6	31.0	-	18.5	-	14/07/2010	3.6	4.1	6.8	3.9	-
13/01/2010	17.6	1.8	29.3	42.1	-	15/07/2010	4.3	6.4	8.2	7.1	-
14/01/2010	7.7	12.3	17.9	12.0	-	16/07/2010	10.1	10.1	11.2	14.1	5.7
15/01/2010	13.4	20.7	28.3	17.7	-	17/07/2010	10.5	11.9	14.7	13.5	0.2
16/01/2010	12.9	16.4	20.7	15.7	-	18/07/2010	5.2	7.1	8.0	9.6	1.9
17/01/2010	15.8	19.3	21.1	16.9	-	19/07/2010	7.5	10.8	13.1	15.4	2.5
18/01/2010	16.2	38.8	30.7	30.4	-	20/07/2010	6.9	14.0	13.9	15.5	2.7
19/01/2010	9.8	21.4	22.7	18.4	-	21/07/2010	6.5	10.2	15.8	15.2	2.7
20/01/2010	-	23.4	20.3	18.6	-	22/07/2010	4.5	12.3	13.7	13.2	2.6
21/01/2010	-	-	-	-	-	23/07/2010	9.5	13.5	12.9	15.1	3.5
22/01/2010	38.1	43.2	39.2	26.3	-	24/07/2010	12.7	12.4	13.0	13.4	4.5
23/01/2010	23.0	49.1	32.9	33.9	-	25/07/2010	13.7	13.2	15.8	16.4	3.3
24/01/2010	36.7	34.8	41.6	38.2	-	26/07/2010	12.7	8.0	10.2	8.6	3.1
25/01/2010	50.7	40.3	42.5	34.0	-	27/07/2010	11.6	10.9	14.6	13.3	3.7
26/01/2010	30.4	35.4	33.2	25.8	-	28/07/2010	6.4	6.2	6.7	7.3	3.6
27/01/2010	32.9	31.6	30.2	40.2	-	29/07/2010	2.0	2.5	3.2	4.3	2.4
28/01/2010	18.1	16.6	16.9	15.8	-	30/07/2010	1.8	4.5	4.5	3.7	-
29/01/2010	13.6	16.8	17.1	16.0	-	31/07/2010	2.3	2.5	3.3	2.8	-
30/01/2010	19.2	20.8	22.3	18.2	-	1/08/2010	10.1	3.4	-	4.1	-
31/01/2010	11.3	8.1	9.5	8.2	-	2/08/2010	1.8	3.4	-	2.7	-
1/02/2010	21.0	17.1	22.0	18.5	-	3/08/2010	6.0	11.0	-	8.4	-
2/02/2010	16.3	17.9	17.8	17.9	-	4/08/2010	3.9	7.5	-	9.3	-
3/02/2010	10.5	12.3	11.9	9.9	-	5/08/2010	3.9	11.6	-	8.0	-
4/02/2010	10.0	12.1	11.7	11.8	-	6/08/2010	3.6	8.6	-	7.8	0.3
5/02/2010	16.7	15.8	17.5	11.7	-	7/08/2010	6.9	8.8	-	10.8	4.6
6/02/2010	6.0	11.0	16.0	8.4	-	8/08/2010	12.3	71.9	-	13.7	3.1
7/02/2010	4.1	6.3	8.4	3.8	-	9/08/2010	20.0	19.4	-	17.0	7.9
8/02/2010	12.9	32.3	55.7	13.4	-	10/08/2010	16.1	20.1	18.8	16.0	9.1
9/02/2010	13.9	13.4	14.1	14.5	-	11/08/2010	1.8	1.3	-	1.9	-
10/02/2010	17.6	26.9	30.9	19.5	-	12/08/2010	2.3	3.3	4.1	2.6	0.3
11/02/2010	19.9	32.4	32.0	23.6	-	13/08/2010	3.9	5.9	5.6	7.3	1.7
12/02/2010	18.8	25.6	21.9	20.0	-	14/08/2010	3.4	4.3	4.3	4.6	1.3
13/02/2010	19.9	22.4	19.6	16.0	-	15/08/2010	6.8	10.5	9.4	7.5	1.2
14/02/2010	12.7	20.2	12.9	-	-	16/08/2010	3.3	10.4	9.6	3.7	0.7
15/02/2010	4.1	20.2	7.8	12.2	-	17/08/2010	6.0	15.5	14.9	8.5	3.6
16/02/2010	17.4	19.8	21.6	18.7	-	18/08/2010	15.5	18.5	18.6	20.8	7.4
17/02/2010	24.3	21.5	24.2	24.0	-	19/08/2010	5.2	-	6.4	5.7	1.9
18/02/2010	19.2	23.6	26.5	25.4	-	20/08/2010	3.9	8.4	13.0	5.0	0.5
19/02/2010	16.9	17.3	16.2	19.0	-	21/08/2010	4.3	7.3	8.2	6.7	1.5
20/02/2010	26.4	19.6	19.2	17.5	-	22/08/2010	11.2	7.8	9.2	8.5	2.3
21/02/2010	15.9	19.1	16.3	13.9	-	23/08/2010	11.2	14.1	17.0	12.8	6.7
22/02/2010	20.0	38.7	16.8	12.5	-	24/08/2010	0.7	1.3	5.0	0.9	-
23/02/2010	30.5	46.9	28.8	44.4	-	25/08/2010	3.0	7.7	13.5	3.6	0.4
24/02/2010	34.9	25.3	23.1	24.9	-	26/08/2010	3.8	5.8	12.7	3.8	0.5
25/02/2010	33.5	20.7	19.7	23.9	-	27/08/2010	4.5	14.9	16.7	5.0	1.6
26/02/2010	22.6	22.0	22.7	22.5	-	28/08/2010	8.0	9.9	9.6	10.0	3.3

Date	DC01	DC02	DC03	DC04	DC05	Date	DC01	DC02	DC03	DC04	DC05
27/02/2010	18.8	32.9	18.1	18.2	-	29/08/2010	14.2	13.1	18.0	16.1	5.7
28/02/2010	26.9	25.3	21.6	19.6	-	30/08/2010	20.5	21.2	19.5	22.2	8.4
1/03/2010	13.9	18.6	17.9	19.8	-	31/08/2010	15.8	19.4	16.0	17.3	7.0
2/03/2010	14.9	13.9	14.8	15.6	-	1/09/2010	22.2	18.0	17.8	16.0	7.6
3/03/2010	14.6	15.8	13.2	18.4	-	2/09/2010	17.1	24.3	26.5	20.3	8.7
4/03/2010	26.1	12.2	12.1	13.3	-	3/09/2010	5.7	9.7	9.5	5.7	0.4
5/03/2010	11.5	17.3	15.1	15.4	-	4/09/2010	4.0	4.4	5.3	4.7	0.3
6/03/2010	11.3	11.2	10.9	8.6	-	5/09/2010	2.4	9.3	9.0	7.4	-
7/03/2010	12.7	11.9	13.3	11.0	-	6/09/2010	3.6	11.7	13.6	9.5	1.8
8/03/2010	8.0	13.5	16.4	12.0	-	7/09/2010	3.8	10.5	8.5	8.2	0.0
9/03/2010	13.8	25.1	14.0	14.8	-	8/09/2010	18.4	17.3	22.8	18.1	-
10/03/2010	11.7	20.4	18.8	23.0	-	9/09/2010	13.8	16.2	19.2	16.7	-
11/03/2010	14.9	16.0	18.6	16.3	-	10/09/2010	3.9	9.1	8.7	5.5	0.8
12/03/2010	25.1	20.0	18.1	22.3	-	11/09/2010	4.6	6.7	8.6	6.8	2.7
13/03/2010	8.1	6.8	7.5	6.2	-	12/09/2010	9.7	6.3	6.3	6.1	0.6
14/03/2010	6.6	4.7	5.5	5.5	-	13/09/2010	9.2	10.9	11.2	8.8	1.9
15/03/2010	18.4	13.4	17.0	15.8	-	14/09/2010	16.0	14.0	14.5	10.2	3.0
16/03/2010	23.7	15.1	18.6	20.8	-	15/09/2010	2.5	7.3	12.2	3.8	0.5
17/03/2010	24.3	25.7	20.3	21.2	-	16/09/2010	3.4	5.3	-	3.7	-
18/03/2010	18.7	19.6	21.5	20.9	-	17/09/2010	4.4	7.0	6.5	4.5	-
19/03/2010	18.3	67.8	17.3	18.2	-	18/09/2010	11.5	11.3	10.9	9.8	3.6
20/03/2010	39.9	32.8	25.9	20.6	-	19/09/2010	15.8	16.0	14.7	14.6	5.6
21/03/2010	32.3	28.6	26.2	20.7	-	20/09/2010	28.3	25.1	23.8	22.8	-
22/03/2010	46.5	28.5	36.9	36.5	-	21/09/2010	29.4	28.9	25.2	29.7	7.4
23/03/2010	34.7	28.9	30.2	34.1	-	22/09/2010	27.1	30.5	24.6	24.9	5.2
24/03/2010	54.0	35.2	37.6	47.4	-	23/09/2010	25.7	27.3	23.5	23.3	-
25/03/2010	35.8	30.6	33.2	35.0	-	24/09/2010	19.4	23.3	21.5	23.3	5.3
26/03/2010	24.1	36.5	21.7	27.2	-	25/09/2010	13.7	31.5	15.7	15.1	3.6
27/03/2010	41.9	35.0	36.1	36.9	-	26/09/2010	21.6	22.0	15.8	15.1	5.8
28/03/2010	32.3	26.1	24.5	23.0	-	27/09/2010	22.4	32.7	23.3	19.7	7.4
29/03/2010	17.7	12.9	15.5	12.8	-	28/09/2010	7.8	19.2	12.0	18.6	1.2
30/03/2010	4.8	-	9.2	9.3	-	29/09/2010	13.8	24.4	15.0	16.1	3.6
31/03/2010	3.0	-	5.5	3.7	-	30/09/2010	17.2	24.1	20.7	16.3	4.0
1/04/2010	8.7	-	8.0	8.2	-	1/10/2010	42.9	41.8	39.4	35.4	10.0
2/04/2010	17.2	-	15.3	13.7	-	2/10/2010	22.4	28.6	31.7	24.9	7.5
3/04/2010	16.9	-	14.6	12.4	-	3/10/2010	5.4	5.8	8.0	5.0	0.8
4/04/2010	7.3	-	9.5	7.3	-	4/10/2010	5.2	5.4	6.3	5.6	0.8
5/04/2010	9.7	-	10.1	9.2	-	5/10/2010	-	9.1	-	-	0.9
6/04/2010	12.4	-	12.2	10.6	-	6/10/2010	7.8	9.1	9.2	7.5	0.7
7/04/2010	8.0	0.7	9.7	9.8	-	7/10/2010	12.4	15.6	14.0	14.3	1.7
8/04/2010	5.5	3.1	5.5	5.1	-	8/10/2010	23.9	26.3	23.2	23.8	3.6
9/04/2010	13.3	15.7	21.6	16.3	-	9/10/2010	15.7	17.2	17.5	19.7	2.5
10/04/2010	11.2	12.2	14.2	12.2	-	10/10/2010	27.1	15.8	14.4	17.3	3.2
11/04/2010	6.9	10.9	12.9	8.4	-	11/10/2010	19.0	10.6	11.2	10.9	1.4
12/04/2010	5.7	9.3	11.2	8.3	-	12/10/2010	24.9	19.5	25.3	19.4	3.4
13/04/2010	20.3	18.1	21.3	20.8	-	13/10/2010	20.5	19.8	20.2	15.0	1.7
14/04/2010	22.4	21.2	20.6	21.0	-	14/10/2010	19.5	12.3	11.3	9.1	3.4
15/04/2010	25.5	27.5	28.9	23.7	-	15/10/2010	7.3	6.3	7.0	5.2	0.7
16/04/2010	24.3	19.5	20.7	23.5	-	16/10/2010	6.0	13.0	16.7	8.2	0.3
17/04/2010	16.3	1.1	13.3	13.6	-	17/10/2010	5.2	11.7	13.2	5.8	0.9
18/04/2010	14.3	9.1	9.3	10.0	-	18/10/2010	4.9	28.4	8.3	17.7	1.1
19/04/2010	14.0	8.8	10.1	19.6	-	19/10/2010	17.2	25.6	22.8	23.4	3.7
20/04/2010	14.5	7.8	10.0	8.8	-	20/10/2010	25.9	34.8	28.6	25.3	4.4
21/04/2010	20.8	16.6	10.4	17.7	-	21/10/2010	25.7	27.1	24.8	23.4	5.5
22/04/2010	20.1	24.4	17.6	19.8	-	22/10/2010	20.2	28.0	22.5	17.7	3.7
23/04/2010	17.5	25.3	19.0	25.8	-	23/10/2010	8.7	26.7	13.8	16.3	3.4
24/04/2010	19.8	18.1	17.7	16.5	-	24/10/2010	2.2	2.8	3.2	2.5	1.7
25/04/2010	6.8	5.9	6.3	7.4	-	25/10/2010	10.6	10.2	9.5	8.9	2.1

Date	DC01	DC02	DC03	DC04	DC05	Date	DC01	DC02	DC03	DC04	DC05
26/04/2010	7.5	5.8	7.6	8.3	-	26/10/2010	13.1	10.2	10.7	8.5	2.7
27/04/2010	6.8	11.1	11.8	10.7	-	27/10/2010	13.3	20.9	18.8	16.5	3.6
28/04/2010	6.2	10.5	12.5	-	-	28/10/2010	17.3	19.2	15.2	18.2	2.7
29/04/2010	7.6	9.4	12.4	-	-	29/10/2010	19.8	24.5	23.5	20.9	5.6
30/04/2010	11.2	15.0	15.4	-	-	30/10/2010	18.0	40.6	15.8	16.3	5.0
1/05/2010	11.5	11.9	15.4	-	-	31/10/2010	16.3	19.3	17.5	15.3	2.2
2/05/2010	8.5	-	10.5	-	-	1/11/2010	5.4	3.4	6.8	5.6	0.1
3/05/2010	-	-	-	-	-	2/11/2010	4.5	78.3	7.6	7.4	0.2
4/05/2010	9.8	-	-	8.0	-	3/11/2010	8.0	16.3	8.2	9.2	1.5
5/05/2010	-	-	11.0	-	-	4/11/2010	15.6	15.5	15.0	15.7	-
6/05/2010	6.9	9.3	8.7	8.6	-	5/11/2010	2.5	4.6	-	4.5	-
7/05/2010	8.4	11.4	12.3	11.3	-	6/11/2010	5.6	4.6	-	5.2	-
8/05/2010	16.0	17.8	26.4	17.9	-	7/11/2010	16.5	13.6	-	13.9	-
9/05/2010	17.2	14.6	17.1	17.7	-	8/11/2010	10.1	14.6	-	10.5	-
10/05/2010	15.8	27.1	19.2	16.8	-	9/11/2010	13.4	14.5	-	10.9	-
11/05/2010	16.5	22.4	25.9	19.2	-	10/11/2010	11.6	15.2	-	12.1	-
12/05/2010	16.0	23.8	19.2	20.0	-	11/11/2010	6.4	5.3	-	4.5	-
13/05/2010	14.7	14.6	11.7	21.9	-	12/11/2010	10.7	12.9	-	7.1	-
14/05/2010	17.0	15.6	15.8	15.5	-	13/11/2010	14.0	20.4	-	12.0	4.2
15/05/2010	18.3	14.9	13.6	18.8	-	14/11/2010	10.9	18.7	-	9.7	2.1
16/05/2010	22.2	18.4	25.1	21.3	-	15/11/2010	6.0	11.3	0.7	6.7	1.5
17/05/2010	23.8	24.6	25.4	26.5	-	16/11/2010	8.2	4.6	5.2	5.5	2.8
18/05/2010	7.9	17.3	15.4	15.5	-	17/11/2010	11.9	8.4	8.0	8.8	2.2
19/05/2010	10.4	13.0	13.0	18.8	-	18/11/2010	16.5	20.9	19.3	22.6	5.1
20/05/2010	14.1	17.4	14.7	17.4	-	19/11/2010	10.7	17.9	17.8	16.1	1.6
21/05/2010	15.2	25.7	17.9	-	-	20/11/2010	18.2	18.2	16.3	18.8	2.5
22/05/2010	4.9	6.9	11.1	-	-	21/11/2010	16.9	16.2	17.3	23.8	3.2
23/05/2010	9.5	12.1	16.0	-	-	22/11/2010	19.6	14.0	15.1	13.2	0.8
24/05/2010	18.1	15.1	20.5	20.3	-	23/11/2010	21.1	22.4	22.4	16.7	4.0
25/05/2010	9.0	10.0	11.8	10.5	-	24/11/2010	27.8	19.3	21.6	19.2	4.5
26/05/2010	3.4	2.8	3.3	2.9	-	25/11/2010	21.0	23.5	18.2	17.8	1.9
27/05/2010	8.8	10.5	12.1	11.2	-	26/11/2010	23.8	28.5	23.3	23.7	3.8
28/05/2010	9.8	10.3	14.4	12.0	-	27/11/2010	21.8	17.7	11.9	10.5	1.8
29/05/2010	4.0	5.5	5.6	4.5	-	28/11/2010	14.8	26.9	12.7	13.7	4.4
30/05/2010	2.1	1.6	2.2	1.9	-	29/11/2010	13.6	25.5	20.5	19.1	6.4
31/05/2010	3.3	3.4	3.7	5.0	-	30/11/2010	13.3	15.4	12.7	15.8	5.7
1/06/2010	5.4	8.6	10.9	9.4	-	1/12/2010	4.8	5.2	4.9	4.3	0.6
2/06/2010	10.6	9.9	16.6	10.8	-	2/12/2010	7.9	10.5	10.1	9.1	3.8
3/06/2010	5.7	8.7	3.7	9.0	-	3/12/2010	14.1	13.2	12.4	12.4	1.2
4/06/2010	2.1	2.4	3.3	2.8	-	4/12/2010	11.0	7.6	8.2	7.6	4.0
5/06/2010	5.5	7.1	9.8	9.5	-	5/12/2010	9.6	7.8	8.0	6.9	3.5
6/06/2010	5.2	7.4	11.1	-	-	6/12/2010	14.7	14.1	14.5	12.8	2.7
7/06/2010	5.7	11.2	16.6	15.3	-	7/12/2010	14.2	16.0	-	12.9	2.1
8/06/2010	8.1	10.0	5.2	12.2	-	8/12/2010	-	18.4	16.1	13.0	3.6
9/06/2010	7.7	11.1	5.5	9.1	-	9/12/2010	13.5	17.1	10.3	9.5	4.4
10/06/2010	4.6	6.6	6.1	5.9	-	10/12/2010	4.8	2.6	-	3.5	0.7
11/06/2010	4.7	6.4	5.7	6.1	-	11/12/2010	6.7	13.8	-	9.2	0.4
12/06/2010	8.6	8.0	12.1	10.0	-	12/12/2010	8.0	19.0	-	16.0	0.3
13/06/2010	15.1	12.5	17.1	13.8	-	13/12/2010	27.4	27.3	-	26.2	4.8
14/06/2010	13.7	12.5	27.7	16.2	-	14/12/2010	29.1	24.6	19.5	22.0	7.8
15/06/2010	11.7	28.6	16.5	15.5	-	15/12/2010	18.1	-	13.3	12.2	4.0
16/06/2010	7.2	14.6	18.2	13.7	-	16/12/2010	13.3	14.4	11.9	12.2	2.6
17/06/2010	5.0	7.2	5.1	6.4	-	17/12/2010	14.3	13.5	18.8	-	2.8
18/06/2010	12.3	12.3	11.9	13.1	-	18/12/2010	10.2	11.9	10.6	5.3	0.2
19/06/2010	8.0	9.9	4.8	8.3	-	19/12/2010	5.7	18.3	4.6	4.5	0.3
20/06/2010	6.0	11.5	5.3	9.2	-	20/12/2010	7.1	1.2	8.3	7.3	-
21/06/2010	12.1	12.7	17.1	13.1	-	21/12/2010	13.7	14.5	-	10.3	0.0
22/06/2010	6.3	7.1	-	6.4	-	22/12/2010	28.9	24.2	24.4	25.5	7.4

Date	DC01	DC02	DC03	DC04	DC05	Date	DC01	DC02	DC03	DC04	DC05
23/06/2010	7.8	5.4	-	7.2	-	23/12/2010	31.8	30.6	33.5	30.6	7.5
24/06/2010	12.2	13.2	-	19.2	-	24/12/2010	28.1	25.9	22.0	25.0	4.7
25/06/2010	7.7	14.2	-	16.5	-	25/12/2010	14.1	15.4	11.2	12.5	6.7
26/06/2010	3.2	4.9	3.5	2.9	-	26/12/2010	3.4	2.9	1.9	1.9	1.7
27/06/2010	2.8	3.4	4.4	6.1	-	27/12/2010	9.3	9.0	9.5	9.8	0.8
28/06/2010	-	-	9.0	9.1	-	28/12/2010	18.3	19.6	17.1	23.4	2.8
29/06/2010	8.5	5.9	-	-	-	29/12/2010	25.3	21.8	18.2	21.5	6.6
30/06/2010	6.0	4.4	7.2	5.1	3.3	30/12/2010	25.9	24.2	26.4	25.7	6.7
1/07/2010	10.0	11.8	9.3	10.3	1.9	31/12/2010	34.8	30.5	28.8	31.3	12.1
2/07/2010	7.3	8.8	9.3	8.1	1.1						

Table B-2: HVAS PM10 monitoring data

Date	PM10-1	PM10-2	PM10-3	PM10-4	Date	PM10-1	PM10-2	PM10-3	PM10-4
5/01/2007	29	18	26	-	12/01/2009	40	30	40	52
11/01/2007	41	42	37	-	18/01/2009	32	25	40	44
17/01/2007	54	37	35	-	24/01/2009	27	23	24	24
23/01/2007	52	40	33	-	30/01/2009	44	39	47	40
29/01/2007	68	48	28	-	5/02/2009	48	45	48	50
4/02/2007	32	28	31	-	11/02/2009	13	17	16	14
10/02/2007	5	2	17	-	17/02/2009	20	10	16	9
16/02/2007	27	37	17	-	23/02/2009	27	27	30	21
22/02/2007	30	30	19	-	1/03/2009	46	42	51	38
28/02/2007	22	22	14	-	7/03/2009	34	37	25	28
6/03/2007	12	12	13	-	13/03/2009	17	17	21	16
12/03/2007	32	32	29	-	19/03/2009	23	22	30	25
18/03/2007	12	14	8	-	25/03/2009	40	41	37	41
24/03/2007	27	22	18	-	31/03/2009	11	12	12	11
30/03/2007	28	21	10	-	6/04/2009	16	20	23	21
5/04/2007	22	21	16	-	12/04/2009	10	10	6	24
11/04/2007	23	-	23	-	18/04/2009	19	26	26	28
12/04/2007	-	24	-	-	24/04/2009	19	39	70	9
17/04/2007	36	30	37	-	30/04/2009	10	13	6	12
23/04/2007	34	21	15	-	6/05/2009	12	14	48	19
29/04/2007	14	10	9	-	12/05/2009	34	29	47	30
5/05/2007	49	43	41	-	18/05/2009	46	28	57	34
11/05/2007	21	18	19	-	24/05/2009	20	16	25	21
17/05/2007	16	14	13	-	30/05/2009	13	9	23	11
23/05/2007	18	11	7	-	5/06/2009	8	8	4	2
29/05/2007	45	33	12	-	11/06/2009	9	13	12	4
4/06/2007	14	11	5	-	17/06/2009	14	13	32	14
10/06/2007	10	14	-	-	23/06/2009	7	11	3	3
13/06/2007	-	-	4	-	29/06/2009	12	11	10	1
14/06/2007	-	-	12	-	5/07/2009	15	12	1	3
16/06/2007	4	4	2	-	11/07/2009	6	9	9	11
22/06/2007	9	11	9	-	17/07/2009	4	45	2	4
28/06/2007	3	1	3	-	23/07/2009	25	16	3	1
4/07/2007	14	10	5	-	29/07/2009	6	10	1	1
10/07/2007	14	13	7	-	4/08/2009	23	27	5	10
16/07/2007	15	17	6	-	10/08/2009	36	35	29	30
22/07/2007	21	18	16	-	16/08/2009	18	20	10	8
28/07/2007	31	52	6	-	22/08/2009	26	26	11	5
3/08/2007	19	11	3	-	28/08/2009	24	25	12	10
9/08/2007	27	19	7	-	3/09/2009	22	24	48	23
15/08/2007	28	26	19	-	9/09/2009	22	10	2	1
21/08/2007	12	11	8	-	15/09/2009	54	65	53	63
27/08/2007	11	14	5	-	21/09/2009	32	29	21	29

Date	PM10-1	PM10-2	PM10-3	PM10-4	Date	PM10-1	PM10-2	PM10-3	PM10-4
2/09/2007	17	19	17	-	27/09/2009	103	85	15	19
8/09/2007	10	11	7	-	3/10/2009	28	21	4	9
14/09/2007	53	38	19	15	9/10/2009	61	26	6	27
20/09/2007	56	22	13	15	15/10/2009	61	44	6	12
26/09/2007	37	36	30	31	21/10/2009	64	48	22	37
2/10/2007	20	41	27	25	27/10/2009	16	16	6	18
8/10/2007	49	38	18	23	2/11/2009	42	41	37	43
14/10/2007	54	20	21	13	8/11/2009	19	20	12	19
20/10/2007	78	55	49	58	14/11/2009	38	41	26	31
26/10/2007	30	17	4	8	20/11/2009	82	100	45	43
1/11/2007	42	51	-	41	26/11/2009	73	64	35	36
7/11/2007	11	12	11	13	2/12/2009	28	32	25	36
13/11/2007	19	22	26	34	8/12/2009	123	125	68	60
19/11/2007	35	32	31	30	14/12/2009	55	68	41	50
25/11/2007	14	14	20	19	20/12/2009	45	37	28	38
1/12/2007	15	17	15	21	26/12/2009	14	16	5	14
7/12/2007	20	24	20	22	1/01/2010	11	14	11	14
13/12/2007	31	27	18	27	7/01/2010	20	21	27	36
19/12/2007	5	26	15	29	13/01/2010	37	30	29	36
25/12/2007	26	17	27	19	19/01/2010	17	15	14	14
31/12/2007	12	24	24	29	25/01/2010	36	33	56	52
6/01/2008	22	12	7	9	31/01/2010	10	11	26	25
12/01/2008	57	36	41	44	6/02/2010	24	20	8	20
18/01/2008	14	10	9	12	12/02/2010	35	37	18	18
24/01/2008	36	22	22	33	18/02/2010	33	29	22	42
30/01/2008	48	27	29	23	24/02/2010	35	30	36	38
5/02/2008	13	9	7	8	2/03/2010	33	34	16	38
11/02/2008	3	11	13	18	8/03/2010	28	32	9	21
17/02/2008	18	14	14	17	14/03/2010	17	14	9	19
23/02/2008	84	62	46	43	20/03/2010	45	38	38	34
29/02/2008	14	14	13	15	26/03/2010	52	42	39	35
6/03/2008	24	24	21	18	1/04/2010	24	20	20	16
12/03/2008	29	19	26	26	7/04/2010	16	17	11	12
18/03/2008	25	24	29	27	13/04/2010	30	26	21	26
24/03/2008	18	14	21	19	19/04/2010	20	18	24	25
30/03/2008	26	18	12	12	25/04/2010	15	13	29	8
5/04/2008	21	17	27	27	1/05/2010	18	24	47	21
11/04/2008	14	15	18	18	7/05/2010	20	18	12	9
17/04/2008	21	20	12	21	13/05/2010	23	22	15	6
23/04/2008	7	6	5	6	19/05/2010	16	20	18	9
29/04/2008	11	13	11	4	25/05/2010	15	17	22	12
5/05/2008	29	36	10	9	31/05/2010	2	12	9	2
11/05/2008	20	18	24	22	6/06/2010	6	10	6	4
17/05/2008	34	28	13	13	12/06/2010	5	15	18	11
23/05/2008	17	17	20	21	18/06/2010	12	17	15	10
29/05/2008	22	18	16	23	24/06/2010	18	22	21	12
4/06/2008	10	4	2	2	30/06/2010	3	9	4	5
10/06/2008	17	14	10	11	6/07/2010	20	23	13	11
16/06/2008	21	12	3	6	12/07/2010	15	15	7	10
22/06/2008	15	11	5	7	18/07/2010	13	24	6	3
28/06/2008	25	18	17	26	24/07/2010	21	22	18	15
4/07/2008	18	16	12	15	30/07/2010	8	10	1	9
10/07/2008	8	6	1	3	5/08/2010	12	13	3	5
16/07/2008	8	9	1	4	11/08/2010	6	8	2	4
22/07/2008	11	13	13	12	17/08/2010	10	11	10	14
28/07/2008	8	8	3	7	23/08/2010	14	13	12	14
3/08/2008	12	10	8	6	29/08/2010	12	17	14	20
9/08/2008	11	10	8	2	4/09/2010	10	11	9	6

Date	PM10-1	PM10-2	PM10-3	PM10-4	Date	PM10-1	PM10-2	PM10-3	PM10-4
15/08/2008	16	9	7	4	10/09/2010	9	10	6	3
21/08/2008	20	19	22	12	16/09/2010	7	7	5	3
27/08/2008	25	25	20	21	22/09/2010	23	31	15	28
2/09/2008	16	15	23	16	28/09/2010	33	23	17	9
8/09/2008	11	15	8	12	4/10/2010	14	11	12	20
14/09/2008	16	16	11	10	10/10/2010	17	17	33	32
20/09/2008	40	39	35	27	16/10/2010	17	31	6	5
26/09/2008	11	12	20	12	22/10/2010	24	23	22	28
2/10/2008	28	28	25	23	28/10/2010	23	22	24	24
8/10/2008	30	37	9	25	3/11/2010	14	21	3	11
14/10/2008	11	11	16	9	9/11/2010	23	18	10	17
20/10/2008	36	25	16	23	15/11/2010	10	10	2	6
26/10/2008	24	19	15	14	21/11/2010	22	2	23	32
1/11/2008	29	26	25	28	27/11/2010	13	8	12	7
7/11/2008	53	45	34	57	3/12/2010	16	16	17	20
13/11/2008	30	22	27	34	9/12/2010	11	11	7	17
19/11/2008	14	13	11	13	15/12/2010	18	17	17	15
25/11/2008	35	22	23	29	21/12/2010	17	18	8	9
1/12/2008	17	15	6	11	27/12/2010	25	19	12	21
7/12/2008	18	18	6	14	2/01/2011	43	38	30	29
13/12/2008	16	19	11	18	8/01/2011	15	14	21	25
19/12/2008	35	21	16	19	14/01/2011	33	26	14	19
25/12/2008	18	14	17	15	20/01/2011	29	26	25	31
31/12/2008	44	45	29	36	26/01/2011	44	44	39	44
6/01/2009	42	34	29	19					

Table B-3: HVAS TSP monitoring data

Date	HV1	HV2	HV3	HV4	HV6	Date	HV1	HV2	HV3	HV4	HV6
5/01/2007	45	63	37	38	-	18/01/2009	59	81	54	55	126
11/01/2007	73	101	73	72	-	24/01/2009	48	69	57	73	69
17/01/2007	64	115	68	48	-	30/01/2009	73	95	62	35	131
23/01/2007	81	102	74	63	-	5/02/2009	121	140	79	83	165
29/01/2007	77	121	70	139	-	11/02/2009	16	36	32	32	33
4/02/2007	64	83	56	65	-	17/02/2009	18	11	20	23	22
10/02/2007	26	62	37	42	-	23/02/2009	46	56	45	46	43
16/02/2007	62	100	66	60	-	1/03/2009	92	123	81	83	105
22/02/2007	30	83	67	60	-	7/03/2009	73	108	63	60	87
28/02/2007	83	59	54	55	-	13/03/2009	34	56	43	28	69
6/03/2007	22	26	23	22	-	19/03/2009	52	71	56	53	73
12/03/2007	65	80	67	63	-	25/03/2009	85	94	86	77	97
18/03/2007	26	33	24	29	-	31/03/2009	31	36	26	27	36
24/03/2007	71	68	61	47	-	6/04/2009	34	37	36	37	58
30/03/2007	54	84	35	49	-	12/04/2009	26	28	21	19	10
5/04/2007	111	79	74	54	-	18/04/2009	52	51	37	51	76
11/04/2007	51	58	41	35	-	24/04/2009	41	46	43	42	30
17/04/2007	79	94	63	64	-	30/04/2009	31	32	30	26	39
23/04/2007	34	119	63	63	-	6/05/2009	30	23	20	20	47
29/04/2007	16	33	17	23	-	12/05/2009	36	42	24	35	35
5/05/2007	92	106	69	80	-	18/05/2009	63	74	56	74	98
11/05/2007	36	50	35	38	-	24/05/2009	32	38	30	34	52
17/05/2007	45	41	31	31	-	30/05/2009	21	22	19	20	30
23/05/2007	16	37	12	26	-	5/06/2009	10	16	9	18	5
29/05/2007	61	65	38	68	-	11/06/2009	9	21	6	25	6
4/06/2007	31	32	25	26	-	17/06/2009	37	38	32	40	55
10/06/2007	28	21	17	36	-	23/06/2009	11	14	10	19	5
16/06/2007	5	7	8	7	-	29/06/2009	6	16	5	15	3

Date	HV1	HV2	HV3	HV4	HV6	Date	HV1	HV2	HV3	HV4	HV6
22/06/2007	25	24	24	24	-	5/07/2009	11	37	13	32	11
28/06/2007	3	10	4	5	-	11/07/2009	24	26	20	30	49
4/07/2007	11	31	12	26	-	17/07/2009	15	141	17	21	10
10/07/2007	27	38	30	40	-	23/07/2009	53	47	22	38	12
16/07/2007	33	42	25	38	-	29/07/2009	17	28	17	28	7
22/07/2007	32	39	25	33	-	4/08/2009	55	80	54	67	21
28/07/2007	20	76	25	75	-	10/08/2009	95	80	56	65	66
3/08/2007	46	68	27	32	-	16/08/2009	28	42	28	36	15
9/08/2007	22	50	95	37	-	22/08/2009	46	63	34	56	15
15/08/2007	44	97	49	50	-	28/08/2009	31	51	34	48	19
21/08/2007	18	23	20	19	-	3/09/2009	58	50	44	56	61
27/08/2007	15	18	16	20	-	9/09/2009	26	47	26	35	5
2/09/2007	30	35	27	35	-	15/09/2009	123	140	111	130	187
8/09/2007	22	29	26	24	-	21/09/2009	73	84	61	65	75
14/09/2007	100	118	59	86	42	27/09/2009	119	148	106	128	88
20/09/2007	156	78	60	63	31	3/10/2009	69	71	51	54	64
26/09/2007	72	84	53	85	106	9/10/2009	125	160	71	73	104
2/10/2007	70	89	55	70	52	15/10/2009	68	128	59	92	41
8/10/2007	16	124	69	95	101	21/10/2009	131	133	79	84	83
14/10/2007	66	102	48	40	38	27/10/2009	44	49	37	36	52
20/10/2007	96	134	90	91	137	2/11/2009	72	84	34	66	124
26/10/2007	53	63	34	40	20	8/11/2009	43	58	30	42	81
1/11/2007	93	109	39	148	111	14/11/2009	85	116	79	26	124
7/11/2007	19	29	18	20	35	20/11/2009	85	207	124	165	112
13/11/2007	43	52	34	42	98	26/11/2009	98	138	93	125	105
19/11/2007	64	79	50	59	88	2/12/2009	62	89	58	68	115
25/11/2007	35	33	27	21	46	8/12/2009	163	190	145	174	140
1/12/2007	37	33	28	26	57	14/12/2009	126	126	86	110	140
7/12/2007	57	48	33	41	60	20/12/2009	60	73	53	57	106
13/12/2007	50	46	40	54	89	26/12/2009	27	29	26	22	24
19/12/2007	53	53	40	51	81	1/01/2010	22	27	24	21	31
25/12/2007	45	37	30	32	42	7/01/2010	35	40	33	37	78
31/12/2007	74	80	55	60	93	13/01/2010	65	79	46	54	96
6/01/2008	45	44	45	27	27	19/01/2010	41	49	36	39	36
12/01/2008	66	98	44	110	128	25/01/2010	69	86	57	68	153
18/01/2008	18	22	16	17	23	31/01/2010	17	25	16	18	71
24/01/2008	47	70	44	53	104	6/02/2010	50	58	39	38	52
30/01/2008	56	76	54	56	51	12/02/2010	92	81	55	69	41
5/02/2008	19	22	19	17	18	18/02/2010	67	89	58	67	106
11/02/2008	21	37	23	25	61	24/02/2010	62	93	51	57	112
17/02/2008	31	38	31	34	62	2/03/2010	100	104	77	80	119
23/02/2008	139	155	121	131	111	8/03/2010	99	91	72	70	58
29/02/2008	28	33	28	33	55	14/03/2010	44	48	32	29	51
6/03/2008	41	47	40	42	52	20/03/2010	90	99	60	69	78
12/03/2008	43	73	43	52	100	26/03/2010	110	122	73	87	86
18/03/2008	54	64	53	58	88	1/04/2010	49	40	40	35	40
24/03/2008	31	46	28	26	67	7/04/2010	19	20	23	25	23
30/03/2008	27	48	24	33	29	13/04/2010	79	67	44	53	68
5/04/2008	43	63	45	38	90	19/04/2010	42	48	35	39	59
11/04/2008	28	37	24	33	61	25/04/2010	41	40	29	33	17
17/04/2008	66	73	59	57	83	1/05/2010	55	53	40	35	56
23/04/2008	17	16	12	11	13	7/05/2010	33	101	23	25	16
29/04/2008	24	32	26	34	13	13/05/2010	42	44	44	53	16
5/05/2008	35	74	52	124	82	19/05/2010	47	48	35	39	25
11/05/2008	37	37	39	27	57	25/05/2010	37	34	29	33	33
17/05/2008	53	68	48	44	31	31/05/2010	7	8	41	42	6
23/05/2008	61	54	41	34	66	6/06/2010	21	20	27	34	8
29/05/2008	42	66	34	33	72	12/06/2010	15	22	36	49	39

Date	HV1	HV2	HV3	HV4	HV6	Date	HV1	HV2	HV3	HV4	HV6
4/06/2008	10	8	6	33	4	18/06/2010	20	30	38	24	18
10/06/2008	23	23	18	32	23	24/06/2010	46	51	31	33	46
16/06/2008	36	54	39	32	27	30/06/2010	4	9	7	16	3
22/06/2008	23	33	19	24	19	6/07/2010	30	53	17	19	25
28/06/2008	25	27	27	31	55	12/07/2010	23	30	12	28	20
4/07/2008	25	26	31	34	44	18/07/2010	21	21	17	28	15
10/07/2008	8	33	8	10	7	24/07/2010	42	45	32	5	59
16/07/2008	9	14	15	15	7	30/07/2010	39	15	6	16	8
22/07/2008	21	22	22	24	35	5/08/2010	11	27	14	23	6
28/07/2008	21	26	32	19	1	11/08/2010	12	11	12	15	9
3/08/2008	18	23	16	29	9	17/08/2010	19	41	15	22	51
9/08/2008	8	30	9	19	4	23/08/2010	26	30	19	27	30
15/08/2008	13	36	12	21	9	29/08/2010	33	43	22	37	63
21/08/2008	34	43	32	30	24	4/09/2010	26	26	19	24	20
27/08/2008	42	53	44	58	61	10/09/2010	24	43	23	32	11
2/09/2008	27	36	27	35	44	16/09/2010	8	28	10	18	8
8/09/2008	46	28	46	36	32	22/09/2010	50	67	53	64	105
14/09/2008	42	38	34	31	28	28/09/2010	61	108	64	73	27
20/09/2008	73	81	82	59	57	4/10/2010	26	38	24	27	65
26/09/2008	18	28	20	28	29	10/10/2010	52	59	61	54	150
2/10/2008	51	60	53	47	-	16/10/2010	27	66	31	37	16
8/10/2008	91	50	39	46	81	22/10/2010	62	98	71	49	108
14/10/2008	18	21	20	23	22	28/10/2010	46	68	49	48	79
20/10/2008	60	82	53	56	84	3/11/2010	33	47	31	46	39
26/10/2008	39	49	35	31	28	9/11/2010	33	36	30	33	41
1/11/2008	52	67	51	51	91	15/11/2010	20	20	27	19	16
7/11/2008	87	133	87	102	168	21/11/2010	55	55	50	60	115
13/11/2008	79	80	104	56	99	27/11/2010	30	30	22	25	25
19/11/2008	48	59	51	35	44	3/12/2010	40	43	31	40	57
25/11/2008	53	74	55	58	85	9/12/2010	31	38	27	24	22
1/12/2008	38	54	29	39	25	15/12/2010	50	39	37	42	42
7/12/2008	36	43	38	42	46	21/12/2010	50	47	35	46	22
13/12/2008	40	64	51	89	40	27/12/2010	55	55	40	46	57
19/12/2008	51	68	75	94	62	2/01/2011	85	101	73	91	81
25/12/2008	26	33	88	85	27	8/01/2011	27	38	27	28	70
31/12/2008	79	127	63	105	84	14/01/2011	77	87	66	72	68
6/01/2009	39	74	91	12	41	20/01/2011	55	76	54	60	92
12/01/2009	77	130	82	33	146	26/01/2011	88	0	74	96	96

Table B-4: Dust deposition monitoring data

DATE	D01	D02	D04A	D05	D06	D07A	D08	D09	D10	D12A	D12B	D12C	D13	D14
Jan-07	0.9	0.9	1.2	1.3	2.9	-	1.8	0.8	1.3	3.2	4.4	5.0	4.3	3.2
Feb-07	0.8	1.3	3.8	1.3	0.7	-	4.6	1.6	2.1	5.9	10.3	5.4	11.2	3.7
Mar-07	2.0	2.4	2.7	1.8	1.9	-	2.9	2.6	2.1	4.0	10.8	7.5	4.6	5.7
Apr-07	2.4	1.0	2.6	1.6	1.0	-	1.6	2.5	1.4	6.1	8.0	5.9	3.7	4.0
May-07	0.8	0.9	2.1	1.3	1.1	-	1.5	1.0	1.3	2.7	3.7	3.8	4.3	3.6
Jun-07	0.6	0.7	1.4	0.9	0.8	-	0.9	0.6	1.0	2.7	2.1	1.6	1.3	4.8
Jul-07	0.8	0.7	1.3	1.1	1.5	-	1.2	0.8	-	2.5	-	1.6	2.4	4.4
Aug-07	0.6	0.5	2.4	0.9	0.7	-	1.1	0.6	1.2	-	2.7	1.6	1.9	3.7
Sep-07	0.7	1.0	1.6		1.0	-	1.5	1.3	1.5	3.6	4.0	10.1	-	3.6
Oct-07	0.9	1.4	1.7	0.9	1.6	-	1.3	2.1	1.2	7.6	2.6	3.9	3.3	3.1
Nov-07	1.8	2.0	2.5	2.0	1.5	1.9	2.0	1.9	2.1	-	8.4	5.0	4.4	4.9
Dec-07	0.8	1.0	1.9	1.6	1.3	1.6	1.3	1.4	1.8	-	5.4	2.2	8.9	2.6
Jan-08	-	1.2	2.4	1.5	1.7	3.1	2.9	1.8	1.7	-	5.9	4.9	4.6	3.7
Feb-08	16.1	0.6	1.6	1.5	0.8	-	2.1	1.8	2.2	2.7	4.7	2.9	1.8	2.7
Mar-08	6.3	1.0	1.6	1.3	0.8	-	1.1	1.3	0.8	2.8	6.4	5.8	1.9	3.0
Apr-08	1.2	1.2	2.5	1.7	1.3	-	2.2	1.4	-	5.7	7.3	5.2	2.1	2.9
May-08	7.4	0.6	1.4	1.0	2.6	-	1.5	1.0	2.1	2.8	3.9	4.8	2.0	5.1
Jun-08	0.6	0.7	1.8	1.0	0.9	0.9	1.2	1.1	1.3	4.2	3.5	2.3	3.3	3.1
Jul-08	0.5	1.6	1.4	1.3	1.0	0.9	1.9	0.9	1.1	4.7	2.4	2.2	3.0	5.2
Aug-08	2.0	0.5	1.6	0.9	1.0	1.1	1.4	0.7	1.3	3.4	1.3	0.6	3.2	4.4
Sep-08	0.8	1.3	1.4	1.4	0.8	1.2	1.3	1.2	1.3	4.4	4.8	3.3	2.0	4.5
Oct-08	0.1	1.6	2.4	1.7	2.0	2.2	1.7	1.6	1.4	3.4	4.1	1.5	3.5	3.0
Nov-08	1.7	1.9	2.6	1.7	2.1	1.9	2.6	1.5	1.8	4.3	5.4	6.3	3.9	4.7
Dec-08	1.9	1.1	2.2	1.9	2.0	0.1	3.8	1.9	2.5	4.2	4.1	4.4	3.3	6.5
Jan-09	1.5	2.1	2.3	1.9	3.8	1.8	3.0	1.7	1.6	3.3	4.5	4.6	5.9	6.0
Feb-09	1.3	2.0	4.0	1.5	1.7	1.9	2.1	1.8	2.0	3.8	7.0	6.1	2.1	3.9
Mar-09	0.9	1.4	2.2	1.4	1.0	1.6	2.2	1.8	1.4	5.3	5.0	6.3	3.1	3.2
Apr-09	2.4	1.4	2.6	1.4	1.4	1.8	2.1	1.5	1.4	5.6	7.5	5.1	3.0	4.9
May-09	0.6	-	2.3	1.3	2.8	1.4	3.7	1.3	1.6	4.4	4.4	4.3	3.3	4.0
Jun-09	0.7	-	1.4	1.2	2.3	1.1	1.4	0.9	1.1	4.6	3.0	3.7	2.6	4.6
Jul-09	0.4	0.4	2.5	1.0	1.5	0.8	0.8	0.9	1.5	3.3	5.4	1.7	1.4	2.3
Aug-09	0.7	0.3	1.4	1.4	1.5	0.7	1.1	1.3	2.5	1.3	1.7	2.4	1.8	2.7
Sep-09	3.1	2.6	3.4	2.6	2.9	2.6	3.4	3.0	2.7	5.3	6.1	5.1	4.5	3.2

DATE	D15	D16	D17	D18	D19	D20	D21	D22	D23A	D24	D25	D26	DA	DB	DC
Jan-07	6.7	4.5	4.0	3.8	3.8	12.9	2.7	1.6	-	2.0	4.6	2.1	2.2	3.4	5.4
Feb-07	4.4	2.8	2.2	6.1	12.2	2.8	6.1	1.2	-	3.9	3.4	3.8	4.0	4.1	7.0
Mar-07	6.9	10.6	2.5	26.3	22	5.2	4.5	2.2	-	IR	2.7	4.6	5.4	5.8	12.3
Apr-07	9.0	6.4	3.3	2.3	15.3	2.3	4.5	2.5	-	4.8	2.1	2.9	2.5	3.8	8.4
May-07	14.5	8.9	2.2	3.6	17.1	0.8	1.3	-	-	11.5	5.6	1.5	1.1	3.0	3.6
Jun-07	7.4	6.2	0.8	2.1	12.9	1.4	1.0	0.70	-	10.5	2.4	1.1	0.9	2.5	2.0
Jul-07	11.5	7.4	0.9	6.4	2.2	1.3	0.8	1.4	-	3.7	0.8	0.5	0.6	1.0	1.4
Aug-07	10.6	6.0	1.4	1.4	3.8	0.7	1.0	0.7	-	1.6	0.7	0.7	0.6	1.1	2.2
Sep-07	9.6	6.9	2.1	1.8	6.4	1.4	1.5	-	-	3.8	1.2	1.0	1.1	2.1	2.8
Oct-07	5.6	4.7	2.0	1.4	2.9	3.5	2.8	1.1	-	2.1	1.1	1.4	1.2	1.1	0.8
Nov-07	6.5	10.2	4.4	4.3	10.5	2.1	4.1	1.0	16.2	3.3	6.5	4.4	19.1	5.8	3.9
Dec-07	5.9	3.2	1.1	2.8	36.6	1.1	2.9	2.7	6.4	2.4	1.7	1.6	1.4	4.8	0.4
Jan-08	4.0	4.2	3.0	14.2	28.8	4.9	5.4	-	-	5.5	4.1	2.8	4.5	3.7	20.4
Feb-08	5.3	6.9	2.0	2.8	11.4	6.5	4.8	1.8	1.5	4.2	2.5	1.7	3.6	3.2	-
Mar-08	4.6	5.2	2.2	5.1	9.0	3.1	1.4	6.1	1.4	4.4	3.7	2.0	2.4	6.9	2.8
Apr-08	9.2	7.2	-	-	12.8	4.2	4.2	1.4	2.5	3.6	2.1	2.0	1.9	2.9	2.4
May-08	12.5	7.7	3.0	2.3	2.4	2.0	2.3	1.0	0.9	2.7	2.1	1.3	2.7	4.2	1.3
Jun-08	5.8	4.7	1.9	10.9	13.7	1.6	2.1	0.8	0.8	1.9	2.6	1.0	2.4	4.1	6.3
Jul-08	12.9	7.0	1.4	1.4	3.7	0.9	1.0	1.4	2.2	2.4	1.8	0.6	2.5	1.1	-
Aug-08	14.1	14.1	1.1	0.5	3.1	0.3	0.3	0.7	3.2	0.5	1.2	0.3	0.7	1.2	1.9
Sep-08	9.7	8.6	2.3	6.6	13.6	1.5	3.0	-	1.7	-	1.4	1.3	1.2	1.8	1.7
Oct-08	9.7	22.9	2.4	2.1	4.2	1.1	2.8	3.2	2.0	-	1.4	2.6	3.4	2.1	4.3
Nov-08	16.2	18.8	4.2	3.4	8.9	1.9	4.4	1.9	2.8	-	3.2	1.9	1.9	3.0	3.5
Dec-08	19.5	14.6	1.9	3.0	11.0	2.5	2.6	3.6	2.8	3.3	2.7	10.9	4.1	3.9	4.3
Jan-09	12.0	6.4	2.7	3.7	8.9	2.0	4.0	5.7	1.4	5.0	4.1	2.0	5.4	4.6	3.7
Feb-09	4.0	3.1	4.0	6.1	18.6	3.4	4.3	-	2.7	5.1	3.4	3.2	2.8	4.0	1.7
Mar-09	9.1	5.0	3.4	2.3	13.7	3.1	4.1	1.4	1.1	4.2	3.5	3.2	3.0	5.7	3.0
Apr-09	6.1	8.1	3.5	7.5	16.2	2.4	4.0	1.4	6.5	4.6	1.9	2.2	1.2	4.3	2.6
May-09	7.2	9.4	2.4	3.5	6.5	2.1	4.1	1.4	4.3	4.7	1.9	3.0	1.8	4.7	2.1
Jun-09	8.0	11.7	1.8	4.0	9.5	2.6	2.7	2.4	5.3	2.8	2.5	1.5	2.8	1.3	-
Jul-09	10.5	13.6	2.7	2.8	2.8	1.5	1.2	3.2	2.4	1.4	1.4	1.7	0.8	1.2	3.2
Aug-09	13.6	11.9	2.2	1.4	2.7	1.2	1.1	7.4	7.9	1.8	0.7	1.7	0.8	0.7	2.4
Sep-09	17.2	20.4	4.6	3.7	7.2	4.2	4.6	2.6	5.6	4.0	2.7	5.1	13.1	2.2	8.2

DATE	D01	D02	D04A	D05	D06	D07A	D08	D09	D10	D12A	D12B	D12C	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23A	D24	D25	D26	DA	DB	DC
Oct-09	2.3	2.3	5.1	3.3	2.7	3.9	4.0	3.0	7.4	4.7	8.9	6.5	5.4	4.7	14.9	9.0	4.2	4.9	27.8	5.1	5.9	3.1	6.9	4.1	3.1	2.8	2.1	4.3	4.6
Nov-09	2.4	0.9	1.8	1.7	1.2	1.3	1.1	0.9	0.7	2.2	8.4	6.6	3.8	2.6	6.7	3.2	3.9	2.7	10.6	3.4	6.5	2.3	1.6	4.6	2.1	1.7	3.5	3.0	1.5
Dec-09	2	1.8	2.9	1.7	1.9	2.0	2.0	2.2	2.8	3.4	6.7	4.9	3.8	5.6	7.4	7.8	3.1	6.6	9.9	3.8	3.7	5.0	4.9	5.2	2.3	2.2	4.7	4.0	3.2
Jan-10	3.2	2.1	2.4	1.4	1.4	1.4	1.5	2.4	1.8	6.7	8.4	9.8	3.6	3.4	10.7	7.6	1.7	6.7	10.4	3	4.7	3.6	6.3	6.7	4.5	7	7.6	10.1	14.6
Feb-10	1.3	1.3	2.1	1.6	1.2	1.8	2.8	1.7	1.4	3.7	10.3	8.1	3.4	3.6	6.5	5.1	3	3.7	12.4	4.6	4.5	1.6	8.1	5.2	10.2	2.2	3	3.8	3.9
Mar-10	1.5	1.7	2.6	1	1.1	1.7	1.1	1.5	2.1	4.8	8.9	5.7	4.2	3.3	6.2	4.6	3	5.9	13.8	4.9	6.1	3.8	8.9	5.5	2.7	1.6	2.9	3.8	1.5
Apr-10	0.4	1	1	0.6	1.2	1	1.2	0.8	1.3	2.7	2.8	5.4	2.1	3.6	6.1	6.1	2.1	2.9	6.1	1.9	1	1.2	2.7	3	10.3	1.5	2.3	1.4	7.5
May-10	1.6	1.6	2.4	1.5	1.7	1.8	1.4	2.1	1.9	2.4	3.4	3.5	5.6	4.6	7.3	7.4	2.8	2.9	19.4	2.6	2.6	1.1	1.7	6.1	5.2	7.7	1.5	2.1	3.1
Jun-10	1.2	0.7	1.3	0.7	0.6	0.8	0.6	0.9	0.9	1.8	2	2.1	2.3	2.8	7.9	4.5	2.8	2.1	14.6	1.4	1.9	2.3	0.8	1.6	0.9	0.7	0.7	2.5	2.3
Jul-10	0.8	0.9	1.4	1	0.9	1	1.1	1.1	0.9	3.2	4	3.5	2.4	2.2	7.3	9.1	2.6	2.4	7.2	1.8	2.6	1.6	1.1	3.1	2.2	1	2.2	7.6	2.9
Aug-10	0.9	1	1.3	0.9	0.6	0.8	0.9	0.6	0.9	2.7	2.9	1.7	1.6	2.6	16.5	22.3	1.4	2.5	6.2	1.6	1.5	1.5	1	2.2	1.8	0.9	0.8	1.4	3.7
Sep-10	0.5	0.6	2.2	3.6	1.5	0.9	1.6	1.1	1.1	4.1	6.6	3.5	3.4	3.9	19.5	24.9	1.8	3.4	17.7	1.4	2.5	2.3	1.1	2.7	1.5	0.6	1.3	1.2	4.1
Oct-10	1.1	1.1	2.5	2.9	1.9	0.8	1.9	1.2	1.4	28.8	12	4	2.9	4	6.3	9.2	2.7	3.2	12.8	2.5	6.3	-	4.3	4.7	1.9	1.7	2	2.6	3
Nov-10	0.5	0.8	2	1.3	1.1	1	1.4	1	10.7	10.7	8.7	7	1.2	2.2	7.3	9.3	2.7	2.5	23.3	2.3	2.8	1.1	2.2	4.3	1.9	1.9	1.7	2.5	2.5
Dec-10	1.5	1.3	2.8	1.1	4.9	1.4	2.6	2	1.3	3.8	8.1	6.3	1.2	4.6	10.3	14.2	2.5	4.9	10.5	3.3	3.7	3.1	3.3	4.4	3.3	1.9	7.5	5.4	5.4

Appendix C

Emission Inventory

Continuation of Bengalla Mine - Emission Calculation

The mining schedule and mine plan designs provided by the Proponent have been combined with emissions factor equations that relate to the quantity of dust emitted from particular activities based on intensity, the prevailing meteorological conditions and composition of the material being handled.

Emission factors and associated controls have been sourced from the US EPA AP42 Emission Factors (**US EPA, 1985 and Updates**), the National Pollutant Inventory document "*Emission Estimation Technique Manual for Mining, Version 3.1*" (**NPI, 2012**), the State Pollution Control Commission document "*Air Pollution from Coal Mining and Related Developments*" (**SPCC, 1983**) and the OEH document, "*NSW Coal Mining Benchmarking Study: International Best Practise Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*", prepared by Katestone Environmental (**Katestone, 2010**).

The emission factor equations used for each dust generating activity are outlined in **Table C-1** below. Detailed emission inventories for each modelled year are presented in **Table C-2** to **Table C-6**.

Table C-1: Emission factor equations

Activity	Emission factor equation	Variables	Control	Source
Drilling (overburden/coal)	$EF = 0.59\ kg/hole$	-	70% - dust suppression system	USEPA, 1985 NPI, 2012
Blasting (overburden/coal)	$EF = 0.00022 \times A^{1.5}\ kg/blast$	A = area to be blasted (m²)	-	USEPA, 1985
Loading / emplacing overburden	$EF = k \times 0.0016 \left(\frac{U}{2.2}^{1.3} \Big/ \frac{M^{1.4}}{2}\right) kg/tonne$	k_{tsp} = 0.74 U = wind speed (m/s) M = moisture content (%)	-	USEPA, 1985
Conveyor transfers	As above	As above	62.5% - water sprays and luffing stacker	NPI, 2012 Katestone, 2010
Hauling on unsealed surfaces	$EF = \left(\frac{0.4536}{1.6093} \times \left(\frac{s}{12}^{0.7} \times 4.9\right) \times \left(M \times \frac{1.1023}{3}\right)\right)^{0.45} kg/VKT$	S = silt content (%) M = average vehicle gross mass (tonnes)	85% - water sprays and/or chemical suppression	USEPA, 1985 Katestone, 2010
Dozers on overburden	$EF = 2.6 \times \frac{s^{1.2}}{M^{1.3}}\ kg/hour$	S = silt content (%) M = moisture content (%)	-	USEPA, 1985
Dozers on coal	$EF = 35.6 \times \frac{s^{1.2}}{M^{1.4}}\ kg/hour$	S = silt content (%) M = moisture content (%)	-	USEPA, 1985
Loading / emplacing coal	$EF = \frac{0.58}{M^{1.2}} kg/tonne$	M = moisture content (%)	85% - enclosed dump hopper and fogging sprays	USEPA, 1985 Katestone, 2010
Wind erosion on exposed areas	$EF = 0.4\ kg/ha/hour$	-	15% - interim stabilisation	SPCC, 1983
Wind erosion on stockpiles	$EF = 1.9 \times \left(\frac{s}{1.5}\right) \times 365 \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) kg/ha/year$	S = silt content (%) P = No. Of days when rainfall >0.25mm F = % of time wind speed >5.4m/s	50% - water sprays	NPI, 2012 Katestone, 2010
Grading roads	$EF = 0.0034 \times s^{2.5}\ kg/VKT$	S = speed of grader (km/hr)	-	USEPA, 1985

Table C-2: Emission Inventory - Year 1

ACTIVITY	TSP emission (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Topsoil Removal	4,184	250	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Drilling	9,776	55,230	holes/year	0.59	kg/hole											70	% Control
OB - Blasting	42,621	298	blasts/year	143	kg/blast	7,500	Area of blast in square metres										
OB - Loading OB to haul truck	94,634	70,557,663	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Hauling to Emplacement	1,900,083	70,557,663	tonnes/year	0.180	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	9.3	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Hauling to Emplacement WOEA	76,183	4,400,000	tonnes/year	0.115	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	6.0	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Emplacing at Dump	94,634	70,557,663	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Emplacing at Dump WOEA	5,901	4,400,000	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Rehandle Overburden	4,826	3,597,968	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Dozers on various OB Activities	683,567	40,846	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dragline	289,777	9,120,270	bcm/year	0.032	kg/bcm	7.0	drop distance (m)	2	moisture content in %								
CL - Drilling	967	5,462	holes/year	0.59	kg/hole											70	% Control
CL - Blasting	4,736	33	blasts / year	143	kg/blast	7,500	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up	248,912	17,634	hours/year	14.1	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading ROM coal to haul truck	444,345	10,700,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CL - Hauling to ROM hopper	233,599	10,700,000	tonnes/year	0.146	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	6.4	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Unloading ROM to hopper	66,652	10,700,000	tonnes/year	0.042	kg/t	9	moisture content in %									85	% Control
CHPP - Rehandle ROM at hopper	66,652	1,605,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CHPP - Dozers at ROM hopper	706	50	hours/year	14.12	kg/h	5	silt content in %	9.0	moisture content in %								
CHPP - Unloading to product coal stockpile	391	8,453,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							62.5	% Control
CHPP - Loading Rejects	367	2,247,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9	moisture content in %								
CHPP - Hauling Rejects	51,505	2,247,000	tonnes/year	0.153	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	6.7	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Dumping Rejects	367	2,247,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9.0	moisture content in %								
PC - Loading coal to train at Bengalla Rail loop	313	8,453,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							70	% Control
WE - Overburden emplacement areas	651,179	219	ha	0.40	kg/ha/hr	8,760	hours									15	% Control
WE - Open pit	463,743	132	ha	0.40	kg/ha/hr	8,760	hours										
WE - ROM stockpiles	1,247	2.5	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
WE - Product stockpiles	7,156	14.3	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
Grading roads	62,778	102,000	km	0.62	kg/VKT	8	speed of graders in km/h										
Total TSP emissions (kg/yr)	**5,511,801**																
TSP/ROM Ratio	**0.52**																

Table C-3: Emission Inventory - Year 4

ACTIVITY	TSP emission (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Topsoil Removal	4,184	250	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Drilling	12,469	70,449	holes/year	0.59	kg/hole											70	% Control
OB - Blasting	53,589	375	blasts/year	143	kg/blast	7,500	Area of blast in square metres										
OB - Loading OB to haul truck	128,650	95,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Loading OB to haul truck SatPit	10,675	7,959,035	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Hauling to Emplacement	2,698,560	91,519,256	tonnes/year	0.197	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	10.2	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Hauling to Emplacement WOEA	60,058	4,400,000	tonnes/year	0.091	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	4.7	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Hauling to Emplacement SatPit	150,162	7,959,035	tonnes/year	0.126	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	6.5	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Emplacing at Dump	133,424	99,478,291	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Emplacing at Dump WOEA	5,901	4,400,000	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Rehandle Overburden	6,175	4,604,124	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Dozers on various OB Activities	677,876	40,506	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dragline	362,222	11,400,338	bcm/year	0.032	kg/bcm	7.0	drop distance (m)	2	moisture content in %								
CL - Drilling	1,233	6,967	holes/year	0.59	kg/hole											70	% Control
CL - Blasting	5,954	42	blasts / year	143	kg/blast	7,500	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up	246,855	17,488	hours/year	14.1	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading ROM coal to haul truck	570,899	13,747,456	tonnes/year	0.042	kg/t	9	moisture content in %										
CL - Loading ROM coal to haul truck SatPit	52,015	1,252,544	tonnes/year	0.042	kg/t	9	moisture content in %										
CL - Hauling to ROM hopper	282,226	13,747,456	tonnes/year	0.137	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	6.0	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CL - Hauling to ROM hopper SatPit	16,347	1,252,544	tonnes/year	0.087	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	3.8	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Unloading ROM to hopper	93,437	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %									85	% Control
CHPP - Rehandle ROM at hopper	93,437	2,250,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CHPP - Dozers at ROM hopper	706	50	hours/year	14.12	kg/h	5	silt content in %	9.0	moisture content in %								
CHPP - Unloading to product coal stockpile	548	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							62.5	% Control
CHPP - Loading Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9	moisture content in %								
CHPP - Hauling Rejects	70,864	3,150,000	tonnes/year	0.150	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	6.6	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Dumping Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9.0	moisture content in %								
PC - Loading coal to train at Bengalla Rail loop	438	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							70	% Control
WE - Overburden emplacement areas	745,689	250	ha	0.40	kg/ha/hr	8,760	hours									15	% Control
WE - Open pit	557,901	159	ha	0.40	kg/ha/hr	8,760	hours										
WE - ROM stockpiles	1,247	2.5	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
WE - Product stockpiles	7,156	14.3	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
Grading roads	62,778	102,000	km	0.62	kg/VKT	8	speed of graders in km/h										
Total TSP emissions (kg/yr)	**7,114,705**																
TSP/ROM Ratio	**0.47**																

Table C-4: Emission Inventory - Year 8

ACTIVITY	TSP emission (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Topsoil Removal	4,184	250	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Drilling	12,469	70,449	holes/year	0.59	kg/hole											70	% Control
OB - Blasting	53,589	375	blasts/year	143	kg/blast	7,500	Area of blast in square metres										
OB - Loading OB to haul truck	128,650	95,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Hauling to Emplacement	3,053,058	95,919,256	tonnes/year	0.212	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	11.0	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Emplacing at Dump	128,650	95,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Loading OB to haul truck at WOEA	17,704	13,200,000	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Hauling to Emplacement from WOEA	283,400	13,200,000	tonnes/year	0.143	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	7.4	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Emplacing at Dump from WOEA	17,704	13,200,000	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Rehandle Overburden	6,175	4,604,124	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Dozers on various OB Activities	677,876	40,506	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dragline	250,169	11,400,338	bcm/year	0.022	kg/bcm	5.0	drop distance (m)	2	moisture content in %								
CL - Drilling	1,233	6,967	holes/year	0.59	kg/hole											70	% Control
CL - Blasting	5,954	42	blasts / year	143	kg/blast	7,500	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up	246,855	17,488	hours/year	14.1	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading ROM coal to haul truck	622,914	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CL - Hauling to ROM hopper	295,294	15,000,000	tonnes/year	0.131	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	5.7	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Unloading ROM to hopper	93,437	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %									85	% Control
CHPP - Rehandle ROM at hopper	93,437	2,250,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CHPP - Dozers at ROM hopper	706	50	hours/year	14.12	kg/h	5	silt content in %	9.0	moisture content in %								
CHPP - Unloading to product coal stockpile	548	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							62.5	% Control
CHPP - Loading Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9	moisture content in %								
CHPP - Hauling Rejects	62,573	3,150,000	tonnes/year	0.132	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	5.8	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Dumping Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9.0	moisture content in %								
PC - Loading coal to train at Bengalla Rail loop	438	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							70	% Control
WE - Overburden emplacement areas	537,260	180	ha	0.40	kg/ha/hr	8,760	hours									15	% Control
WE - Open pit	1,146,130	327	ha	0.40	kg/ha/hr	8,760	hours										
WE - ROM stockpiles	1,247	2.5	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
WE - Product stockpiles	7,156	14.3	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
Grading roads	62,778	102,000	km	0.62	kg/VKT	8	speed of graders in km/h										
Total TSP emissions (kg/yr)	**7,812,619**																
TSP/ROM Ratio	**0.52**																

Table C-5: Emission Inventory - Year 15

ACTIVITY	TSP emission (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Topsoil Removal	4,184	250	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Drilling	14,695	83,021	holes/year	0.59	kg/hole											70	% Control
OB - Blasting	63,065	441	blasts/year	143	kg/blast	7,500	Area of blast in square metres										
OB - Loading OB to haul truck	158,157	117,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Hauling to Emplacement	3,887,377	117,919,256	tonnes/year	0.220	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	11.4	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Emplacing at Dump	158,157	117,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Rehandle Overburden	7,592	5,660,124	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Dozers on various OB Activities	677,876	40,506	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dragline	250,169	11,400,338	bcm/year	0.022	kg/bcm	5.0	drop distance (m)	2	moisture content in %								
CL - Drilling	1,453	8,211	holes/year	0.59	kg/hole											70	% Control
CL - Blasting	7,007	49	blasts / year	143	kg/blast	7,500	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up	246,855	17,488	hours/year	14.1	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading ROM coal to haul truck	622,914	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CL - Hauling to ROM hopper	451,063	15,000,000	tonnes/year	0.200	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	8.8	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Unloading ROM to hopper	93,437	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %									85	% Control
CHPP - Rehandle ROM at hopper	93,437	2,250,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CHPP - Dozers at ROM hopper	706	50	hours/year	14.12	kg/h	5	silt content in %	9.0	moisture content in %								
CHPP - Unloading to product coal stockpile	548	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							62.5	% Control
CHPP - Loading Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9	moisture content in %								
CHPP - Hauling Rejects	55,621	3,150,000	tonnes/year	0.118	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	5.2	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Dumping Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9.0	moisture content in %								
PC - Loading coal to train at Bengalla Rail loop	438	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							70	% Control
WE - Overburden emplacement areas	754,144	253	ha	0.40	kg/ha/hr	8,760	hours									15	% Control
WE - Open pit	1,108,718	316	ha	0.40	kg/ha/hr	8,760	hours										
WE - ROM stockpiles	1,247	2.5	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
WE - Product stockpiles	7,156	14.3	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
Grading roads	62,778	102,000	km	0.62	kg/VKT	8	speed of graders in km/h										
Total TSP emissions (kg/yr)	**8,729,823**																
TSP/ROM Ratio	**0.58**																

Table C-6: Emission Inventory - Year 24

ACTIVITY	TSP emission (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
OB - Topsoil Removal	4,184	250	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Drilling	16,920	95,593	holes/year	0.59	kg/hole											70	% Control
OB - Blasting	72,541	508	blasts/year	143	kg/blast	7,500	Area of blast in square metres										
OB - Loading OB to haul truck	187,665	139,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Hauling to Emplacement	4,986,527	139,919,256	tonnes/year	0.238	kg/t	209	tonnes/load	281	Vehicle gross (tonnes)	12.4	km/return t	4.0	kg/VKT	2.8	% silt conte	85	% Control
OB - Emplacing at Dump	187,665	139,919,256	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Rehandle Overburden	9,008	6,716,124	tonnes/year	0.001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	2	moisture content in %								
OB - Dozers on various OB Activities	677,876	40,506	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
OB - Dragline	362,222	11,400,338	bcm/year	0.032	kg/bcm	7.0	drop distance (m)	2	moisture content in %								
CL - Drilling	1,673	9,454	holes/year	0.59	kg/hole											70	% Control
CL - Blasting	8,060	56	blasts / year	143	kg/blast	7,500	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up	246,855	17,488	hours/year	14.1	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading ROM coal to haul truck	622,914	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CL - Hauling to ROM hopper	511,623	15,000,000	tonnes/year	0.227	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	10.0	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Unloading ROM to hopper	93,437	15,000,000	tonnes/year	0.042	kg/t	9	moisture content in %									85	% Control
CHPP - Rehandle ROM at hopper	93,437	2,250,000	tonnes/year	0.042	kg/t	9	moisture content in %										
CHPP - Dozers at ROM hopper	706	50	hours/year	14.12	kg/h	5	silt content in %	9.0	moisture content in %								
CHPP - Unloading to product coal stockpile	548	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							62.5	% Control
CHPP - Loading Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9	moisture content in %								
CHPP - Hauling Rejects	80,732	3,150,000	tonnes/year	0.171	kg/t	180	tonnes/load	296	Vehicle gross (tonnes)	7.5	km/return t	4.1	kg/VKT	2.8	% silt conte	85	% Control
CHPP - Dumping Rejects	514	3,150,000	tonnes/year	0.000	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	9.0	moisture content in %								
PC - Loading coal to train at Bengalla Rail loop	438	11,850,000	tonnes/year	0.0001	kg/t	1.133	Ave(WS/2.2)^1.3 [m/s]	11.0	moisture content in %							70	% Control
WE - Overburden emplacement areas	582,837	196	ha	0.40	kg/ha/hr	8,760	hours									15	% Control
WE - Open pit	891,955	255	ha	0.40	kg/ha/hr	8,760	hours										
WE - ROM stockpiles	1,247	2.5	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
WE - Product stockpiles	7,156	14.3	ha	1,003.66	kg/ha/year	5	silt content in %	97	(p)	5.7	(f)					50	% Control
Grading roads	62,778	102,000	km	0.62	kg/VKT	8	speed of graders in km/h										
Total TSP emissions (kg/yr)	**9,712,032**																
TSP/ROM Ratio	**0.65**																

Appendix D

CALMET/CALPUFF Input Variables

Table D-1: CALMET input variables

Parameter	Value
Terrain radius of influence (TERRAD)	10km
Vertical extrapolation of surface wind observations (IEXTRP)	-4
Layer dependent weighting factor of surface vs. upper air wind observations (BIAS [NZ])	-1,-0.5,-0.25,0,0,0,0,0
Weighting parameter for Step 1 wind field vs. Observations	R1 = 0.5km, R2 = 0.5km
Maximum radius of influence for meteorological stations in Layer 1 and layers aloft	RMAX1=1.0km, RMAX2=1.0km

Table D-2: CALPUFF input variables

Parameter	Used option	Value
Aqueous phase transformation modelled?	No	0
Boundary conditions modelled?	No	0
CGRUP (Species groups)	PM2.5, PM10 and TSP	-
Chemical transformation	Not modelled	0
Dry deposition modelled?	Yes	1
Gravitational settling (plume tilt) modelled?	No	0
Horizontal size of puff (m) beyond which time-dependent dispersion equations (Heffter) are used to determine sigma-y and sigma-z	Default	550
Individual source conditions saved?	No	0
Maximum length of a slug (met. grid units)	Default	1
Maximum mixing height	Default	3000
Maximum number of sampling steps for one puff/slug during one time step	-	60
Maximum number of slugs/puffs release from one source during one time step	-	60
Maximum sigma z allowed to avoid numerical problem in calculating virtual time or distance	Default	5.00E+06
Maximum travel distance of a puff/slug during one sampling step	Default	1
Method used to compute dispersion coefficients?	Internally calculated sigma v, sigma w using micrometeorological variables	2
Method used for lagrangian timescale for Sigma-y	Draxler default 617.284	0
Method used to compute turbulence sigma-v & sigma-w using micrometeorological variables	Standard CALPUFF subroutines	1
Minimum mixing height	Default	50
Minimum sigma y for a new puff/slug	Default	1
Minimum sigma z for a new puff/slug	Default	1
Minimum turbulence velocities sigma-v and sigma-w for each stability class over land and over water	Default	-
Near-field puffs modelled as elongated slugs?	No	0
Plume path coefficients for each stability class	Default	-
Potential temperature gradient for stable classes E, F	Default	-
Puff splitting allowed?	No	0
Range of land use categories for which urban dispersion is assumed	Default	-
Slug - to - puff transition criterion factor	Default	10
Stability class used to determine plume growth rates for puffs above the boundary layer	Default	5
Sub grid-scale complex terrain	Not Modelled	0
Switch for using Heffter equation for sigma-z	Default(Not use Heffter)	0
Terrain adjustment method	Default(Partial plume path adjustment)	3
Vegetation state in unirrigated areas	Default(Active and unstressed)	1
Vertical dispersion constant for stable conditions	Default	0.01
Vertical distribution used in the near field	Default (Gaussian)	1
Wet removal modelled?	No	0
Wind speed classes	Default	-
Wind speed profile power-law exponents for stabilities	Default	-

Appendix E

Isopleth Diagrams - Dust emissions

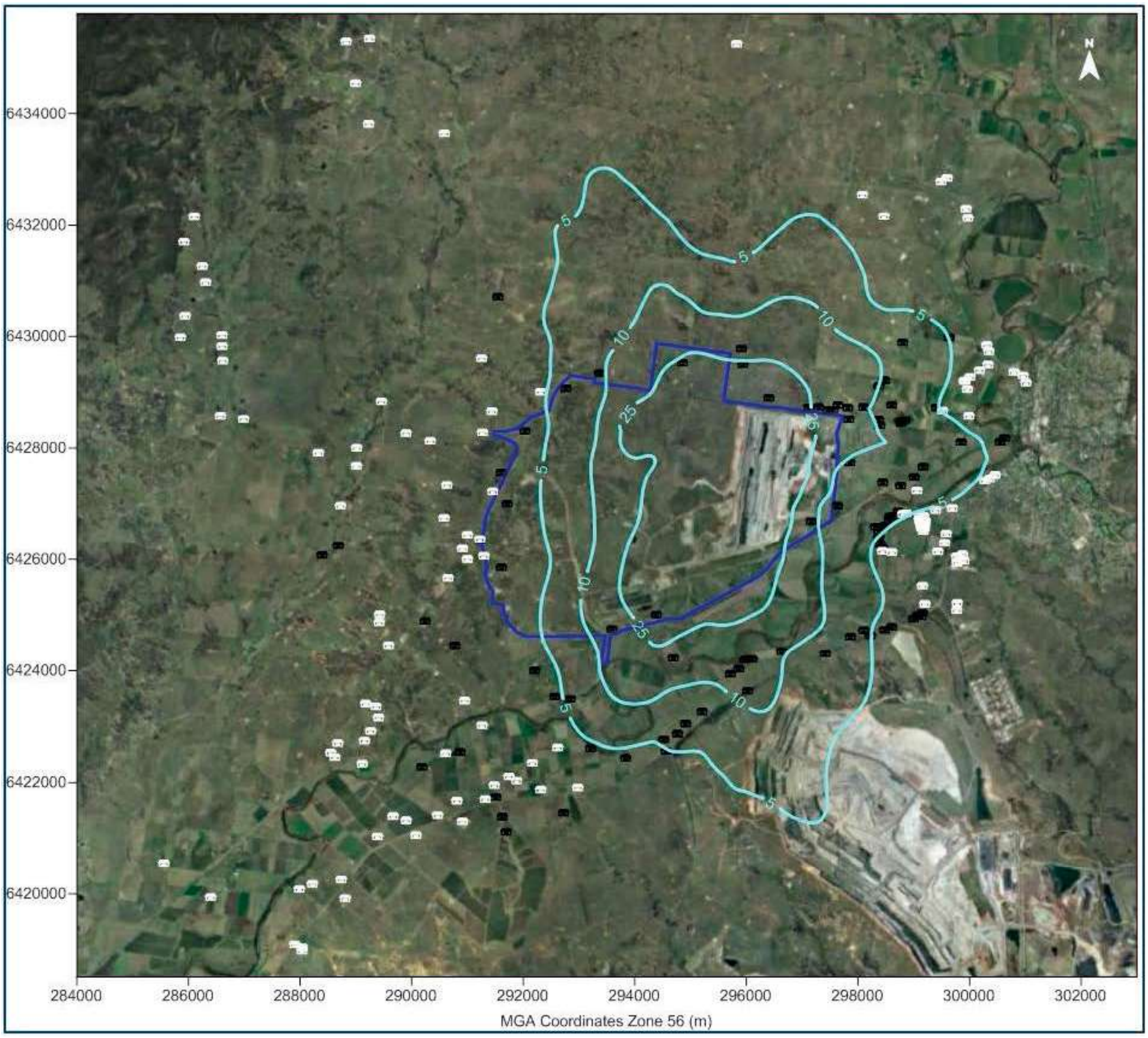

Figure E-1: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project in Year 1 (µg/m³)

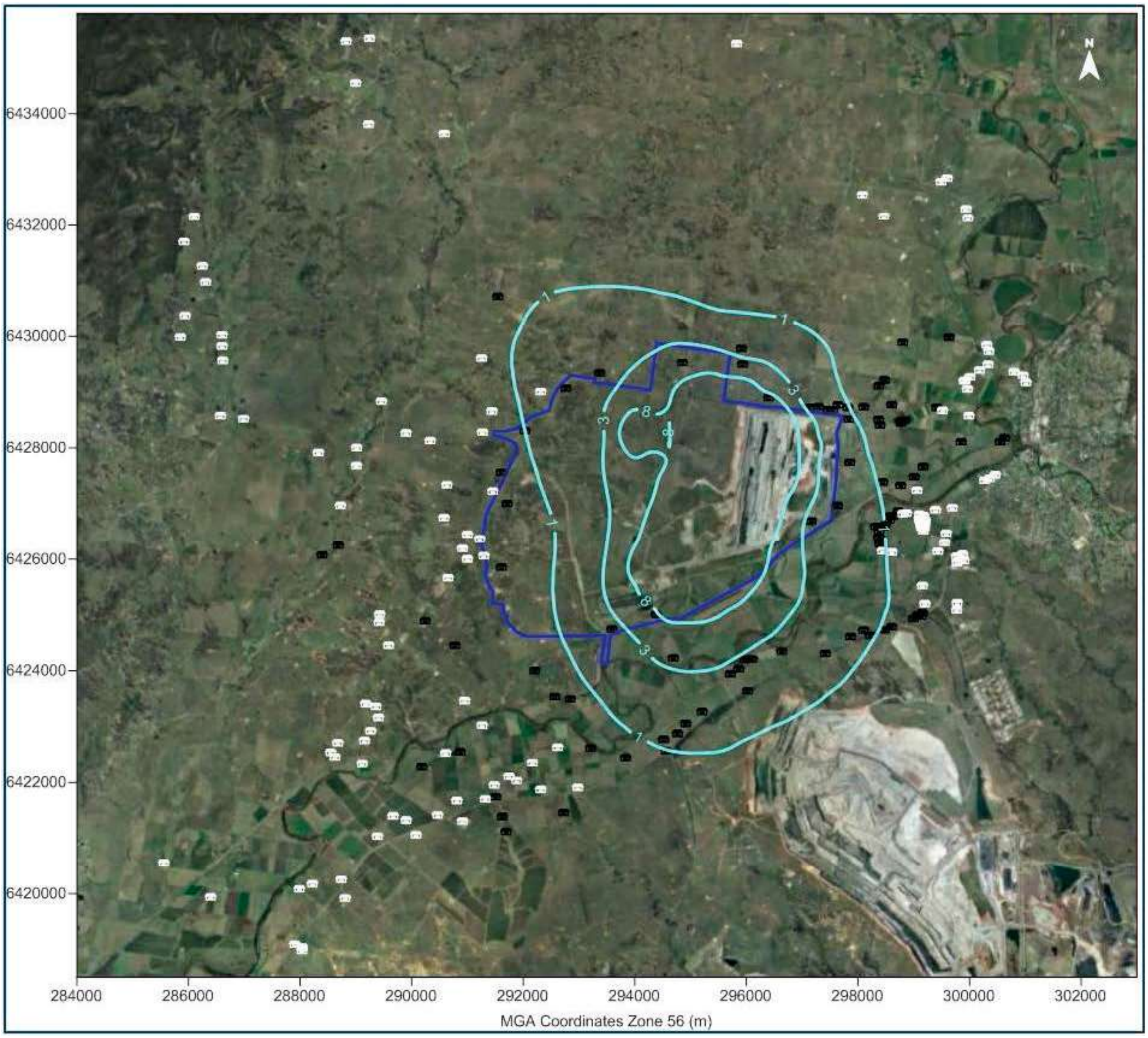

Figure E-2: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project in Year 1 (µg/m³)

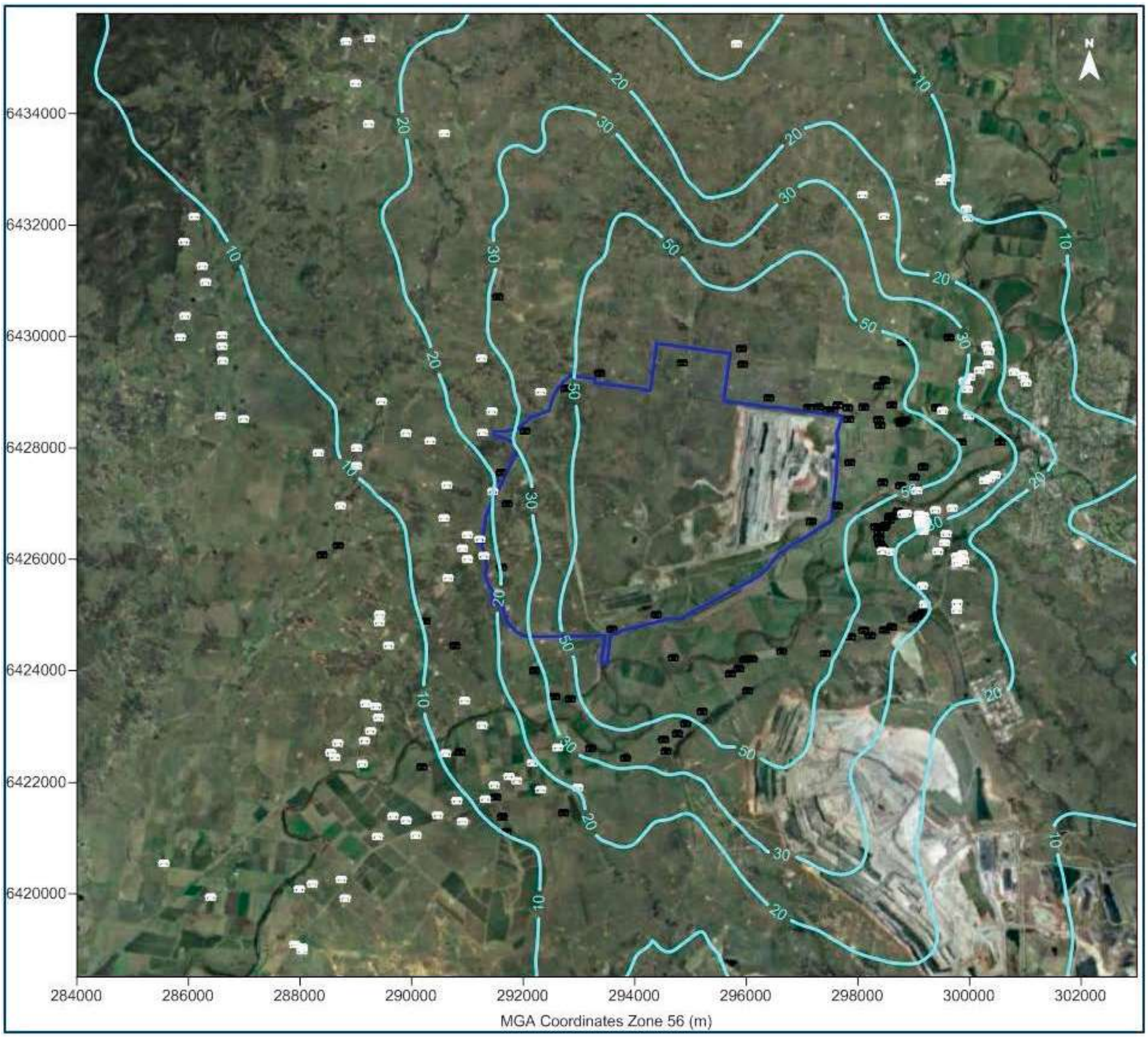

Figure E-3: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Project in Year 1 (µg/m³)

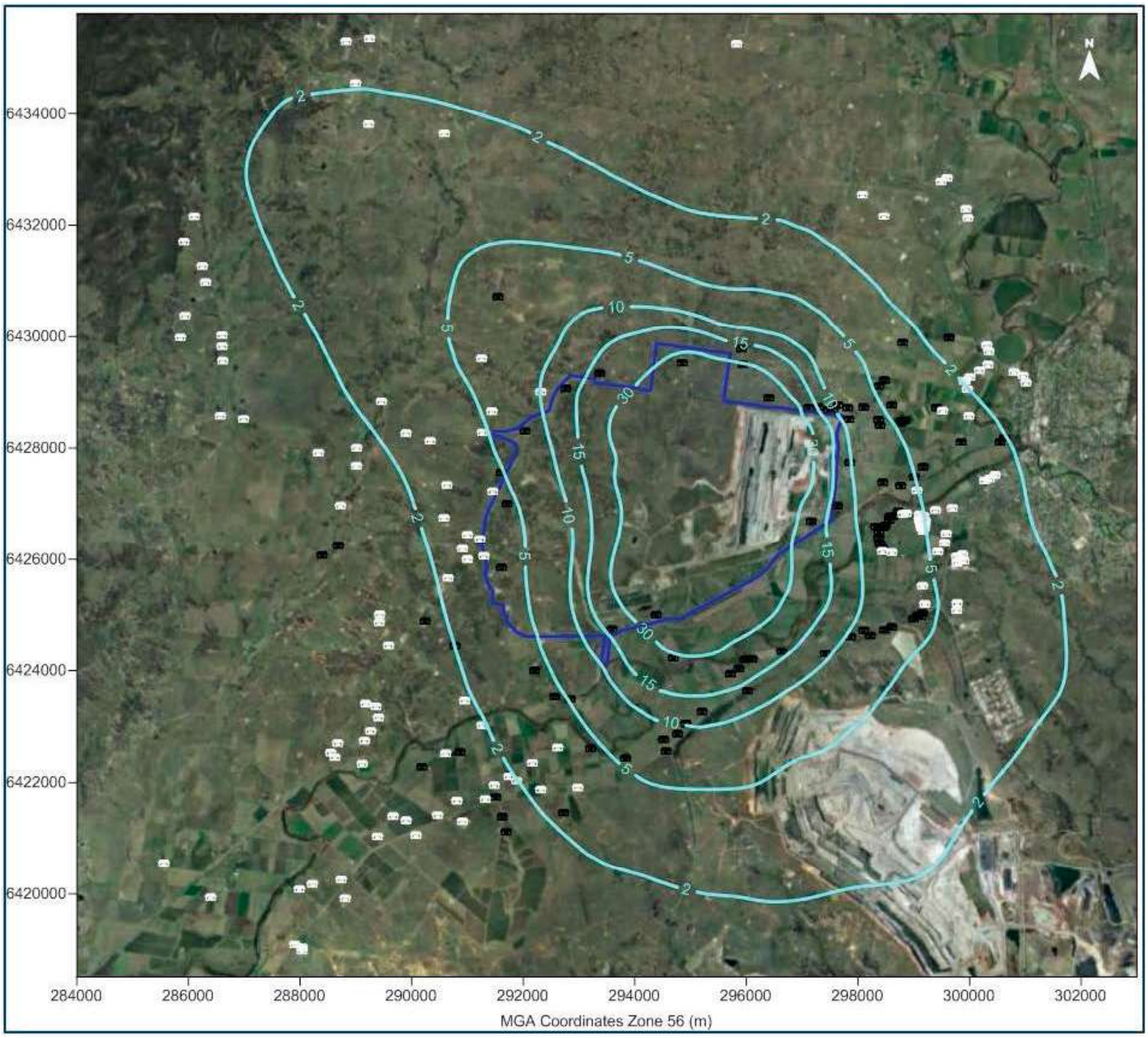

Figure E-4: Predicted annual average PM_{10} concentrations due to emissions from the Project in Year 1 (µg/m³)

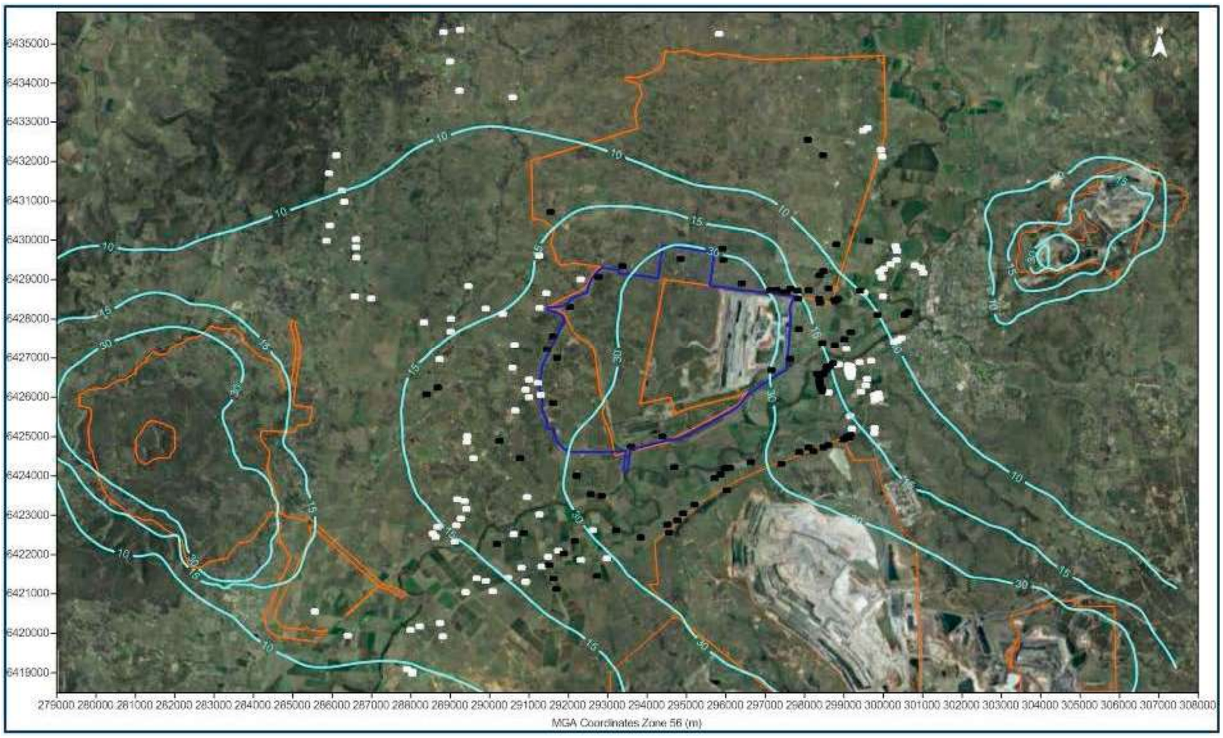

Figure E-5: Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources in Year 1 (µg/m³)

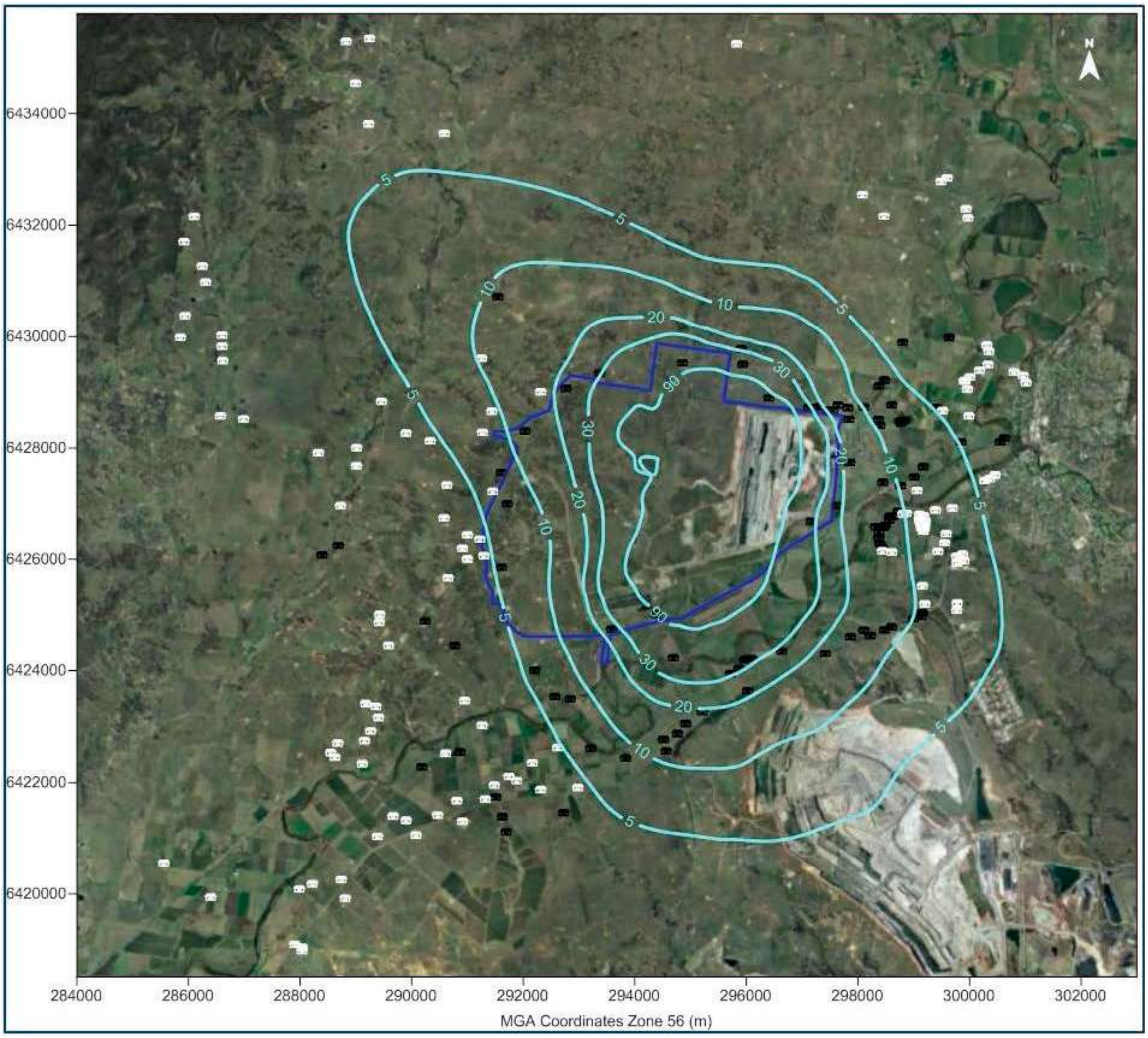

Figure E-6: Predicted annual average TSP concentrations due to emissions from the Project in Year 1 (µg/m³)

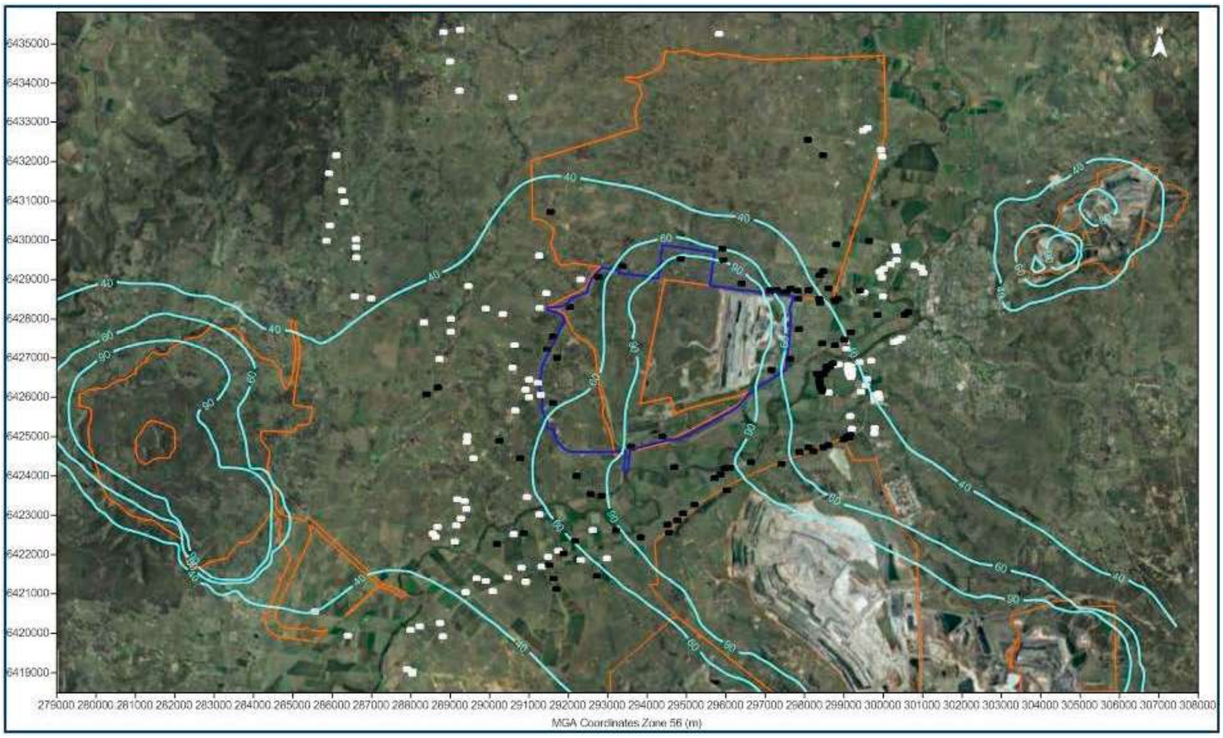

Figure E-7: Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 1 (µg/m³)

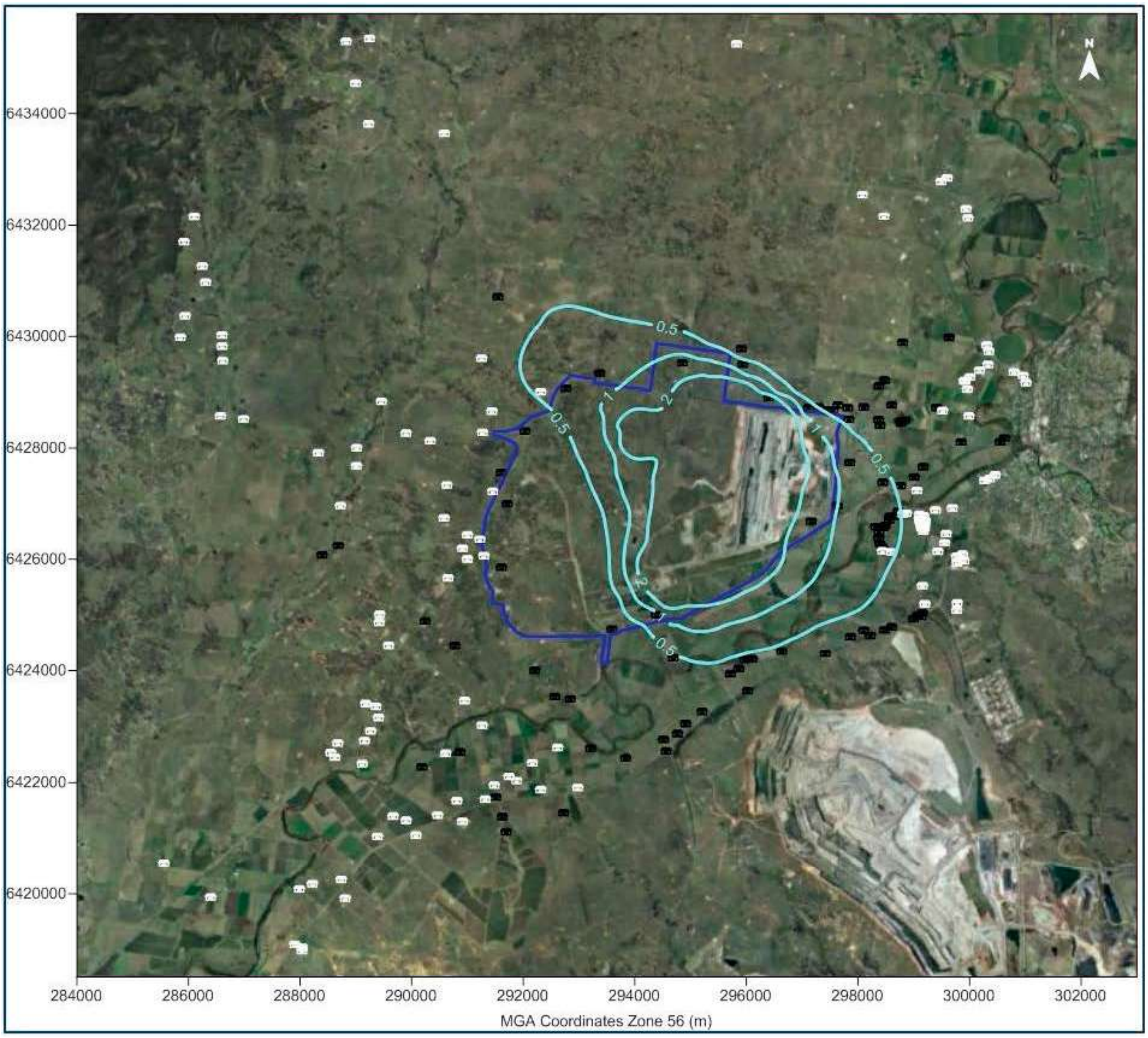

Figure E-8: Predicted annual average dust deposition levels due to emissions from the Project in Year 1 (µg/m³)

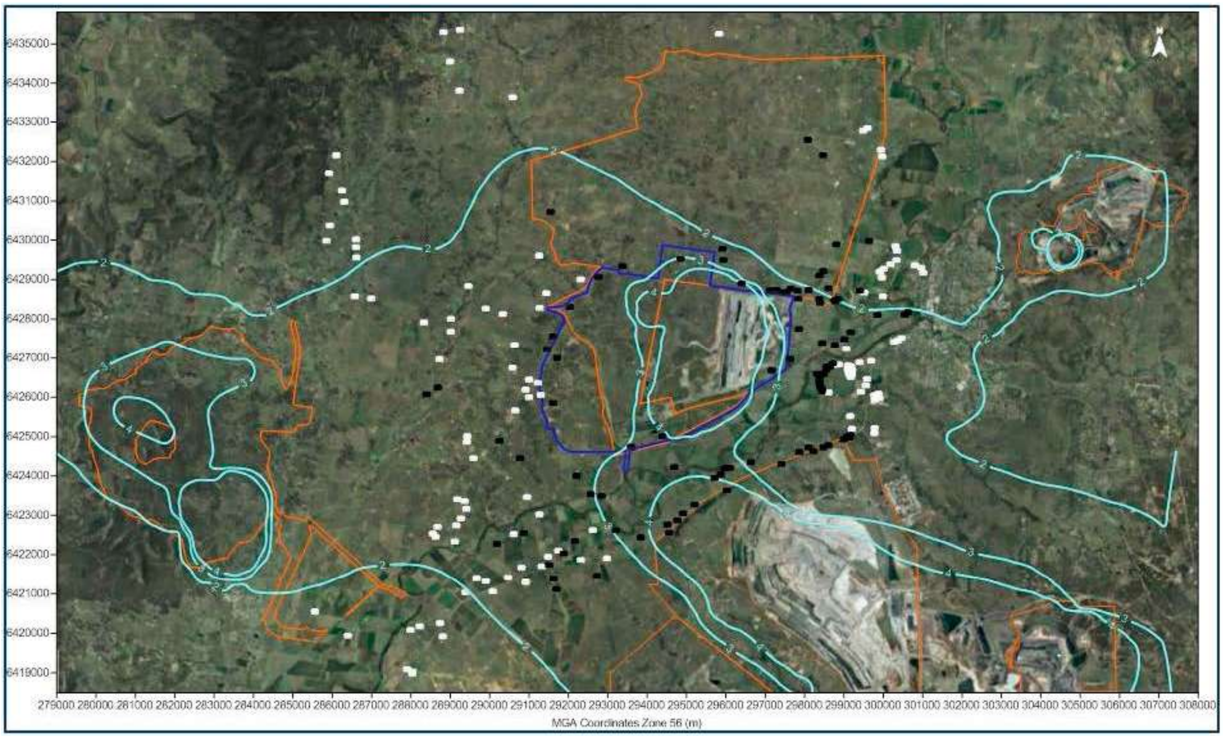

Figure E-9: Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 1 (µg/m³)

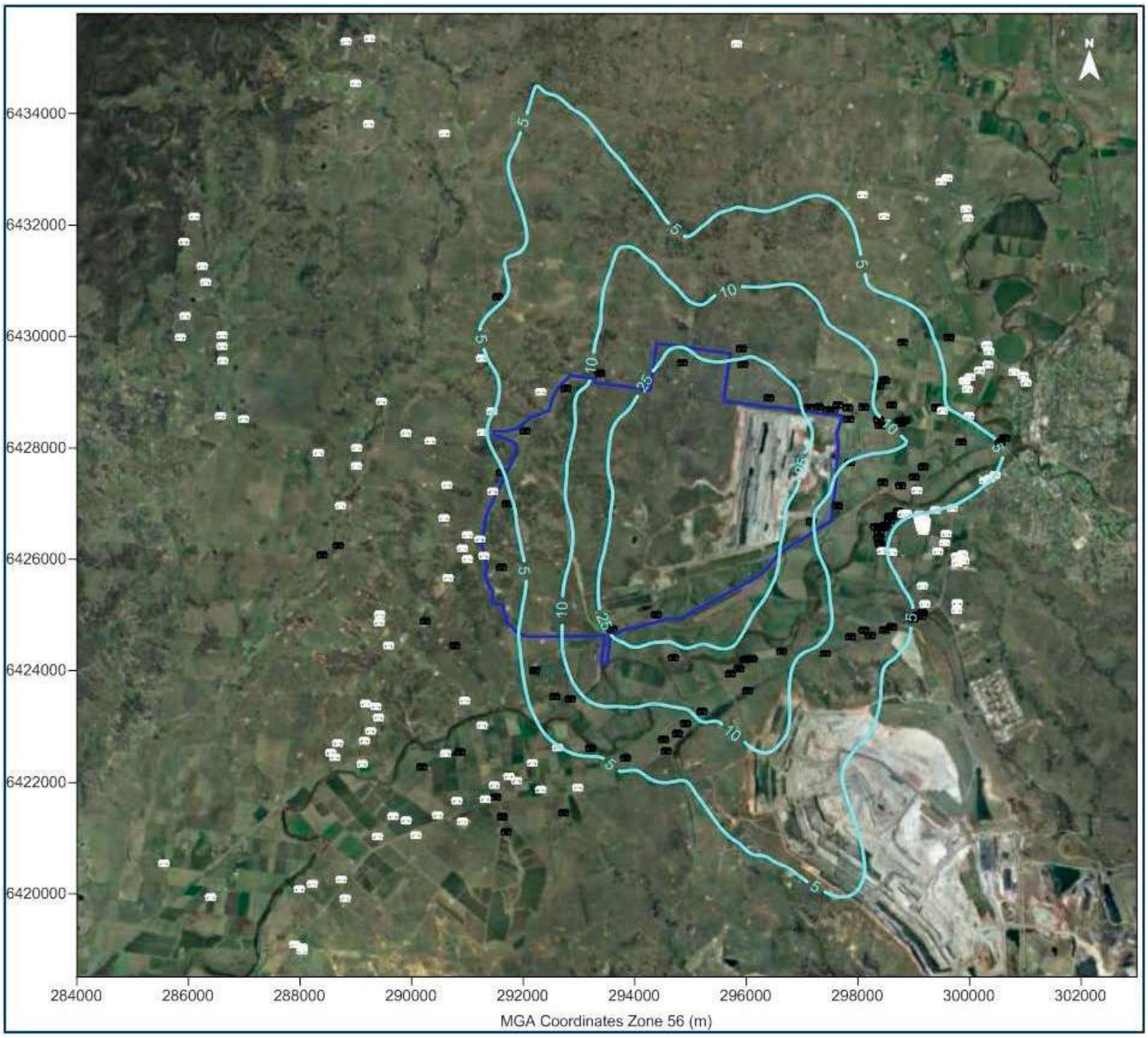

Figure E-10: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project in Year 4 (µg/m³)

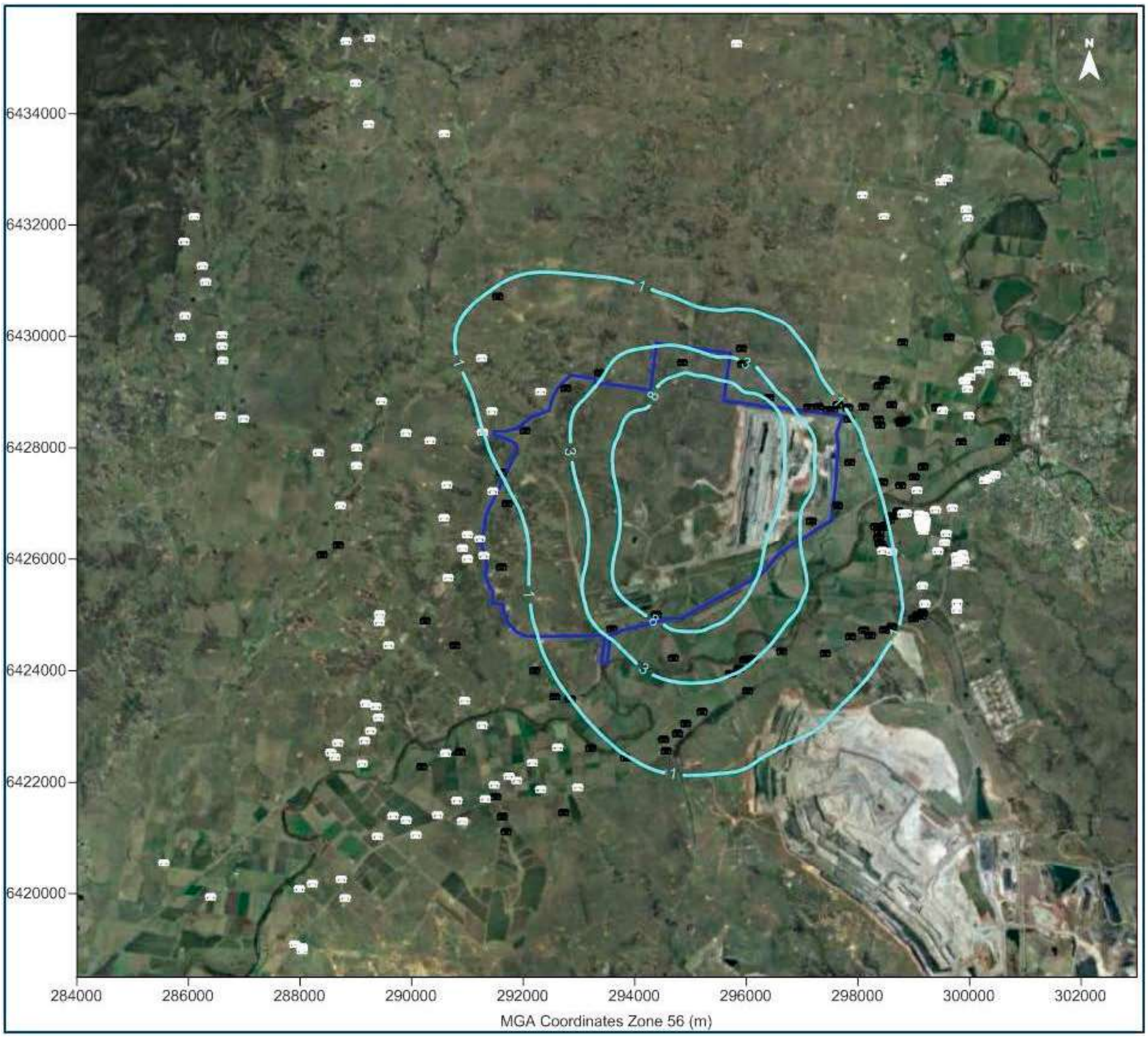

Figure E-11: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project in Year 4 (µg/m³)

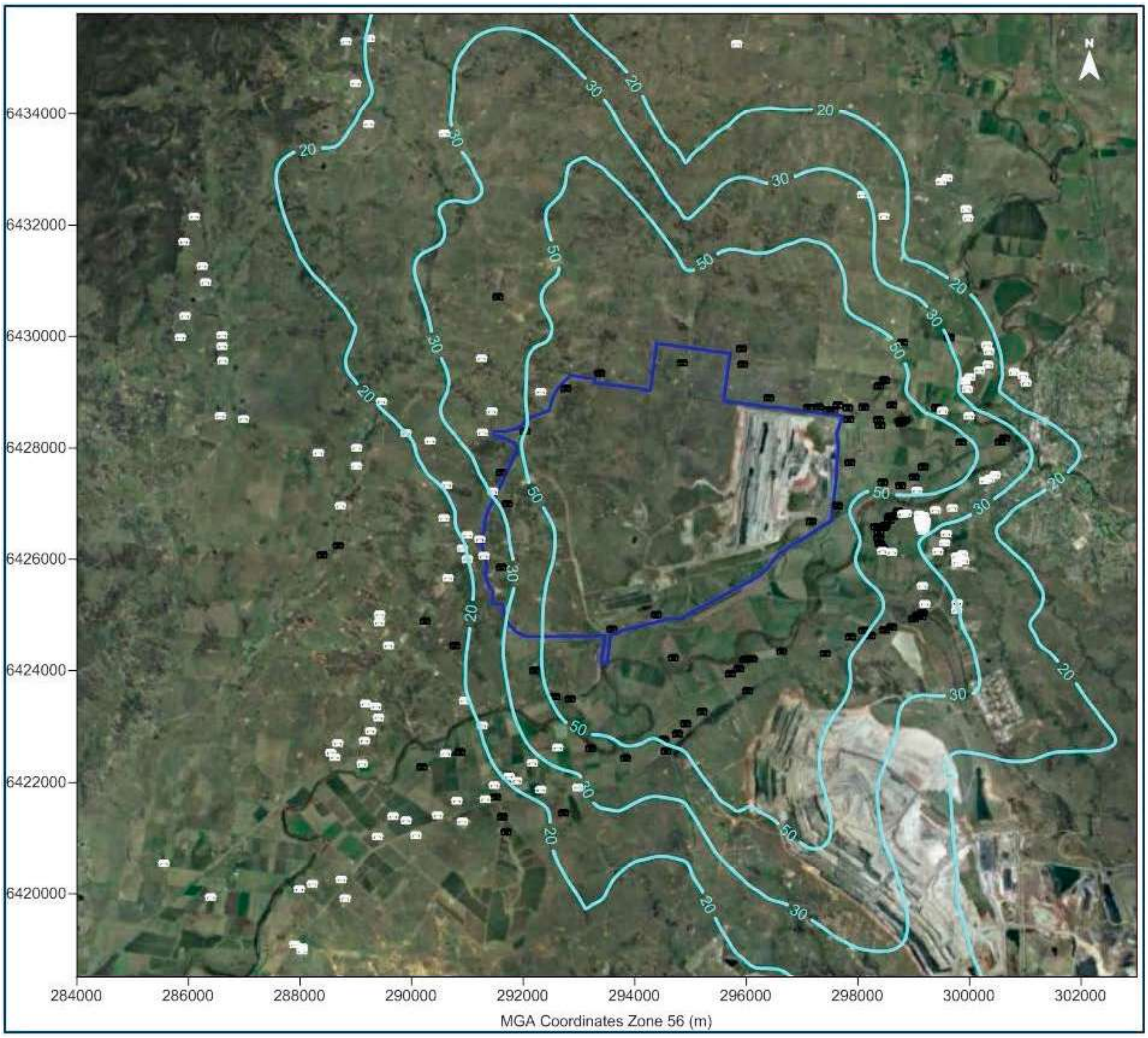

Figure E-12: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Project in Year 4 (µg/m³)

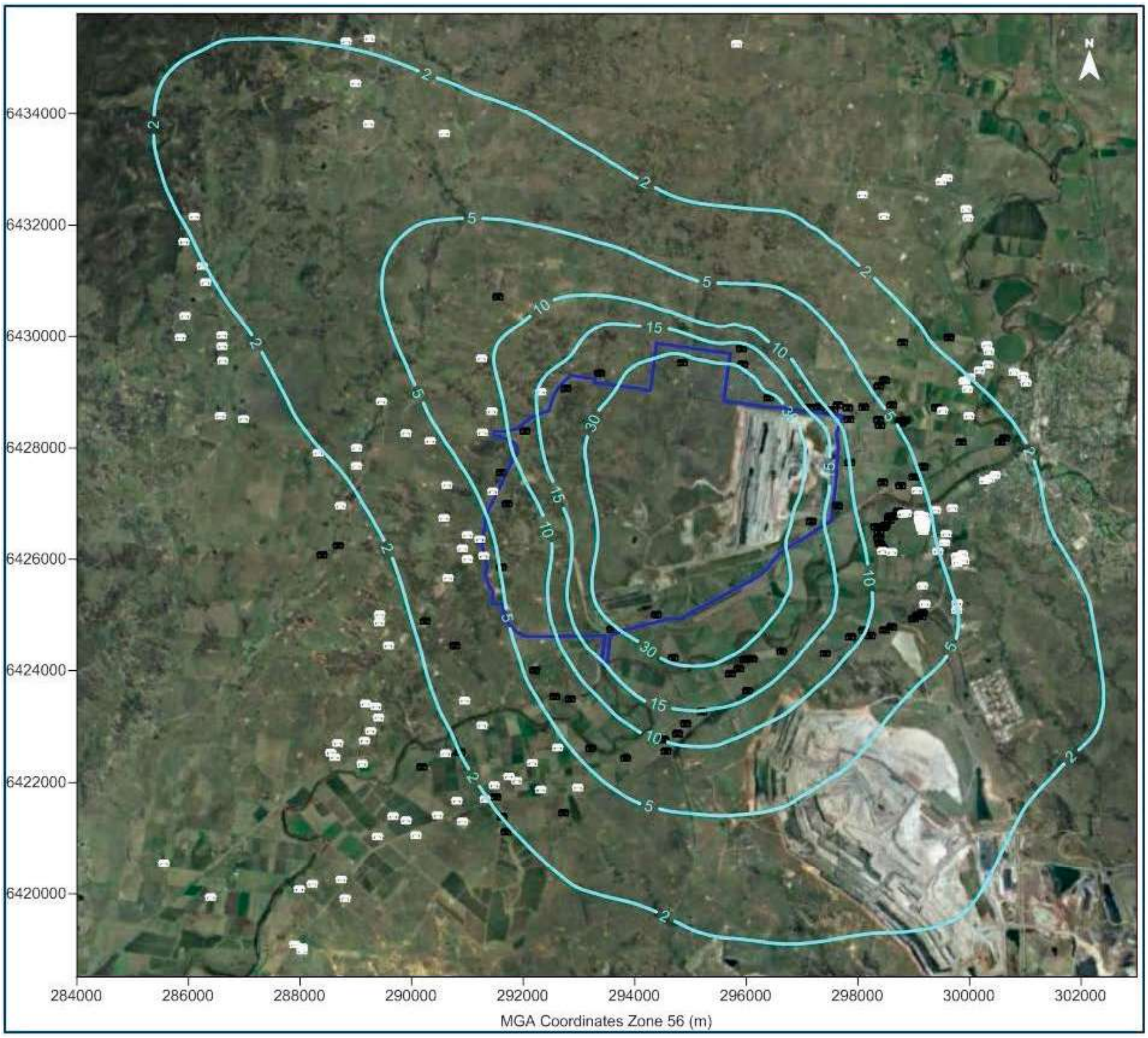

Figure E-13: Predicted annual average PM_{10} concentrations due to emissions from the Project in Year 4 (µg/m³)

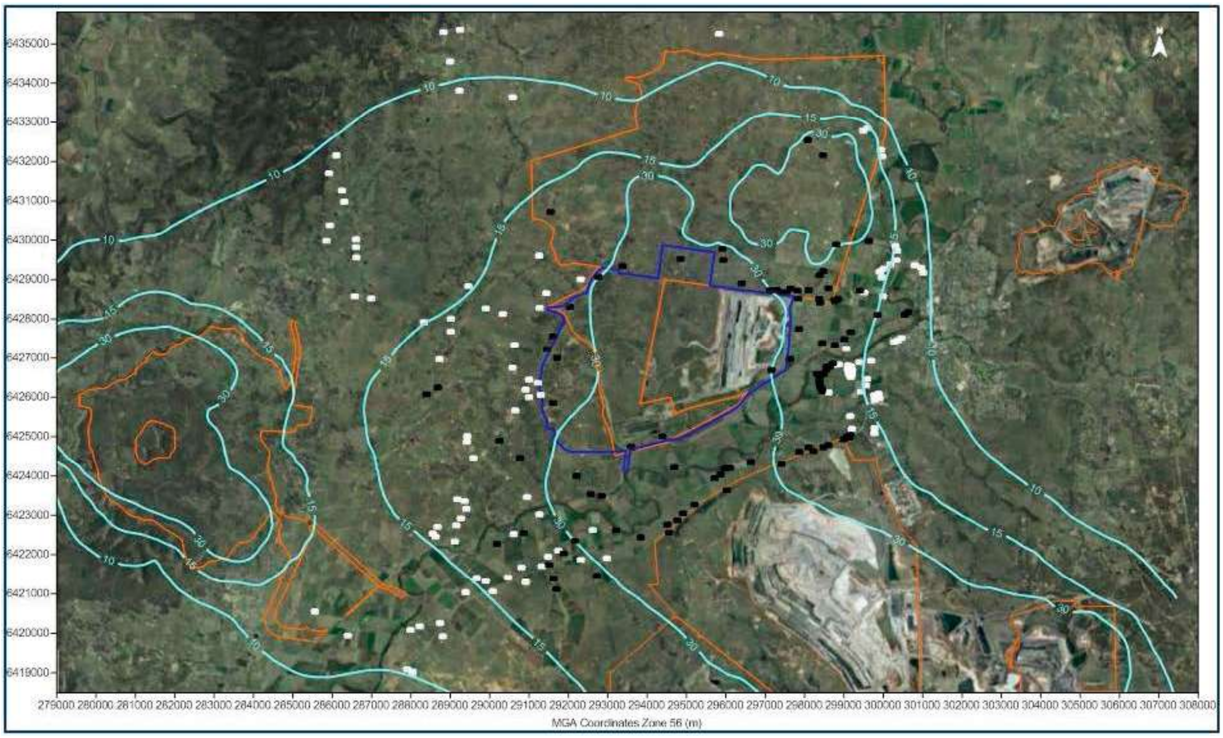

Figure E-14: Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources in Year 4 (µg/m³)

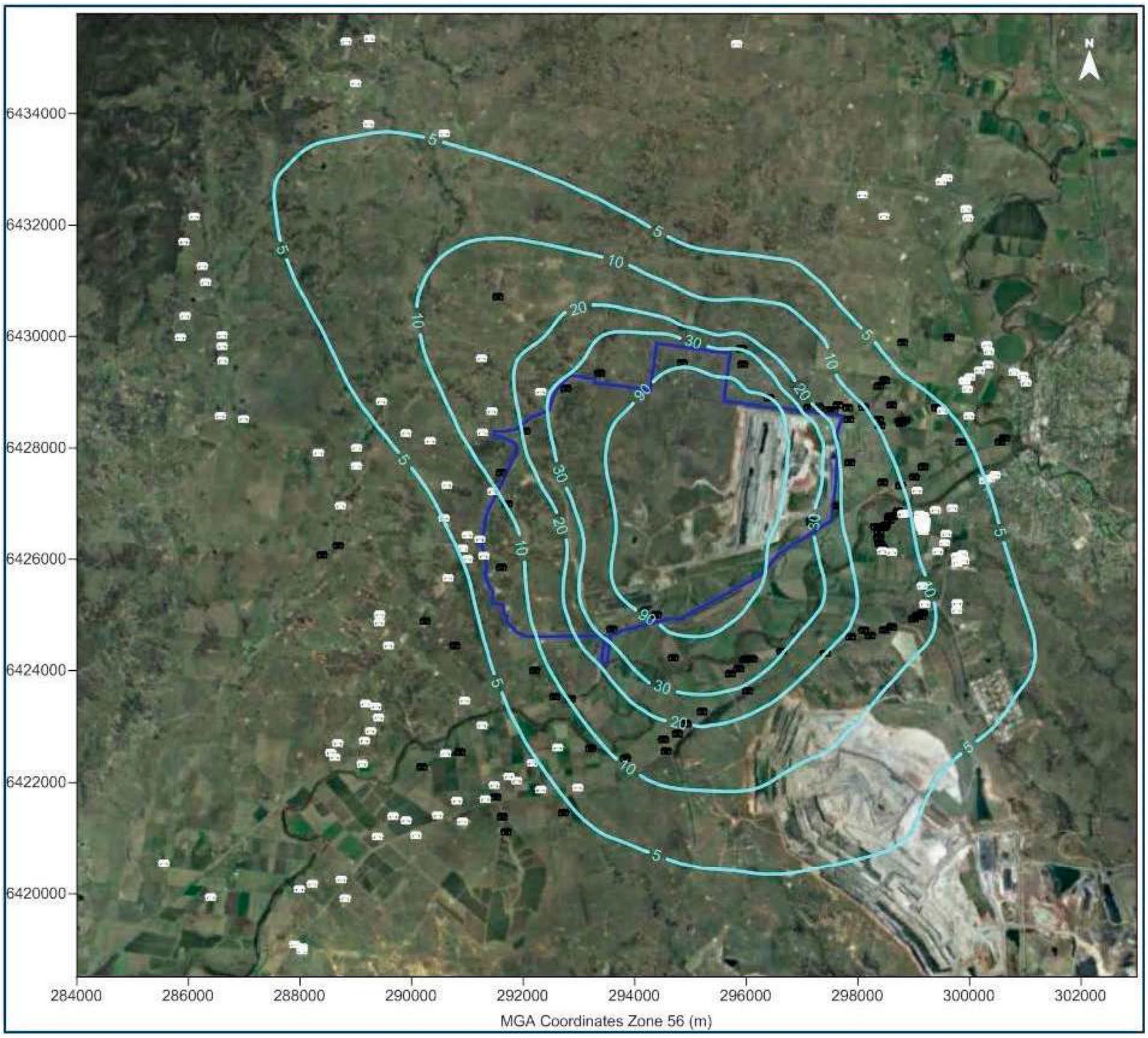

Figure E-15: Predicted annual average TSP concentrations due to emissions from the Project in Year 4 (µg/m³)

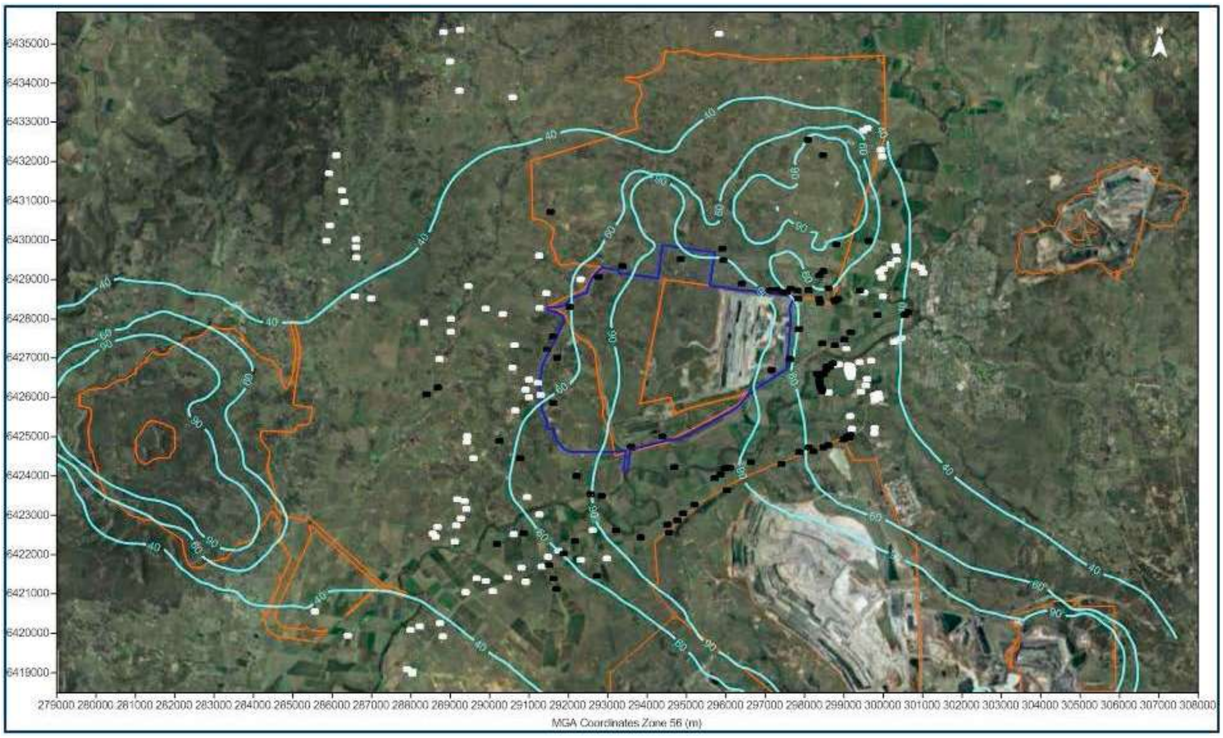

Figure E-16: Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 4 (µg/m³)

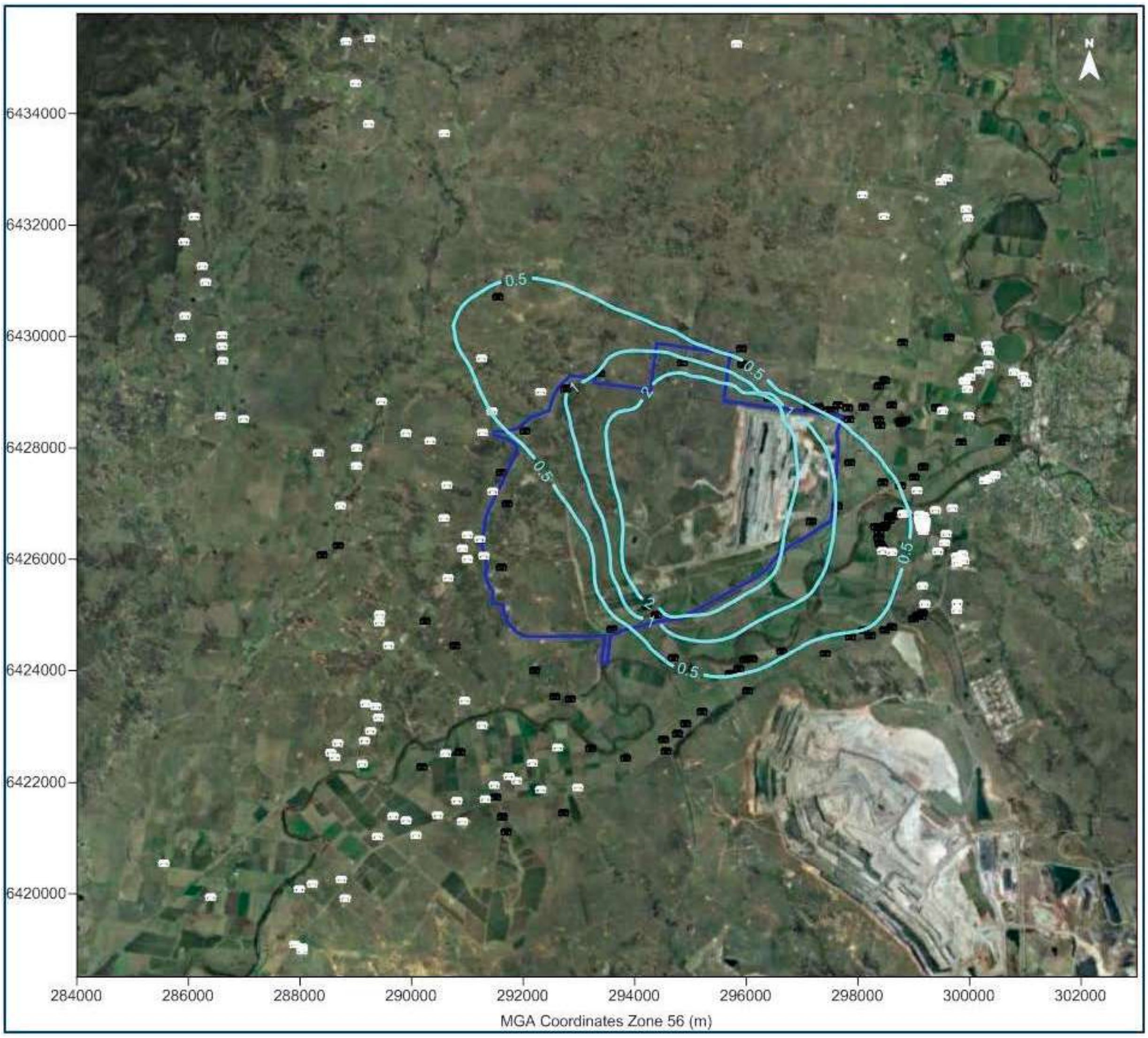

Figure E-17: Predicted annual average dust deposition levels due to emissions from the Project in Year 4 (µg/m³)

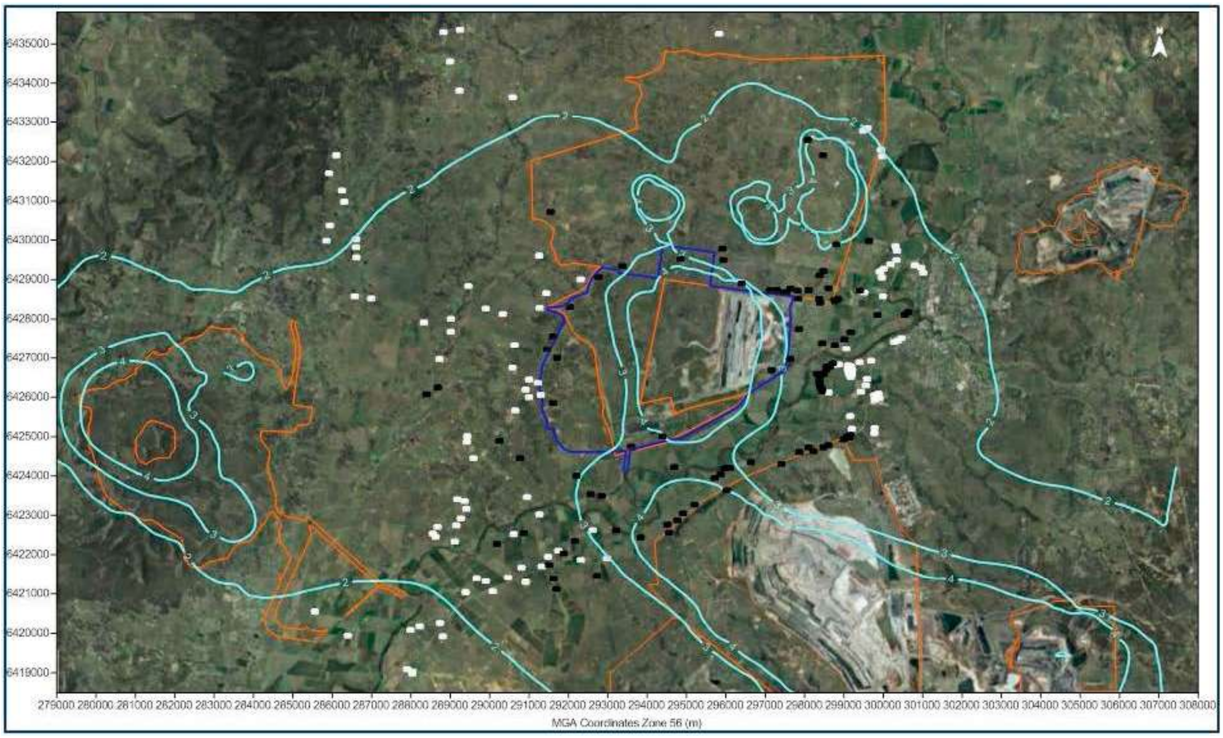

Figure E-18: Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 4 (µg/m³)

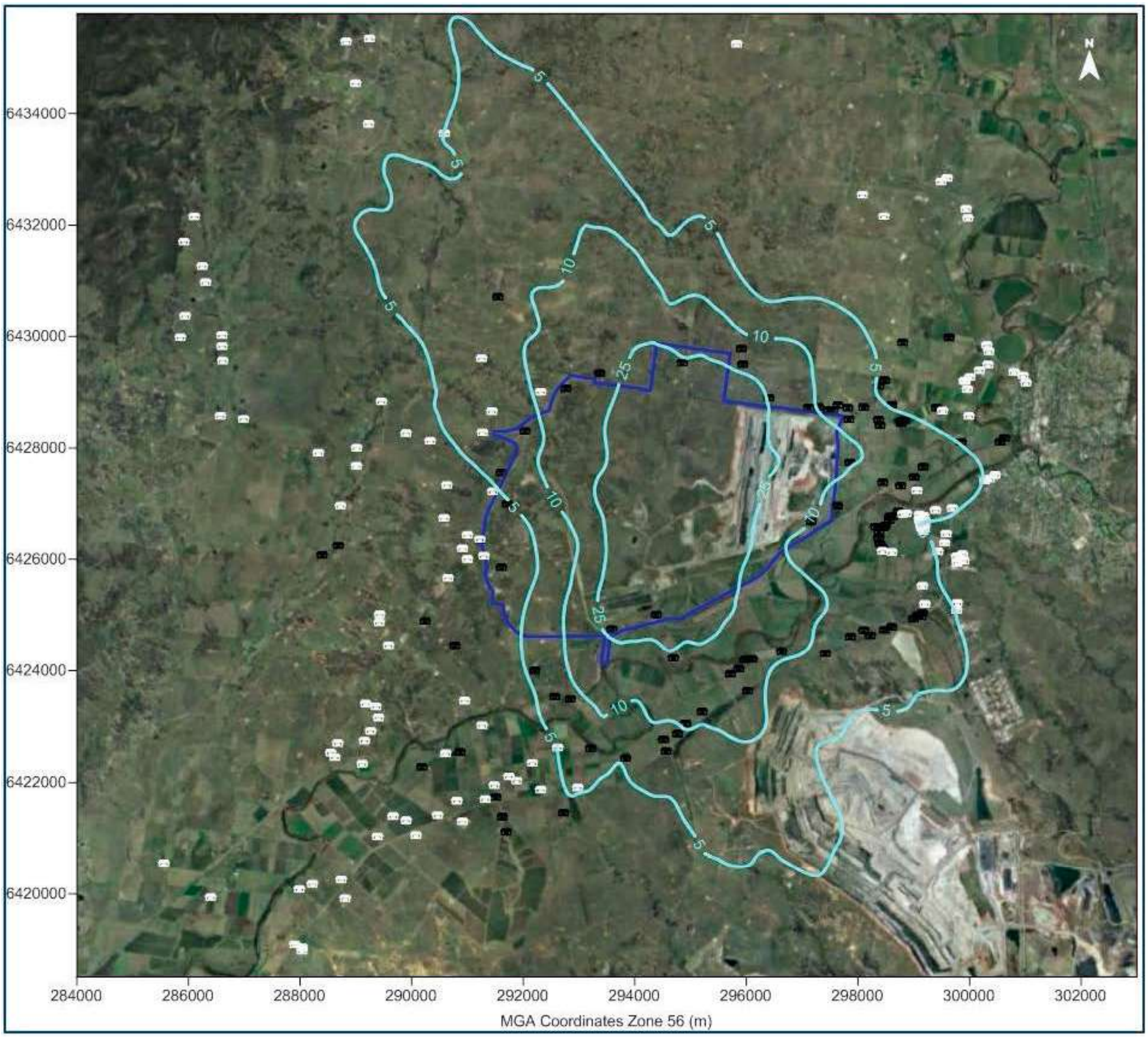

Figure E-19: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project in Year 8 (µg/m³)

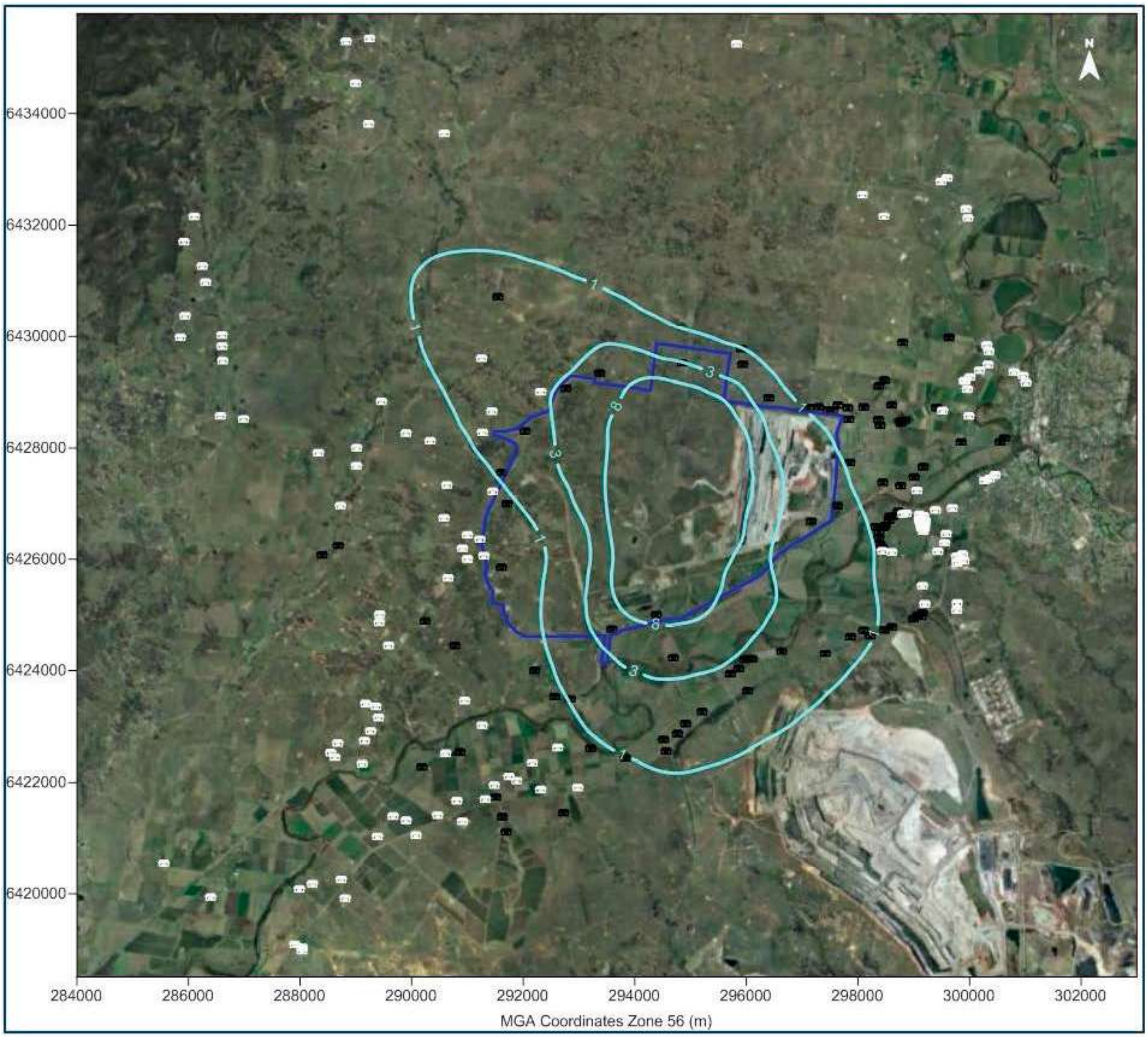

Figure E-20: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project in Year 8 (µg/m³)

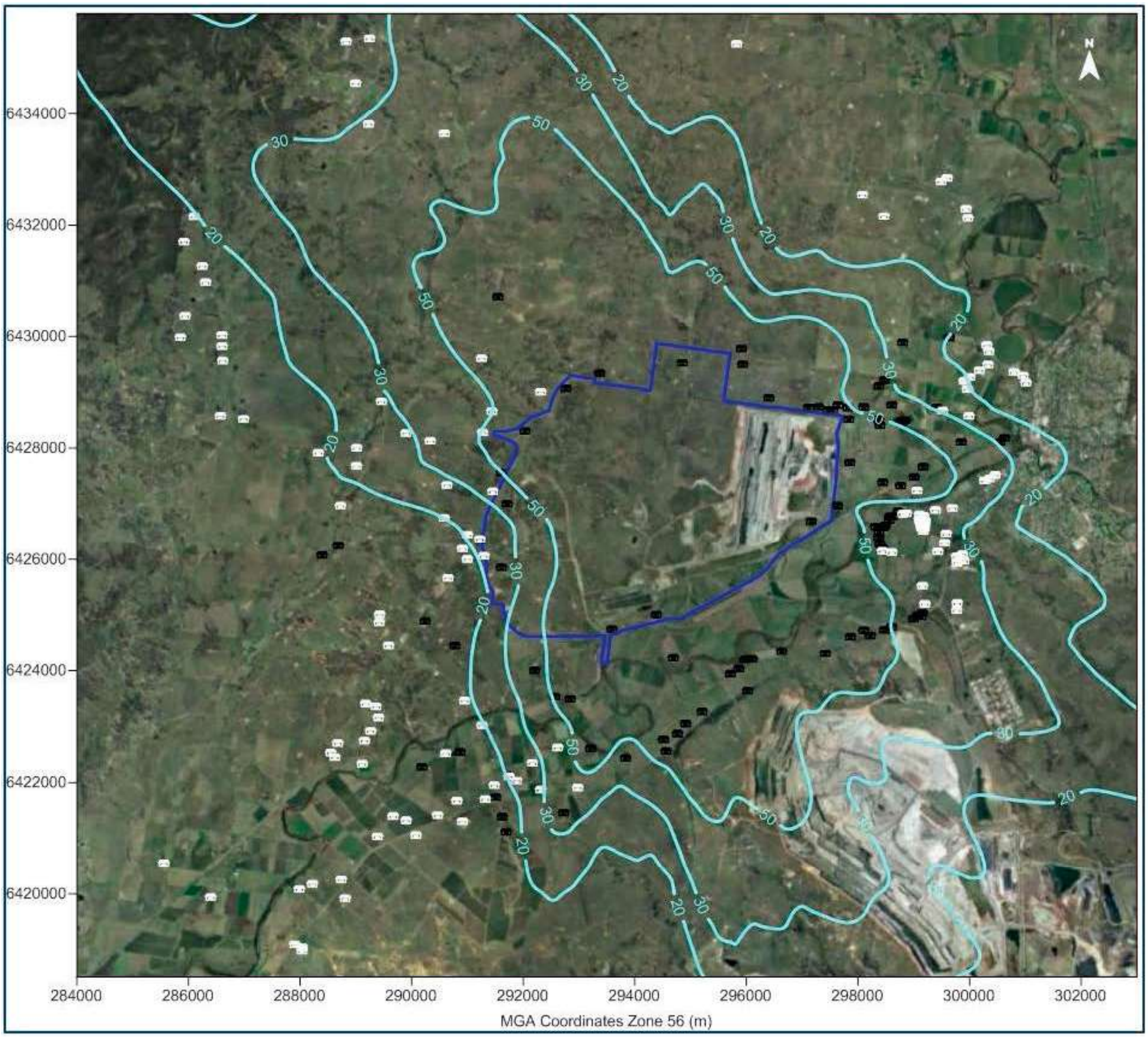

Figure E-21: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Project in Year 8 (µg/m³)

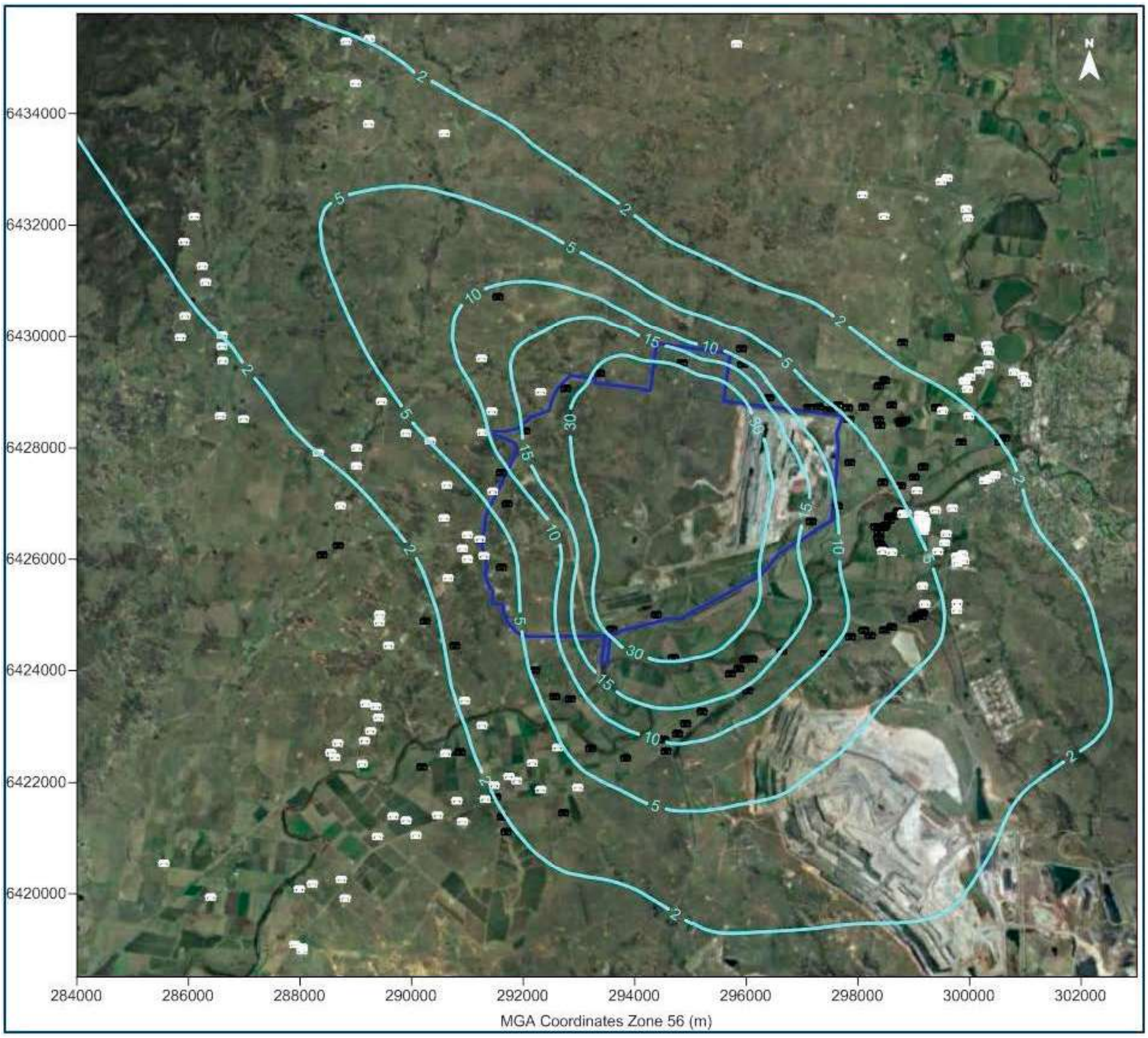

Figure E-22: Predicted annual average PM_{10} concentrations due to emissions from the Project in Year 8 (µg/m³)

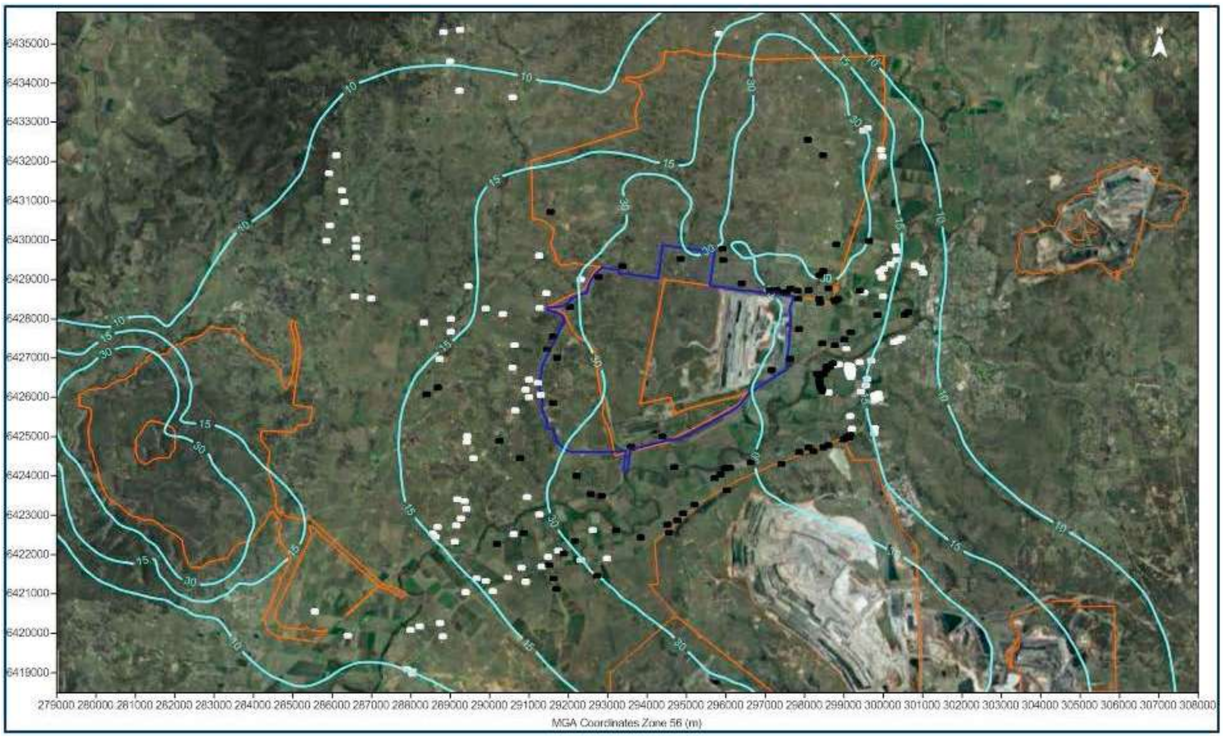

Figure E-23: Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources in Year 8 (µg/m³)

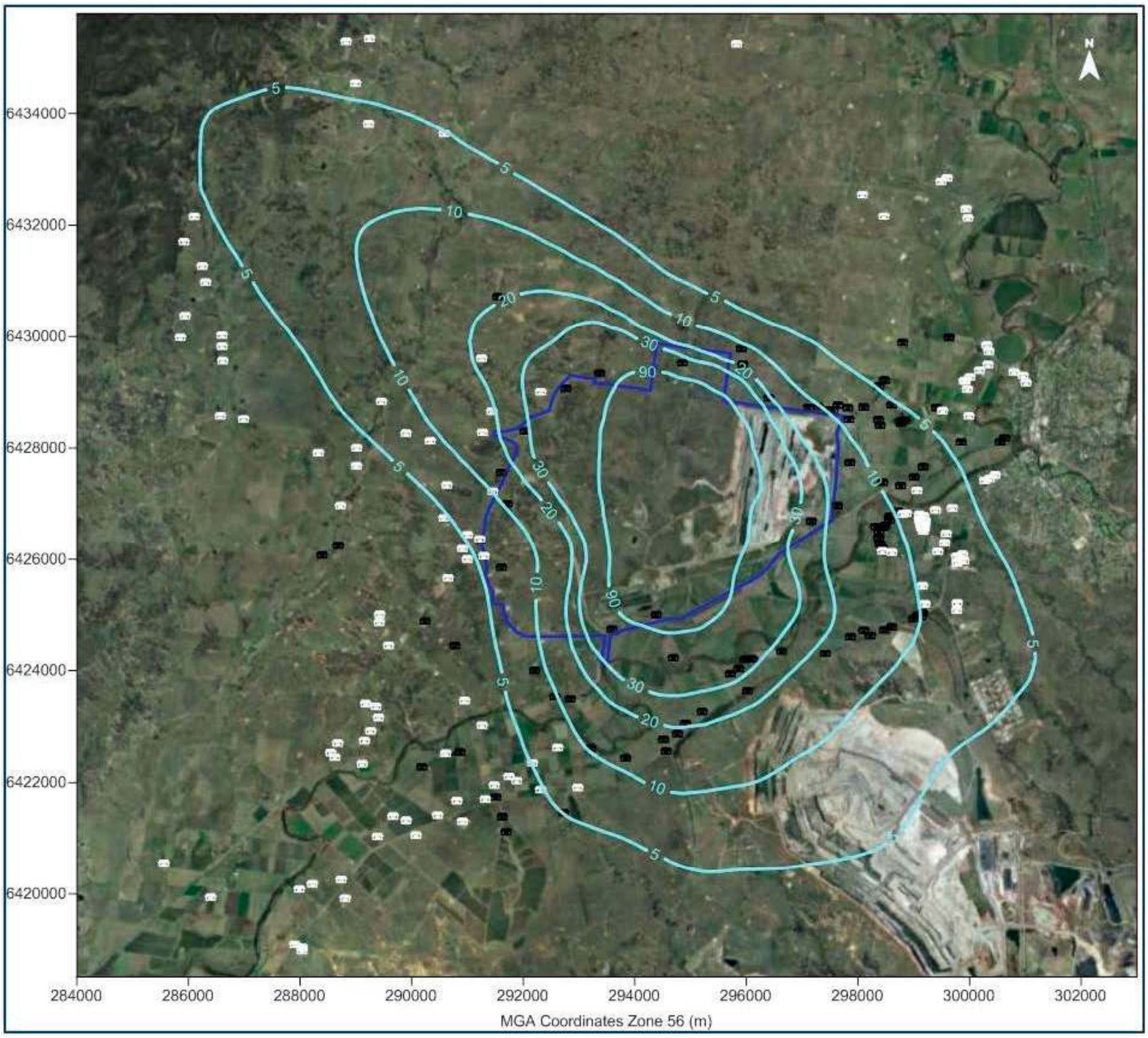

Figure E-24: Predicted annual average TSP concentrations due to emissions from the Project in Year 8 (µg/m³)

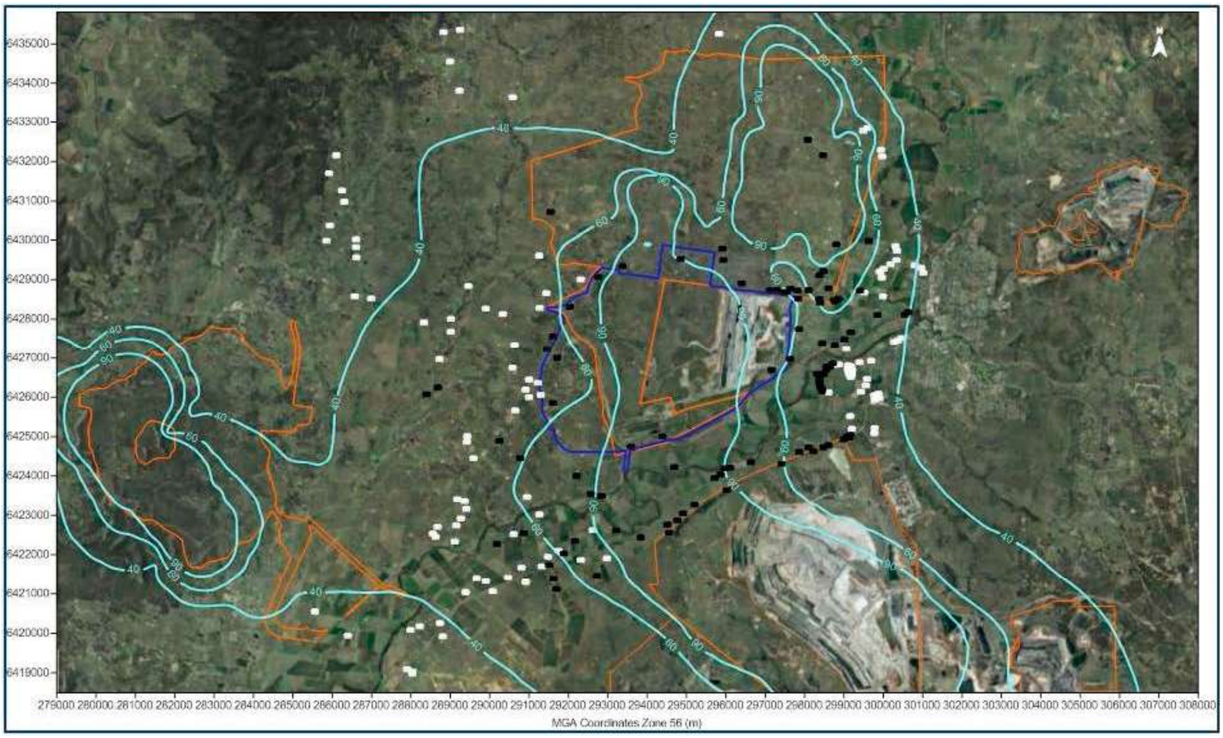

Figure E-25: Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 8 (µg/m³)

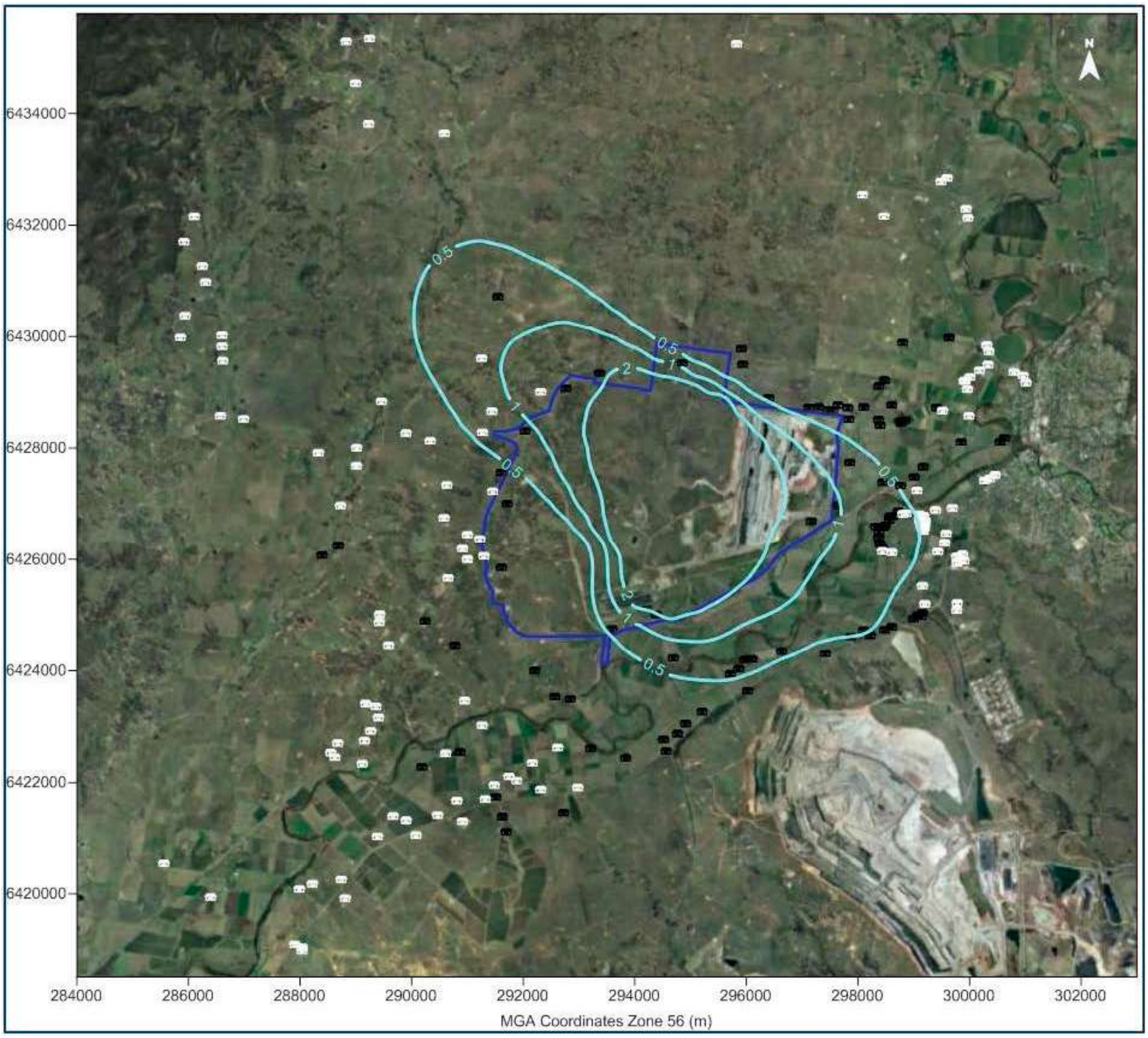

Figure E-26: Predicted annual average dust deposition levels due to emissions from the Project in Year 8 (µg/m³)

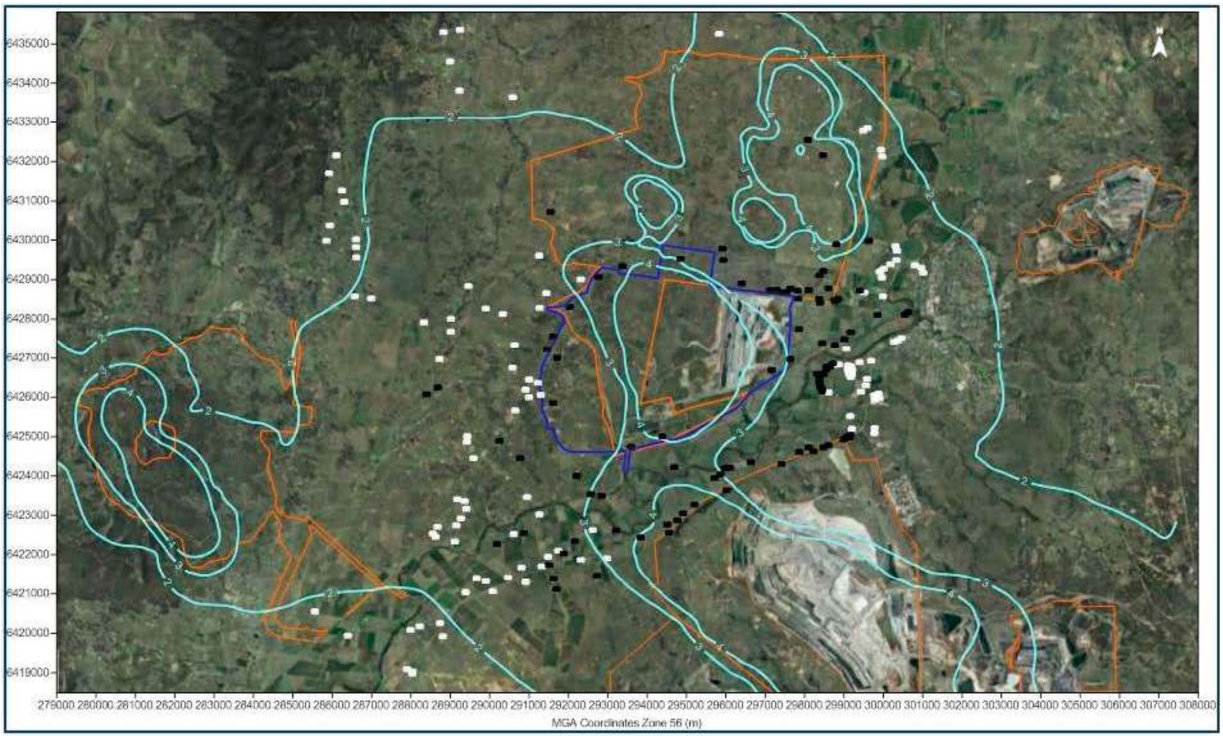

Figure E-27: Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 8 (µg/m³)

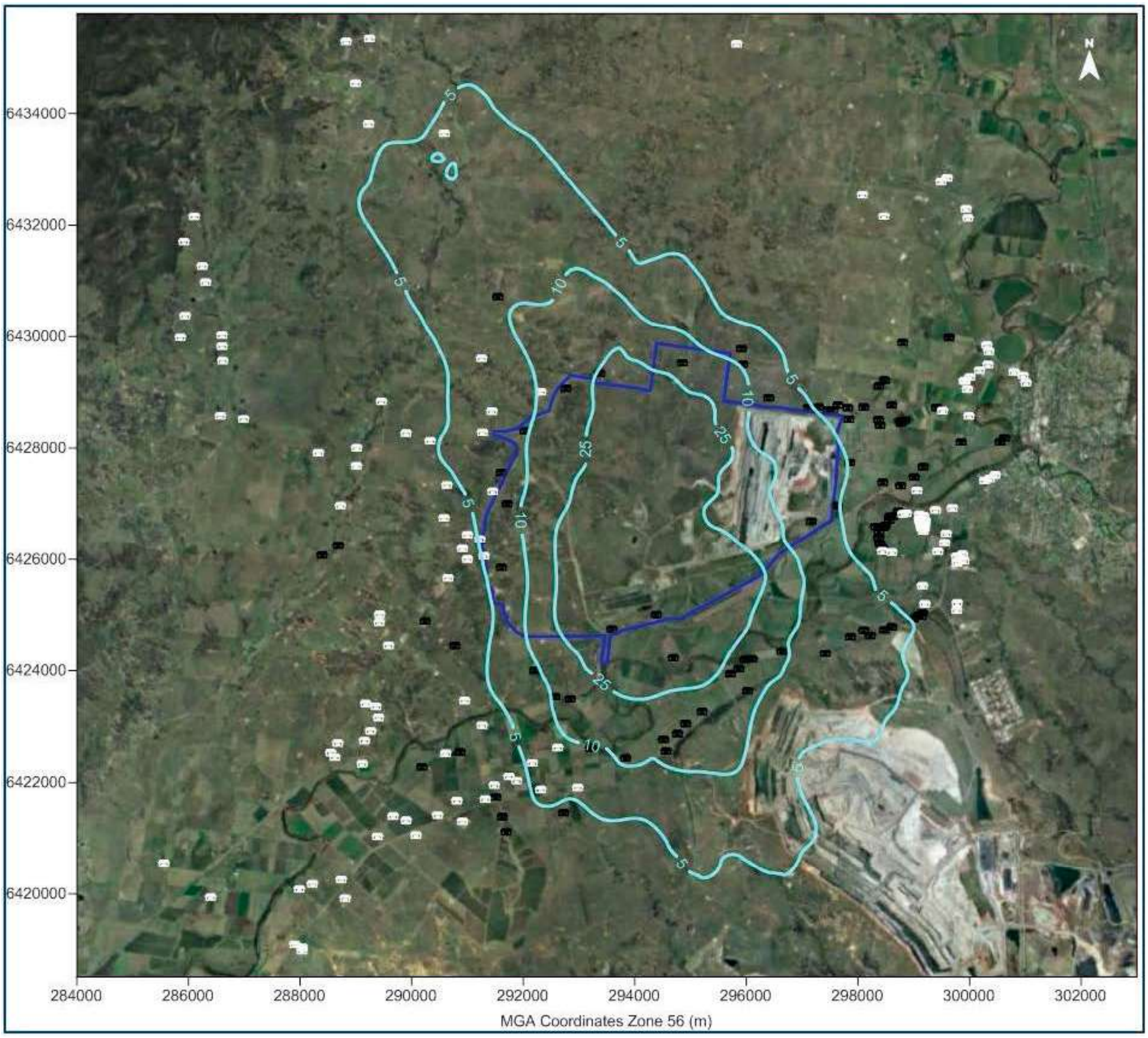

Figure E-28: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project in Year 15 (µg/m³)

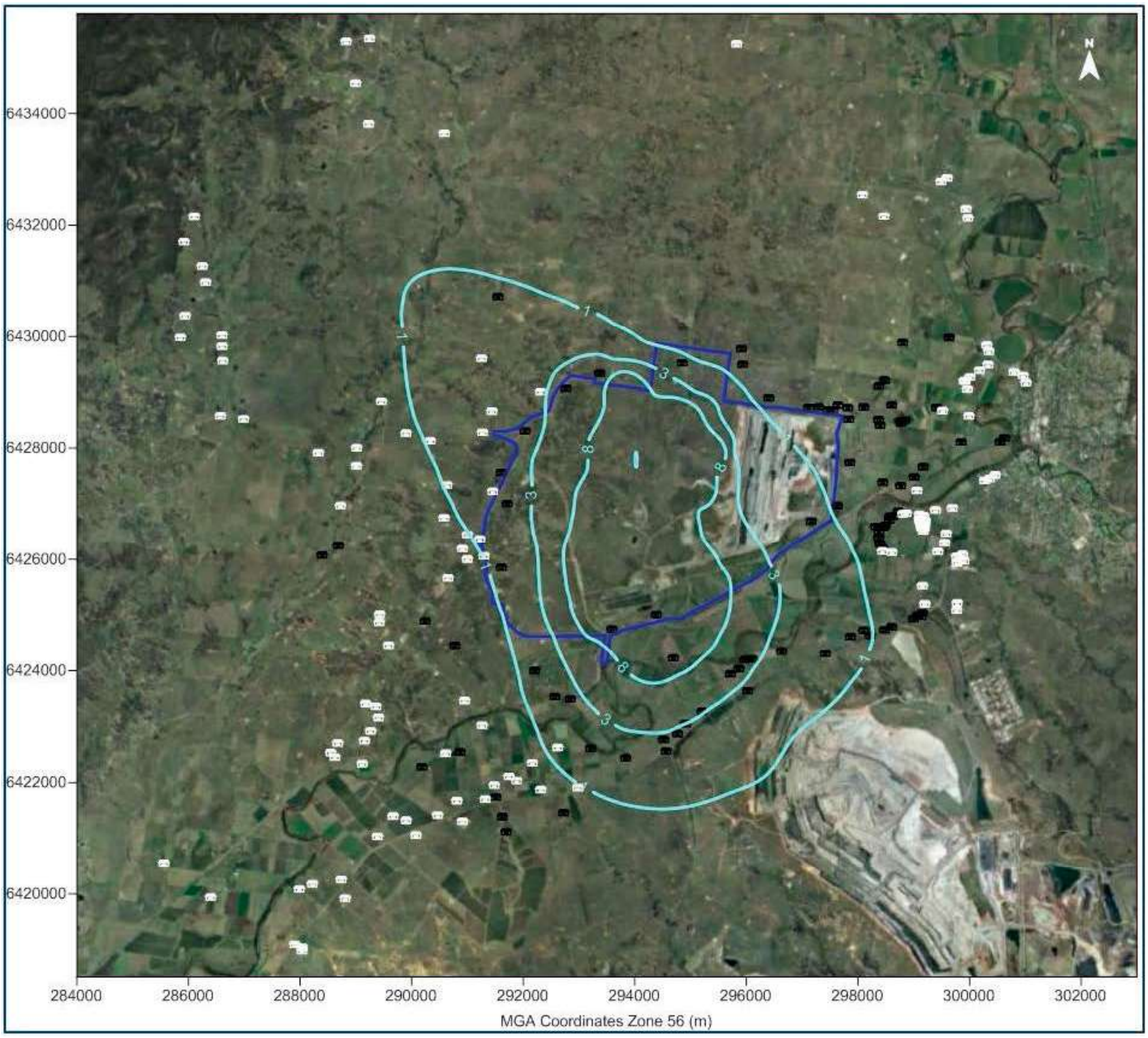

Figure E-29: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project in Year 15 (µg/m³)

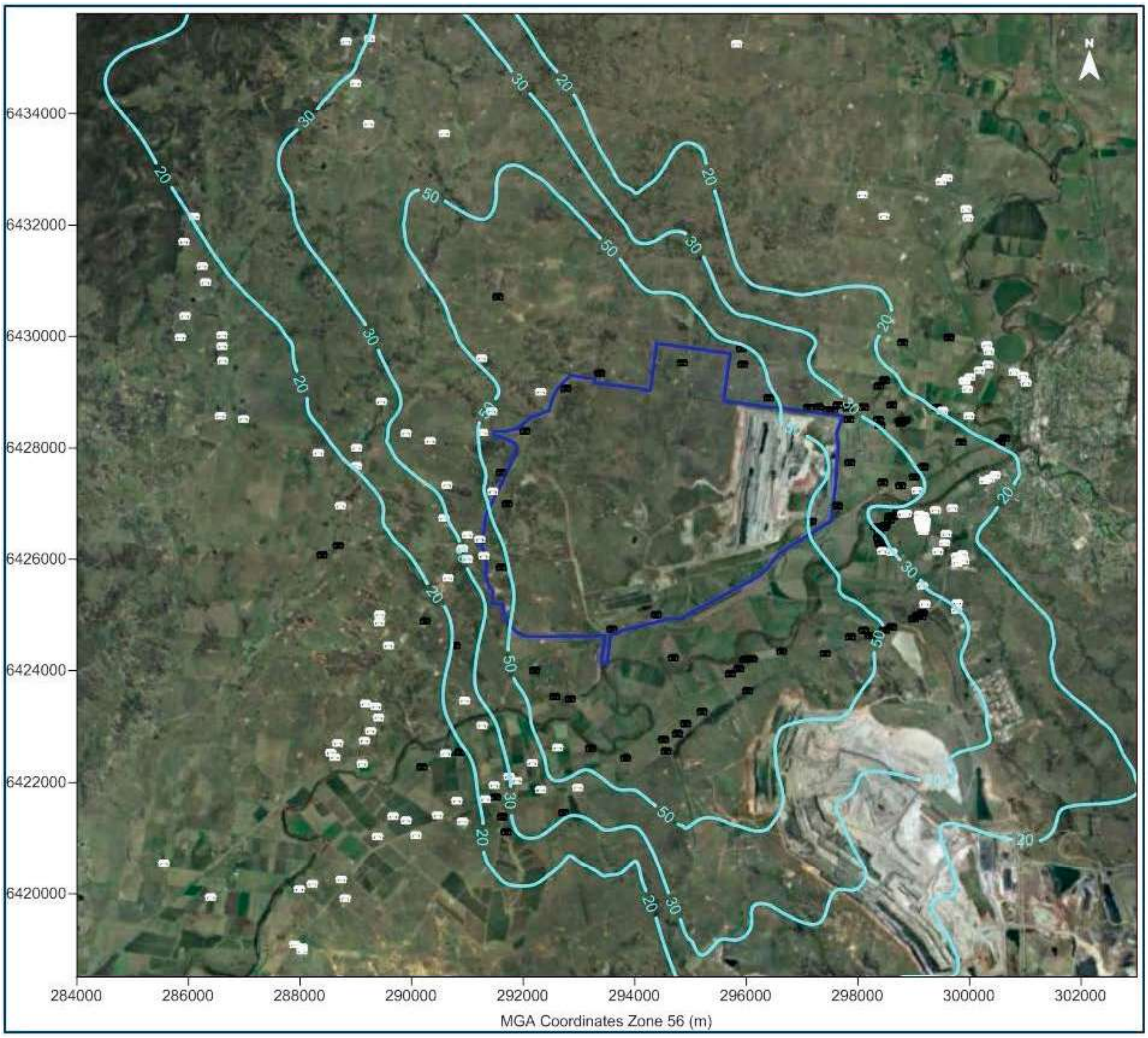

Figure E-30: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Project in Year 15 (µg/m³)

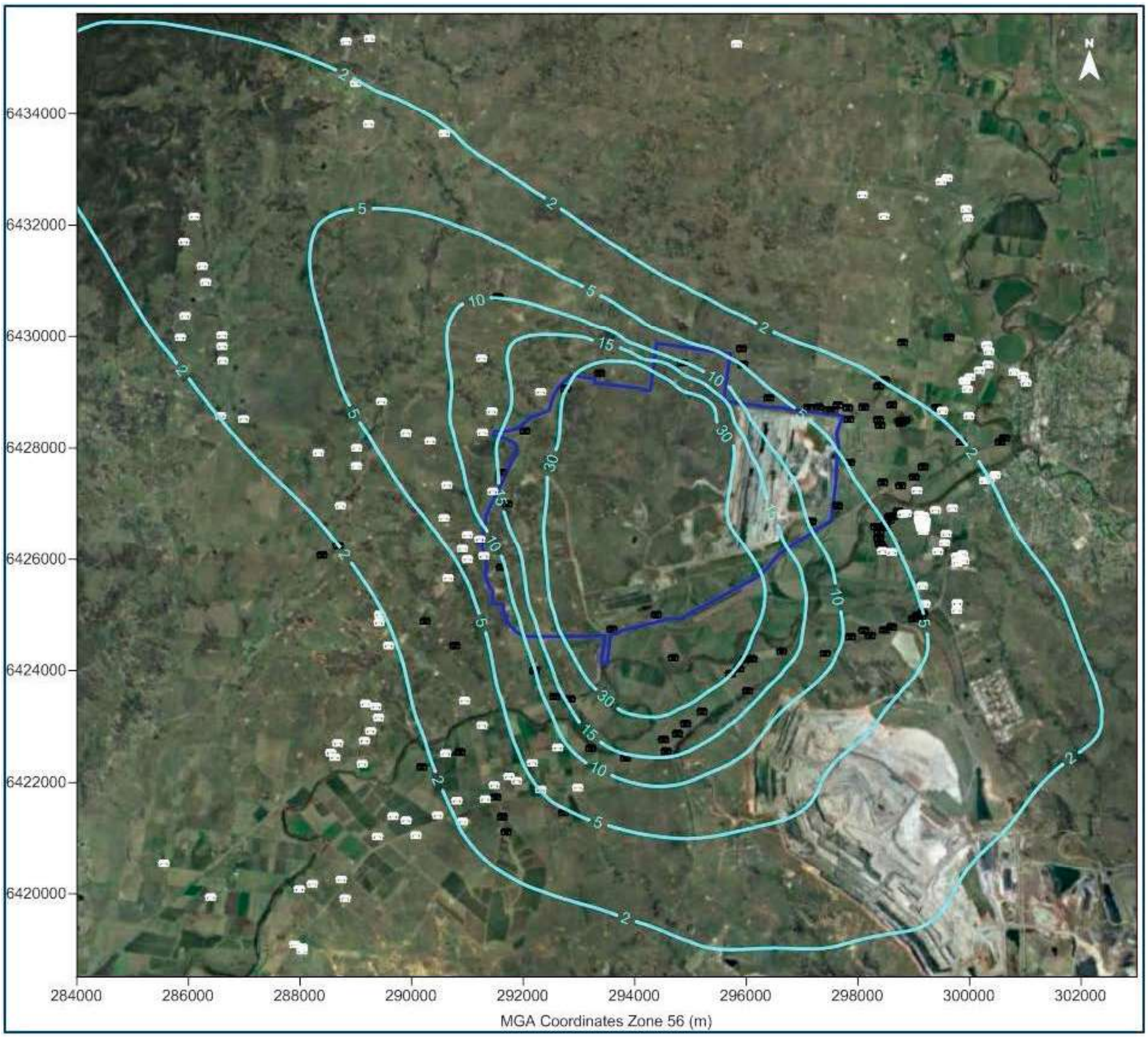

Figure E-31: Predicted annual average PM_{10} concentrations due to emissions from the Project in Year 15 (µg/m³)

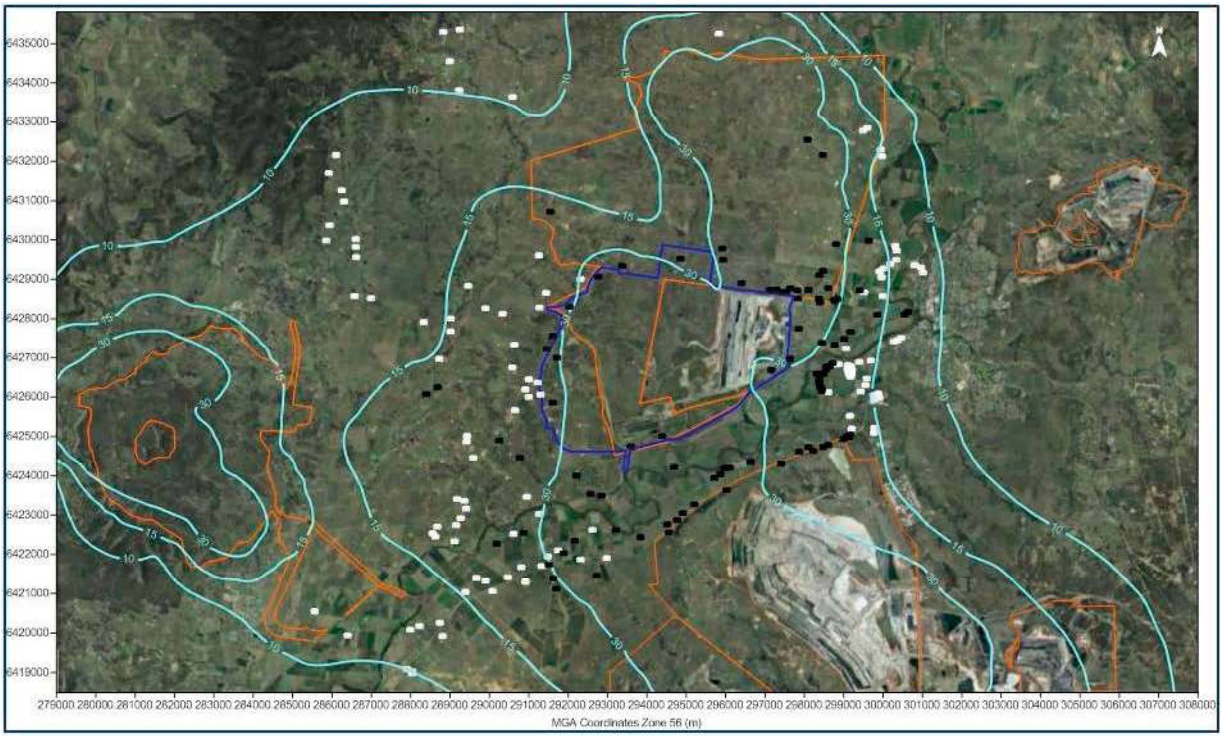

Figure E-32: Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources in Year 15 (µg/m³)

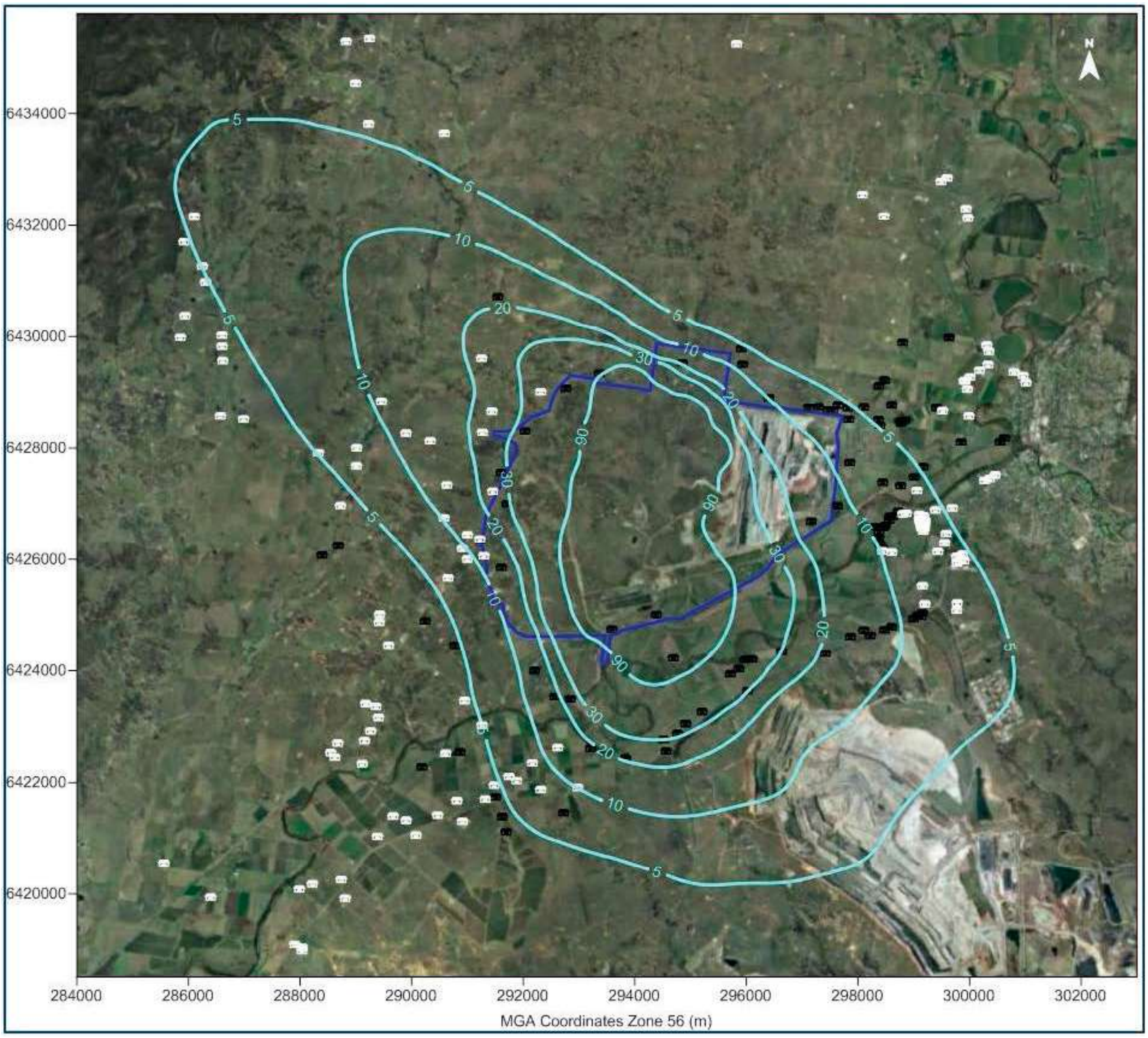

Figure E-33: Predicted annual average TSP concentrations due to emissions from the Project in Year 15 (µg/m³)

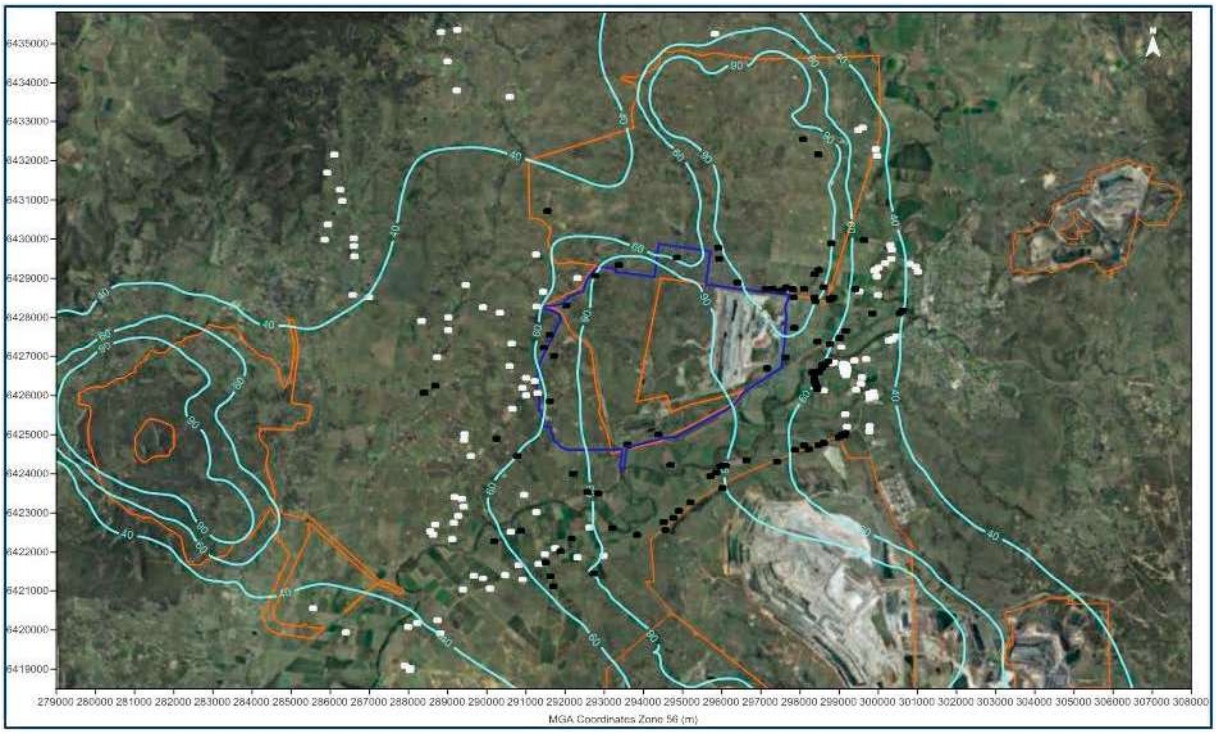

Figure E-34: Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 15 (µg/m³)

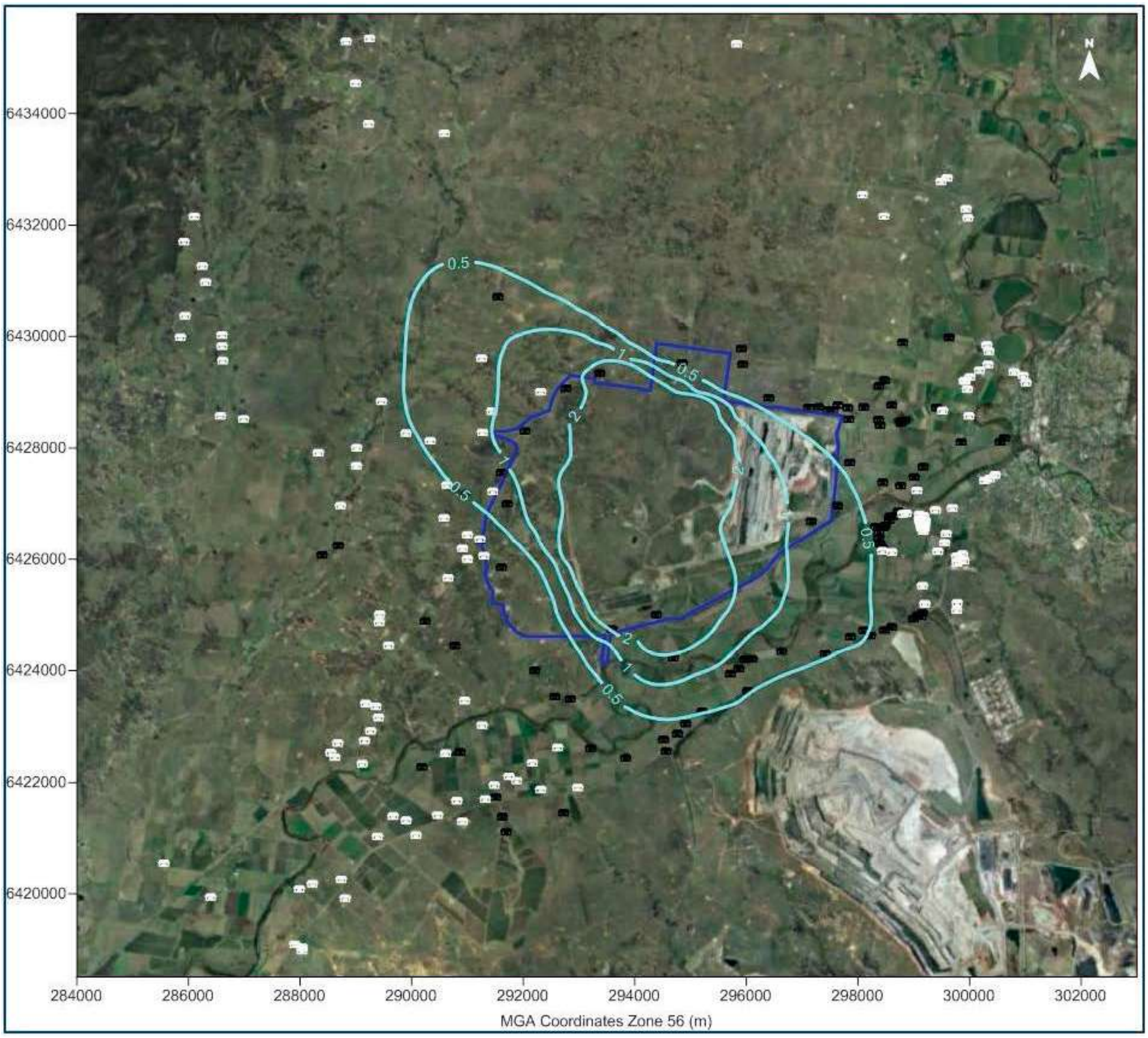

Figure E-35: Predicted annual average dust deposition levels due to emissions from the Project in Year 15 (µg/m³)

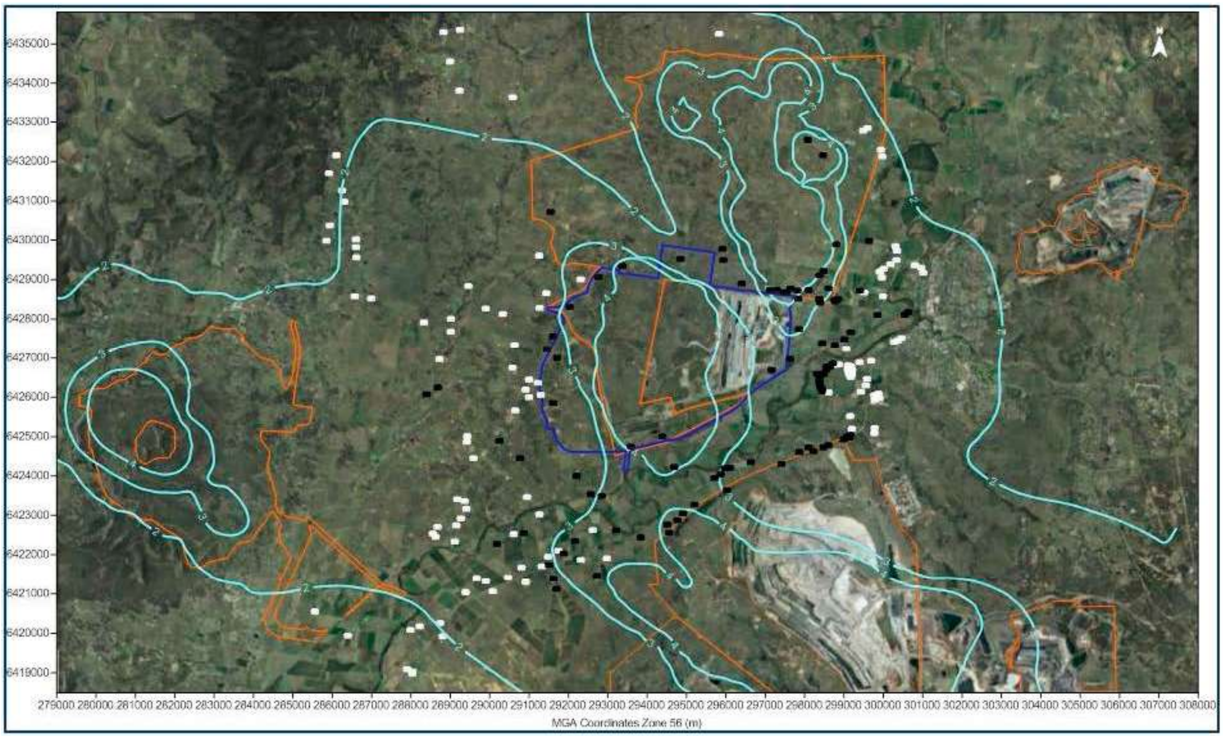

Figure E-36: Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 15 (µg/m³)

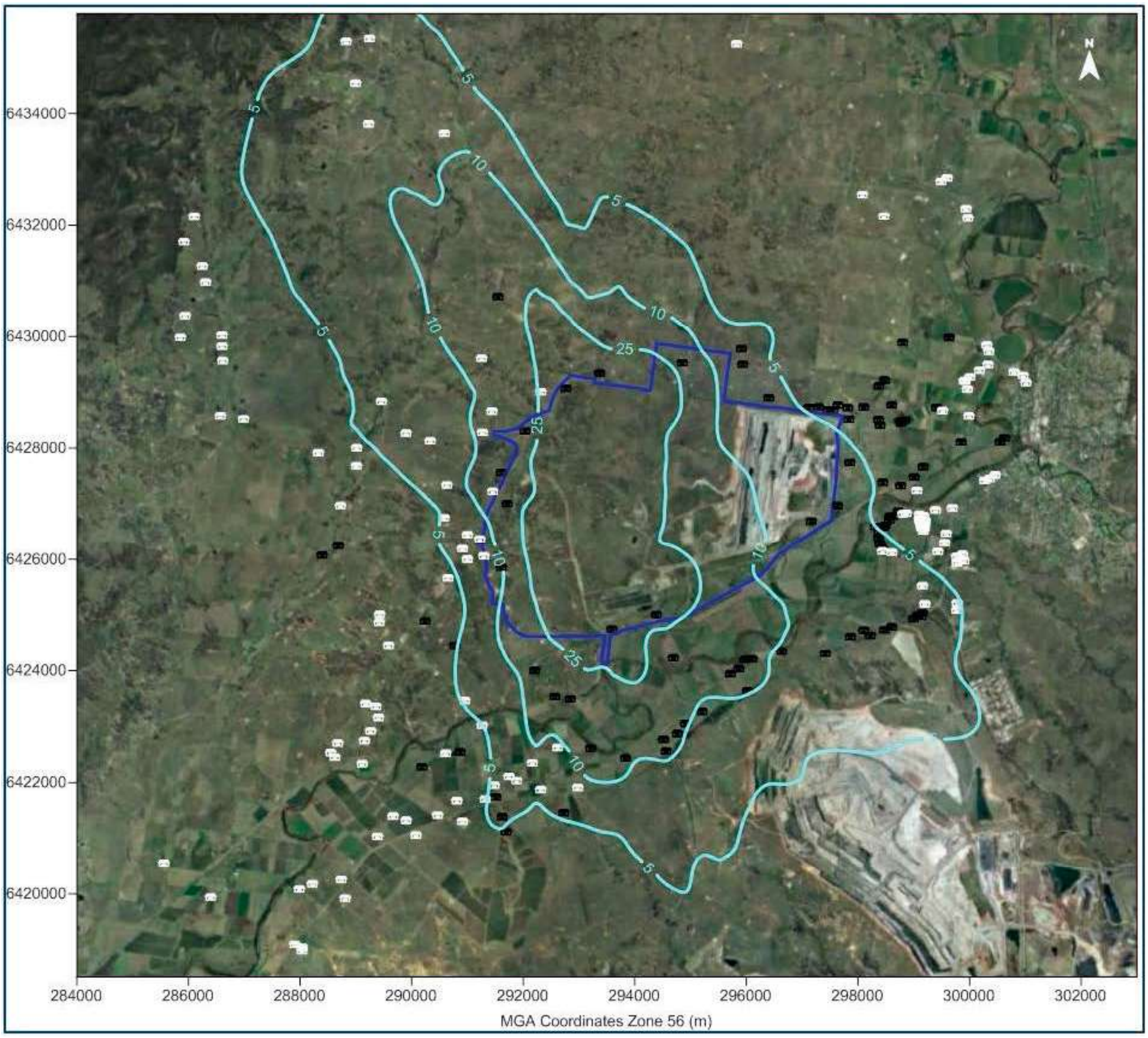

Figure E-37: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project in Year 24 (µg/m³)

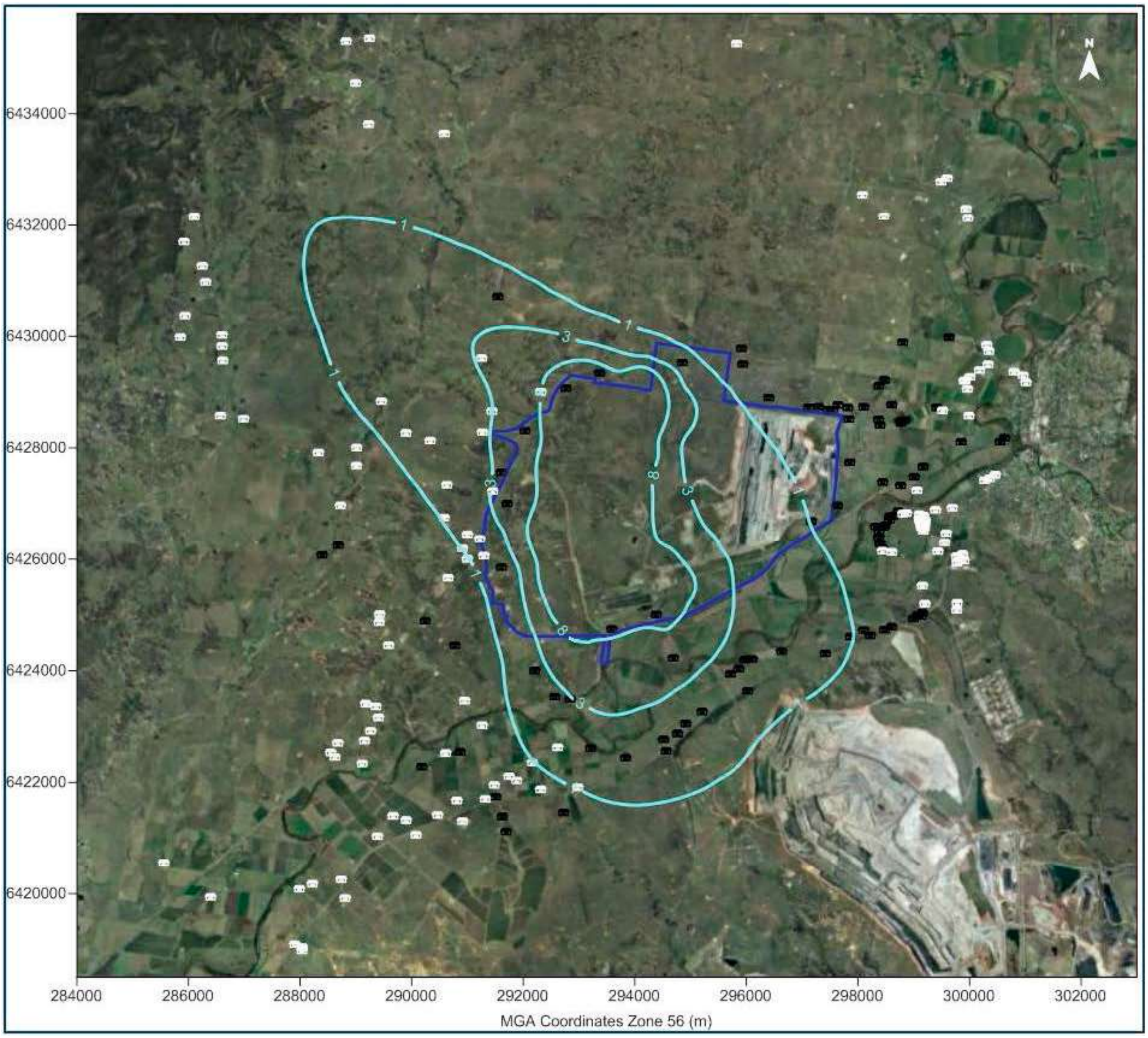

Figure E-38: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project in Year 24 (µg/m³)

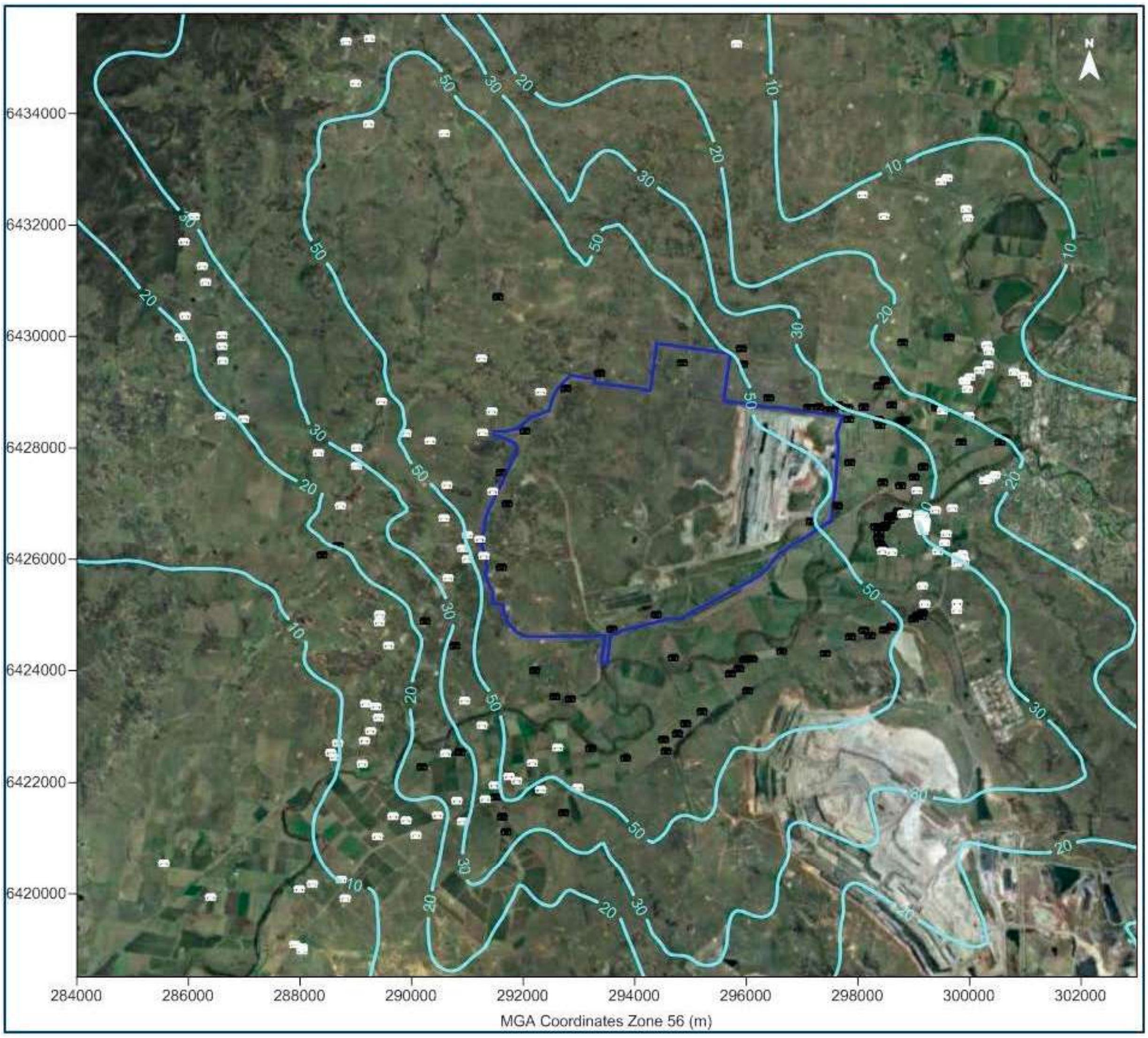

Figure E-39: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Project in Year 24 (µg/m³)

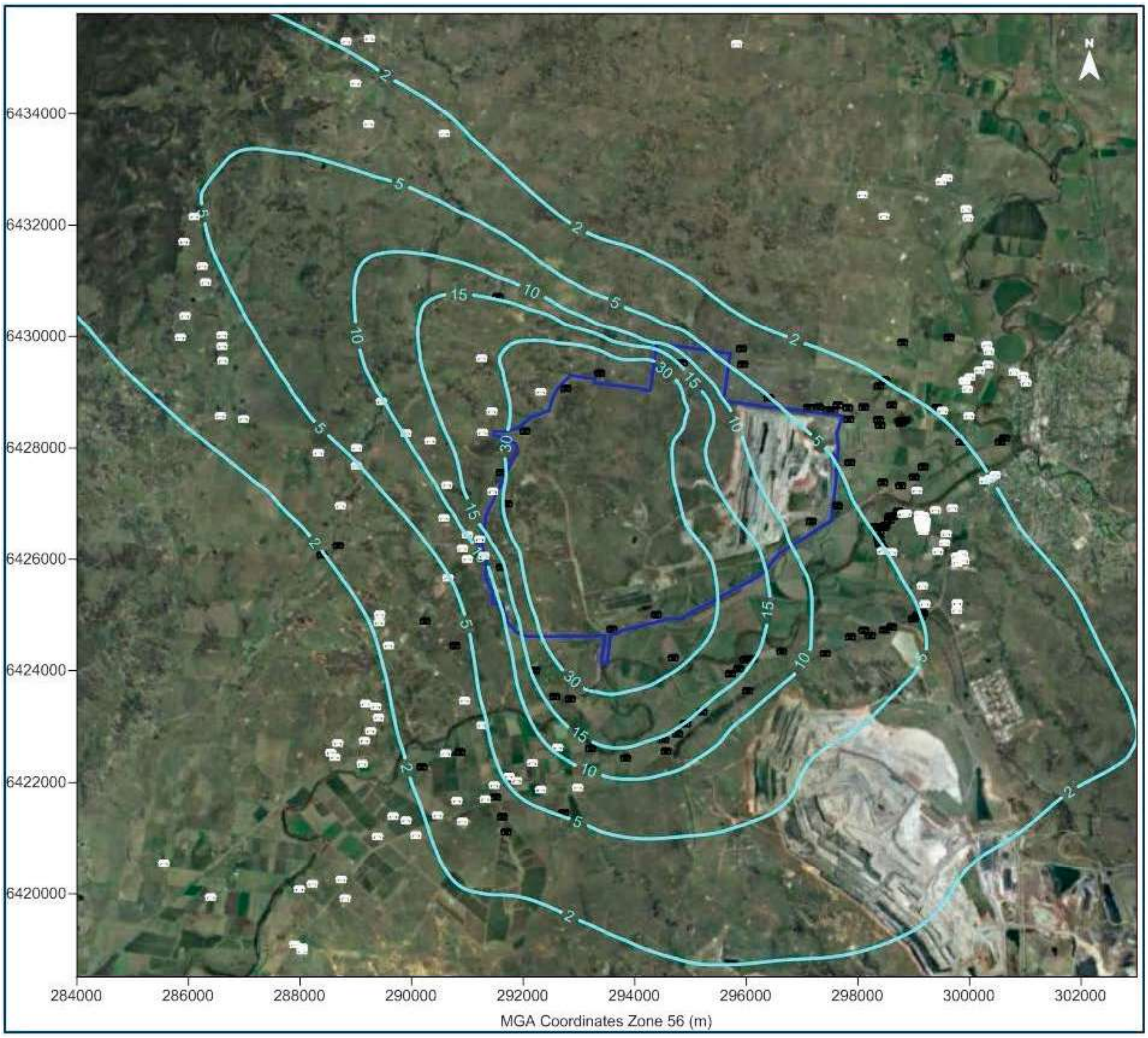

Figure E-40: Predicted annual average PM_{10} concentrations due to emissions from the Project in Year 24 (µg/m³)

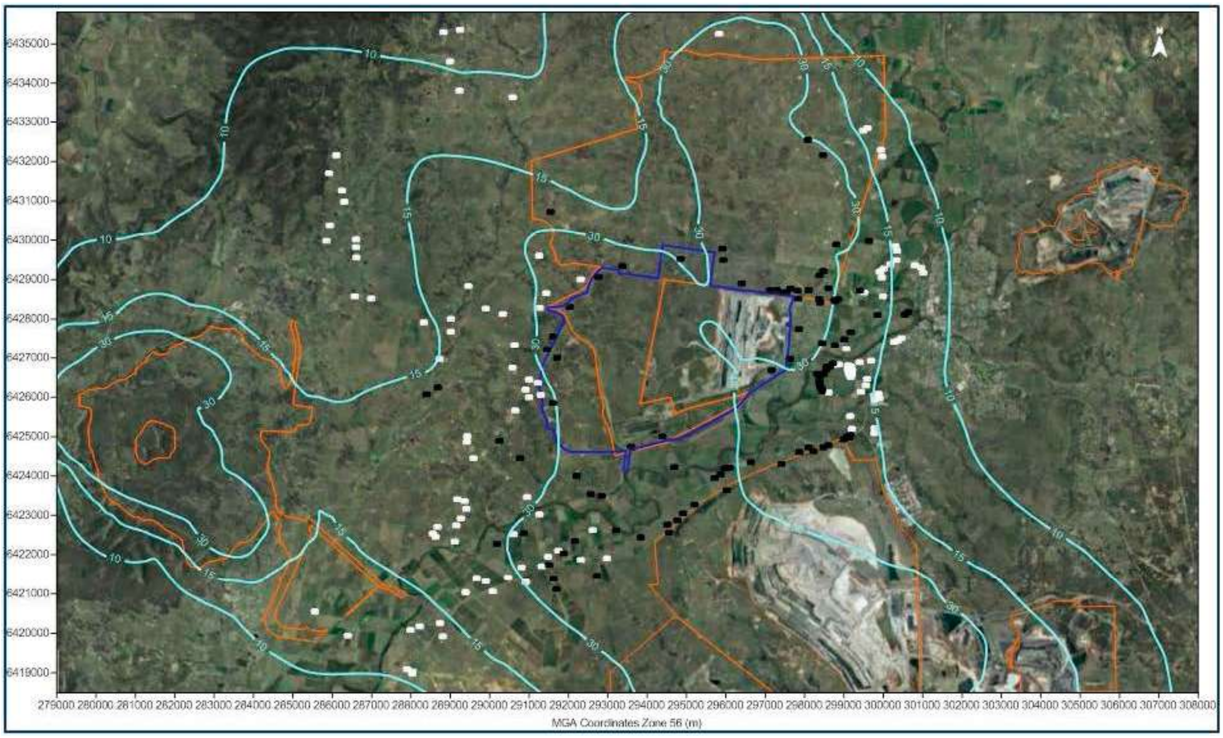

Figure E-41: Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources in Year 24 (µg/m³)

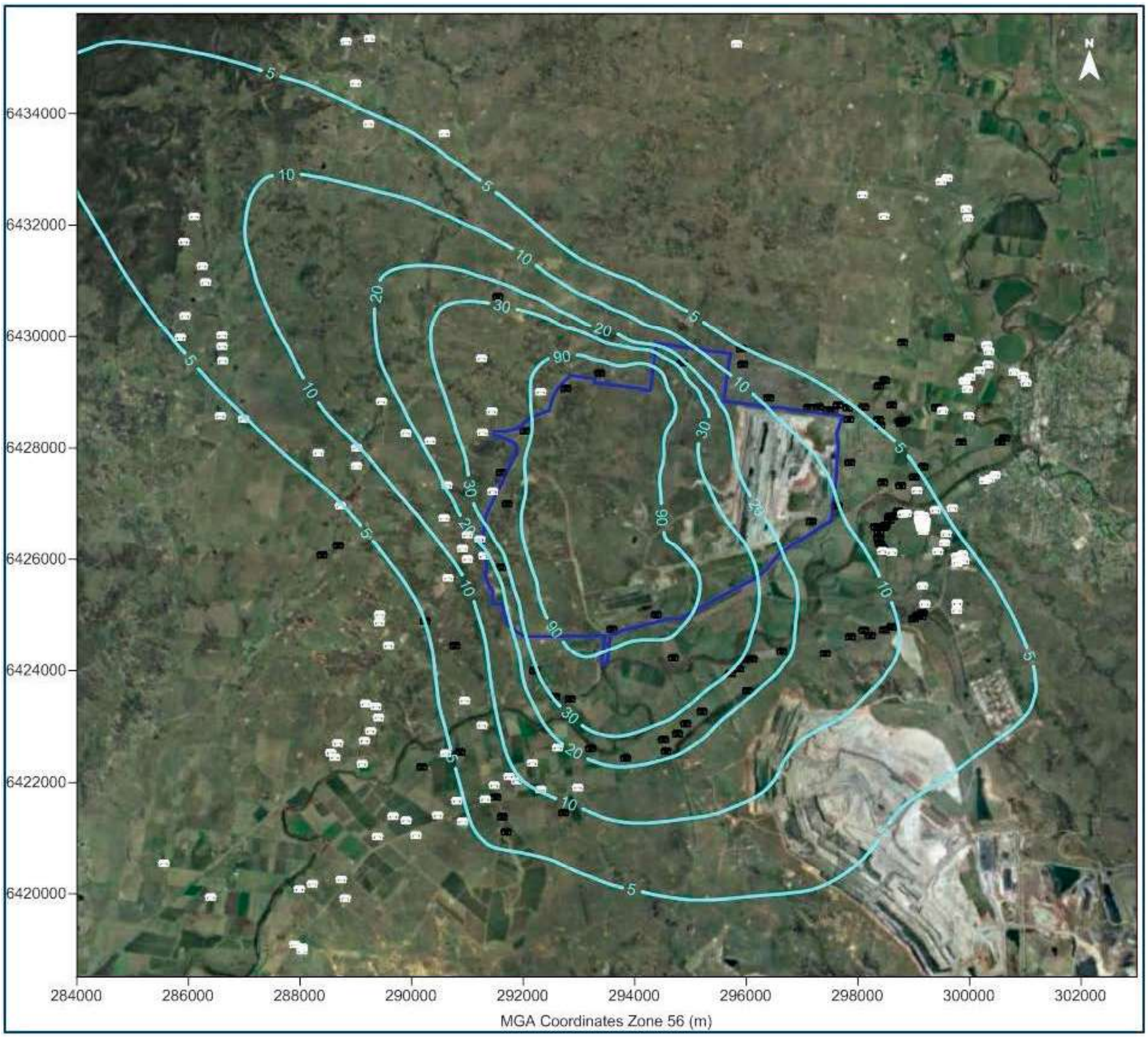

Figure E-42: Predicted annual average TSP concentrations due to emissions from the Project in Year 24 (µg/m³)

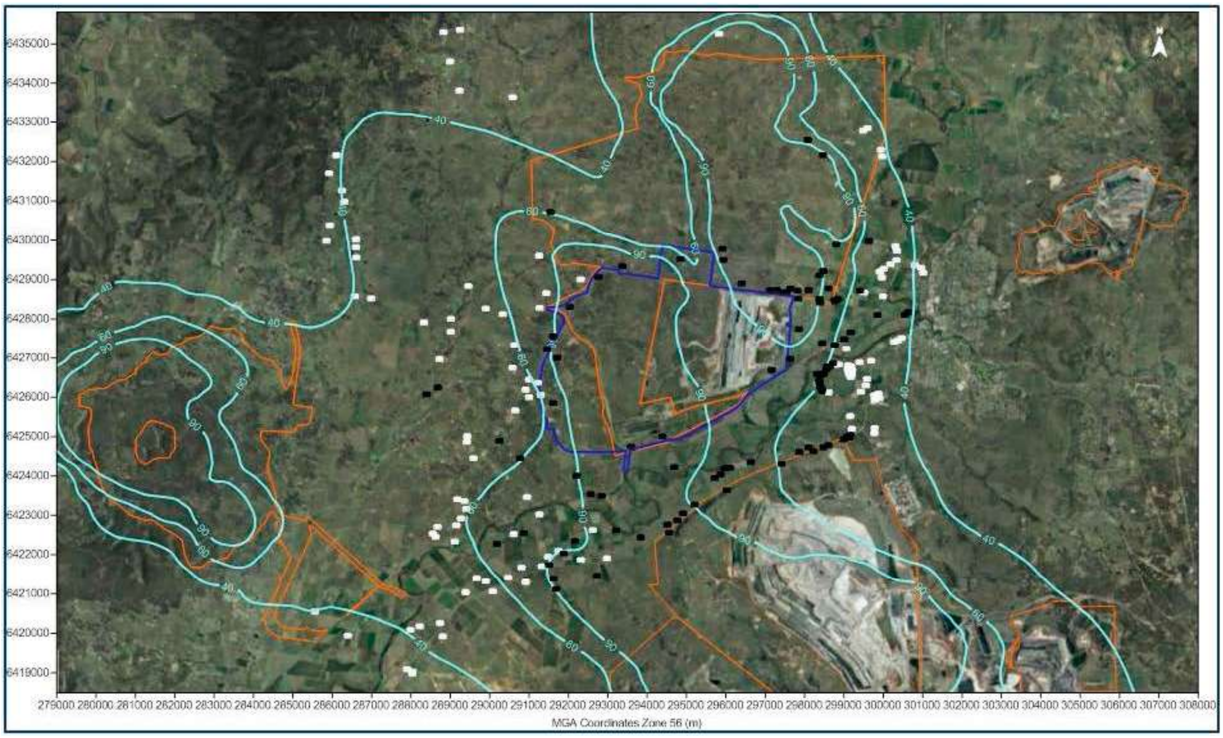

Figure E-43: Predicted annual average TSP concentrations due to emissions from the Project and other sources in Year 24 (µg/m³)

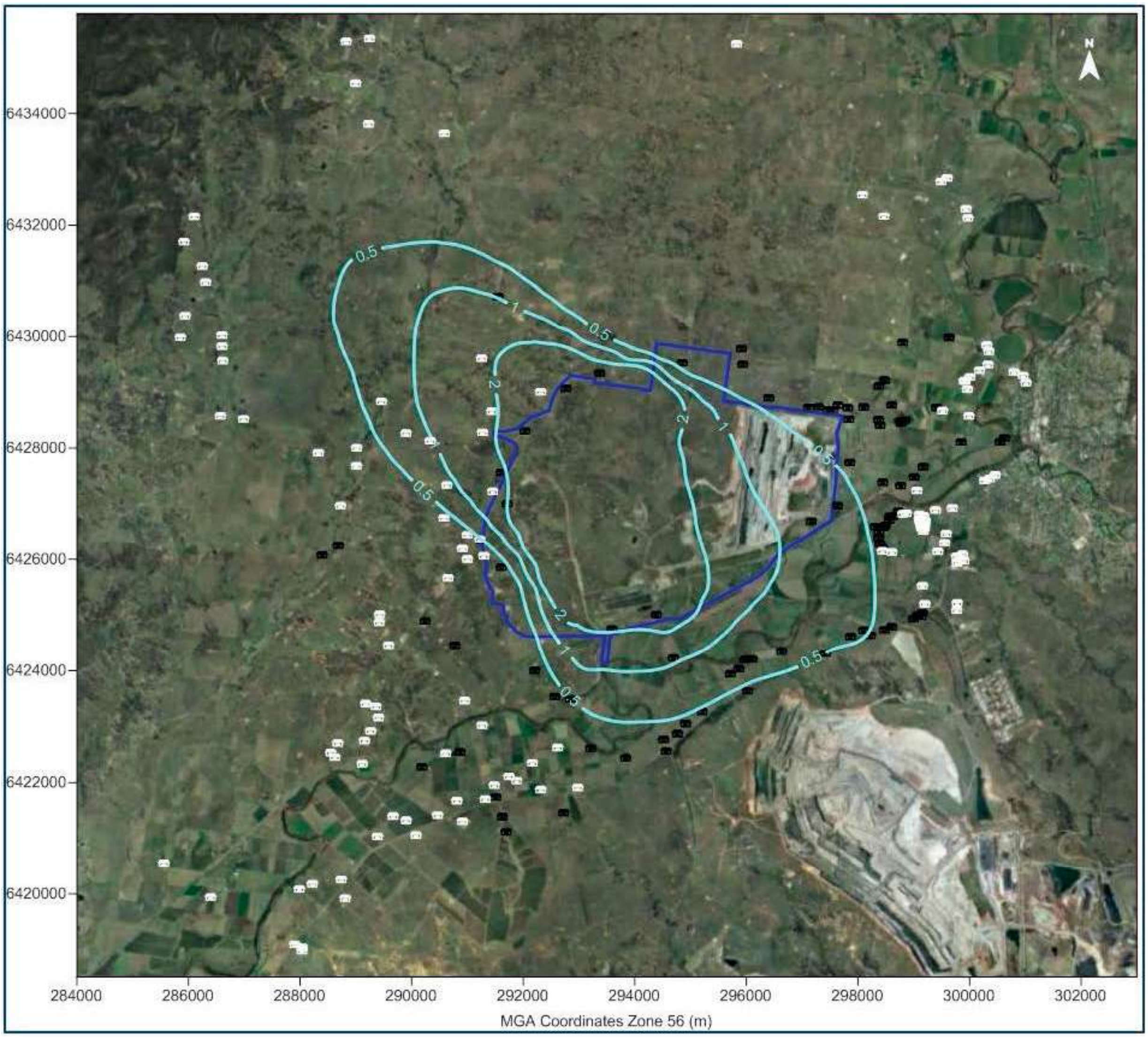

Figure E-44: Predicted annual average dust deposition levels due to emissions from the Project in Year 24 (µg/m³)

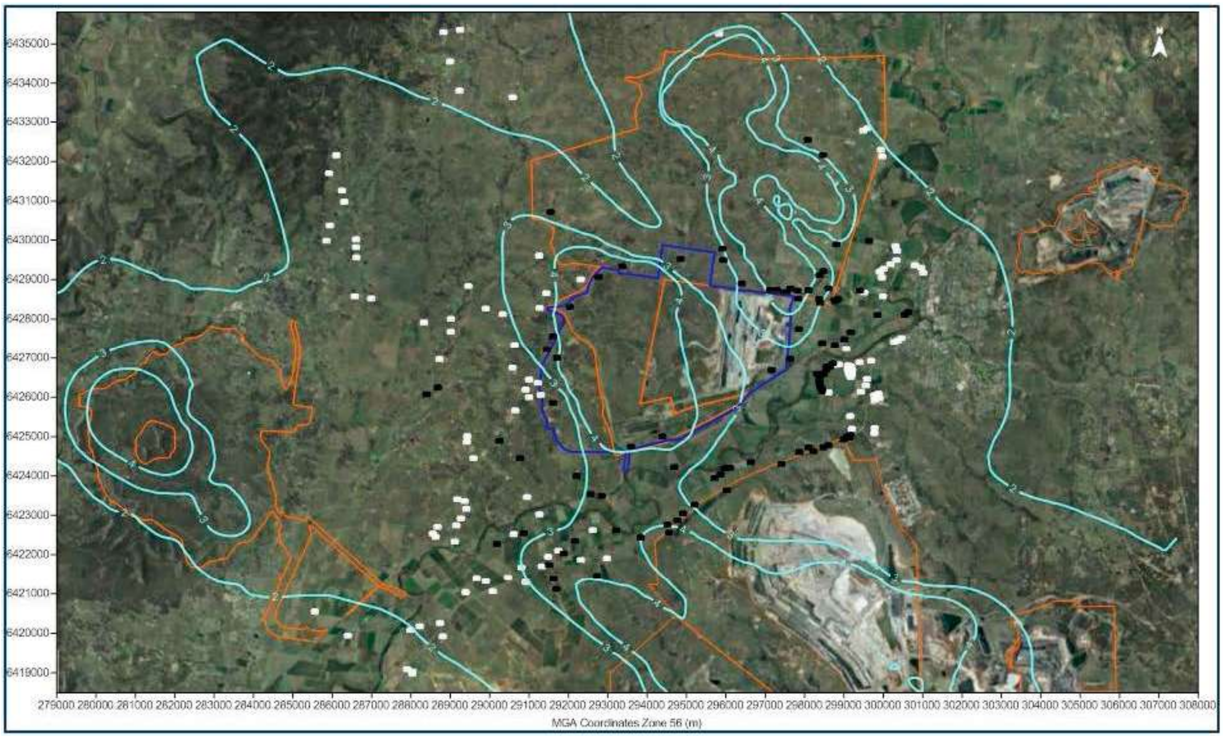

Figure E-45: Predicted annual average dust deposition levels due to emissions from the Project and other sources in Year 24 (µg/m³)

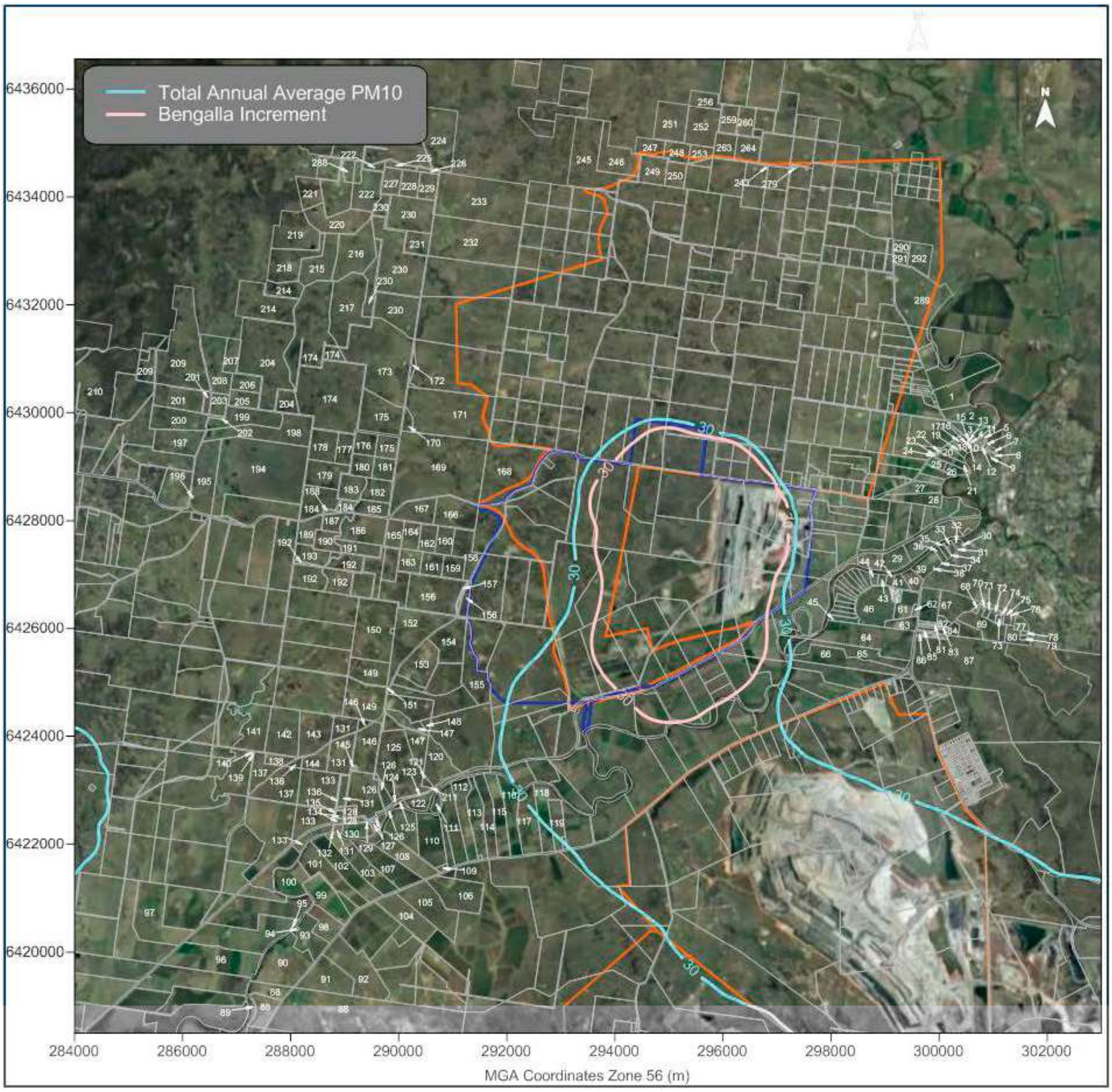

Figure E-46: Predicted annual average PM_{10} concentrations for properties due to emissions from the Project and other sources in Year 1 (µg/m³)

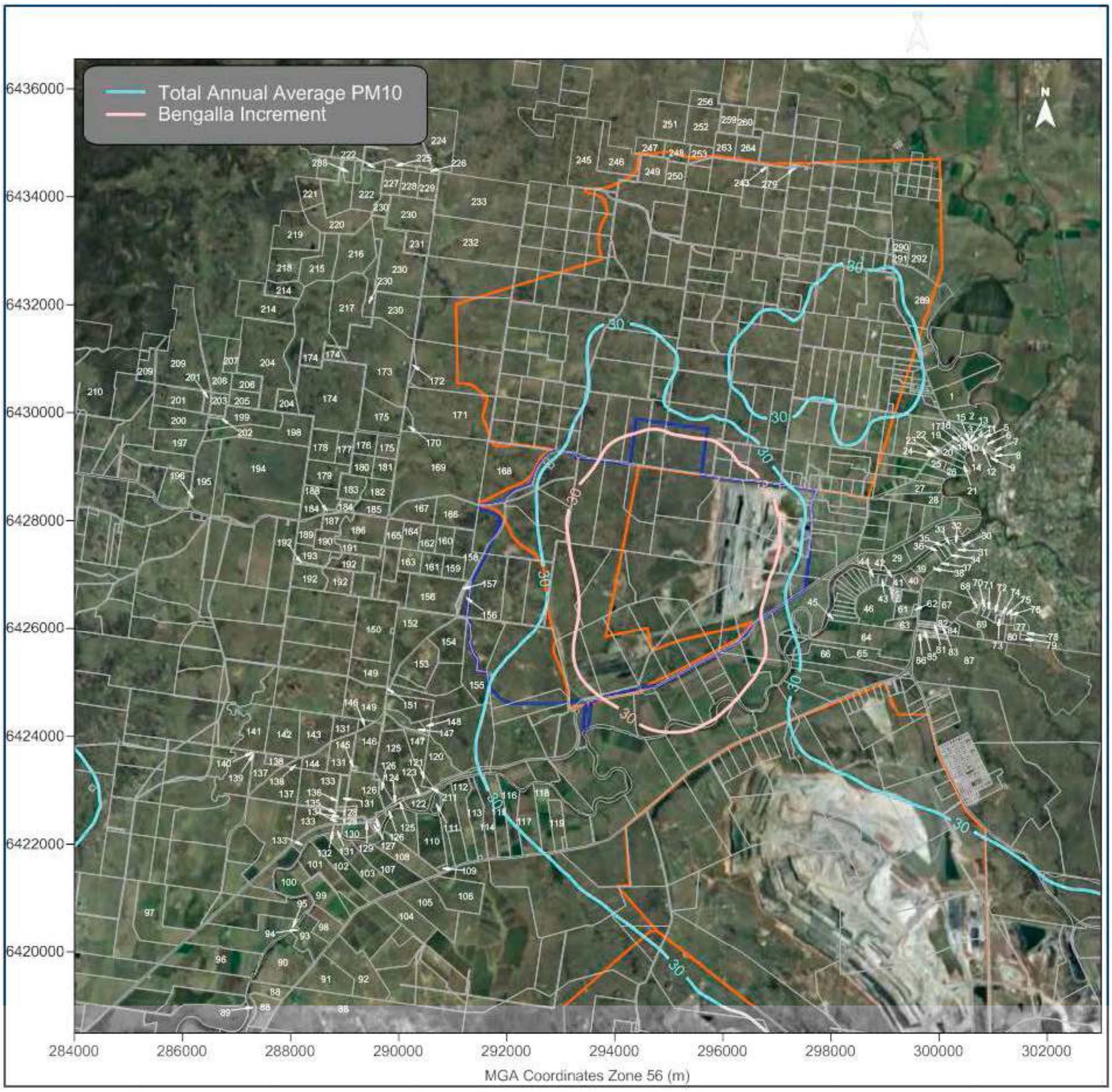

Figure E-47: Predicted annual average PM_{10} concentrations for properties due to emissions from the Project and other sources in Year 4 (µg/m³)

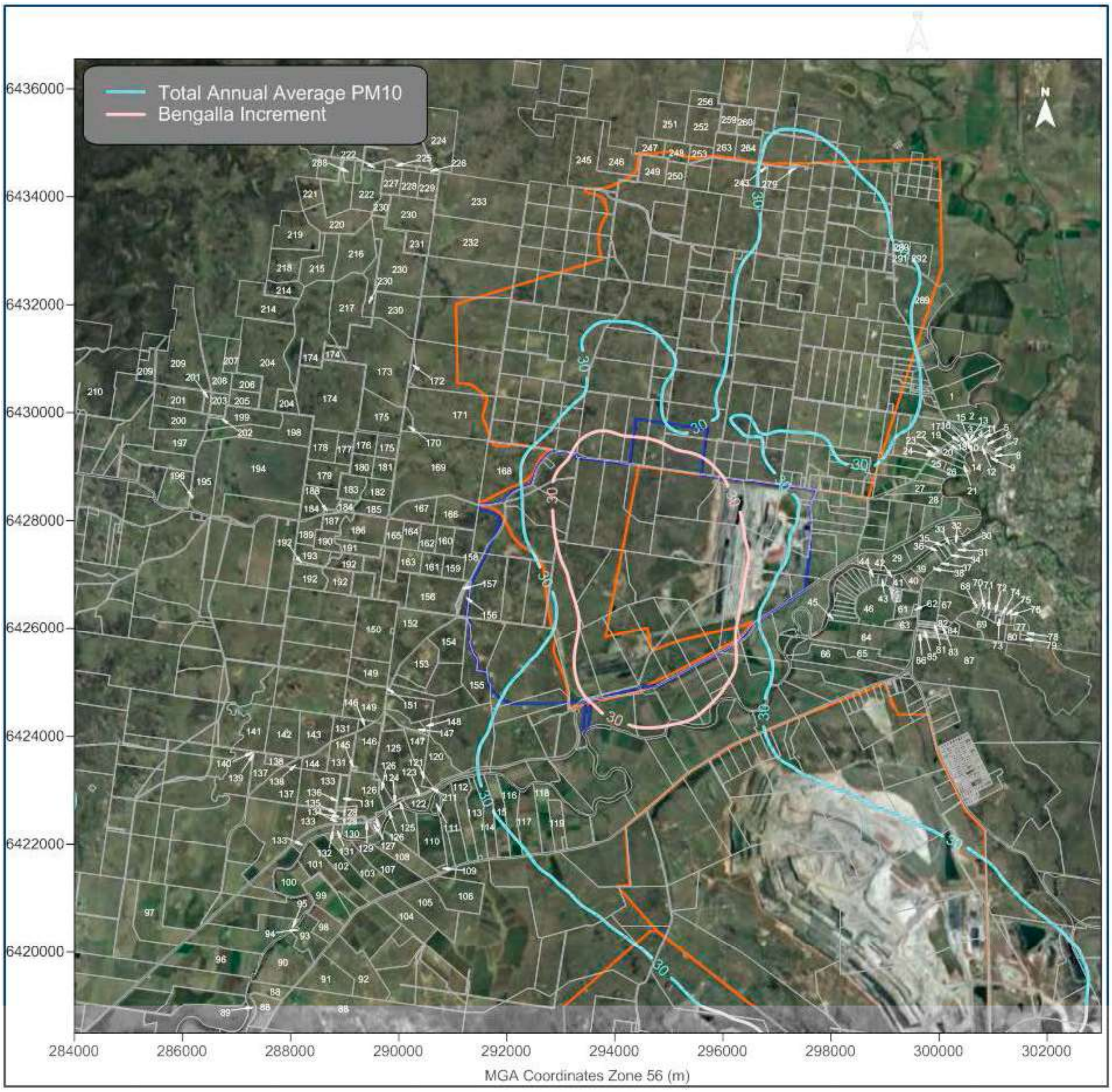

Figure E-48: Predicted annual average PM_{10} concentrations for properties due to emissions from the Project and other sources in Year 8 (µg/m³)

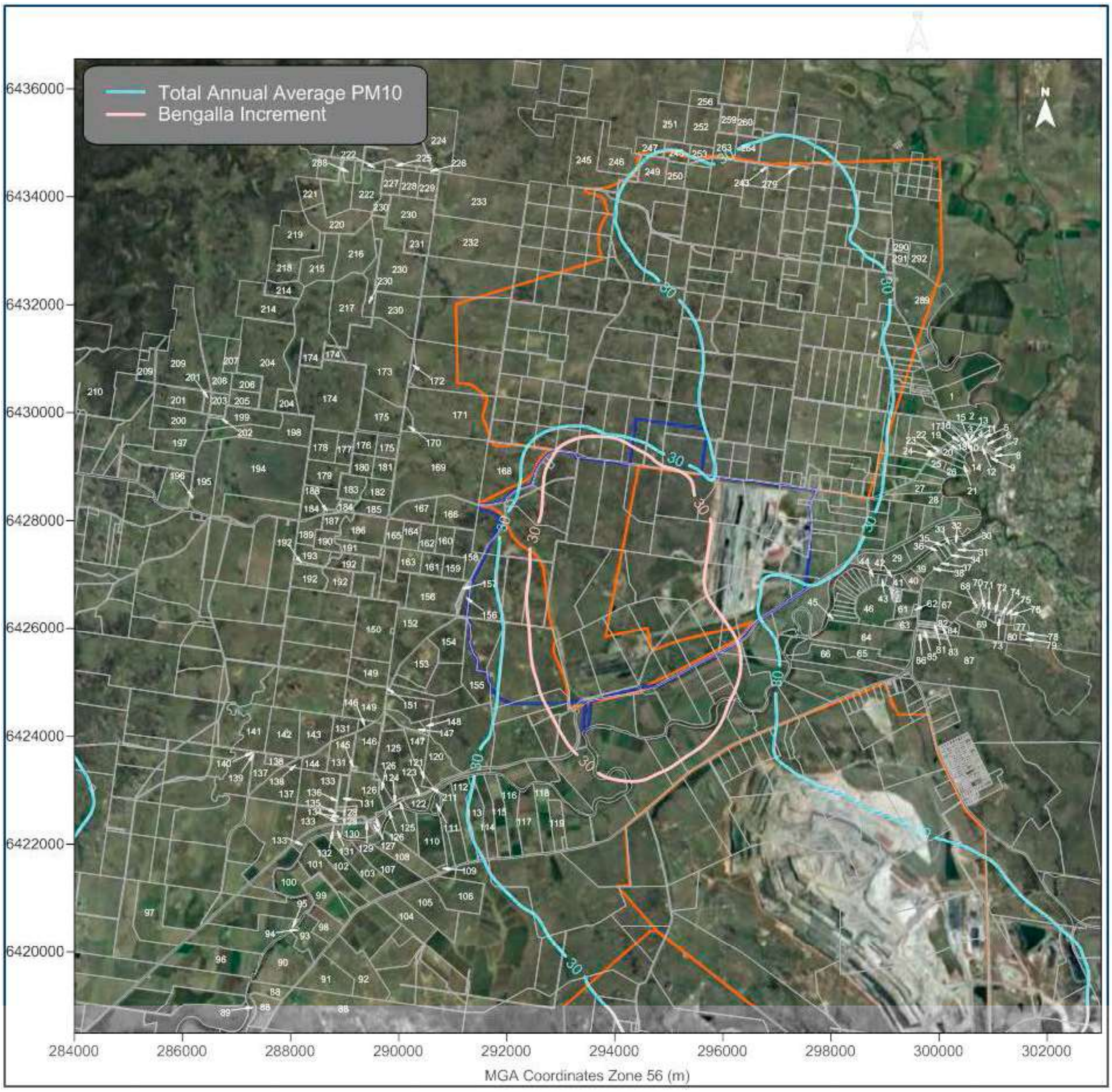

Figure E-49: Predicted annual average PM_{10} concentrations for properties due to emissions from the Project and other sources in Year 15 (µg/m³)

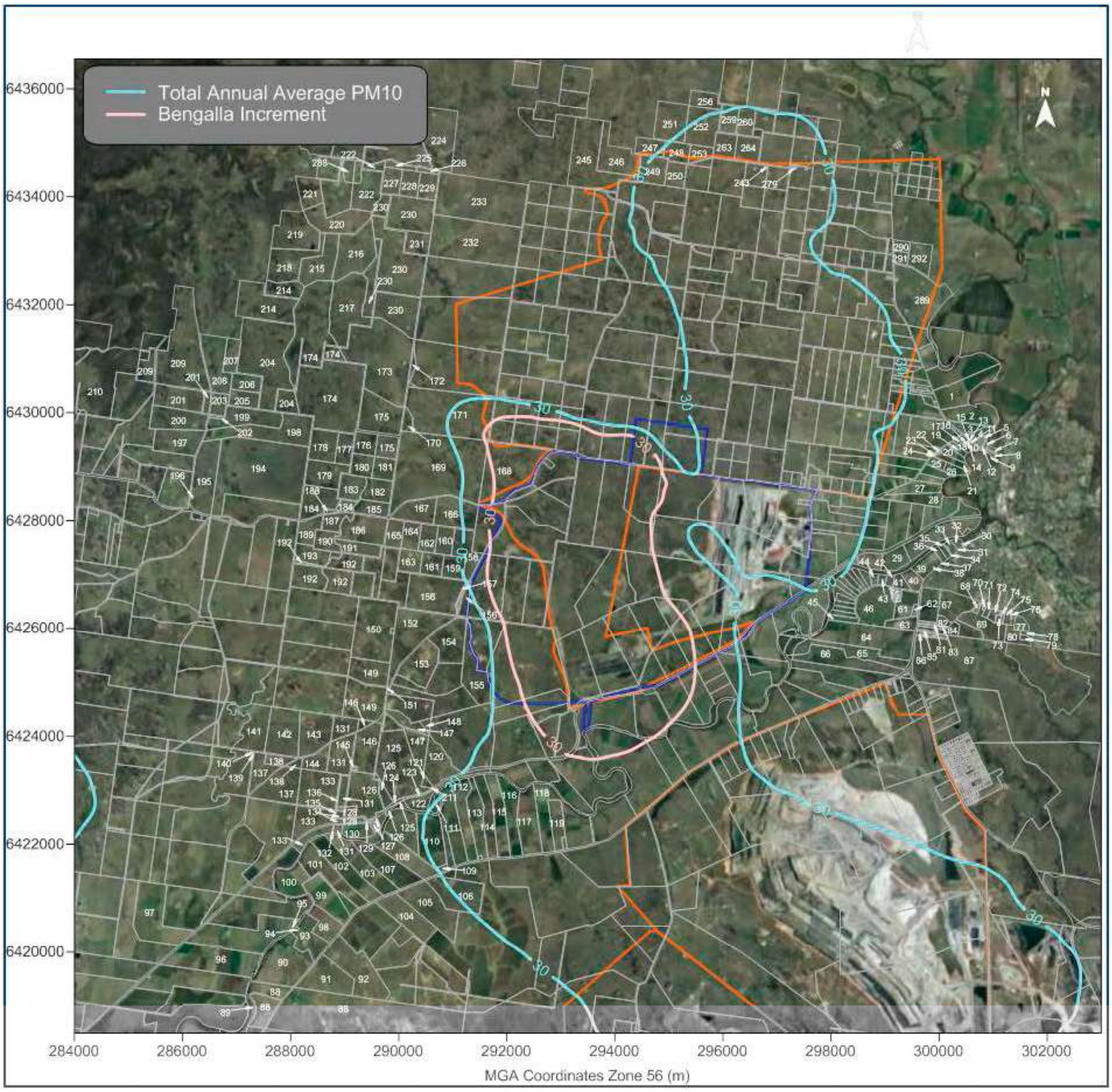

Figure E-50: Predicted annual average PM_{10} concentrations for properties due to emissions from the Project and other sources in Year 24 (µg/m³)

Appendix F

Contemporaneous 24-hour PM_{10} Analysis

Table F-1: PM10-3 - Year 1

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	-3.8	43	22/03/2010	0.0	0.2	0
26/03/2010	39.0	0.0	39	21/01/2010	0.0	0.1	0
20/03/2010	38.0	-1.0	37	26/11/2010	0.0	0.1	0
24/02/2010	36.0	0.0	36	2/01/2010	0.0	0.1	0
10/10/2010	33.0	-0.7	32	17/06/2010	0.0	0.0	0
13/01/2010	29.0	0.0	29	26/12/2010	0.0	0.0	0
25/04/2010	29.0	0.0	29	31/07/2010	0.0	0.0	0
7/01/2010	27.0	-0.2	27	6/09/2010	0.0	0.0	0
31/01/2010	26.0	0.0	26	12/11/2010	0.0	0.0	0
19/04/2010	24.0	-2.2	22	25/02/2010	0.0	0.0	0

Table F-2: DC01 - Year 1

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.4	47	22/03/2010	46.5	0.4	47
1/10/2010	42.9	-7.7	35	4/04/2010	7.3	0.2	7
27/03/2010	41.9	-2.7	39	2/09/2010	17.1	0.1	17
20/03/2010	39.9	-10.1	30	23/06/2010	7.8	0.0	8
22/01/2010	38.1	-4.1	34	6/12/2010	14.7	0.0	15
24/01/2010	36.7	0.0	37	25/02/2010	33.5	0.0	34
25/03/2010	35.8	-7.7	28	17/11/2010	11.9	0.0	12
24/02/2010	34.9	0.0	35	11/10/2010	19.0	0.0	19
31/12/2010	34.8	-9.9	25	24/01/2010	36.7	0.0	37
23/03/2010	34.7	-0.6	34	14/01/2010	7.7	0.0	8

Table F-3: DC02 - Year 1

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
23/01/2010	49.1	-0.3	49	22/03/2010	28.5	0.3	29
23/02/2010	46.9	-0.5	46	7/11/2010	13.6	0.1	14
22/01/2010	43.2	-3.3	40	6/04/2010	0.0	0.1	0
1/10/2010	41.8	-0.6	41	9/12/2010	17.1	0.0	17
30/10/2010	40.6	-0.8	40	23/06/2010	5.4	0.0	5
25/01/2010	40.3	0.0	40	22/11/2010	14.0	0.0	14
18/01/2010	38.8	-13.3	26	6/12/2010	14.1	0.0	14
22/02/2010	38.7	-2.6	36	11/01/2010	0.0	0.0	0
26/03/2010	36.5	-1.9	35	11/10/2010	10.6	0.0	11
26/01/2010	35.4	-2.6	33	24/01/2010	34.8	0.0	35

Table F-4: DC03 - Year 1

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
25/01/2010	42.5	0.0	42	22/03/2010	36.9	0.8	38
24/01/2010	41.6	0.0	42	7/11/2010	0.0	0.1	0
1/10/2010	39.4	-0.3	39	10/01/2010	26.6	0.0	27
22/01/2010	39.2	-1.6	38	6/04/2010	12.2	0.0	12
24/03/2010	37.6	-0.5	37	22/11/2010	15.1	0.0	15
22/03/2010	36.9	0.8	38	23/06/2010	0.0	0.0	0
27/03/2010	36.1	-0.5	36	6/12/2010	14.5	0.0	15
11/01/2010	34.7	0.0	35	24/01/2010	41.6	0.0	42
23/12/2010	33.5	-0.9	33	4/01/2010	20.6	0.0	21
25/03/2010	33.2	-0.2	33	14/01/2010	17.9	0.0	18

Table F-5: DC04 - Year 1

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
24/03/2010	47.4	-0.1	47	22/03/2010	36.5	0.4	37
23/02/2010	44.4	-0.1	44	14/11/2010	9.7	0.3	10
13/01/2010	42.1	-0.3	42	6/04/2010	10.6	0.0	11
27/01/2010	40.2	0.0	40	22/12/2010	25.5	0.0	26
24/01/2010	38.2	0.0	38	7/11/2010	13.9	0.0	14
27/03/2010	36.9	-0.2	37	3/05/2010	0.0	0.0	0
22/03/2010	36.5	0.4	37	26/02/2010	22.5	0.0	22
1/10/2010	35.4	0.0	35	29/03/2010	12.8	0.0	13
25/03/2010	35.0	-0.1	35	23/01/2010	33.9	0.0	34
23/03/2010	34.1	-0.1	34	24/01/2010	38.2	0.0	38

Table F-6: DC05 - Year 1

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
11/07/2010	12.5	-0.1	12	26/11/2010	3.8	0.2	4
31/12/2010	12.1	-2.3	10	22/03/2010	0.0	0.1	0
1/10/2010	10.0	-2.7	7	2/01/2010	0.0	0.0	0
10/08/2010	9.1	-2.8	6	26/01/2010	0.0	0.0	0
2/09/2010	8.7	-0.1	9	27/01/2010	0.0	0.0	0
30/08/2010	8.4	-3.3	5	6/09/2010	1.8	0.0	2
9/08/2010	7.9	-1.0	7	26/12/2010	1.7	0.0	2
14/12/2010	7.8	-0.2	8	10/11/2010	0.0	0.0	0
1/09/2010	7.6	0.0	8	21/01/2010	0.0	0.0	0
23/12/2010	7.5	-2.2	5	6/06/2010	0.0	0.0	0

Table F-7: PM10-3 - Year 4

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	-1.9	45	26/11/2010	0.0	2.2	2
26/03/2010	39.0	0.0	39	27/01/2010	0.0	2.1	2
20/03/2010	38.0	0.2	38	8/08/2010	0.0	1.7	2
24/02/2010	36.0	0.0	36	13/12/2010	0.0	1.6	2
10/10/2010	33.0	-0.9	32	7/05/2010	12.0	1.5	13
13/01/2010	29.0	0.0	29	5/07/2010	0.0	1.5	1
25/04/2010	29.0	0.0	29	15/12/2010	17.0	1.5	18
7/01/2010	27.0	0.0	27	5/02/2010	0.0	1.3	1
31/01/2010	26.0	0.0	26	25/01/2010	56.0	1.2	57
19/04/2010	24.0	-2.6	21	4/12/2010	0.0	1.1	1

Table F-8: DC01 - Year 4

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.4	47	31/10/2010	16.3	7.4	24
1/10/2010	42.9	-6.6	36	13/11/2010	14.0	4.5	18
27/03/2010	41.9	-1.7	40	27/11/2010	21.8	3.6	25
20/03/2010	39.9	-5.1	35	30/10/2010	18.0	2.1	20
22/01/2010	38.1	-0.4	38	20/01/2010	0.0	1.5	1
24/01/2010	36.7	0.0	37	15/04/2010	25.5	1.5	27
25/03/2010	35.8	-5.5	30	5/02/2010	16.7	0.8	18
24/02/2010	34.9	0.0	35	23/04/2010	17.5	0.6	18
31/12/2010	34.8	-7.6	27	2/09/2010	17.1	0.6	18
23/03/2010	34.7	-0.9	34	21/08/2010	4.3	0.5	5

Table F-9: DC02 - Year 4

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
23/01/2010	49.1	-0.3	49	6/06/2010	7.4	1.0	8
23/02/2010	46.9	-0.3	47	9/12/2010	17.1	0.3	17
22/01/2010	43.2	-3.7	39	21/01/2010	0.0	0.2	0
1/10/2010	41.8	-0.7	41	19/10/2010	25.6	0.1	26
30/10/2010	40.6	-0.9	40	22/03/2010	28.5	0.1	29
25/01/2010	40.3	0.0	40	10/01/2010	0.8	0.0	1
18/01/2010	38.8	-9.6	29	22/11/2010	14.0	0.0	14
22/02/2010	38.7	-2.8	36	3/04/2010	0.0	0.0	0
26/03/2010	36.5	-1.8	35	17/11/2010	8.4	0.0	8
26/01/2010	35.4	-2.2	33	11/10/2010	10.6	0.0	11

Table F-10: DC03 - Year 4

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
25/01/2010	42.5	0.0	42	20/01/2010	20.3	1.2	22
24/01/2010	41.6	0.0	42	22/03/2010	36.9	0.6	38
1/10/2010	39.4	-0.3	39	16/10/2010	16.7	0.4	17
22/01/2010	39.2	-1.8	37	18/10/2010	8.3	0.2	8
24/03/2010	37.6	-0.3	37	1/11/2010	6.8	0.1	7
22/03/2010	36.9	0.6	38	21/01/2010	0.0	0.1	0
27/03/2010	36.1	-0.4	36	10/01/2010	26.6	0.1	27
11/01/2010	34.7	0.0	35	23/02/2010	28.8	0.0	29
23/12/2010	33.5	-0.9	33	3/01/2010	13.2	0.0	13
25/03/2010	33.2	-0.2	33	25/01/2010	42.5	0.0	42

Table F-11: DC04 - Year 4

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
24/03/2010	47.4	-0.1	47	6/06/2010	0.0	1.0	1
23/02/2010	44.4	0.1	45	22/03/2010	36.5	0.3	37
13/01/2010	42.1	-0.1	42	3/11/2010	9.2	0.3	9
27/01/2010	40.2	0.0	40	21/01/2010	0.0	0.2	0
24/01/2010	38.2	0.0	38	23/02/2010	44.4	0.1	45
27/03/2010	36.9	-0.1	37	9/12/2010	9.5	0.1	10
22/03/2010	36.5	0.3	37	7/05/2010	11.3	0.1	11
1/10/2010	35.4	0.0	35	6/01/2010	0.0	0.0	0
25/03/2010	35.0	-0.1	35	5/05/2010	0.0	0.0	0
23/03/2010	34.1	-0.1	34	20/01/2010	18.6	0.0	19

Table F-12: DC05 - Year 4

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
11/07/2010	12.5	-0.1	12	5/07/2010	3.4	1.6	5
31/12/2010	12.1	-0.7	11	5/02/2010	0.0	1.4	1
1/10/2010	10.0	-1.2	9	26/11/2010	3.8	1.4	5
10/08/2010	9.1	1.1	10	25/01/2010	0.0	1.1	1
2/09/2010	8.7	0.0	9	10/08/2010	9.1	1.1	10
30/08/2010	8.4	-0.6	8	27/01/2010	0.0	1.1	1
9/08/2010	7.9	0.3	8	22/08/2010	2.3	1.0	3
14/12/2010	7.8	-0.2	8	13/12/2010	4.8	1.0	6
1/09/2010	7.6	0.0	8	4/12/2010	4.0	0.9	5
23/12/2010	7.5	-1.3	6	15/12/2010	4.0	0.9	5

Table F-13: PM10-3 - Year 8

PM10 24-hour average (µg/m³)							
Date	**Background**	**Predicted increment**	**Total**	**Date**	**Background**	**Highest predicted increment**	**Total**
1/05/2010	47.0	-3.1	44	27/01/2010	0.0	4.7	5
26/03/2010	39.0	0.0	39	25/01/2010	56.0	2.7	59
20/03/2010	38.0	0.6	39	26/11/2010	0.0	2.5	2
24/02/2010	36.0	0.0	36	5/02/2010	0.0	1.1	1
10/10/2010	33.0	-1.1	32	6/01/2010	0.0	1.1	1
13/01/2010	29.0	0.0	29	28/08/2010	0.0	0.8	1
25/04/2010	29.0	0.0	29	15/12/2010	17.0	0.7	18
7/01/2010	27.0	0.1	27	20/03/2010	38.0	0.6	39
31/01/2010	26.0	0.0	26	22/08/2010	0.0	0.5	1
19/04/2010	24.0	-3.3	21	21/01/2010	0.0	0.5	1

Table F-14: DC01 - Year 8

PM10 24-hour average (µg/m³)							
Date	**Background**	**Predicted increment**	**Total**	**Date**	**Background**	**Highest predicted increment**	**Total**
22/03/2010	46.5	0.0	46	7/03/2010	12.7	23.5	36
1/10/2010	42.9	-8.6	34	31/10/2010	16.3	15.4	32
27/03/2010	41.9	-2.3	40	13/11/2010	14.0	12.5	26
20/03/2010	39.9	-0.1	40	7/04/2010	8.0	11.6	20
22/01/2010	38.1	1.7	40	27/11/2010	21.8	9.6	31
24/01/2010	36.7	0.0	37	30/10/2010	18.0	9.1	27
25/03/2010	35.8	-4.1	32	12/01/2010	23.6	8.4	32
24/02/2010	34.9	0.0	35	8/03/2010	8.0	6.2	14
31/12/2010	34.8	-7.7	27	21/02/2010	15.9	6.2	22
23/03/2010	34.7	-1.4	33	15/04/2010	25.5	5.9	31

Table F-15: DC02 - Year 8

PM10 24-hour average (µg/m³)							
Date	**Background**	**Predicted increment**	**Total**	**Date**	**Background**	**Highest predicted increment**	**Total**
23/01/2010	49.1	-0.4	49	2/11/2010	78.3	6.2	84
23/02/2010	46.9	-0.6	46	18/06/2010	12.3	5.3	18
22/01/2010	43.2	-5.0	38	11/09/2010	6.7	3.8	11
1/10/2010	41.8	-0.7	41	20/08/2010	8.4	3.8	12
30/10/2010	40.6	-1.1	39	11/08/2010	1.3	2.4	4
25/01/2010	40.3	0.0	40	21/08/2010	7.3	2.0	9
18/01/2010	38.8	-14.4	24	2/08/2010	3.4	1.9	5
22/02/2010	38.7	-3.1	36	30/06/2010	4.4	1.5	6
26/03/2010	36.5	-1.8	35	14/07/2010	4.1	0.7	5
26/01/2010	35.4	-0.4	35	15/11/2010	11.3	0.3	12

Table F-16: DC03 - Year 8

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
25/01/2010	42.5	0.0	42	27/08/2010	16.7	6.4	23
24/01/2010	41.6	0.0	42	24/08/2010	5.0	5.9	11
1/10/2010	39.4	-0.4	39	17/10/2010	13.2	5.4	19
22/01/2010	39.2	-2.8	36	2/11/2010	7.6	4.8	12
24/03/2010	37.6	-1.0	37	10/06/2010	6.1	4.4	11
22/03/2010	36.9	-0.4	36	2/08/2010	0.0	4.2	4
27/03/2010	36.1	-0.8	35	16/08/2010	9.6	3.6	13
11/01/2010	34.7	0.0	35	14/07/2010	6.8	3.4	10
23/12/2010	33.5	-1.7	32	20/12/2010	8.3	2.1	10
25/03/2010	33.2	-0.5	33	20/01/2010	20.3	1.8	22

Table F-17: DC04 - Year 8

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
24/03/2010	47.4	-0.4	47	2/11/2010	7.4	3.5	11
23/02/2010	44.4	-0.1	44	18/06/2010	13.1	3.1	16
13/01/2010	42.1	0.2	42	20/08/2010	5.0	2.9	8
27/01/2010	40.2	0.0	40	17/10/2010	5.8	2.6	8
24/01/2010	38.2	0.0	38	2/08/2010	2.7	1.9	5
27/03/2010	36.9	-0.3	37	11/08/2010	1.9	1.6	4
22/03/2010	36.5	-0.1	36	11/09/2010	6.8	1.3	8
1/10/2010	35.4	0.0	35	21/08/2010	6.7	1.0	8
25/03/2010	35.0	-0.2	35	10/06/2010	5.9	1.0	7
23/03/2010	34.1	-0.4	34	29/04/2010	0.0	1.0	1

Table F-18: DC05 - Year 8

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
11/07/2010	12.5	-0.1	12	27/01/2010	0.0	3.2	3
31/12/2010	12.1	-1.1	11	25/01/2010	0.0	2.4	2
1/10/2010	10.0	-2.8	7	26/11/2010	3.8	1.8	6
10/08/2010	9.1	0.7	10	5/02/2010	0.0	1.4	1
2/09/2010	8.7	0.2	9	28/08/2010	3.3	0.8	4
30/08/2010	8.4	-3.4	5	6/01/2010	0.0	0.8	1
9/08/2010	7.9	-0.4	7	10/08/2010	9.1	0.7	10
14/12/2010	7.8	-0.2	8	4/09/2010	0.3	0.6	1
1/09/2010	7.6	0.0	8	22/04/2010	0.0	0.6	1
23/12/2010	7.5	-2.5	5	20/03/2010	0.0	0.5	1

Table F-19: PM10-3 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	0.6	48	25/01/2010	56.0	7.1	63
26/03/2010	39.0	0.0	39	28/08/2010	0.0	5.2	5
20/03/2010	38.0	3.2	41	27/01/2010	0.0	4.9	5
24/02/2010	36.0	0.0	36	26/11/2010	0.0	4.9	5
10/10/2010	33.0	-1.1	32	7/08/2010	0.0	4.0	4
13/01/2010	29.0	0.1	29	4/12/2010	0.0	4.0	4
25/04/2010	29.0	0.0	29	24/07/2010	18.0	3.3	21
7/01/2010	27.0	0.0	27	1/06/2010	0.0	3.3	3
31/01/2010	26.0	0.0	26	20/03/2010	38.0	3.2	41
19/04/2010	24.0	-0.6	23	22/04/2010	0.0	3.1	3

Table F-20: DC01 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.1	47	26/03/2010	24.1	42.7	67
1/10/2010	42.9	-5.4	37	21/02/2010	15.9	38.6	55
27/03/2010	41.9	13.5	55	19/03/2010	18.3	37.2	55
20/03/2010	39.9	21.1	61	29/03/2010	17.7	33.0	51
22/01/2010	38.1	11.2	49	24/09/2010	19.4	28.6	48
24/01/2010	36.7	0.0	37	28/03/2010	32.3	27.7	60
25/03/2010	35.8	-2.8	33	29/07/2010	2.0	27.6	30
24/02/2010	34.9	0.0	35	12/01/2010	23.6	25.7	49
31/12/2010	34.8	0.3	35	14/10/2010	19.5	24.0	43
23/03/2010	34.7	-0.4	34	8/11/2010	10.1	21.7	32

Table F-21: DC02 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
23/01/2010	49.1	-0.4	49	3/06/2010	8.7	1.1	10
23/02/2010	46.9	-0.9	46	31/03/2010	0.0	0.2	0
22/01/2010	43.2	-4.8	38	1/05/2010	11.9	0.0	12
1/10/2010	41.8	-0.7	41	16/02/2010	19.8	0.0	20
30/10/2010	40.6	-1.5	39	22/11/2010	14.0	0.0	14
25/01/2010	40.3	-0.1	40	9/02/2010	13.4	0.0	13
18/01/2010	38.8	-15.7	23	17/11/2010	8.4	0.0	8
22/02/2010	38.7	-3.9	35	4/01/2010	0.0	0.0	0
26/03/2010	36.5	-2.9	34	14/01/2010	12.3	0.0	12
26/01/2010	35.4	-3.2	32	15/01/2010	20.7	0.0	21

Table F-22: DC03 - Year 15

PM10 24-hour average (μg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
25/01/2010	42.5	0.0	42	15/07/2010	8.2	3.3	12
24/01/2010	41.6	0.0	42	12/04/2010	11.2	2.1	13
1/10/2010	39.4	-0.3	39	18/10/2010	8.3	2.1	10
22/01/2010	39.2	-2.7	37	20/12/2010	8.3	1.4	10
24/03/2010	37.6	-0.9	37	21/12/2010	0.0	1.2	1
22/03/2010	36.9	-0.6	36	2/05/2010	10.5	0.4	11
27/03/2010	36.1	-1.0	35	15/02/2010	7.8	0.2	8
11/01/2010	34.7	0.0	35	3/06/2010	3.7	0.1	4
23/12/2010	33.5	-1.9	32	10/05/2010	19.2	0.1	19
25/03/2010	33.2	-0.5	33	31/03/2010	5.5	0.1	6

Table F-23: DC04 - Year 15

PM10 24-hour average (μg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
24/03/2010	47.4	-0.3	47	21/12/2010	10.3	1.0	11
23/02/2010	44.4	-0.3	44	28/11/2010	13.7	0.3	14
13/01/2010	42.1	-0.2	42	19/08/2010	5.7	0.2	6
27/01/2010	40.2	0.0	40	21/08/2010	6.7	0.2	7
24/01/2010	38.2	0.0	38	13/05/2010	21.9	0.2	22
27/03/2010	36.9	-0.4	37	3/06/2010	9.0	0.1	9
22/03/2010	36.5	-0.2	36	10/11/2010	12.1	0.0	12
1/10/2010	35.4	0.0	35	13/09/2010	8.8	0.0	9
25/03/2010	35.0	-0.2	35	15/12/2010	12.2	0.0	12
23/03/2010	34.1	-0.4	34	10/01/2010	26.2	0.0	26

Table F-24: DC05 - Year 15

PM10 24-hour average (μg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
11/07/2010	12.5	0.0	12	25/01/2010	0.0	4.8	5
31/12/2010	12.1	2.7	15	21/10/2010	5.5	3.9	9
1/10/2010	10.0	-0.2	10	28/08/2010	3.3	3.8	7
10/08/2010	9.1	3.4	12	10/08/2010	9.1	3.4	12
2/09/2010	8.7	0.4	9	20/03/2010	0.0	3.3	3
30/08/2010	8.4	0.1	9	22/04/2010	0.0	3.2	3
9/08/2010	7.9	0.7	9	27/01/2010	0.0	2.9	3
14/12/2010	7.8	-0.2	8	26/11/2010	3.8	2.9	7
1/09/2010	7.6	0.0	8	31/12/2010	12.1	2.7	15
23/12/2010	7.5	-0.7	7	25/05/2010	0.0	2.5	2

Table F-25: Receptor 106 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.0	46	7/03/2010	12.7	8.2	21
1/10/2010	42.9	-0.5	42	21/01/2010	0.0	7.9	8
27/03/2010	41.9	0.0	42	27/11/2010	21.8	4.9	27
20/03/2010	39.9	3.2	43	9/01/2010	14.3	4.9	19
22/01/2010	38.1	1.4	40	6/04/2010	12.4	4.5	17
24/01/2010	36.7	0.0	37	7/04/2010	8.0	4.4	12
25/03/2010	35.8	1.1	37	15/12/2010	18.1	3.6	22
24/02/2010	34.9	0.0	35	12/11/2010	10.7	3.4	14
31/12/2010	34.8	0.5	35	10/05/2010	15.8	3.2	19
23/03/2010	34.7	-0.2	34	20/03/2010	39.9	3.2	43

Table F-26: Receptor 110S - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.0	46	21/01/2010	0.0	10.1	10
1/10/2010	42.9	-0.3	43	6/04/2010	12.4	4.4	17
27/03/2010	41.9	0.0	42	7/03/2010	12.7	4.3	17
20/03/2010	39.9	2.4	42	9/01/2010	14.3	4.3	19
22/01/2010	38.1	1.5	40	18/08/2010	15.5	3.2	19
24/01/2010	36.7	0.0	37	26/11/2010	23.8	3.2	27
25/03/2010	35.8	0.8	37	10/05/2010	15.8	3.1	19
24/02/2010	34.9	0.0	35	7/04/2010	8.0	3.0	11
31/12/2010	34.8	1.0	36	27/11/2010	21.8	3.0	25
23/03/2010	34.7	-0.3	34	12/11/2010	10.7	2.7	13

Table F-27: Receptor 110N - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.0	46	21/01/2010	0.0	10.1	10
1/10/2010	42.9	0.1	43	26/11/2010	23.8	3.7	27
27/03/2010	41.9	-0.2	42	6/04/2010	12.4	3.4	16
20/03/2010	39.9	1.8	42	4/12/2010	11.0	3.3	14
22/01/2010	38.1	1.9	40	7/11/2010	16.5	3.1	20
24/01/2010	36.7	0.0	37	28/08/2010	8.0	2.7	11
25/03/2010	35.8	0.8	37	31/12/2010	34.8	2.7	37
24/02/2010	34.9	0.0	35	18/08/2010	15.5	2.6	18
31/12/2010	34.8	2.7	37	9/01/2010	14.3	2.5	17
23/03/2010	34.7	-0.3	34	10/05/2010	15.8	2.3	18

Table F-28: Receptor 152 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	2.9	50	11/10/2010	0.0	18.2	18
26/03/2010	39.0	0.0	39	29/12/2010	0.0	17.2	17
20/03/2010	38.0	10.0	48	19/04/2010	24.0	14.5	39
24/02/2010	36.0	-0.1	36	25/01/2010	56.0	12.9	69
10/10/2010	33.0	0.6	34	23/11/2010	0.0	12.8	13
13/01/2010	29.0	0.0	29	9/02/2010	0.0	12.7	13
25/04/2010	29.0	0.0	29	18/04/2010	0.0	12.7	13
7/01/2010	27.0	0.3	27	1/04/2010	20.0	12.6	33
31/01/2010	26.0	0.9	27	22/11/2010	0.0	11.6	12
19/04/2010	24.0	14.5	39	21/10/2010	0.0	11.1	11

Table F-29: Receptor 153 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	1.6	49	25/11/2010	0.0	10.9	11
26/03/2010	39.0	0.0	39	21/10/2010	0.0	10.4	10
20/03/2010	38.0	7.9	46	29/12/2010	0.0	9.9	10
24/02/2010	36.0	0.0	36	25/01/2010	56.0	8.8	65
10/10/2010	33.0	-2.3	31	23/11/2010	0.0	8.5	8
13/01/2010	29.0	0.0	29	20/03/2010	38.0	7.9	46
25/04/2010	29.0	0.0	29	9/11/2010	10.0	7.5	18
7/01/2010	27.0	0.1	27	20/04/2010	0.0	7.3	7
31/01/2010	26.0	0.4	26	19/04/2010	24.0	7.3	31
19/04/2010	24.0	7.3	31	11/02/2010	0.0	7.0	7

Table F-30: Receptor 154 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	2.9	50	29/12/2010	0.0	17.8	18
26/03/2010	39.0	0.0	39	11/10/2010	0.0	14.3	14
20/03/2010	38.0	11.1	49	19/04/2010	24.0	13.7	38
24/02/2010	36.0	-0.1	36	23/11/2010	0.0	12.9	13
10/10/2010	33.0	-1.1	32	25/01/2010	56.0	12.6	69
13/01/2010	29.0	0.0	29	21/10/2010	0.0	12.2	12
25/04/2010	29.0	0.0	29	25/11/2010	0.0	12.0	12
7/01/2010	27.0	0.2	27	11/02/2010	0.0	11.2	11
31/01/2010	26.0	0.3	26	20/03/2010	38.0	11.1	49
19/04/2010	24.0	13.7	38	1/04/2010	20.0	10.6	31

Table F-31: Receptor 156E - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	3.6	51	9/02/2010	0.0	19.2	19
26/03/2010	39.0	0.0	39	18/04/2010	0.0	18.9	19
20/03/2010	38.0	9.6	48	11/10/2010	0.0	17.8	18
24/02/2010	36.0	0.3	36	19/04/2010	24.0	17.8	42
10/10/2010	33.0	5.7	39	1/04/2010	20.0	16.4	36
13/01/2010	29.0	0.0	29	29/12/2010	0.0	16.4	16
25/04/2010	29.0	0.0	29	16/04/2010	0.0	15.4	15
7/01/2010	27.0	0.7	28	16/11/2010	0.0	14.1	14
31/01/2010	26.0	4.0	30	28/07/2010	0.0	13.9	14
19/04/2010	24.0	17.8	42	20/04/2010	0.0	13.5	14

Table F-32: Receptor 156W - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	2.8	50	9/02/2010	0.0	17.3	17
26/03/2010	39.0	0.0	39	18/04/2010	0.0	16.9	17
20/03/2010	38.0	6.5	44	30/11/2010	0.0	14.8	15
24/02/2010	36.0	1.0	37	17/11/2010	0.0	13.6	14
10/10/2010	33.0	8.4	41	16/04/2010	0.0	13.3	13
13/01/2010	29.0	0.0	29	11/10/2010	0.0	13.2	13
25/04/2010	29.0	0.0	29	19/04/2010	24.0	13.0	37
7/01/2010	27.0	0.7	28	1/04/2010	20.0	12.9	33
31/01/2010	26.0	6.6	33	16/11/2010	0.0	12.7	13
19/04/2010	24.0	13.0	37	17/04/2010	0.0	12.3	12

Table F-33: Receptor 161 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	3.6	51	17/11/2010	0.0	20.9	21
26/03/2010	39.0	0.0	39	3/10/2010	0.0	19.0	19
20/03/2010	38.0	5.7	44	24/12/2010	0.0	18.9	19
24/02/2010	36.0	8.9	45	3/02/2010	0.0	18.8	19
10/10/2010	33.0	18.6	52	10/10/2010	33.0	18.6	52
13/01/2010	29.0	0.6	30	11/10/2010	0.0	18.5	19
25/04/2010	29.0	0.0	29	2/02/2010	0.0	18.1	18
7/01/2010	27.0	2.4	29	1/12/2010	0.0	17.4	17
31/01/2010	26.0	16.1	42	21/09/2010	0.0	17.4	17
19/04/2010	24.0	9.4	33	4/10/2010	12.0	17.1	29

Table F-34: Receptor 180 - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	2.5	50	5/09/2010	0.0	16.8	17
26/03/2010	39.0	0.0	39	25/08/2010	0.0	16.1	16
20/03/2010	38.0	2.0	40	15/07/2010	0.0	15.9	16
24/02/2010	36.0	12.8	49	16/03/2010	0.0	15.2	15
10/10/2010	33.0	8.1	41	22/01/2010	0.0	15.1	15
13/01/2010	29.0	2.8	32	24/08/2010	0.0	14.9	15
25/04/2010	29.0	0.0	29	1/06/2010	0.0	14.7	15
7/01/2010	27.0	6.4	33	26/11/2010	0.0	14.6	15
31/01/2010	26.0	12.9	39	4/07/2010	0.0	14.1	14
19/04/2010	24.0	5.3	29	17/03/2010	0.0	14.0	14

Table F-35: Receptor 186N - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	1.6	49	10/10/2010	33.0	11.3	44
26/03/2010	39.0	0.0	39	11/10/2010	0.0	10.6	11
20/03/2010	38.0	2.2	40	17/11/2010	0.0	10.0	10
24/02/2010	36.0	3.5	40	24/12/2010	0.0	9.8	10
10/10/2010	33.0	11.3	44	3/10/2010	0.0	9.4	9
13/01/2010	29.0	0.0	29	2/10/2010	0.0	9.2	9
25/04/2010	29.0	0.0	29	14/12/2010	0.0	9.0	9
7/01/2010	27.0	0.8	28	1/12/2010	0.0	8.9	9
31/01/2010	26.0	7.6	34	2/02/2010	0.0	8.0	8
19/04/2010	24.0	4.9	29	17/04/2010	0.0	7.9	8

Table F-36: Receptor 186S - Year 15

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	1.5	49	14/12/2010	0.0	9.6	10
26/03/2010	39.0	0.0	39	1/12/2010	0.0	8.8	9
20/03/2010	38.0	2.3	40	17/11/2010	0.0	8.6	9
24/02/2010	36.0	1.6	38	10/10/2010	33.0	8.5	41
10/10/2010	33.0	8.5	41	2/10/2010	0.0	8.5	8
13/01/2010	29.0	0.0	29	30/11/2010	0.0	8.4	8
25/04/2010	29.0	0.0	29	9/02/2010	0.0	8.3	8
7/01/2010	27.0	0.4	27	11/10/2010	0.0	8.2	8
31/01/2010	26.0	6.4	32	3/10/2010	0.0	8.0	8
19/04/2010	24.0	5.2	29	17/04/2010	0.0	7.8	8

Table F-37: PM10-3 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	1.8	49	4/12/2010	0.0	18.4	18
26/03/2010	39.0	0.0	39	21/01/2010	0.0	16.2	16
20/03/2010	38.0	3.9	42	26/11/2010	0.0	14.6	15
24/02/2010	36.0	0.0	36	6/04/2010	0.0	12.6	13
10/10/2010	33.0	-1.1	32	25/01/2010	56.0	12.3	68
13/01/2010	29.0	0.1	29	27/01/2010	0.0	12.1	12
25/04/2010	29.0	0.0	29	28/08/2010	0.0	10.8	11
7/01/2010	27.0	0.4	27	10/02/2010	0.0	7.9	8
31/01/2010	26.0	0.0	26	5/02/2010	0.0	6.7	7
19/04/2010	24.0	-0.4	24	25/05/2010	22.0	6.6	29

Table F-38: DC01 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.2	47	26/03/2010	24.1	84.5	109
1/10/2010	42.9	-9.0	34	11/11/2010	6.4	75.8	82
27/03/2010	41.9	33.6	75	29/03/2010	17.7	68.5	86
20/03/2010	39.9	25.7	66	14/10/2010	19.5	63.3	83
22/01/2010	38.1	15.9	54	12/02/2010	18.8	62.4	81
24/01/2010	36.7	0.0	37	21/02/2010	15.9	53.1	69
25/03/2010	35.8	-10.6	25	19/03/2010	18.3	52.6	71
24/02/2010	34.9	0.0	35	25/12/2010	14.1	49.8	64
31/12/2010	34.8	1.3	36	23/04/2010	17.5	47.7	65
23/03/2010	34.7	-1.2	33	4/05/2010	9.8	41.6	51

Table F-39: DC02 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
23/01/2010	49.1	-0.4	49	9/12/2010	17.1	1.7	19
23/02/2010	46.9	-1.0	46	2/11/2010	78.3	1.2	80
22/01/2010	43.2	-5.3	38	21/08/2010	7.3	0.4	8
1/10/2010	41.8	-0.7	41	31/03/2010	0.0	0.0	0
30/10/2010	40.6	-1.6	39	16/02/2010	19.8	0.0	20
25/01/2010	40.3	-0.1	40	10/01/2010	0.8	0.0	1
18/01/2010	38.8	-15.1	24	9/02/2010	13.4	0.0	13
22/02/2010	38.7	-4.3	34	17/11/2010	8.4	0.0	8
26/03/2010	36.5	-3.1	33	24/01/2010	34.8	0.0	35
26/01/2010	35.4	-1.7	34	4/01/2010	0.0	0.0	0

Table F-40: DC03 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
25/01/2010	42.5	-0.1	42	2/08/2010	0.0	7.5	8
24/01/2010	41.6	0.0	42	2/11/2010	7.6	7.4	15
1/10/2010	39.4	-0.4	39	20/12/2010	8.3	5.7	14
22/01/2010	39.2	-3.0	36	20/08/2010	13.0	5.0	18
24/03/2010	37.6	-1.3	36	16/10/2010	16.7	3.6	20
22/03/2010	36.9	-0.5	36	15/07/2010	8.2	3.3	12
27/03/2010	36.1	-1.1	35	12/08/2010	4.1	2.8	7
11/01/2010	34.7	0.0	35	18/10/2010	8.3	2.3	11
23/12/2010	33.5	-1.9	32	12/04/2010	11.2	1.9	13
25/03/2010	33.2	-0.6	33	10/06/2010	6.1	1.7	8

Table F-41: DC04 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
24/03/2010	47.4	-0.4	47	2/11/2010	7.4	2.7	10
23/02/2010	44.4	-0.3	44	20/12/2010	7.3	2.2	9
13/01/2010	42.1	-0.1	42	9/12/2010	9.5	1.4	11
27/01/2010	40.2	0.0	40	18/06/2010	13.1	1.3	14
24/01/2010	38.2	0.0	38	15/07/2010	7.1	1.1	8
27/03/2010	36.9	-0.4	36	19/08/2010	5.7	1.1	7
22/03/2010	36.5	-0.2	36	19/12/2010	4.5	1.0	6
1/10/2010	35.4	0.0	35	25/09/2010	15.1	0.9	16
25/03/2010	35.0	-0.2	35	13/09/2010	8.8	0.8	10
23/03/2010	34.1	-0.4	34	28/11/2010	13.7	0.8	14

Table F-42: DC05 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
11/07/2010	12.5	0.1	13	25/01/2010	0.0	12.3	12
31/12/2010	12.1	1.3	13	10/08/2010	9.1	11.3	20
1/10/2010	10.0	1.4	11	27/01/2010	0.0	8.8	9
10/08/2010	9.1	11.3	20	4/12/2010	4.0	7.4	11
2/09/2010	8.7	0.6	9	26/11/2010	3.8	7.2	11
30/08/2010	8.4	1.3	10	6/04/2010	0.0	6.4	6
9/08/2010	7.9	2.2	10	25/05/2010	0.0	6.2	6
14/12/2010	7.8	-0.2	8	5/02/2010	0.0	5.9	6
1/09/2010	7.6	0.0	8	28/08/2010	3.3	5.9	9
23/12/2010	7.5	-0.1	7	21/01/2010	0.0	4.9	5

Table F-43: Receptor 106 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.0	47	7/03/2010	12.7	23.5	36
1/10/2010	42.9	0.1	43	27/11/2010	21.8	20.6	42
27/03/2010	41.9	0.1	42	30/10/2010	18.0	15.5	34
20/03/2010	39.9	10.1	50	7/04/2010	8.0	13.5	21
22/01/2010	38.1	4.9	43	12/11/2010	10.7	12.8	23
24/01/2010	36.7	0.0	37	15/12/2010	18.1	12.0	30
25/03/2010	35.8	3.1	39	9/01/2010	14.3	11.3	26
24/02/2010	34.9	0.0	35	20/03/2010	39.9	10.1	50
31/12/2010	34.8	2.1	37	6/04/2010	12.4	9.9	22
23/03/2010	34.7	-0.3	34	11/02/2010	19.9	7.6	28

Table F-44: Receptor 110S - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.1	47	7/03/2010	12.7	15.3	28
1/10/2010	42.9	0.6	43	27/11/2010	21.8	12.6	34
27/03/2010	41.9	0.0	42	21/01/2010	0.0	12.2	12
20/03/2010	39.9	8.5	48	12/11/2010	10.7	10.9	22
22/01/2010	38.1	3.8	42	6/04/2010	12.4	10.5	23
24/01/2010	36.7	0.0	37	7/04/2010	8.0	10.1	18
25/03/2010	35.8	3.1	39	9/01/2010	14.3	10.1	24
24/02/2010	34.9	0.0	35	20/03/2010	39.9	8.5	48
31/12/2010	34.8	3.2	38	15/12/2010	18.1	8.4	26
23/03/2010	34.7	-0.4	34	11/02/2010	19.9	7.8	28

Table F-45: Receptor 110N - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
22/03/2010	46.5	0.1	47	21/01/2010	0.0	25.5	26
1/10/2010	42.9	1.8	45	29/05/2010	4.0	10.5	15
27/03/2010	41.9	-0.2	42	4/12/2010	11.0	10.0	21
20/03/2010	39.9	4.1	44	6/04/2010	12.4	9.4	22
22/01/2010	38.1	4.7	43	18/08/2010	15.5	8.6	24
24/01/2010	36.7	0.0	37	8/08/2010	12.3	8.1	20
25/03/2010	35.8	2.0	38	31/12/2010	34.8	7.9	43
24/02/2010	34.9	0.0	35	11/02/2010	19.9	7.0	27
31/12/2010	34.8	7.9	43	7/11/2010	16.5	7.0	23
23/03/2010	34.7	-0.5	34	12/11/2010	10.7	6.9	18

Table F-46: Receptor 152 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	5.5	53	11/10/2010	0.0	35.6	36
26/03/2010	39.0	0.0	39	25/01/2010	56.0	33.4	89
20/03/2010	38.0	24.0	62	5/01/2010	0.0	33.0	33
24/02/2010	36.0	0.1	36	21/10/2010	0.0	32.8	33
10/10/2010	33.0	3.4	36	29/12/2010	0.0	30.7	31
13/01/2010	29.0	0.0	29	19/04/2010	24.0	28.9	53
25/04/2010	29.0	0.0	29	9/11/2010	10.0	26.3	36
7/01/2010	27.0	0.7	28	14/01/2010	0.0	25.9	26
31/01/2010	26.0	-0.6	25	25/11/2010	0.0	25.4	25
19/04/2010	24.0	28.9	53	20/03/2010	38.0	24.0	62

Table F-47: Receptor 153 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	3.7	51	25/01/2010	56.0	24.9	81
26/03/2010	39.0	0.0	39	21/10/2010	0.0	21.1	21
20/03/2010	38.0	14.0	52	20/04/2010	0.0	17.0	17
24/02/2010	36.0	0.0	36	19/04/2010	24.0	15.9	40
10/10/2010	33.0	-2.9	30	10/08/2010	0.0	14.8	15
13/01/2010	29.0	0.0	29	25/11/2010	0.0	14.5	14
25/04/2010	29.0	0.0	29	9/11/2010	10.0	14.0	24
7/01/2010	27.0	0.4	27	20/03/2010	38.0	14.0	52
31/01/2010	26.0	-0.7	25	28/08/2010	0.0	12.3	12
19/04/2010	24.0	15.9	40	29/12/2010	0.0	11.3	11

Table F-48: Receptor 154 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	5.5	53	25/01/2010	56.0	34.7	91
26/03/2010	39.0	0.0	39	21/10/2010	0.0	33.8	34
20/03/2010	38.0	24.9	63	29/12/2010	0.0	28.4	28
24/02/2010	36.0	-0.1	36	19/04/2010	24.0	28.1	52
10/10/2010	33.0	-1.1	32	5/01/2010	0.0	27.7	28
13/01/2010	29.0	0.0	29	9/11/2010	10.0	26.8	37
25/04/2010	29.0	0.0	29	25/11/2010	0.0	26.3	26
7/01/2010	27.0	0.5	28	20/03/2010	38.0	24.9	63
31/01/2010	26.0	-1.6	24	11/10/2010	0.0	24.3	24
19/04/2010	24.0	28.1	52	20/04/2010	0.0	23.3	23

Table F-49: Receptor 156E - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	6.9	54	11/10/2010	0.0	39.0	39
26/03/2010	39.0	0.0	39	5/01/2010	0.0	36.8	37
20/03/2010	38.0	24.4	62	19/04/2010	24.0	35.3	59
24/02/2010	36.0	1.4	37	29/12/2010	0.0	33.7	34
10/10/2010	33.0	13.9	47	21/10/2010	0.0	32.5	33
13/01/2010	29.0	0.0	29	25/01/2010	56.0	31.0	87
25/04/2010	29.0	0.0	29	14/01/2010	0.0	30.1	30
7/01/2010	27.0	1.7	29	20/04/2010	0.0	28.9	29
31/01/2010	26.0	6.0	32	23/11/2010	0.0	27.6	28
19/04/2010	24.0	35.3	59	1/04/2010	20.0	26.9	47

Table F-50: Receptor 156W - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	5.4	52	9/02/2010	0.0	25.8	26
26/03/2010	39.0	0.0	39	5/01/2010	0.0	25.4	25
20/03/2010	38.0	15.1	53	11/10/2010	0.0	23.1	23
24/02/2010	36.0	2.6	39	17/04/2010	0.0	22.8	23
10/10/2010	33.0	18.2	51	16/04/2010	0.0	22.7	23
13/01/2010	29.0	0.0	29	19/04/2010	24.0	21.8	46
25/04/2010	29.0	0.0	29	21/10/2010	0.0	21.8	22
7/01/2010	27.0	1.9	29	22/12/2010	0.0	21.2	21
31/01/2010	26.0	10.3	36	16/11/2010	0.0	20.5	21
19/04/2010	24.0	21.8	46	29/12/2010	0.0	20.2	20

Table F-51: Receptor 161 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	7.6	55	10/10/2010	33.0	46.5	79
26/03/2010	39.0	0.0	39	11/10/2010	0.0	45.8	46
20/03/2010	38.0	11.4	49	24/12/2010	0.0	40.6	41
24/02/2010	36.0	15.9	52	3/02/2010	0.0	36.7	37
10/10/2010	33.0	46.5	79	21/09/2010	0.0	36.4	36
13/01/2010	29.0	6.5	36	2/02/2010	0.0	34.9	35
25/04/2010	29.0	0.0	29	27/12/2010	12.0	33.6	46
7/01/2010	27.0	10.6	38	17/11/2010	0.0	32.2	32
31/01/2010	26.0	24.6	51	28/10/2010	24.0	31.1	55
19/04/2010	24.0	18.6	43	4/01/2010	0.0	30.5	31

Table F-52: Receptor 180 - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	6.5	54	3/02/2010	0.0	33.3	33
26/03/2010	39.0	0.0	39	24/01/2010	0.0	32.9	33
20/03/2010	38.0	4.2	42	7/02/2010	0.0	32.7	33
24/02/2010	36.0	21.5	57	31/01/2010	26.0	32.6	59
10/10/2010	33.0	20.4	53	28/12/2010	0.0	31.1	31
13/01/2010	29.0	9.6	39	30/11/2010	0.0	30.4	30
25/04/2010	29.0	0.0	29	24/12/2010	0.0	30.1	30
7/01/2010	27.0	18.3	45	2/03/2010	16.0	30.0	46
31/01/2010	26.0	32.6	59	11/10/2010	0.0	29.9	30
19/04/2010	24.0	13.5	37	2/02/2010	0.0	29.4	29

Table F-53: Receptor 186N - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	3.3	50	10/10/2010	33.0	22.2	55
26/03/2010	39.0	0.0	39	11/10/2010	0.0	21.8	22
20/03/2010	38.0	4.5	43	24/12/2010	0.0	16.7	17
24/02/2010	36.0	6.1	42	9/02/2010	0.0	15.6	16
10/10/2010	33.0	22.2	55	2/10/2010	0.0	15.1	15
13/01/2010	29.0	0.6	30	27/12/2010	12.0	14.8	27
25/04/2010	29.0	0.0	29	21/09/2010	0.0	14.7	15
7/01/2010	27.0	2.3	29	1/02/2010	0.0	14.0	14
31/01/2010	26.0	10.9	37	17/11/2010	0.0	13.1	13
19/04/2010	24.0	10.0	34	22/12/2010	0.0	12.9	13

Table F-54: Receptor 186S - Year 24

PM10 24-hour average (µg/m³)							
Date	Background	Predicted increment	Total	Date	Background	Highest predicted increment	Total
1/05/2010	47.0	2.9	50	10/10/2010	33.0	16.4	49
26/03/2010	39.0	0.0	39	9/02/2010	0.0	15.4	15
20/03/2010	38.0	4.8	43	11/10/2010	0.0	14.8	15
24/02/2010	36.0	3.2	39	22/12/2010	0.0	13.5	13
10/10/2010	33.0	16.4	49	5/01/2010	0.0	12.5	12
13/01/2010	29.0	0.1	29	14/12/2010	0.0	12.3	12
25/04/2010	29.0	0.0	29	1/02/2010	0.0	12.2	12
7/01/2010	27.0	1.2	28	17/04/2010	0.0	12.1	12
31/01/2010	26.0	7.7	34	16/11/2010	0.0	12.0	12
19/04/2010	24.0	9.5	34	22/11/2010	0.0	11.8	12

Appendix G

Isopleth Diagrams - Diesel emissions NO_2 assessment

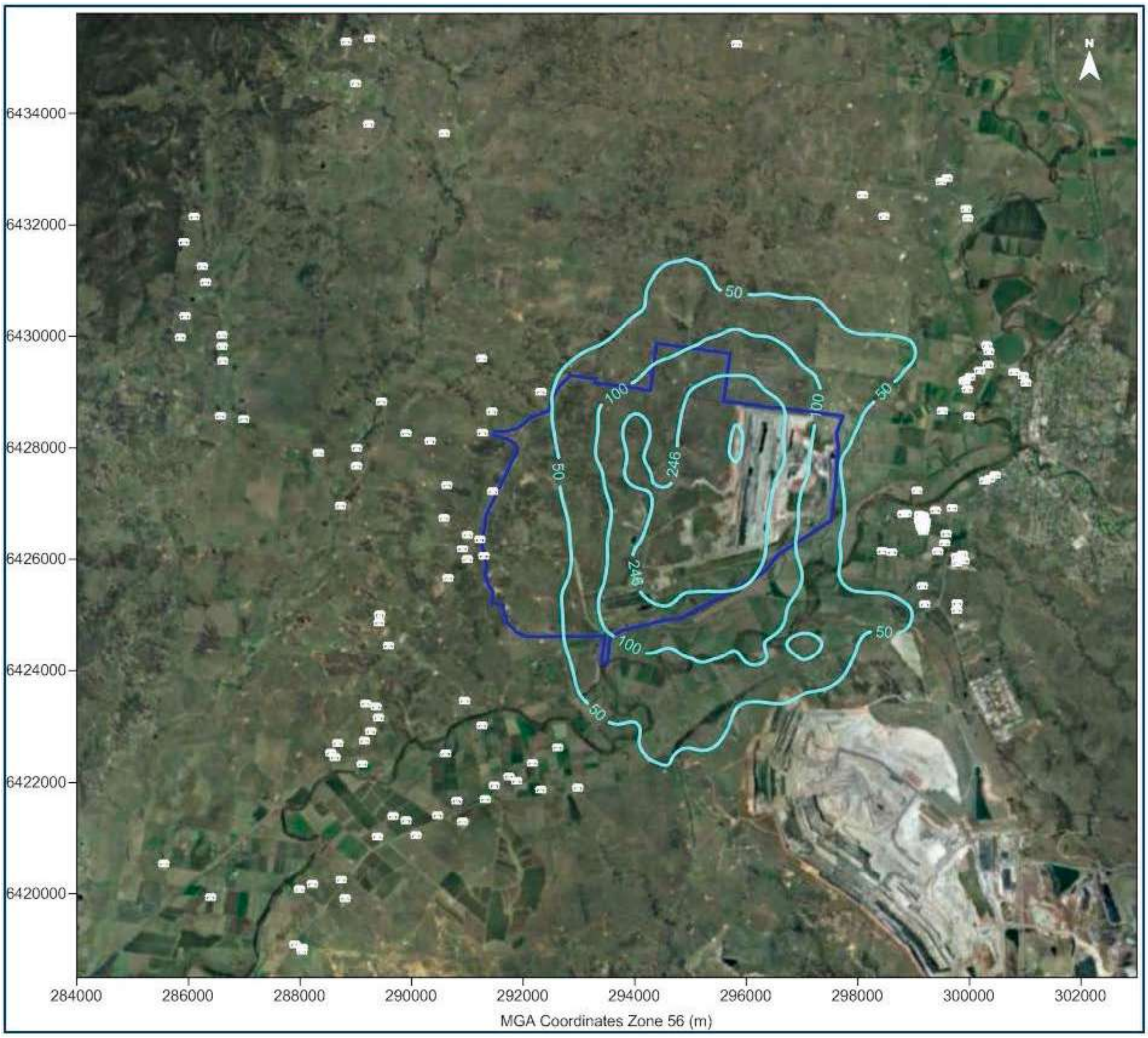

Figure G-1: Predicted 1-hour average NO_2 concentrations from the Project in Year 1 (µg/m³)

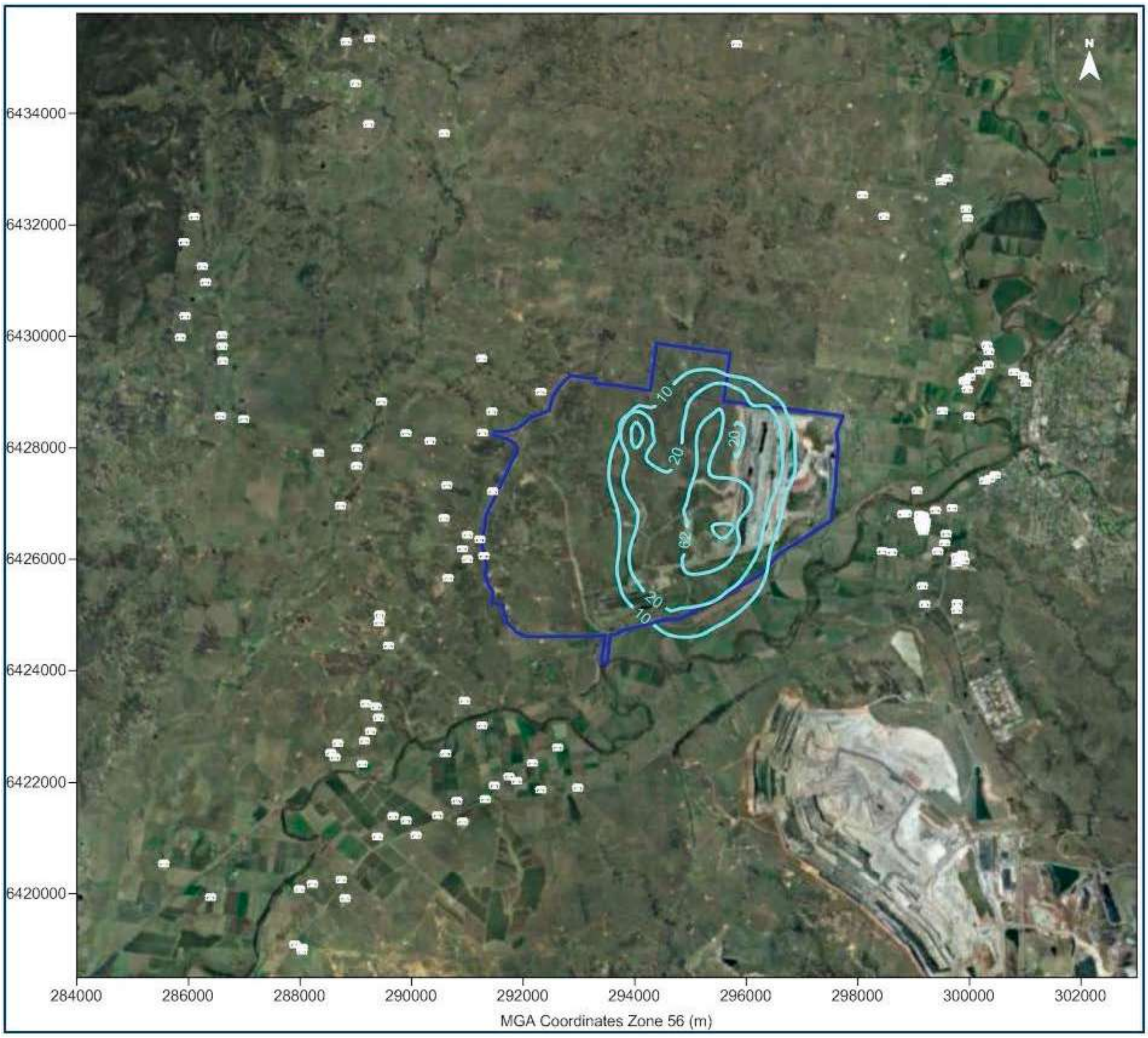

Figure G-2: Predicted annual average NO_2 concentrations from the Project in Year 1 (µg/m³)

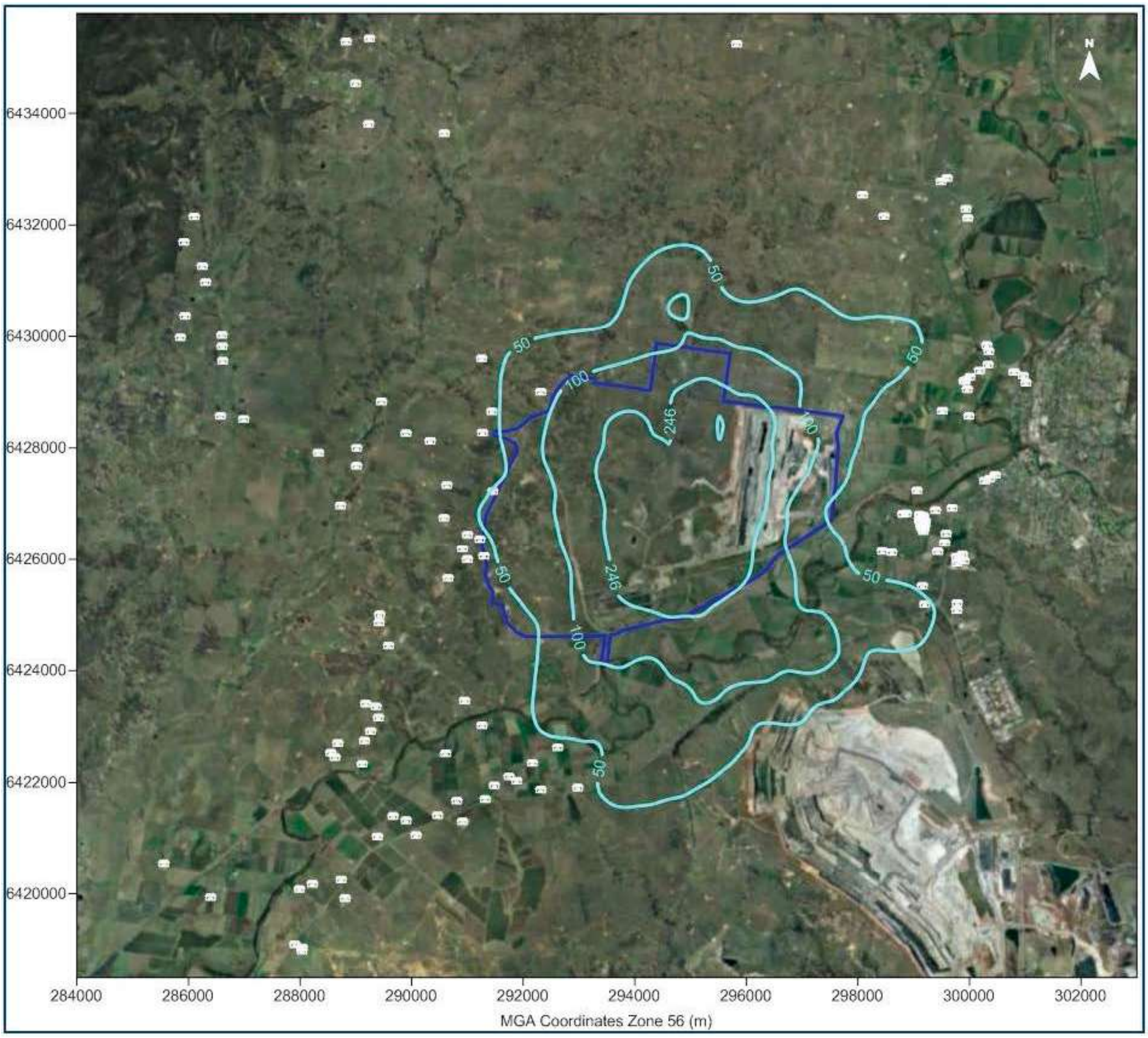

Figure G-3: Predicted 1-hour average NO_2 concentrations from the Project in Year 4 (µg/m³)

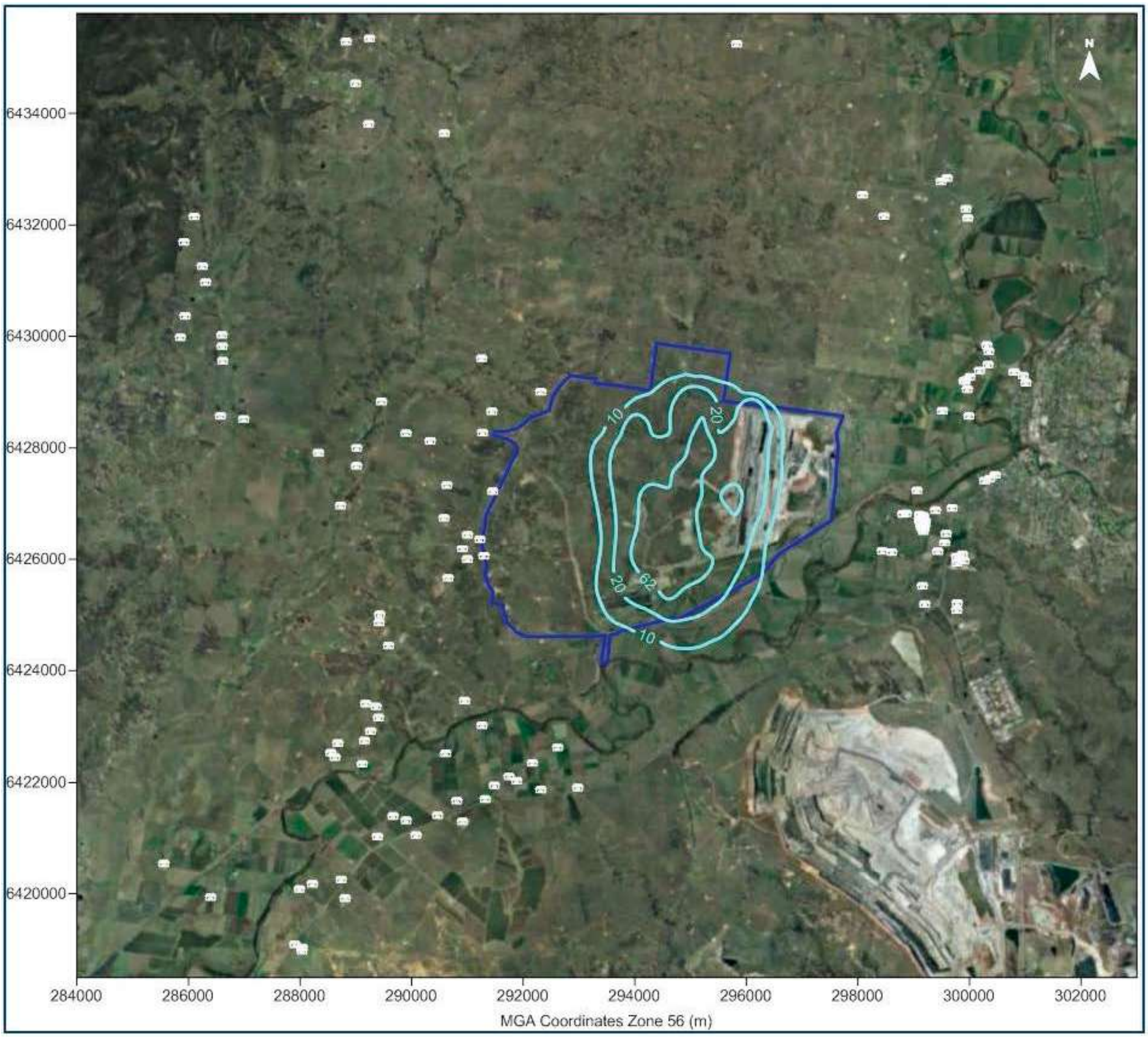

Figure G-4: Predicted annual average NO_2 concentrations from the Project in Year 4 (µg/m³)

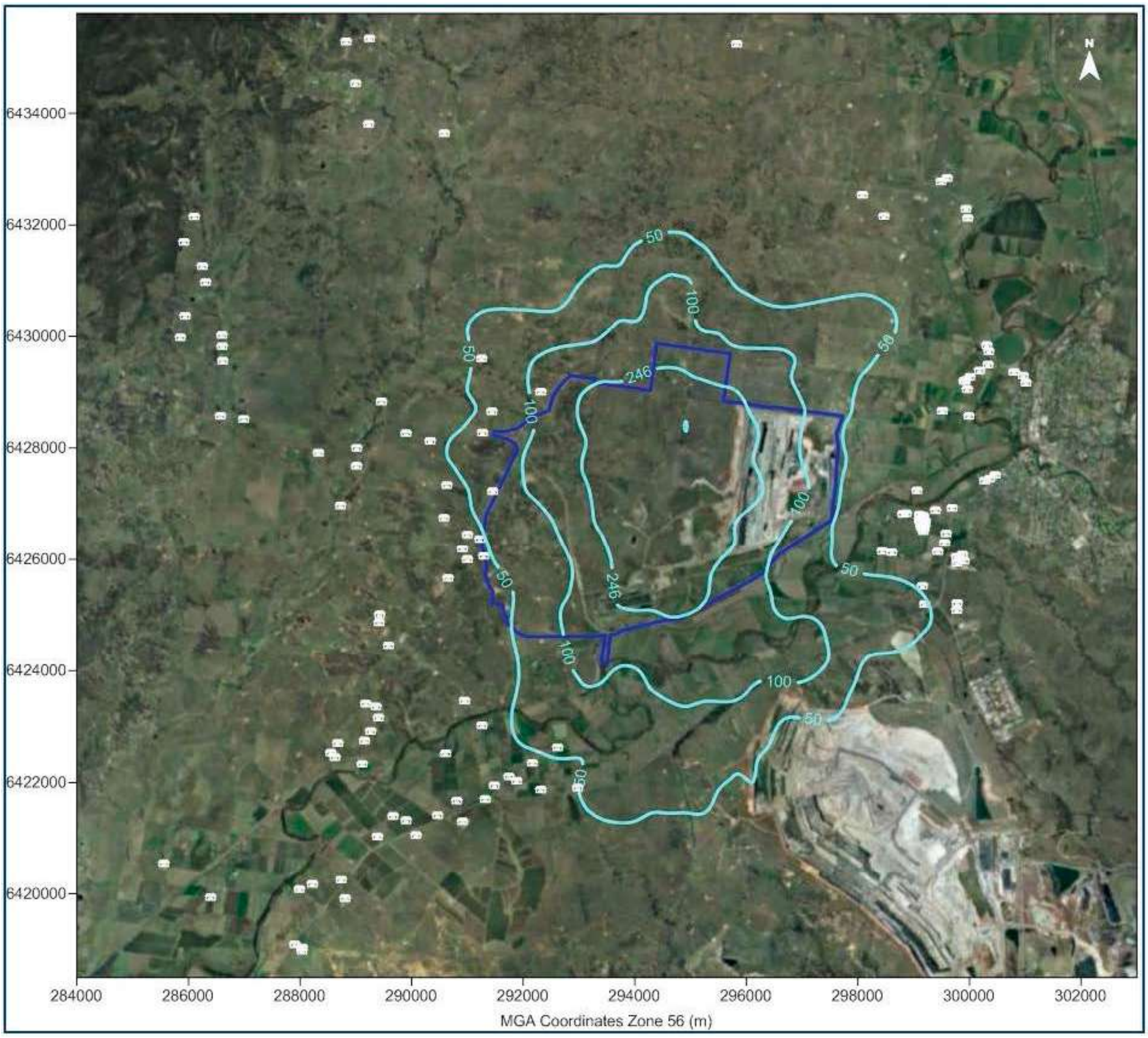

Figure G-5: Predicted 1-hour average NO_2 concentrations from the Project in Year 8 (µg/m³)

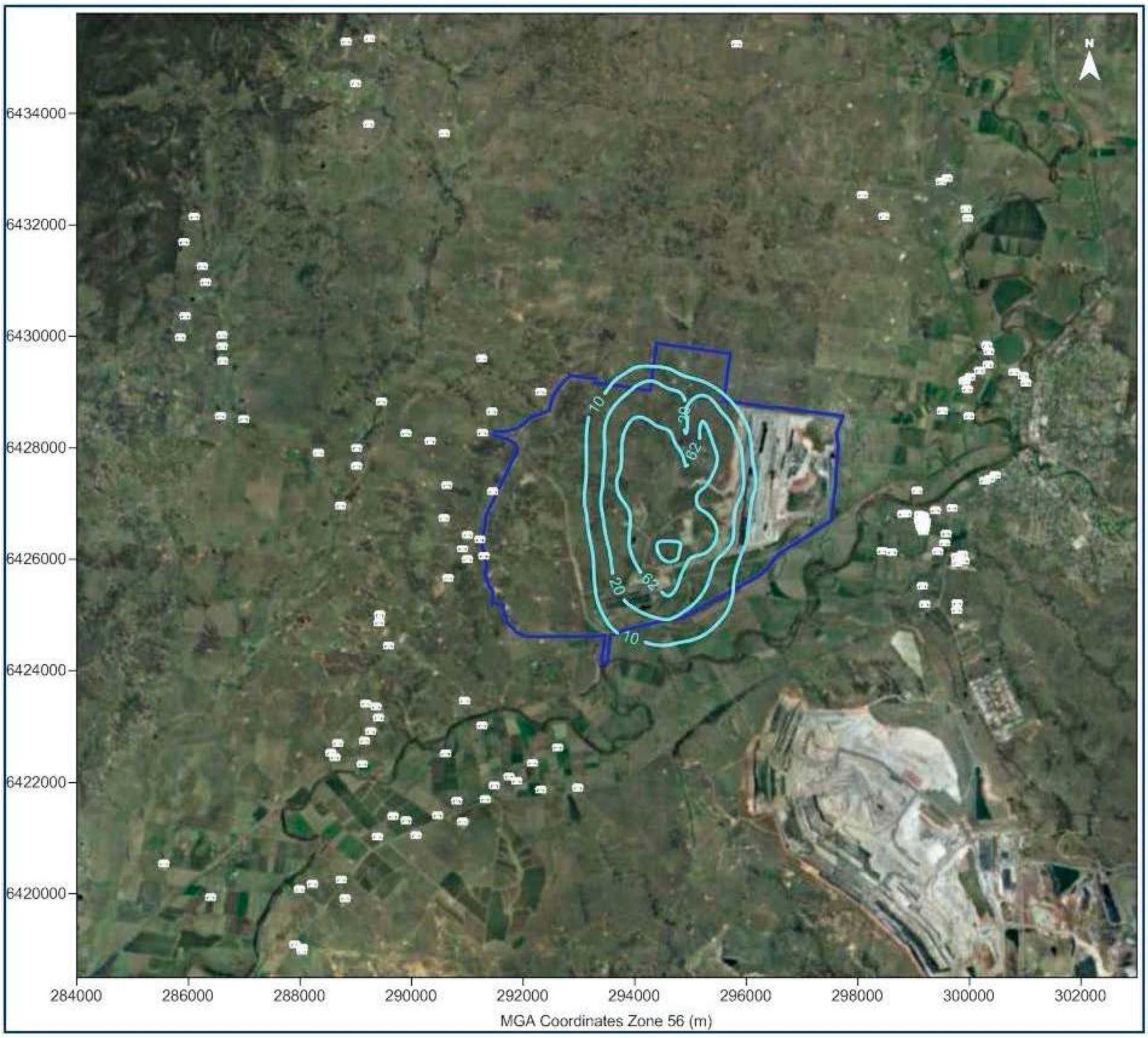

Figure G-6: Predicted annual average NO_2 concentrations from the Project in Year 8 (µg/m³)

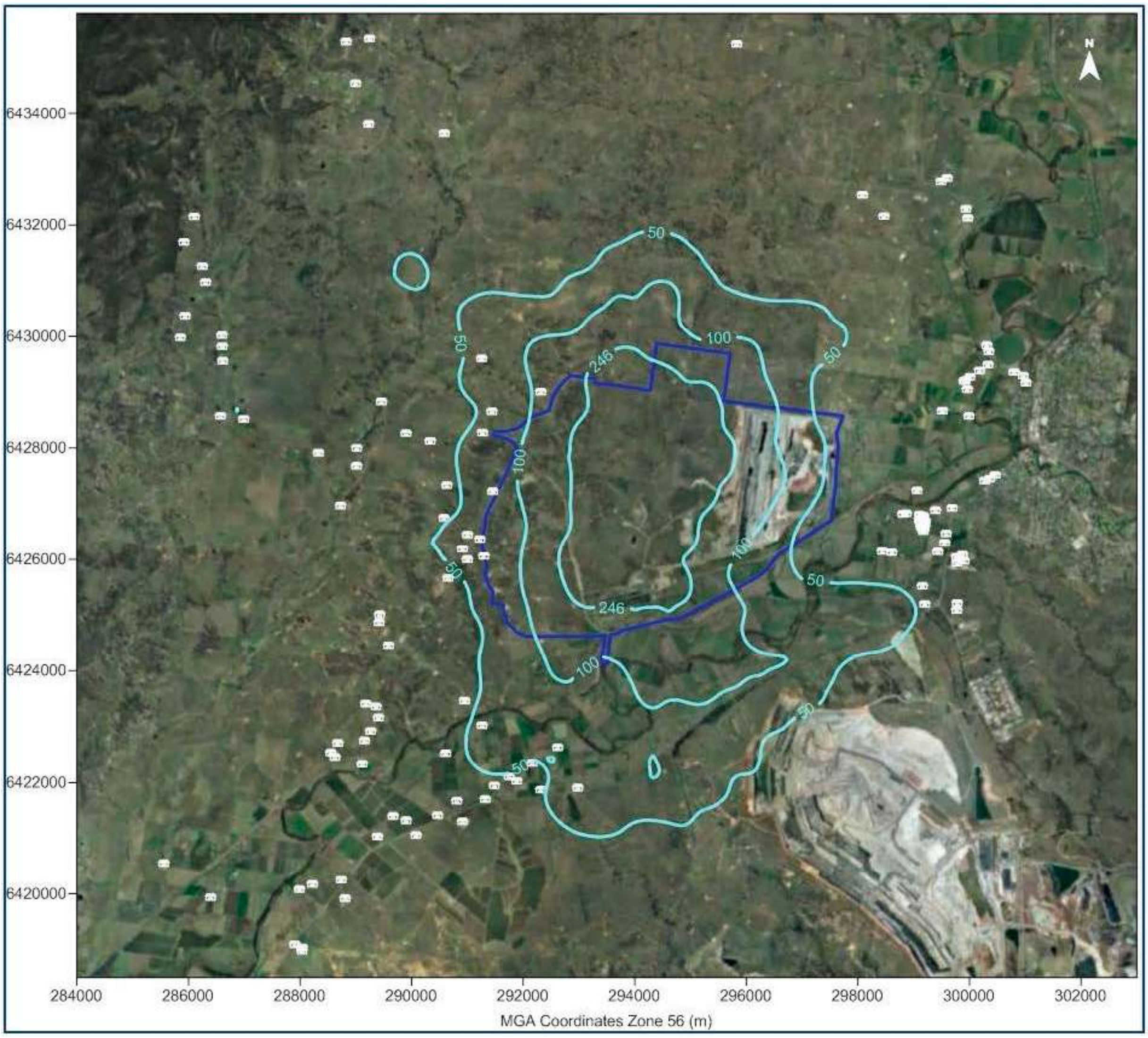

Figure G-7: Predicted 1-hour average NO_2 concentrations from the Project in Year 15 (µg/m³)

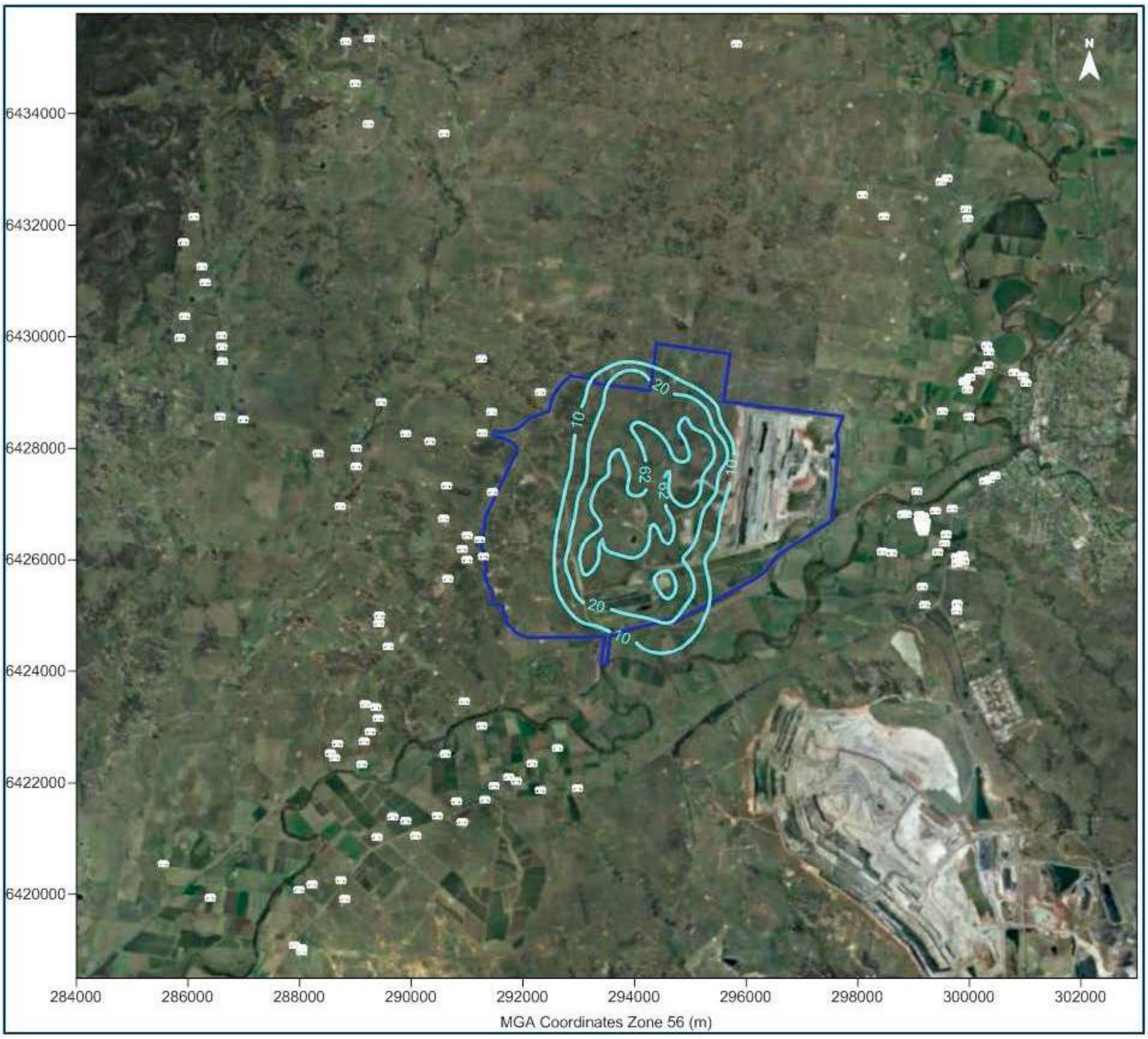

Figure G-8: Predicted annual average NO_2 concentrations from the Project in Year 15 (µg/m³)

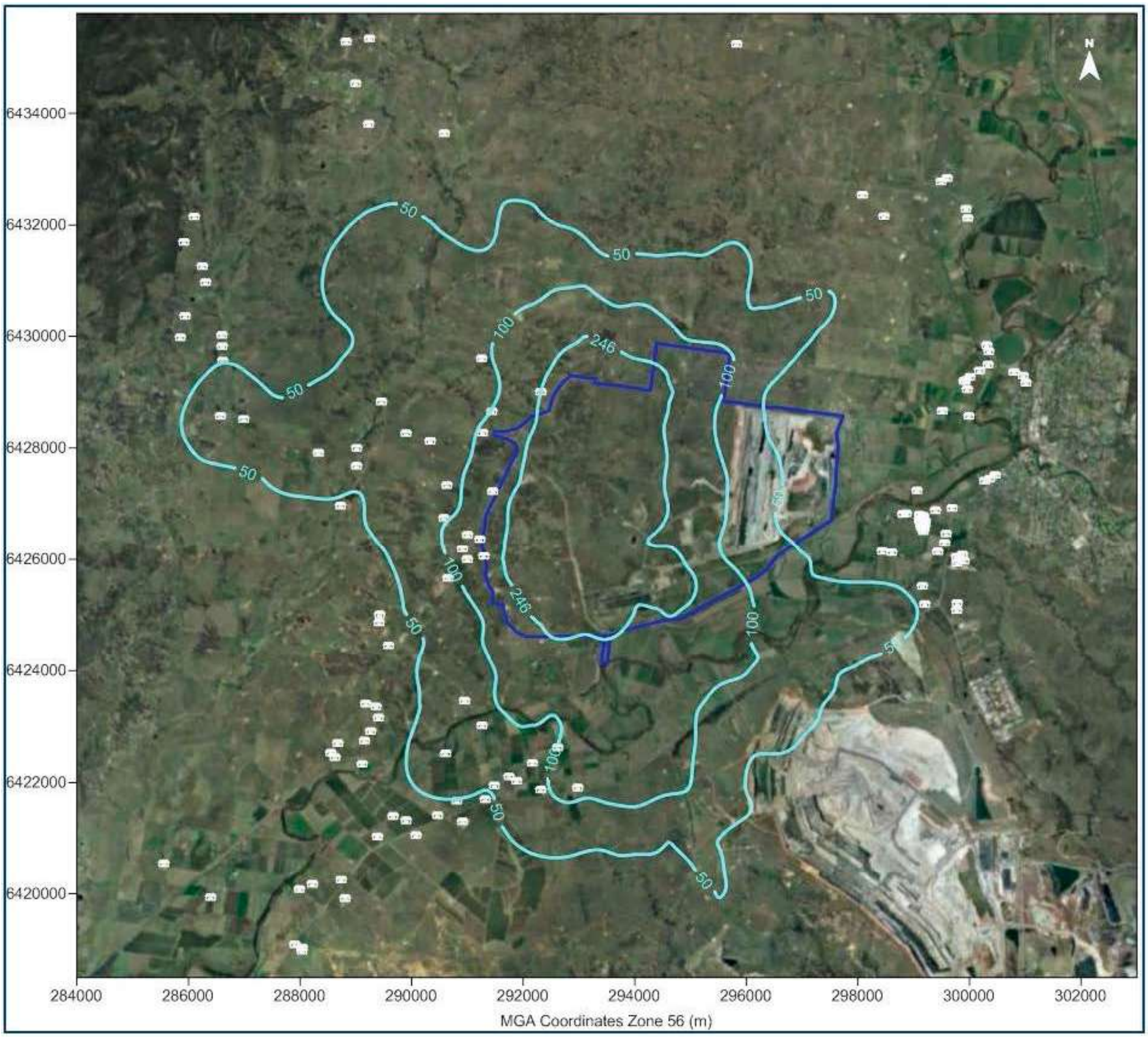

Figure G-9: Predicted 1-hour average NO_2 concentrations from the Project in Year 24 (µg/m³)

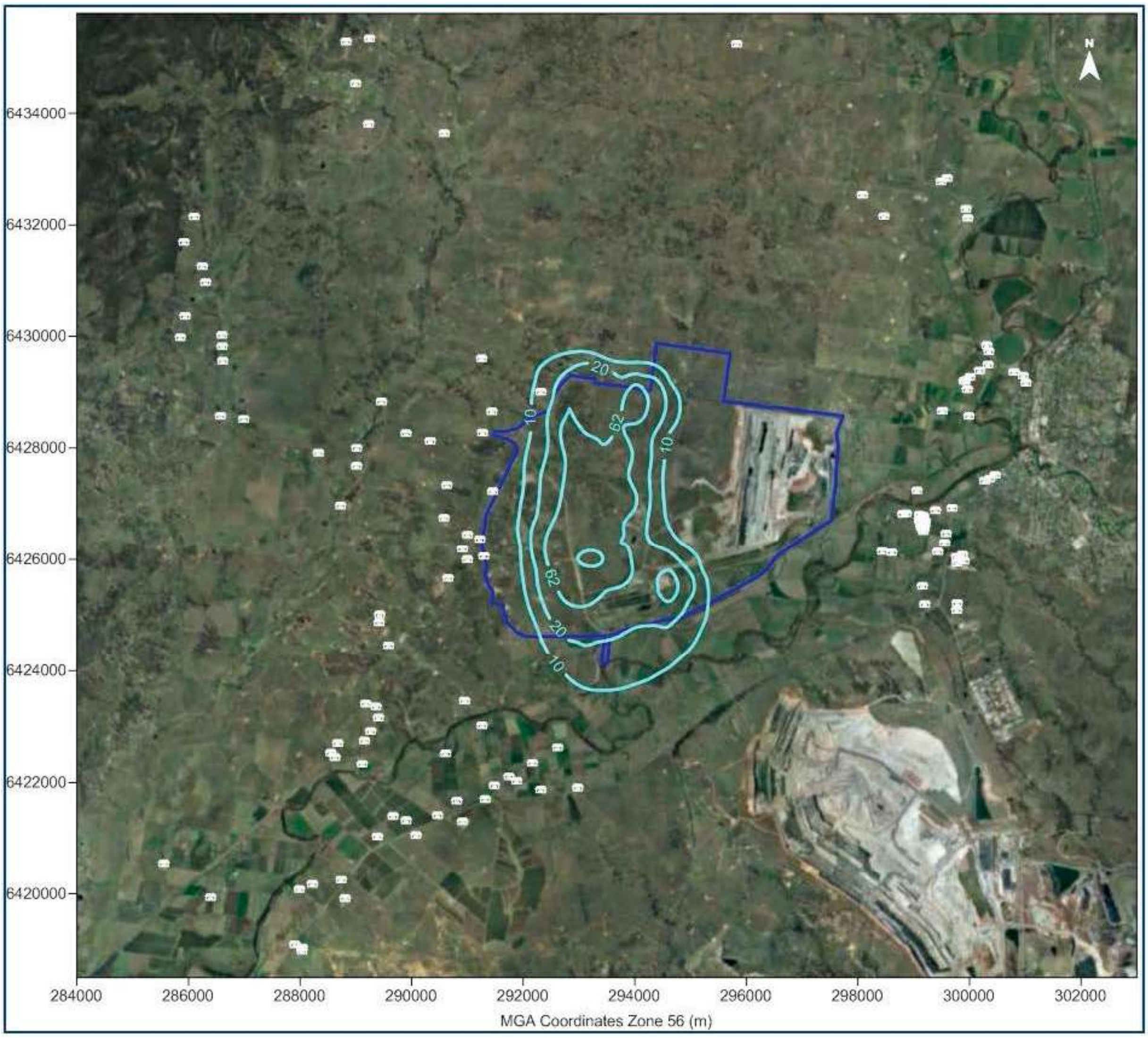

Figure G-10: Predicted annual average NO_2 concentrations from the Project in Year 24 (µg/m³)

Appendix H

Isopleth Diagrams - Blast emissions

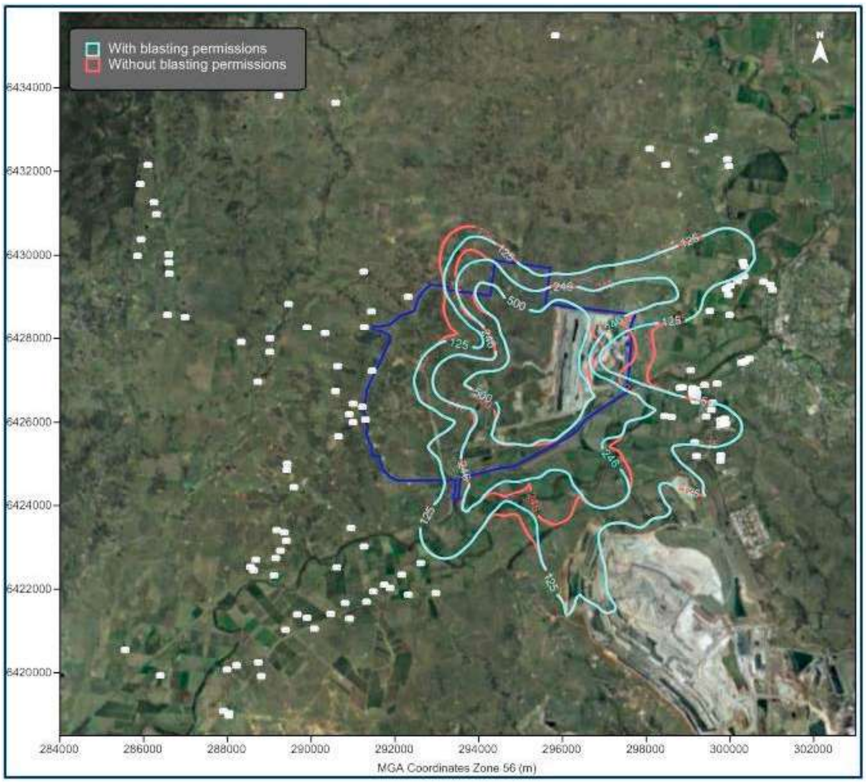

Figure H-1: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 07:00 (NO_2 concentrations µg/m³)

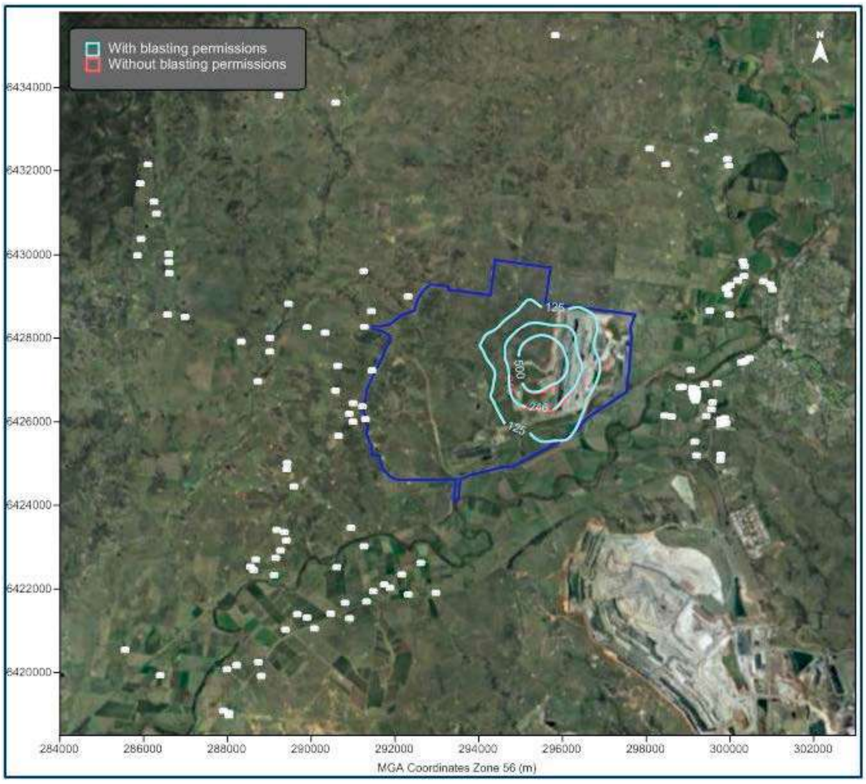

Figure H-2: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 08:00 (NO_2 concentrations µg/m³)

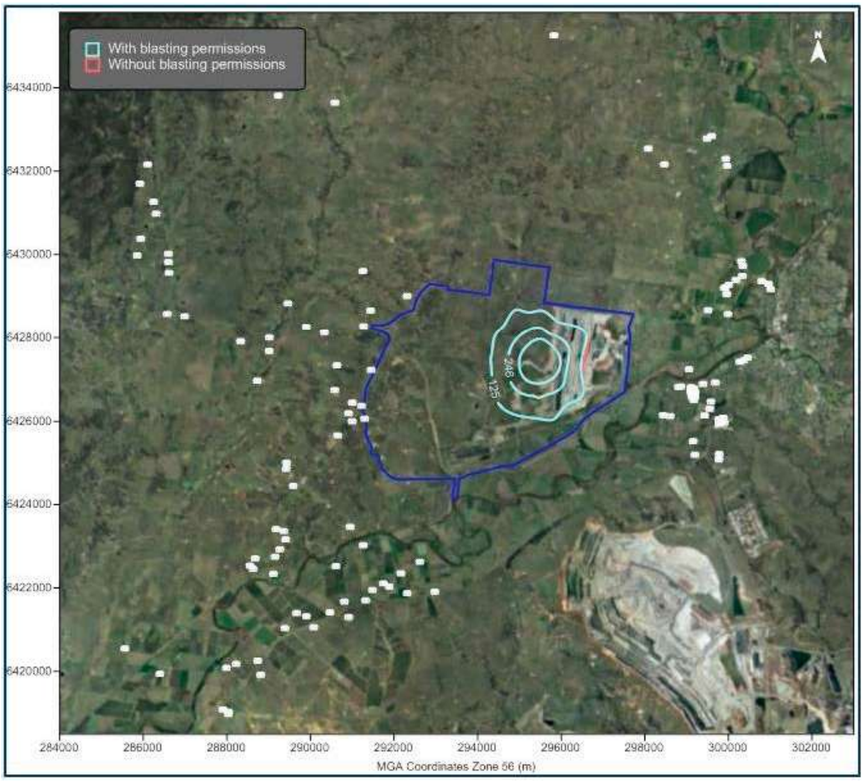

Figure H-3: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 09:00 (NO_2 concentrations µg/m³)

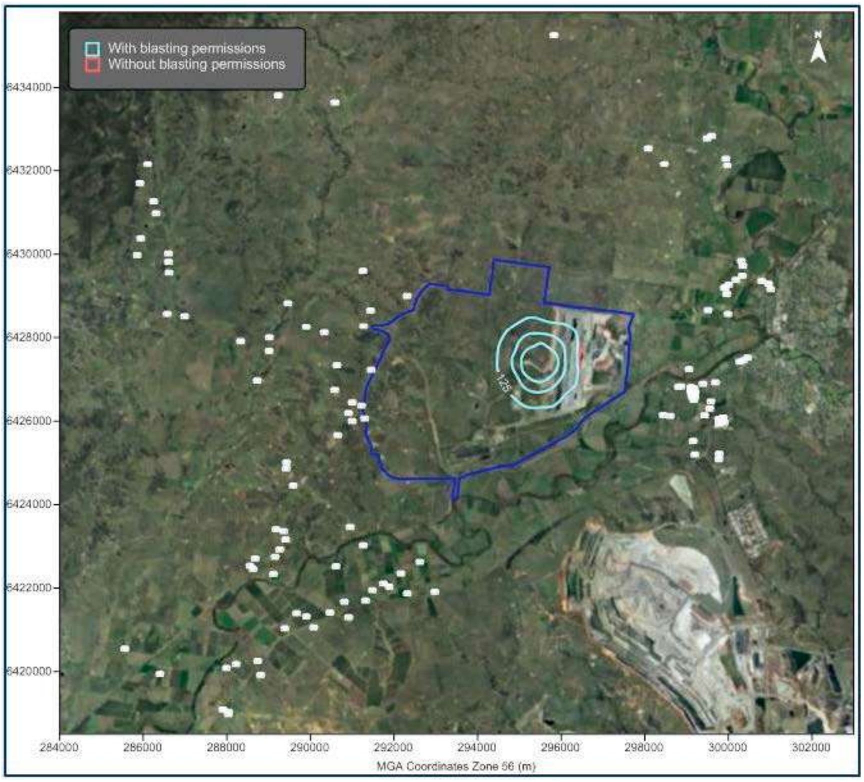

Figure H-4: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 10:00 (NO_2 concentrations µg/m³)

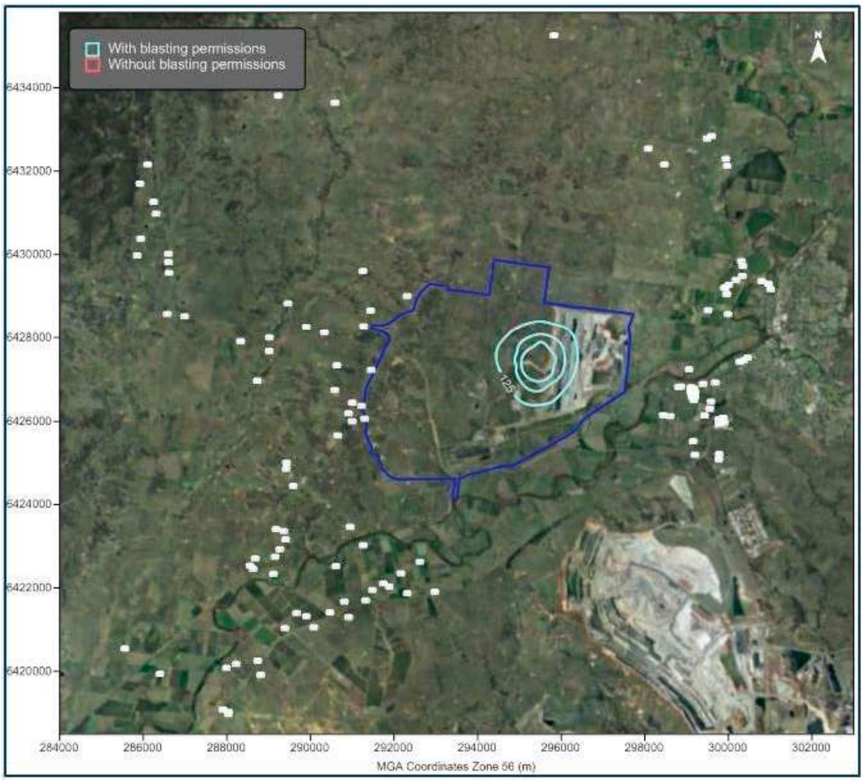

Figure H-5: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 11:00 (NO_2 concentrations µg/m³)

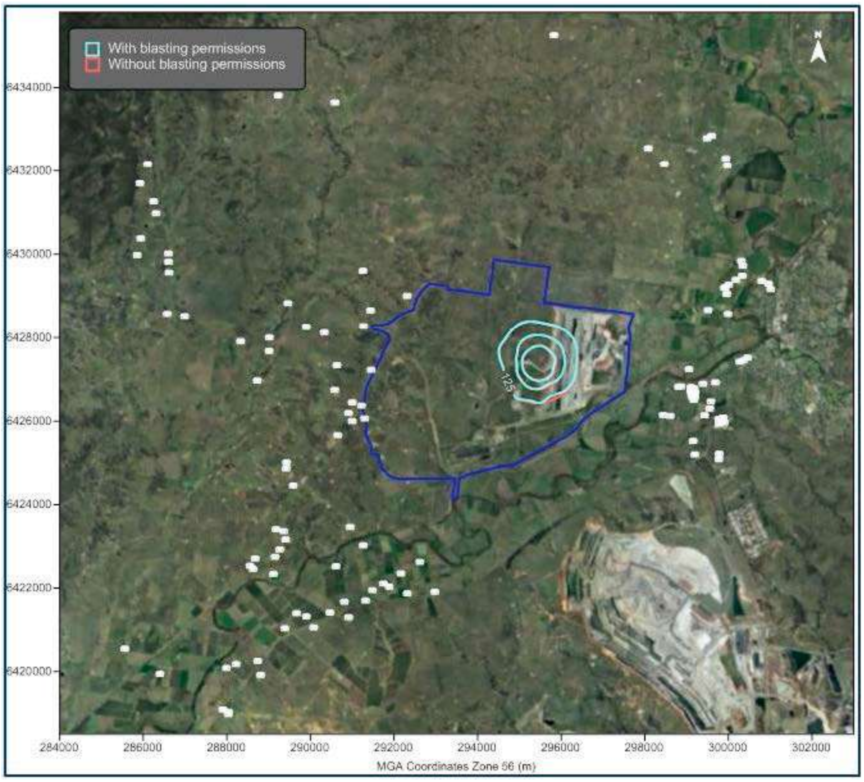

Figure H-6: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 12:00 (NO_2 concentrations µg/m³)

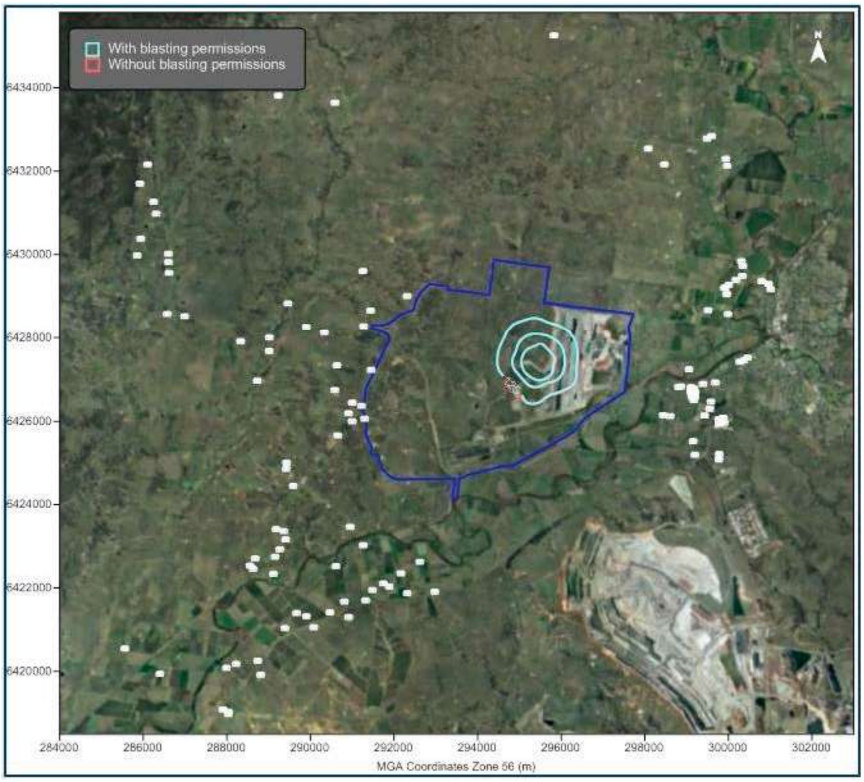

Figure H-7: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 13:00 (NO_2 concentrations µg/m³)

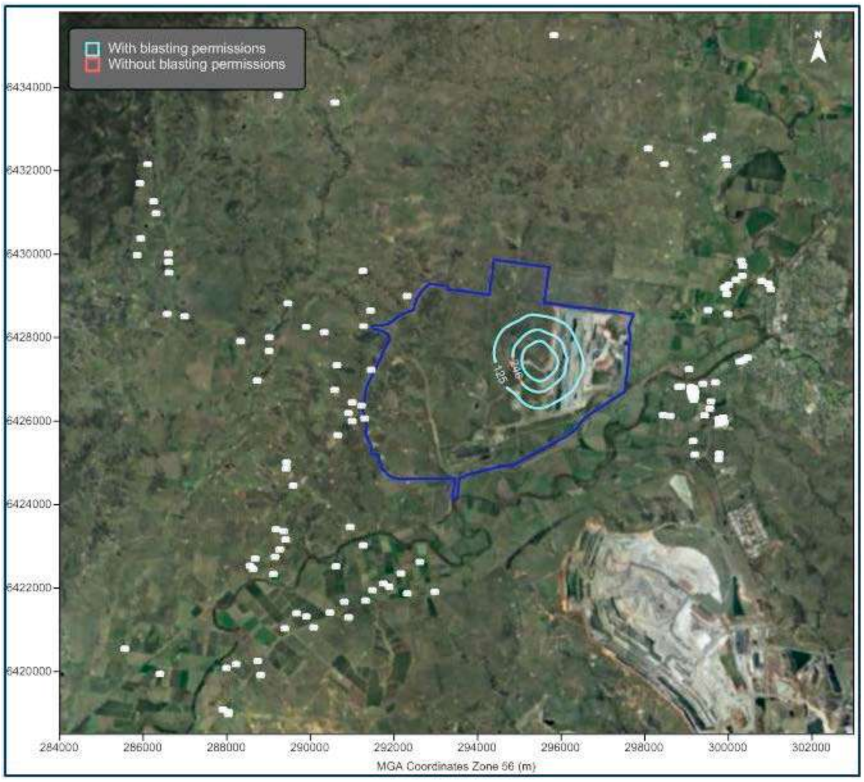

Figure H-8: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 14:00 (NO_2 concentrations µg/m³)

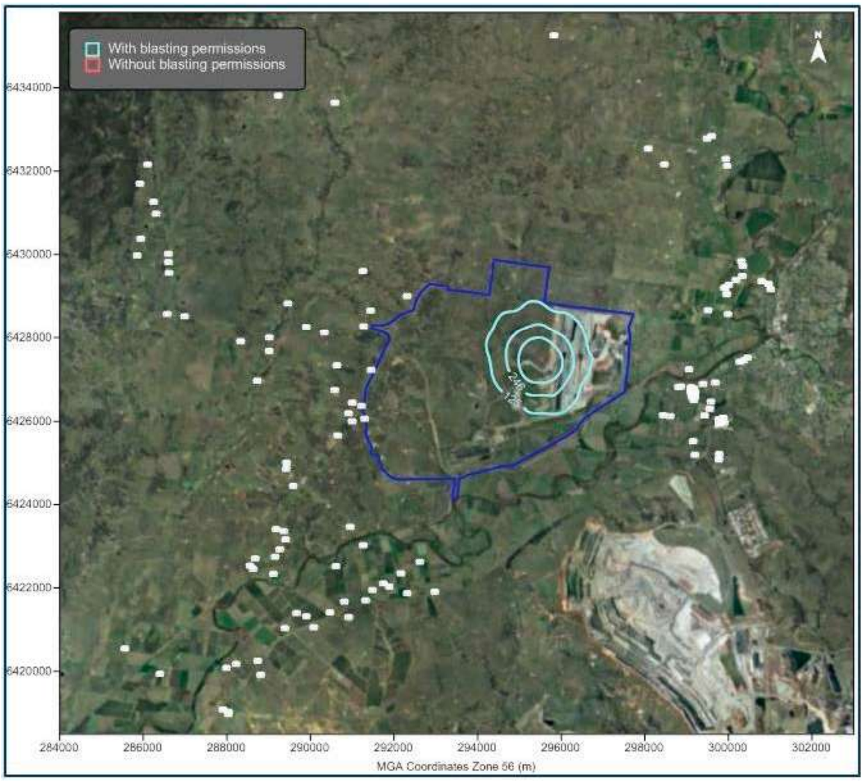

Figure H-9: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 15:00 (NO_2 concentrations µg/m³)

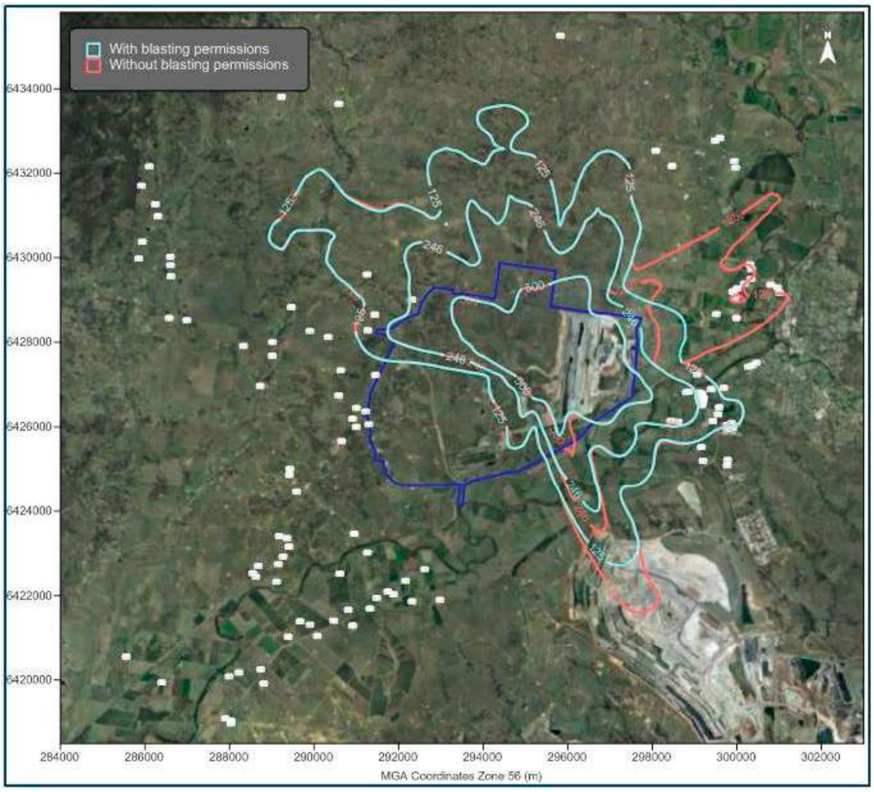

Figure H-10: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 16:00 (NO_2 concentrations µg/m³)

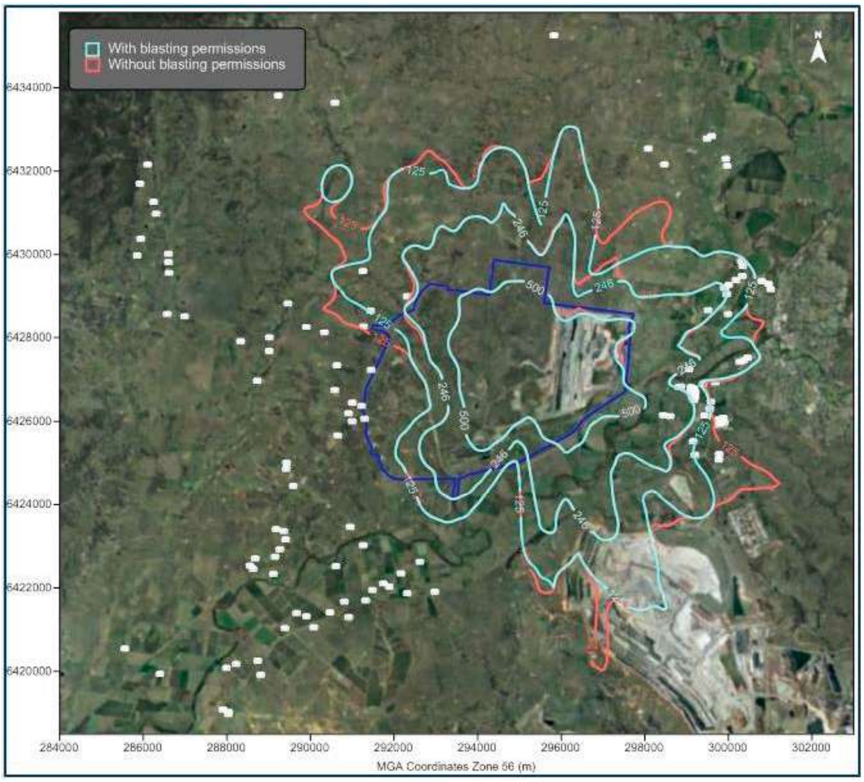

Figure H-11: Predicted maximum 1-hour average blast emissions from the Project in Year 1 - 17:00 (NO_2 concentrations µg/m³)

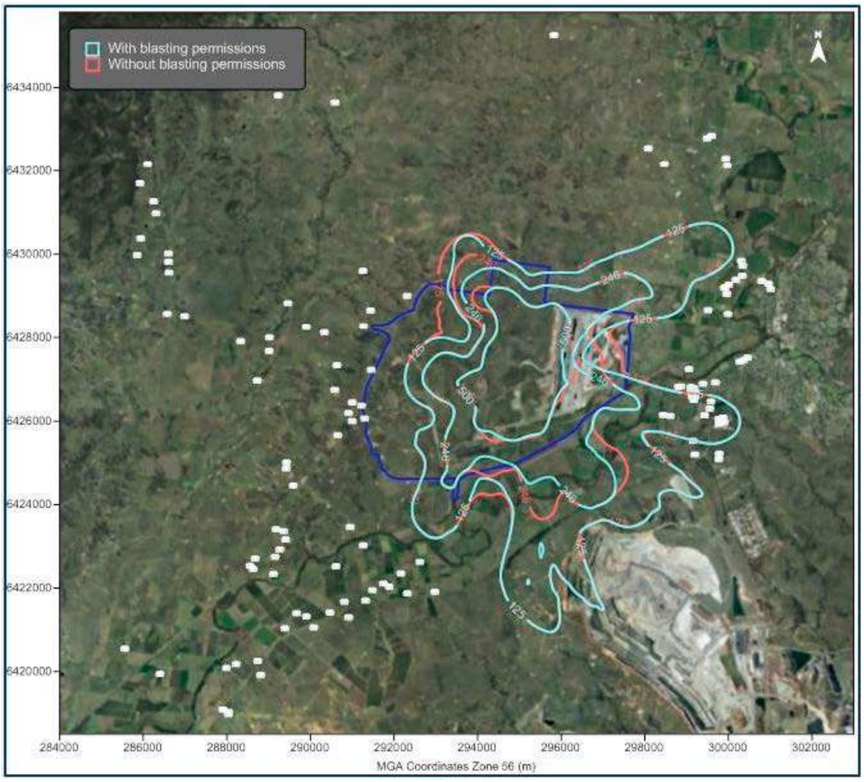

Figure H-12: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 07:00 (NO_2 concentrations µg/m³)

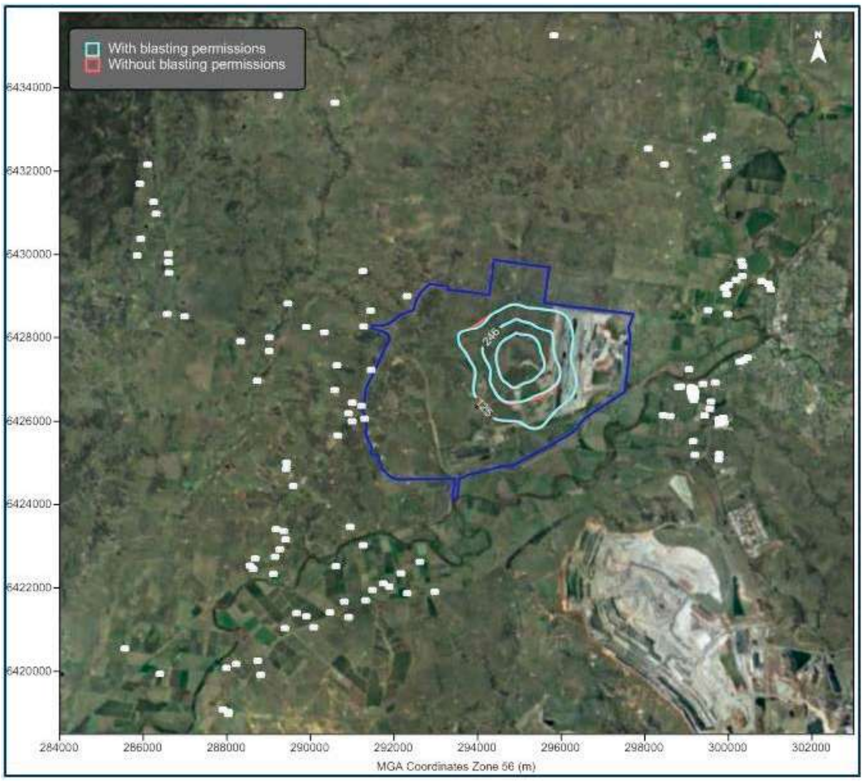

Figure H-13: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 08:00 (NO_2 concentrations µg/m³)

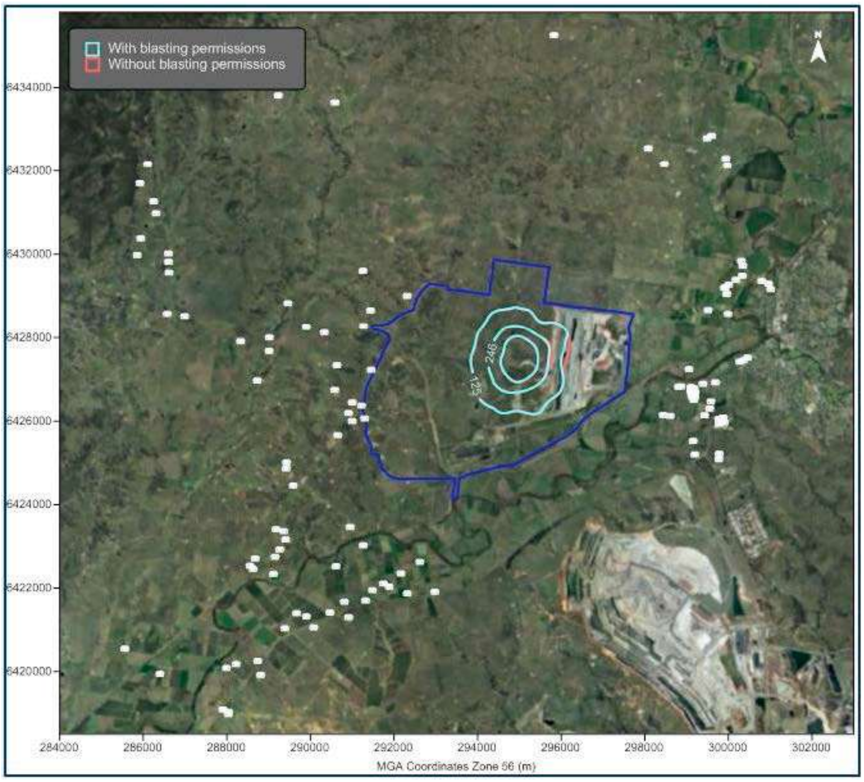

Figure H-14: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 09:00 (NO_2 concentrations µg/m³)

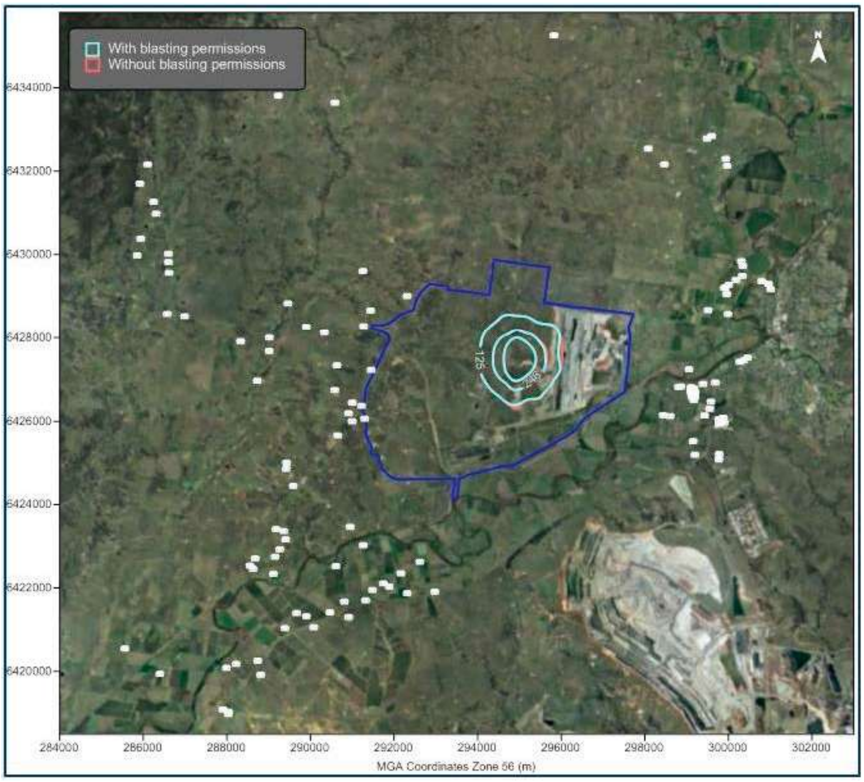

Figure H-15: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 10:00 (NO_2 concentrations µg/m³)

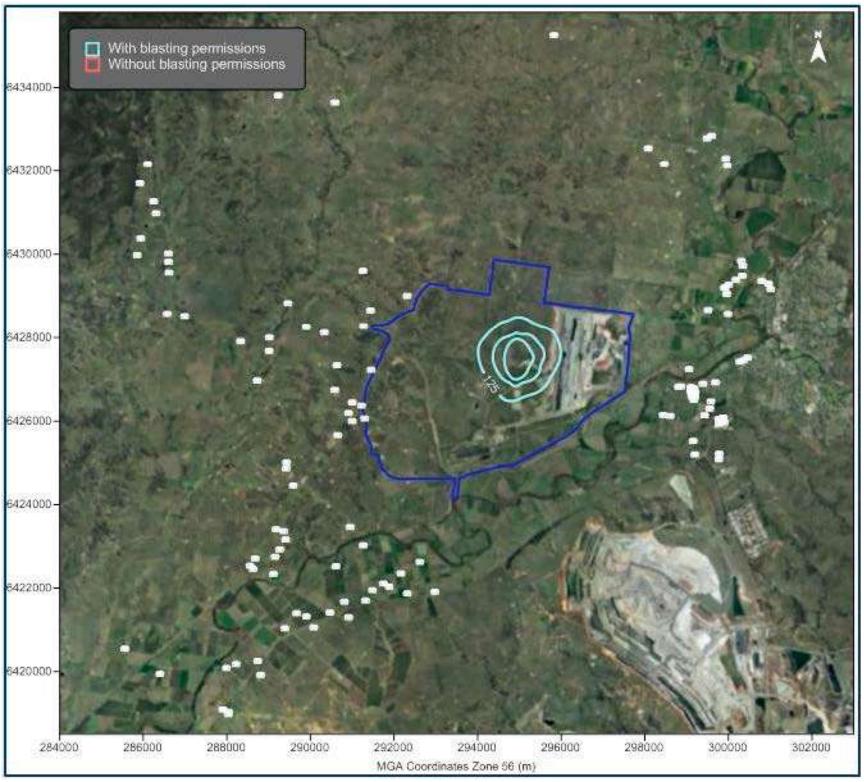

Figure H-16: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 11:00 (NO_2 concentrations µg/m³)

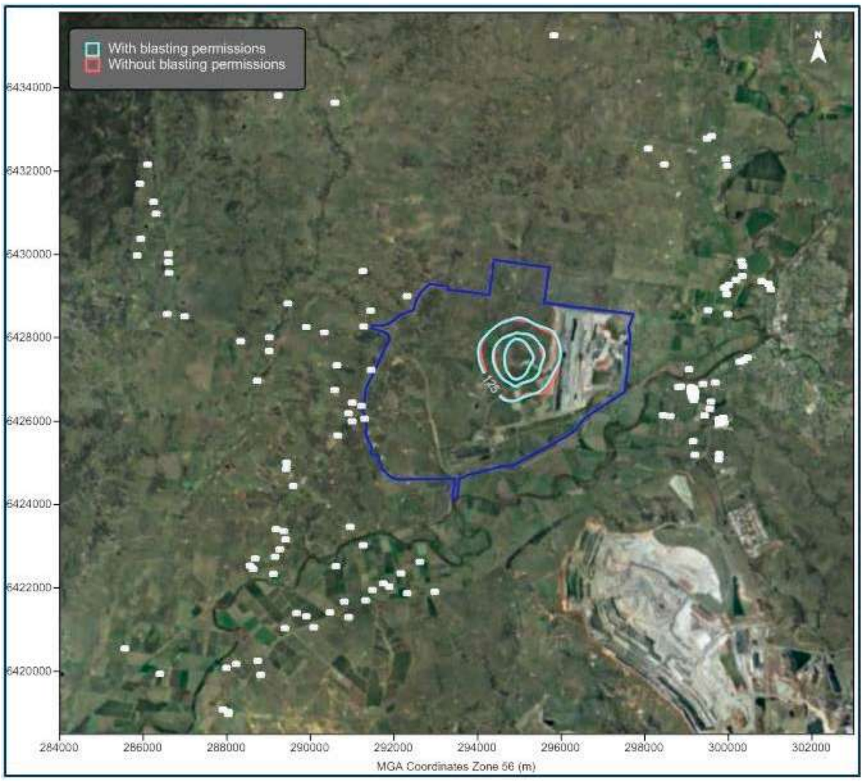

Figure H-17: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 12:00 (NO_2 concentrations µg/m³)

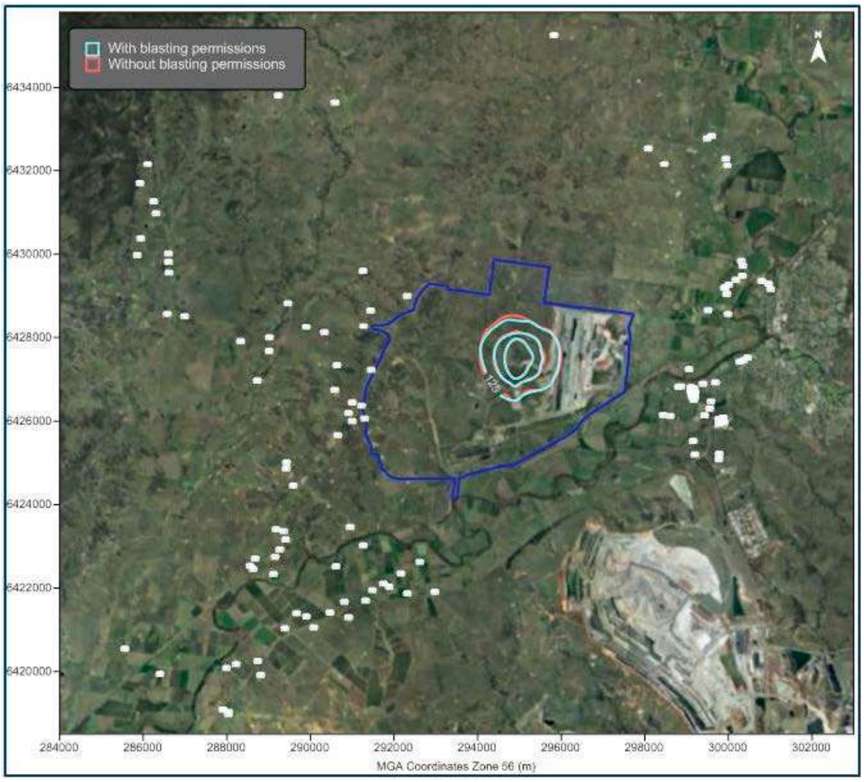

Figure H-18: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 13:00 (NO_2 concentrations µg/m³)

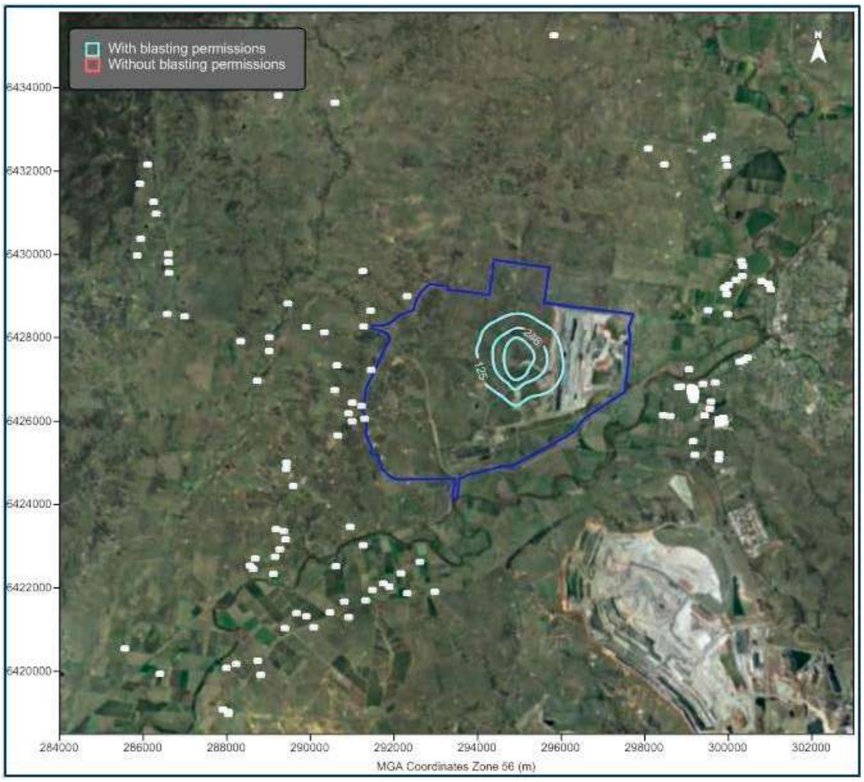

Figure H-19: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 14:00 (NO_2 concentrations µg/m³)

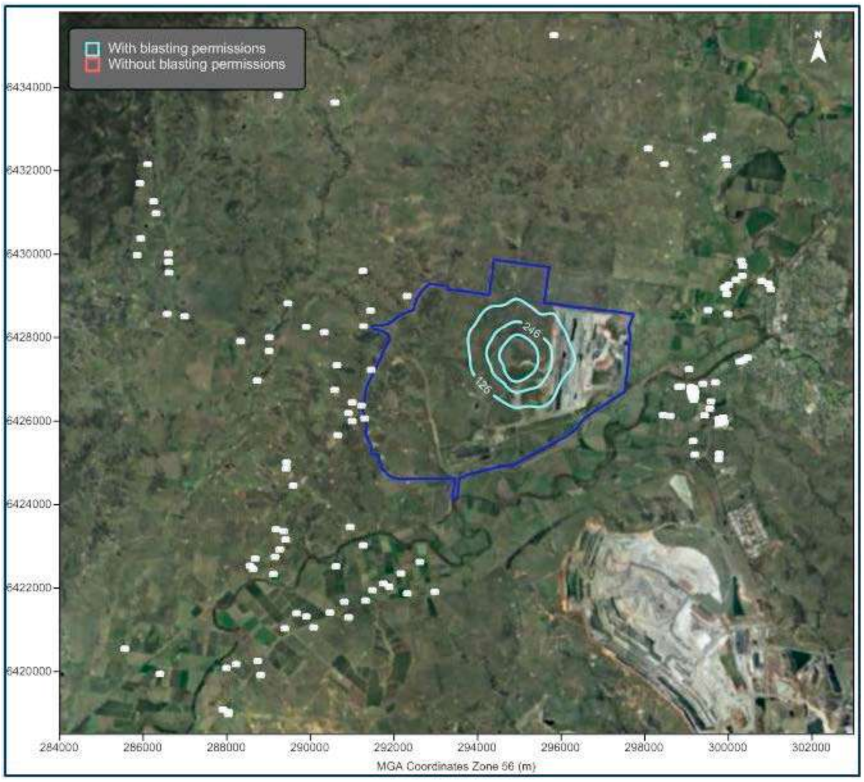

Figure H-20: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 15:00 (NO_2 concentrations µg/m³)

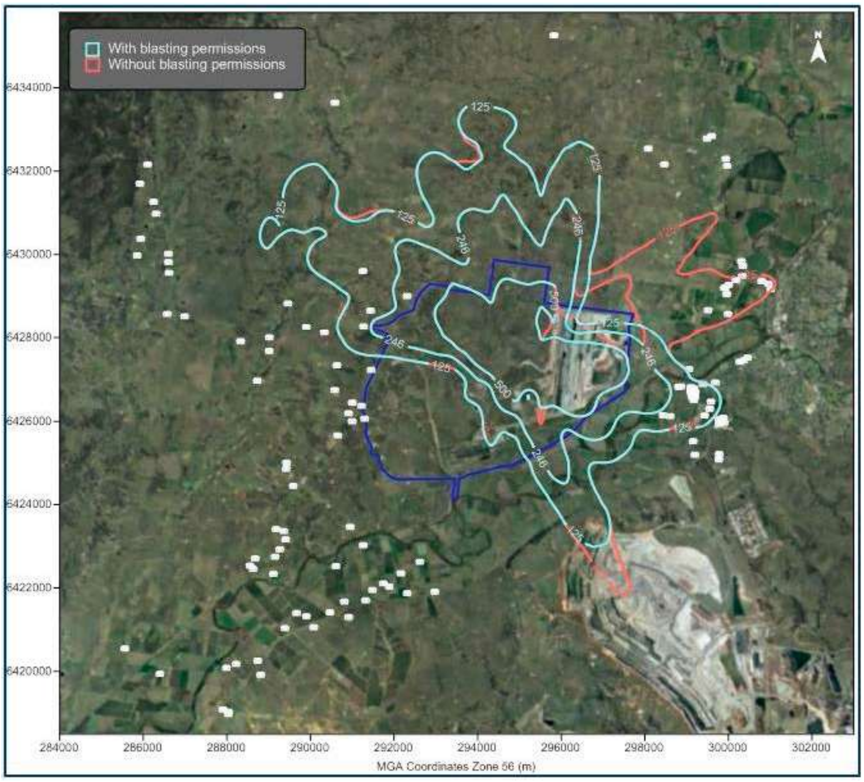

Figure H-21: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 16:00 (NO_2 concentrations µg/m³)

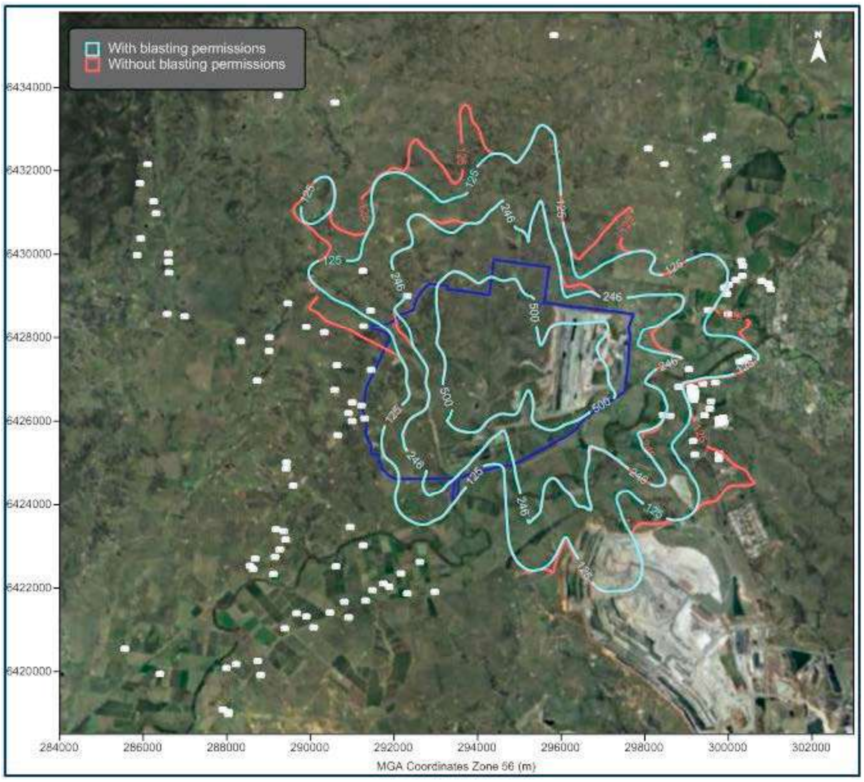

Figure H-22: Predicted maximum 1-hour average blast emissions from the Project in Year 4 - 17:00 (NO_2 concentrations µg/m³)

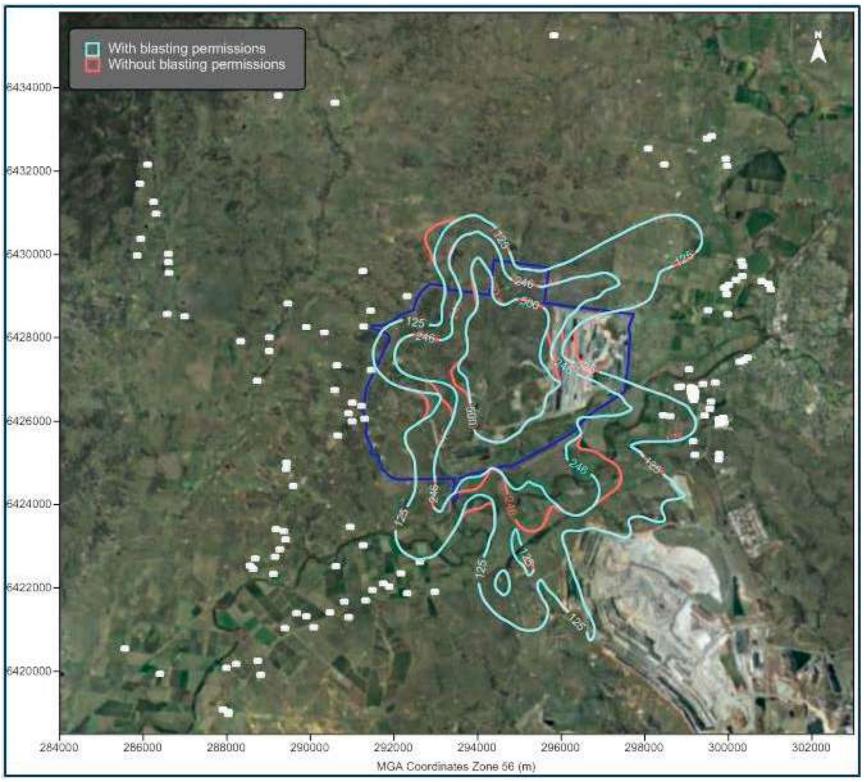

Figure H-23: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 07:00 (NO_2 concentrations µg/m³)

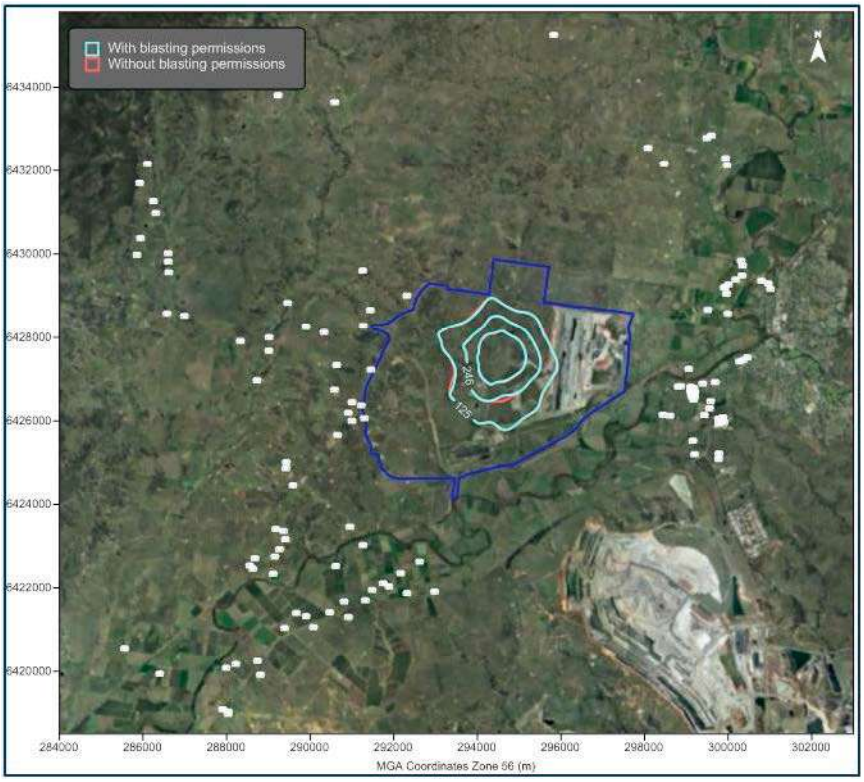

Figure H-24: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 08:00 (NO_2 concentrations µg/m³)

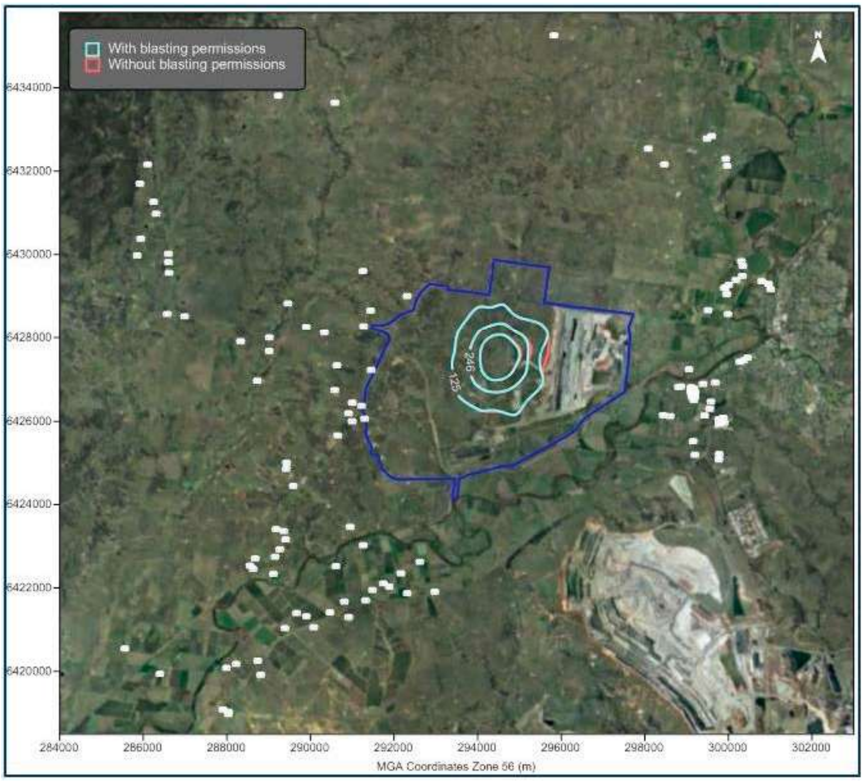

Figure H-25: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 09:00 (NO_2 concentrations µg/m³)

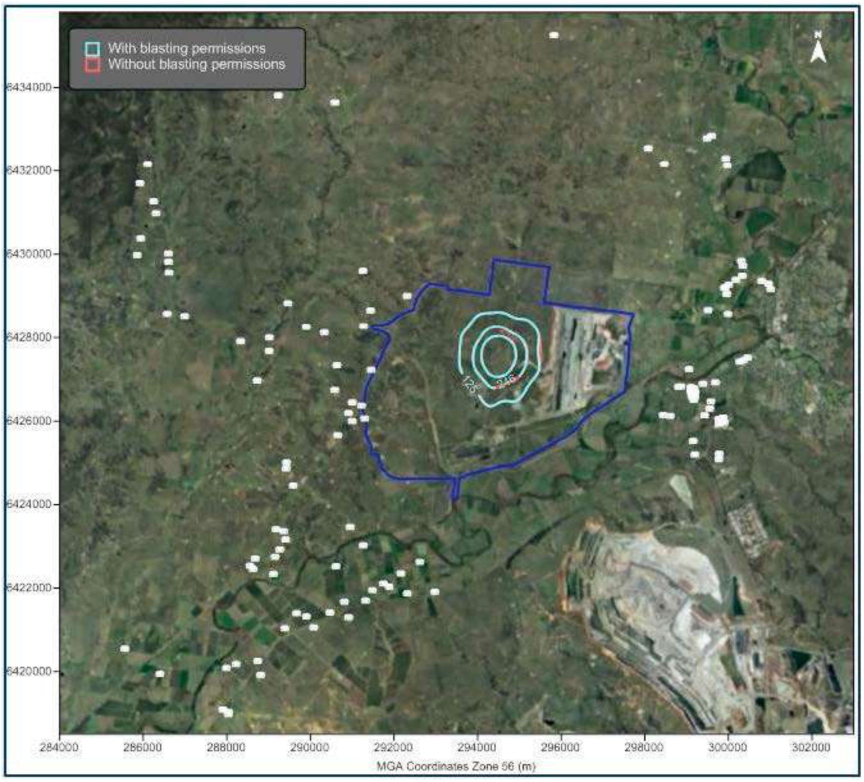

Figure H-26: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 10:00 (NO_2 concentrations µg/m³)

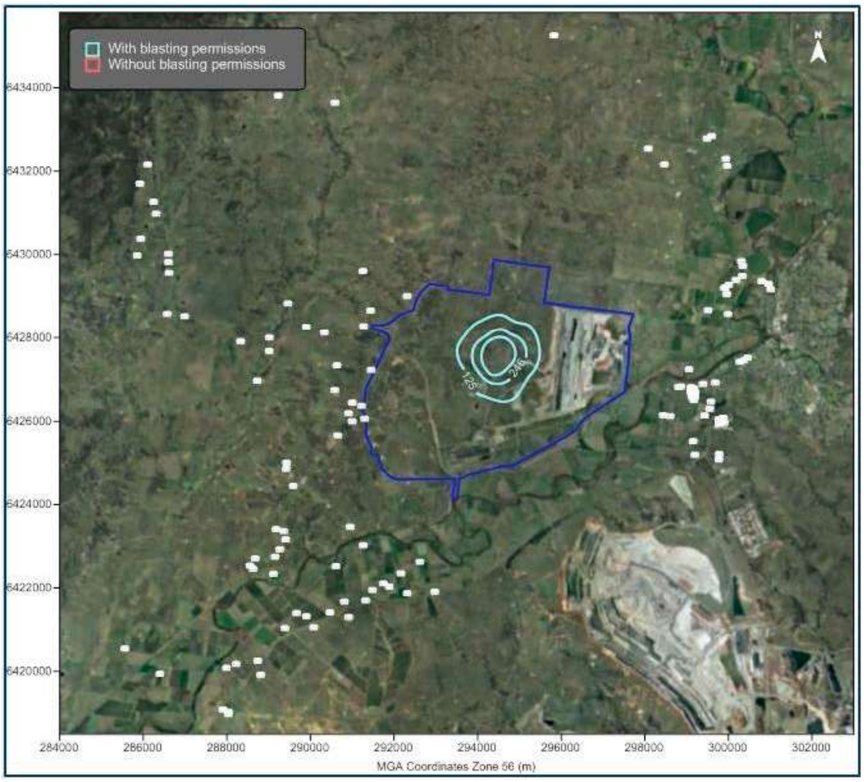

Figure H-27: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 11:00 (NO_2 concentrations µg/m³)

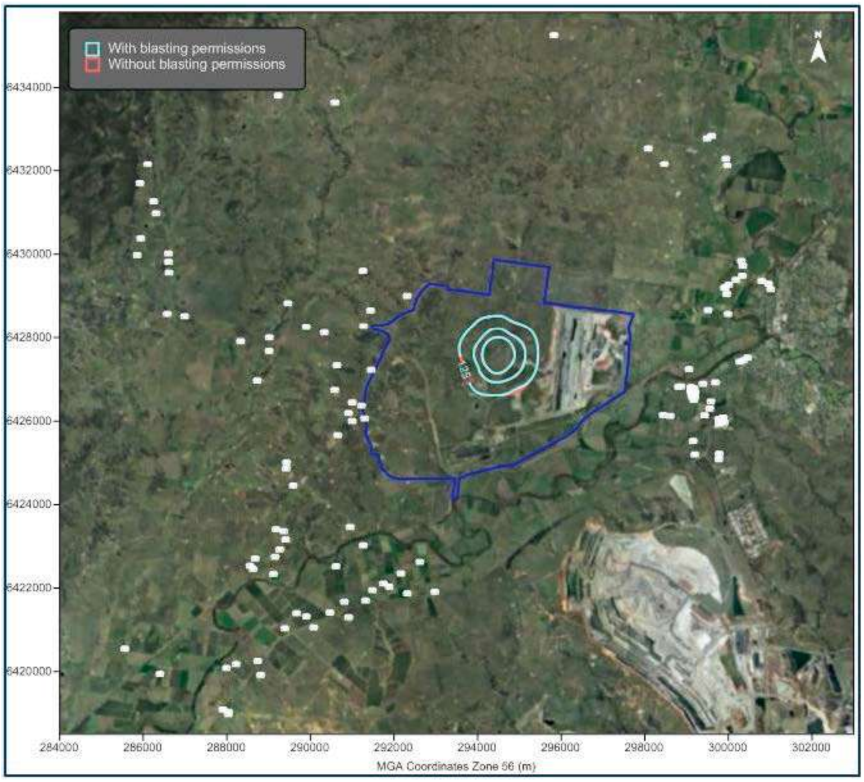

Figure H-28: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 12:00 (NO_2 concentrations µg/m³)

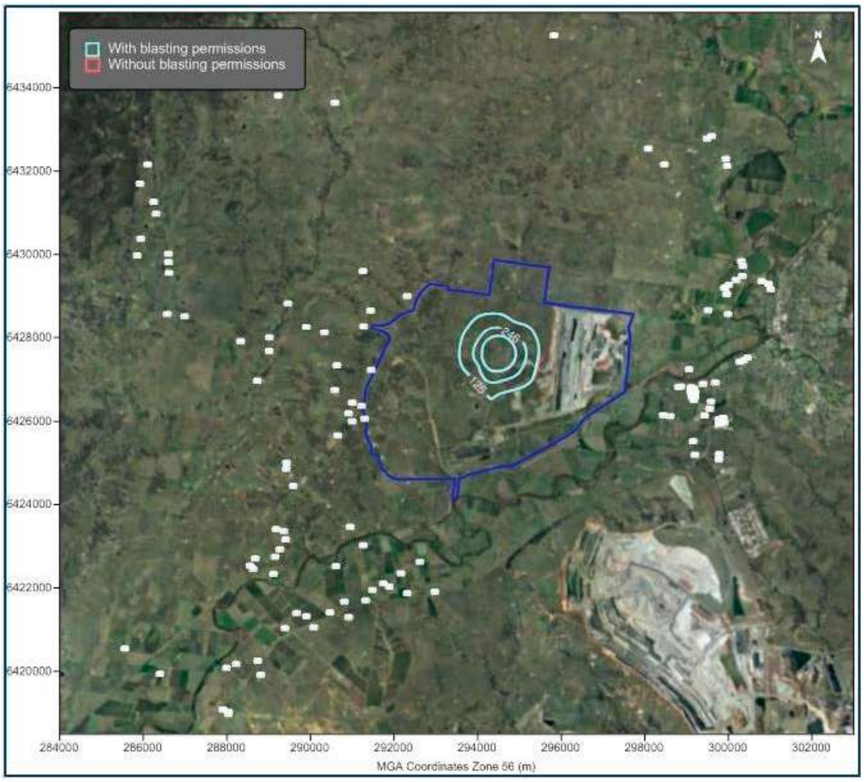

Figure H-29: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 13:00 (NO_2 concentrations µg/m³)

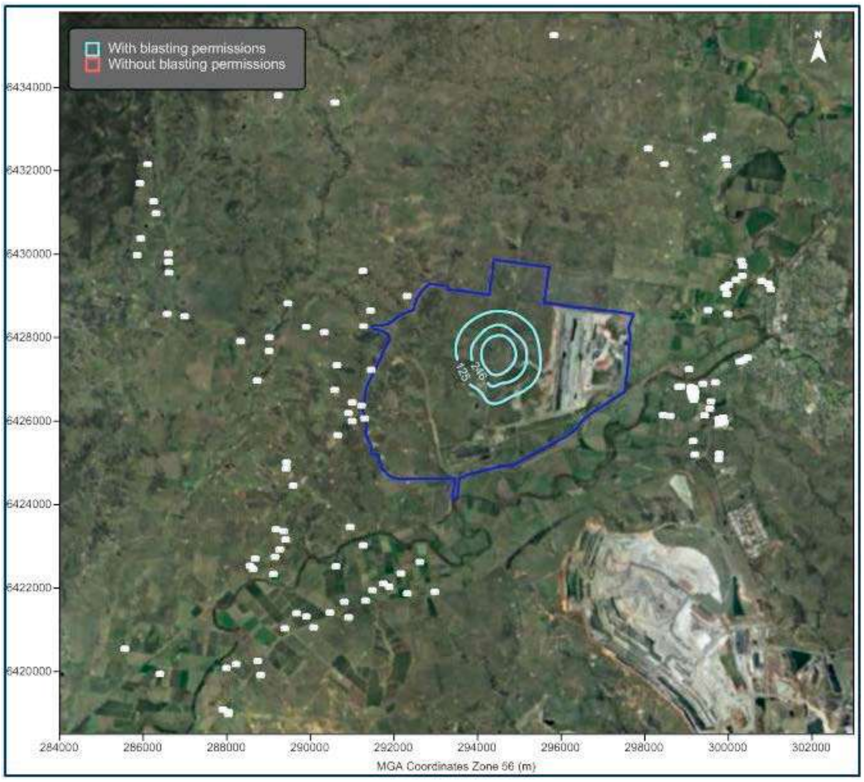

Figure H-30: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 14:00 (NO_2 concentrations µg/m³)

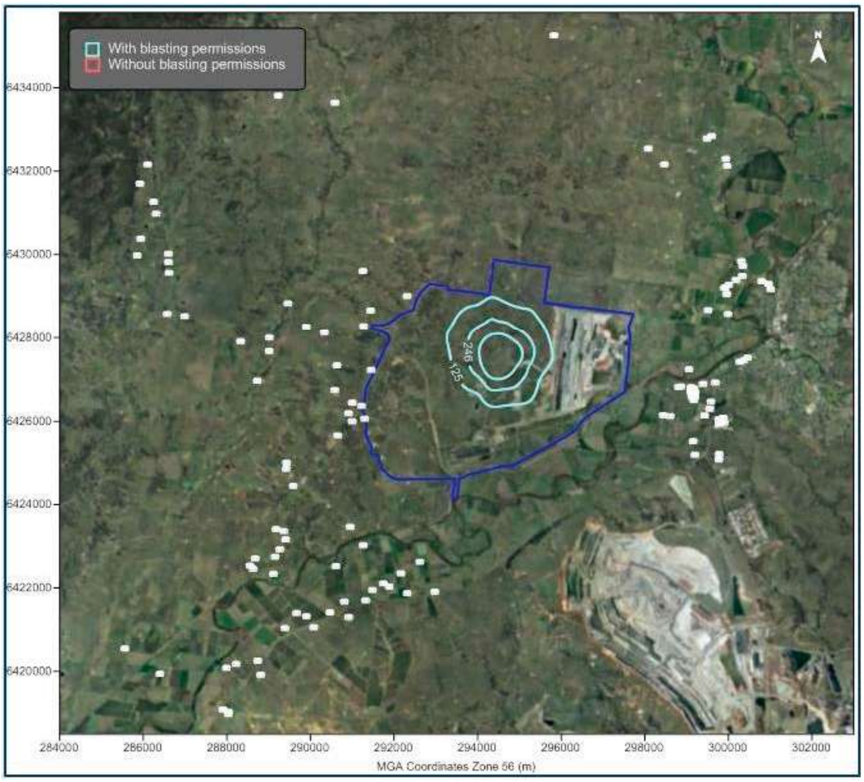

Figure H-31: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 15:00 (NO_2 concentrations µg/m³)

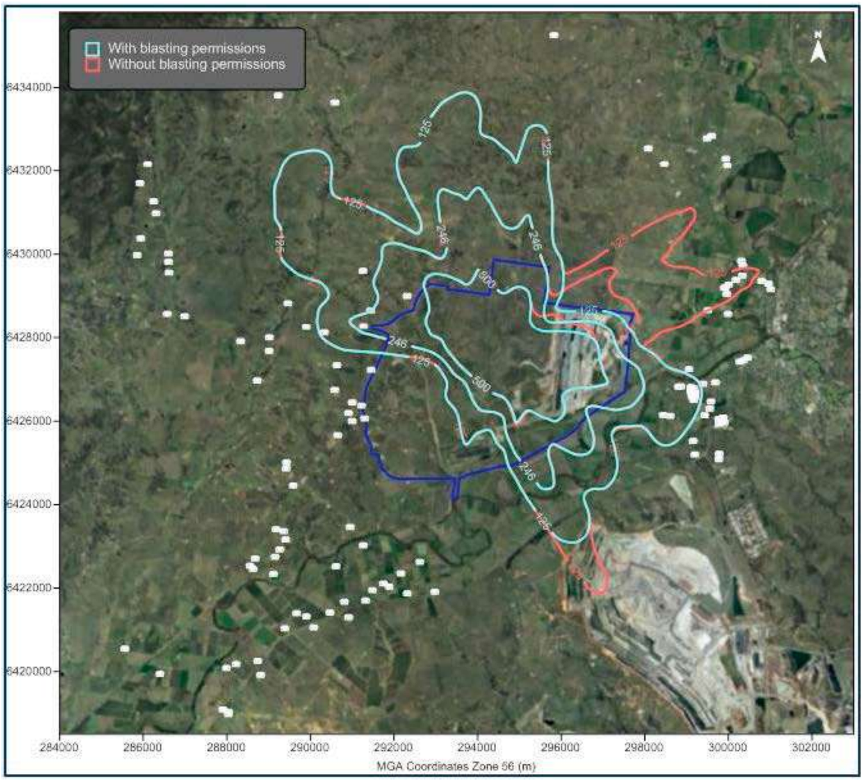

Figure H-32: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 16:00 (NO_2 concentrations µg/m³)

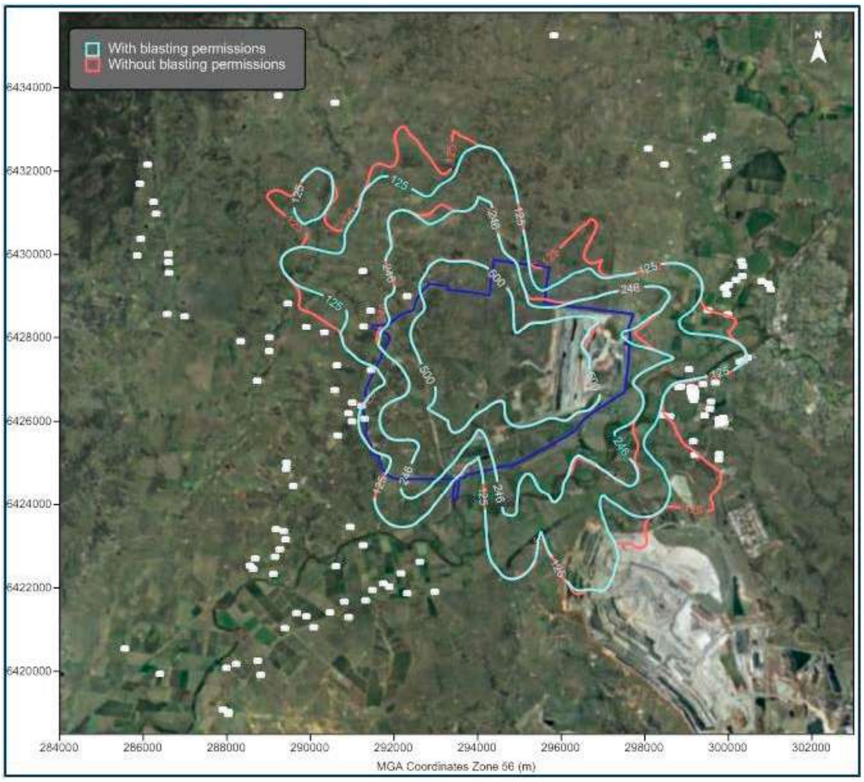

Figure H-33: Predicted maximum 1-hour average blast emissions from the Project in Year 8 - 17:00 (NO_2 concentrations µg/m³)

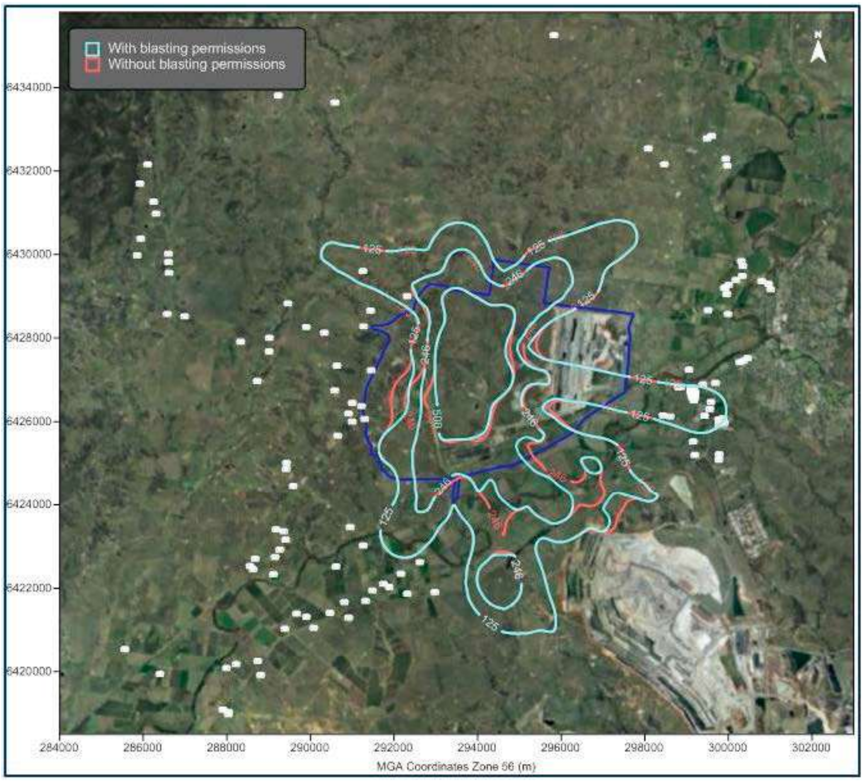

Figure H-34: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 07:00 (NO_2 concentrations µg/m³)

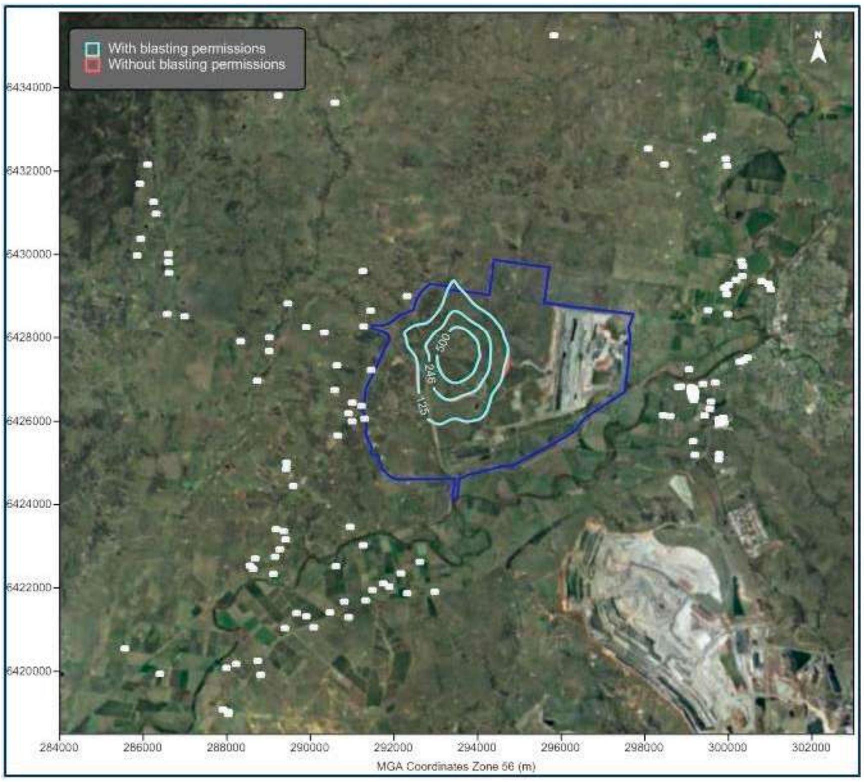

Figure H-35: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 08:00 (NO_2 concentrations µg/m³)

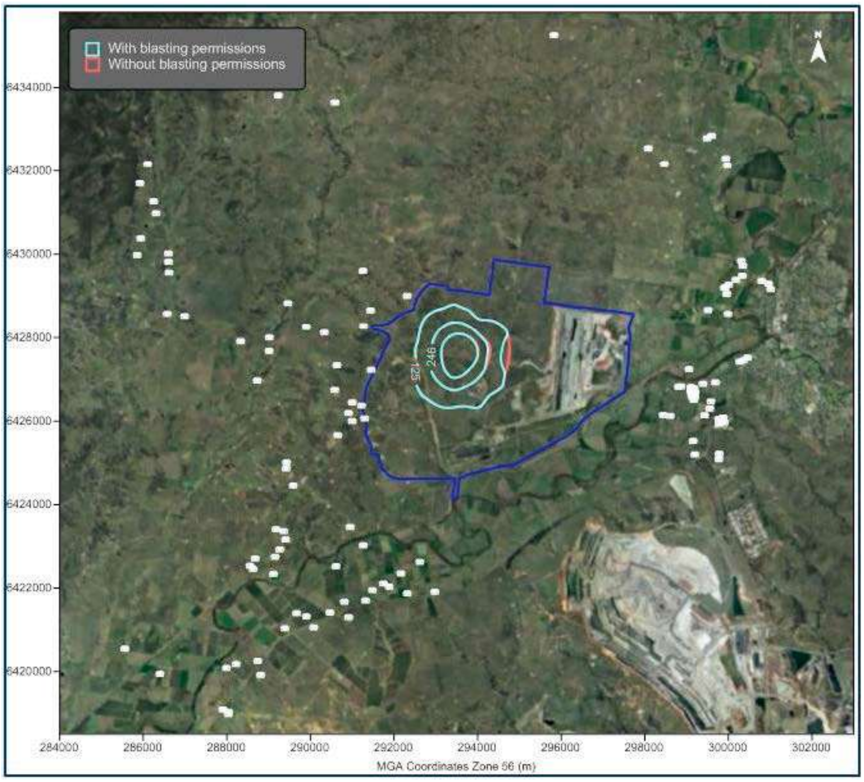

Figure H-36: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 09:00 (NO_2 concentrations µg/m³)

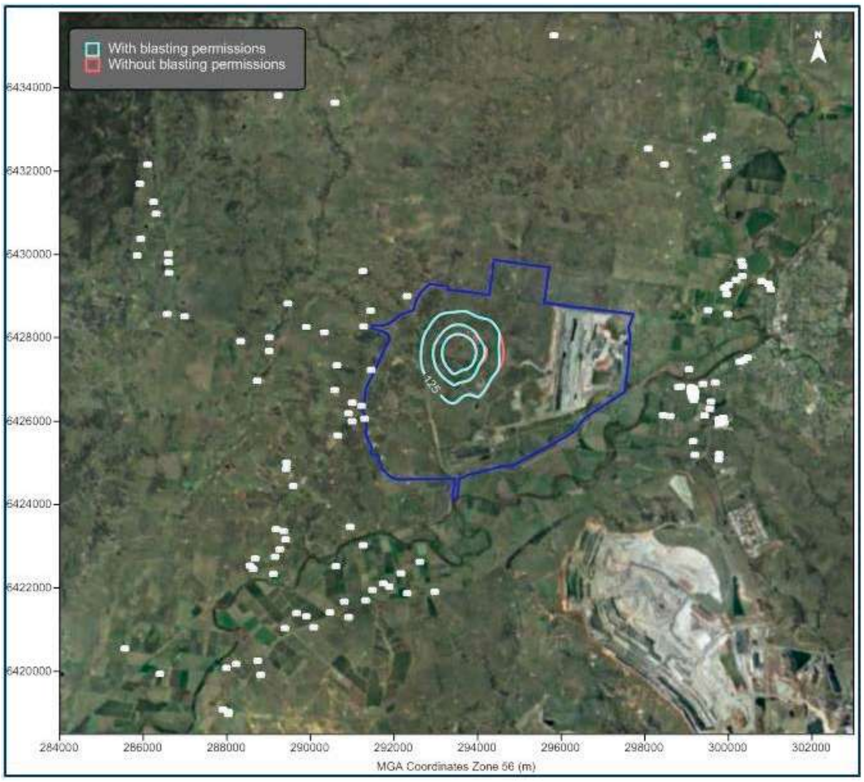

Figure H-37: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 10:00 (NO_2 concentrations µg/m³)

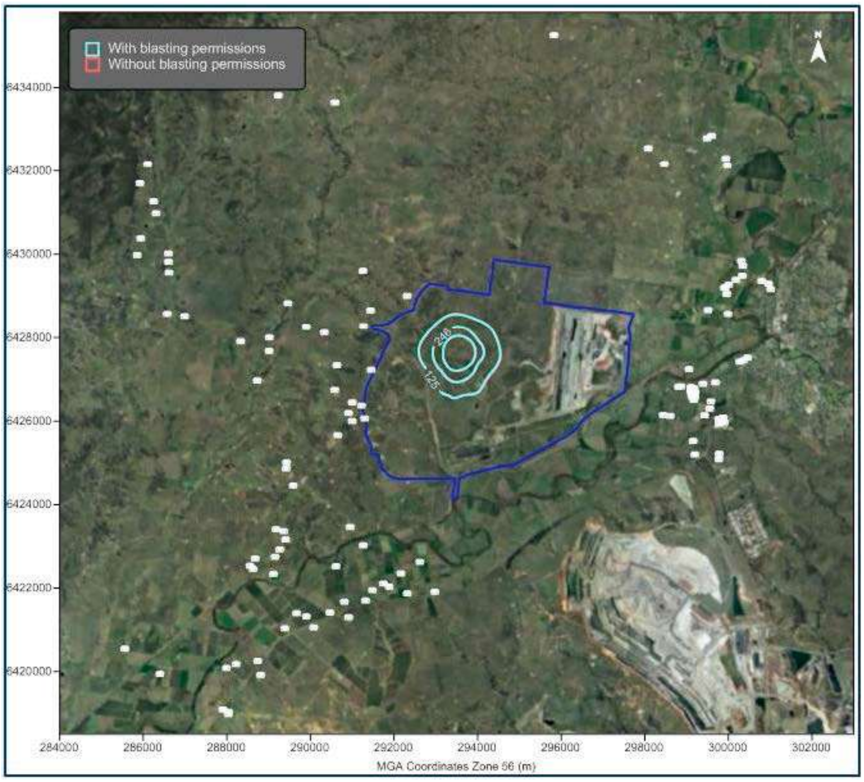

Figure H-38: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 11:00 (NO_2 concentrations µg/m³)

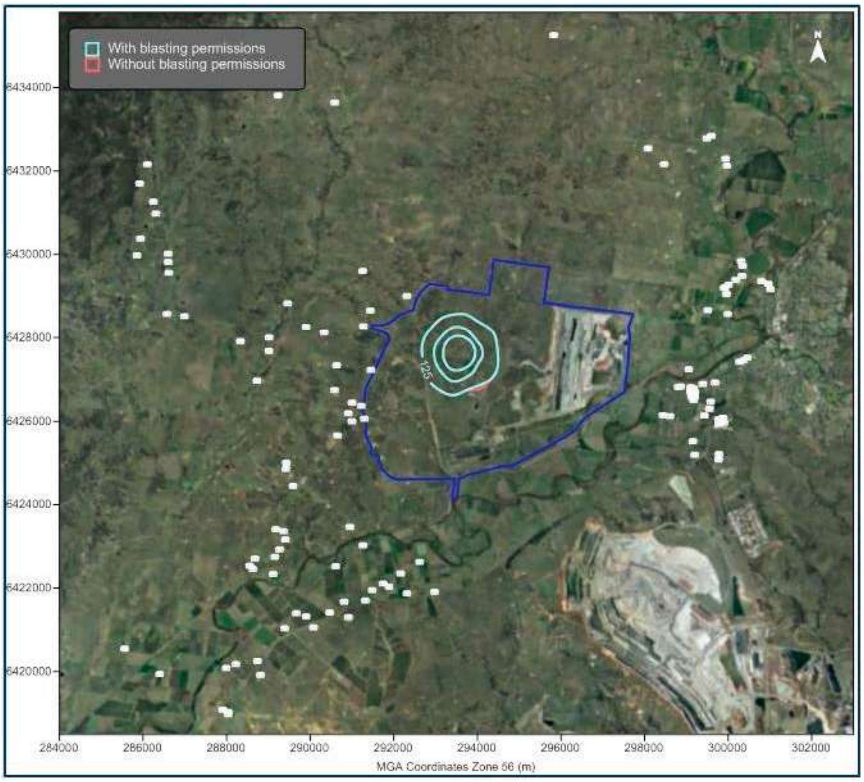

Figure H-39: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 12:00 (NO_2 concentrations µg/m³)

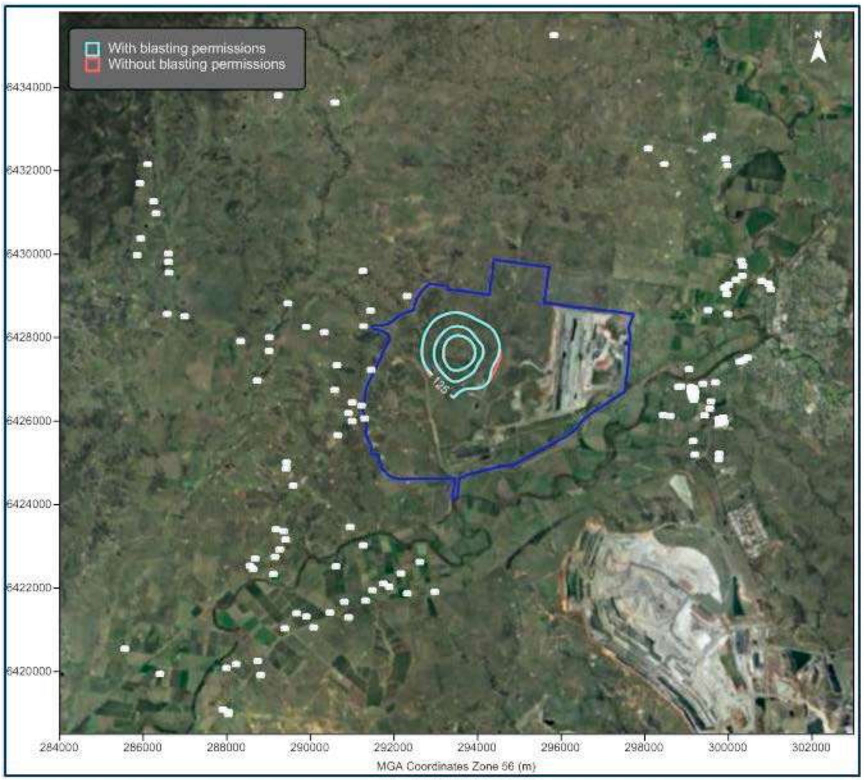

Figure H-40: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 13:00 (NO_2 concentrations µg/m³)

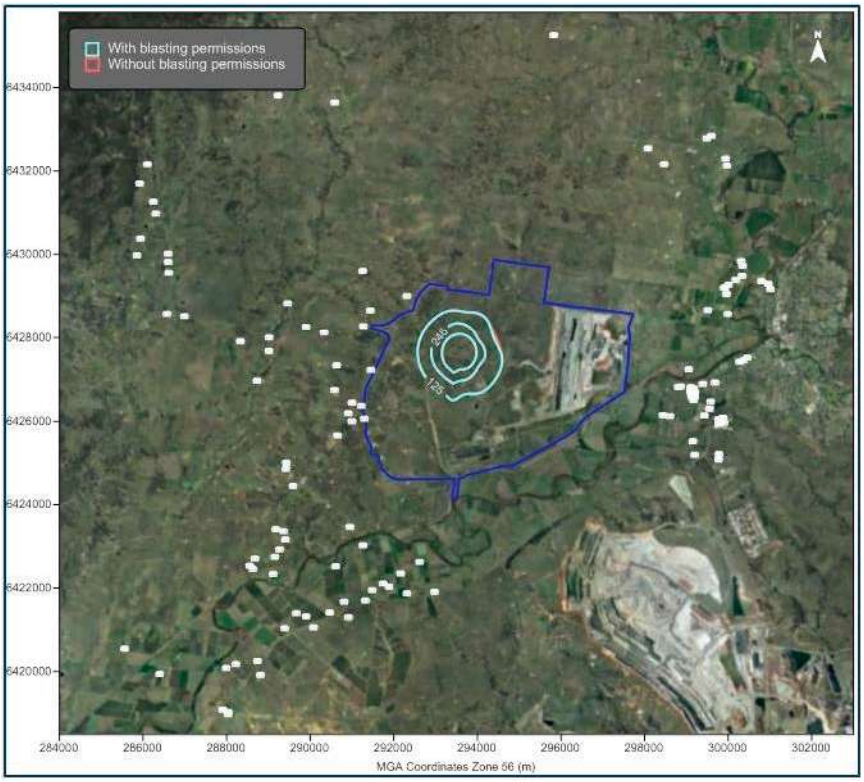

Figure H-41: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 14:00 (NO_2 concentrations µg/m³)

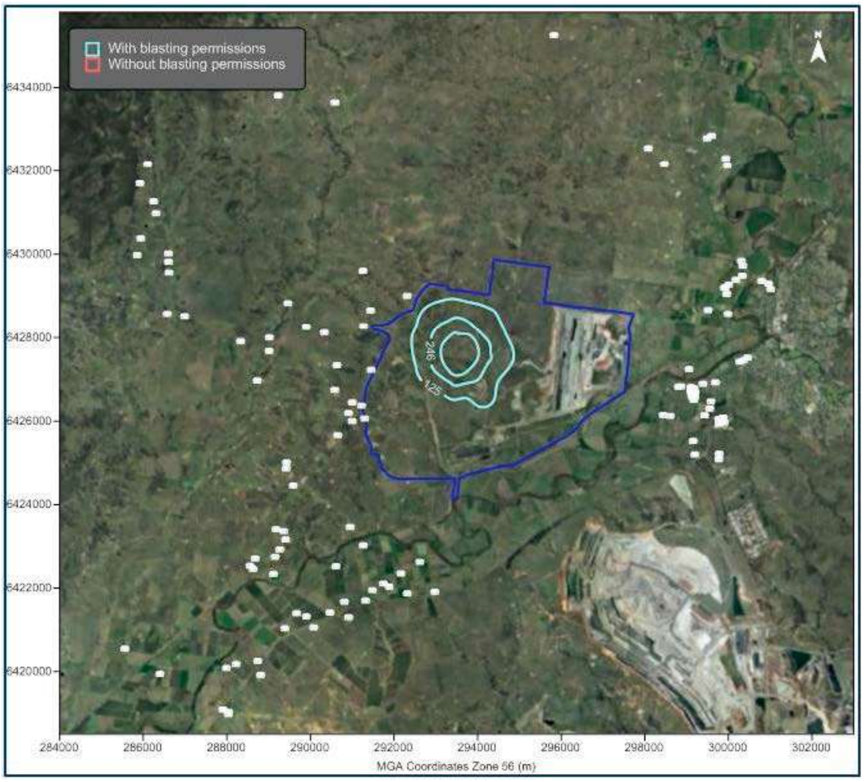

Figure H-42: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 15:00 (NO_2 concentrations µg/m³)

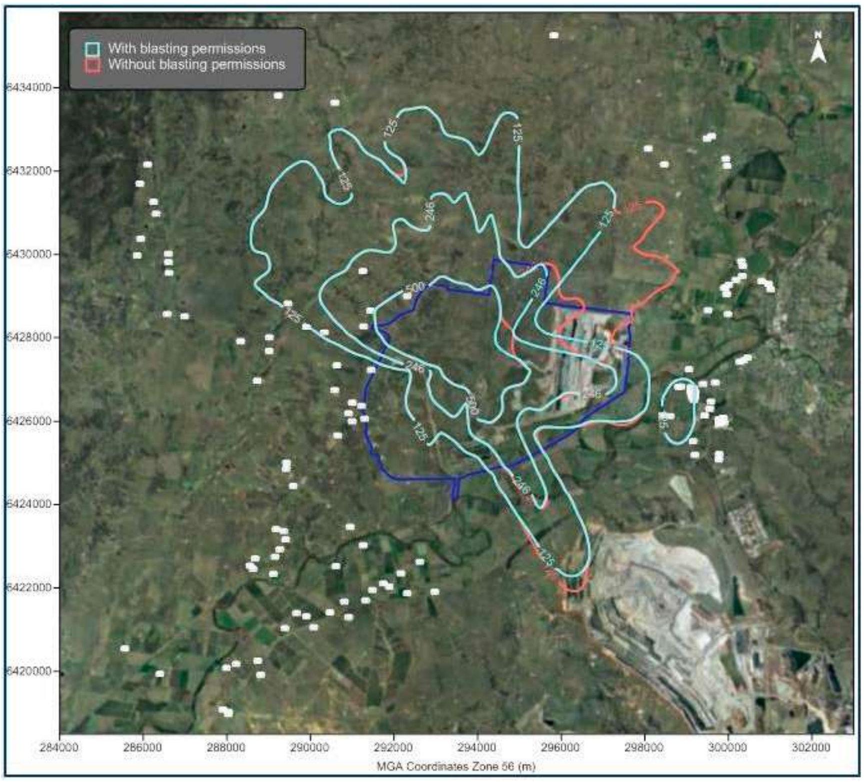

Figure H-43: Predicted maximum 1-hour average blast emissions from the Project in Year 15 - 16:00 (NO_2 concentrations µg/m³)

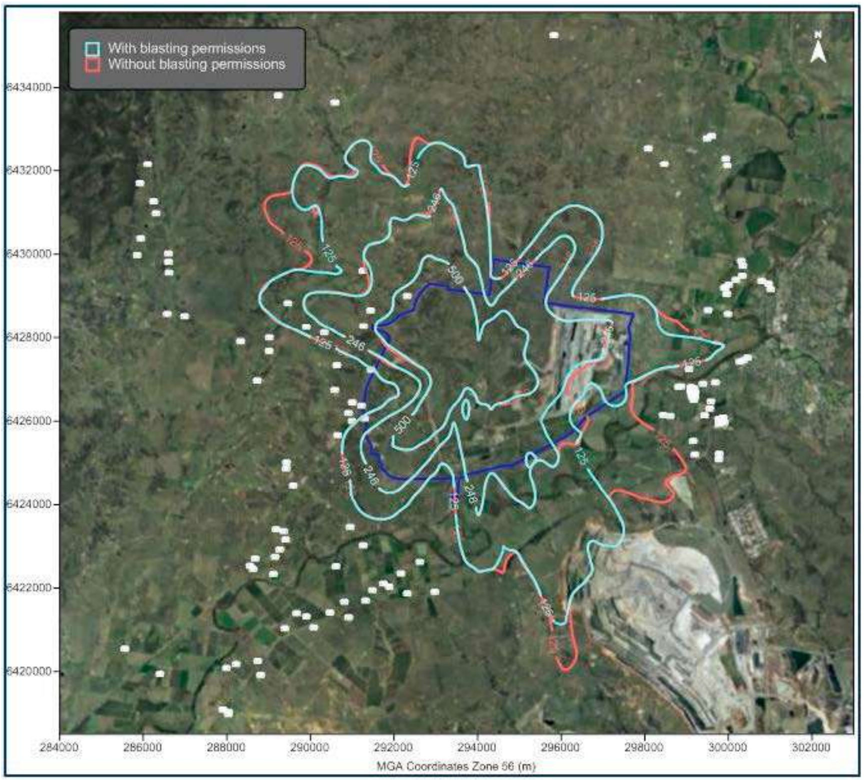

Figure H-44: Predicted maximum 1-hour average blast emissions from the Project in Year 15- 17:00 (NO_2 concentrations µg/m³)

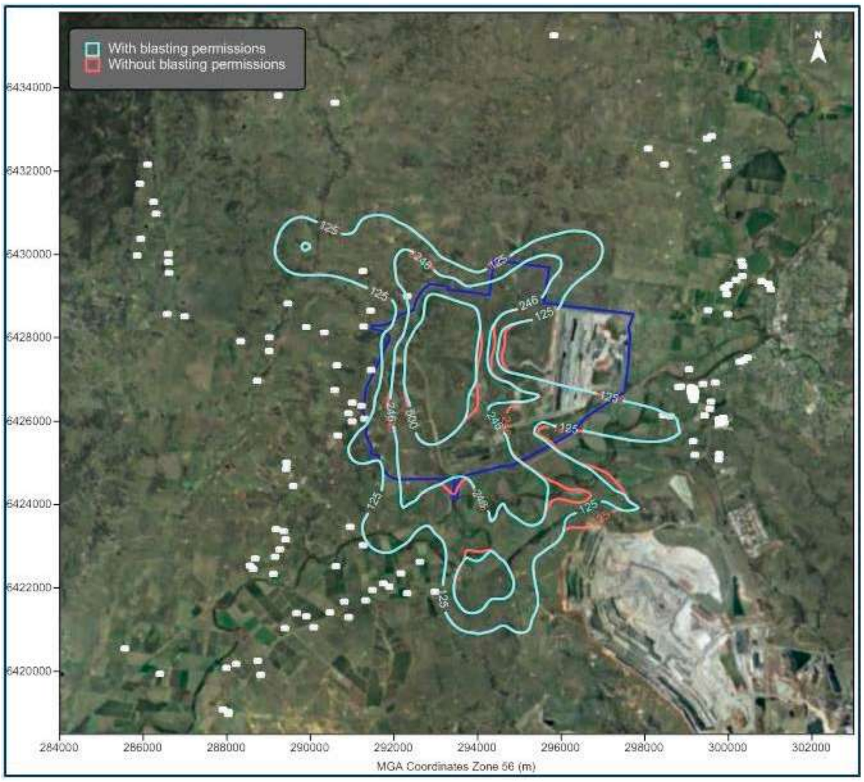

Figure H-45: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 07:00 (NO_2 concentrations µg/m³)

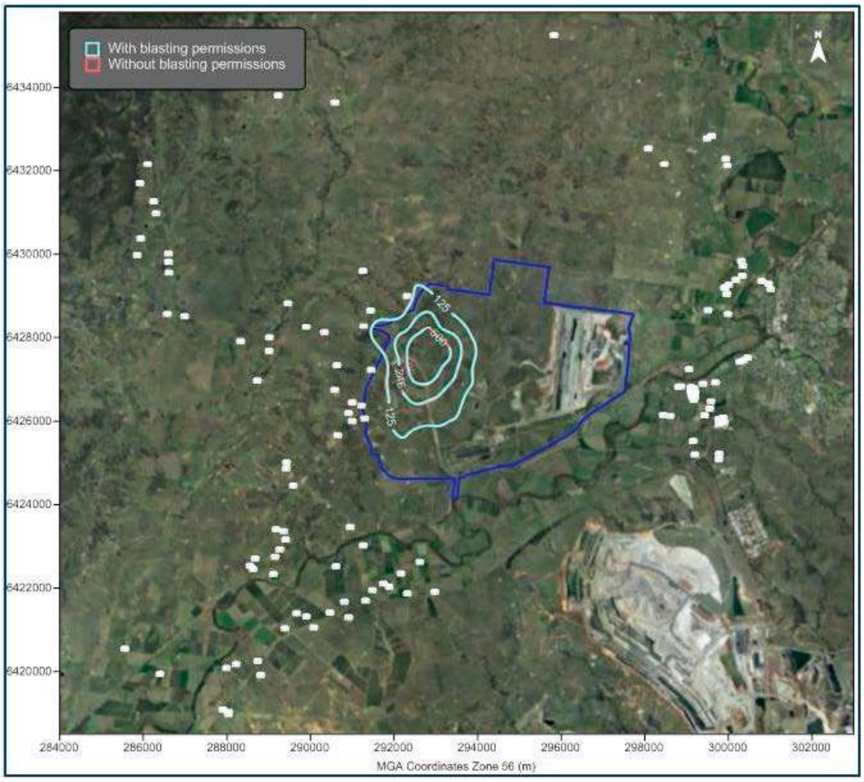

Figure H-46: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 08:00 (NO_2 concentrations µg/m³)

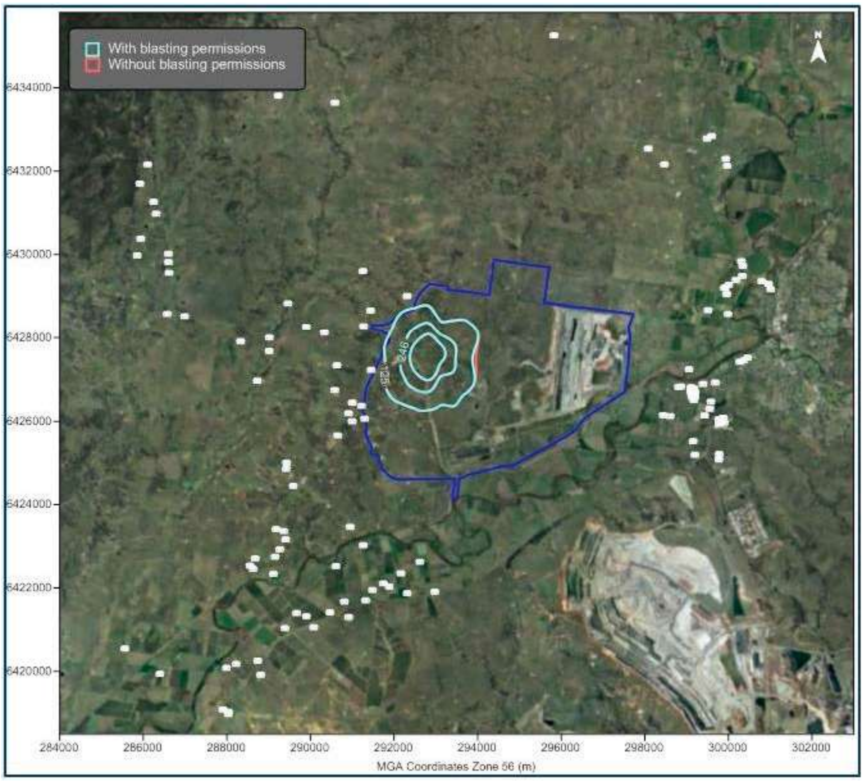

Figure H-47: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 09:00 (NO_2 concentrations µg/m³)

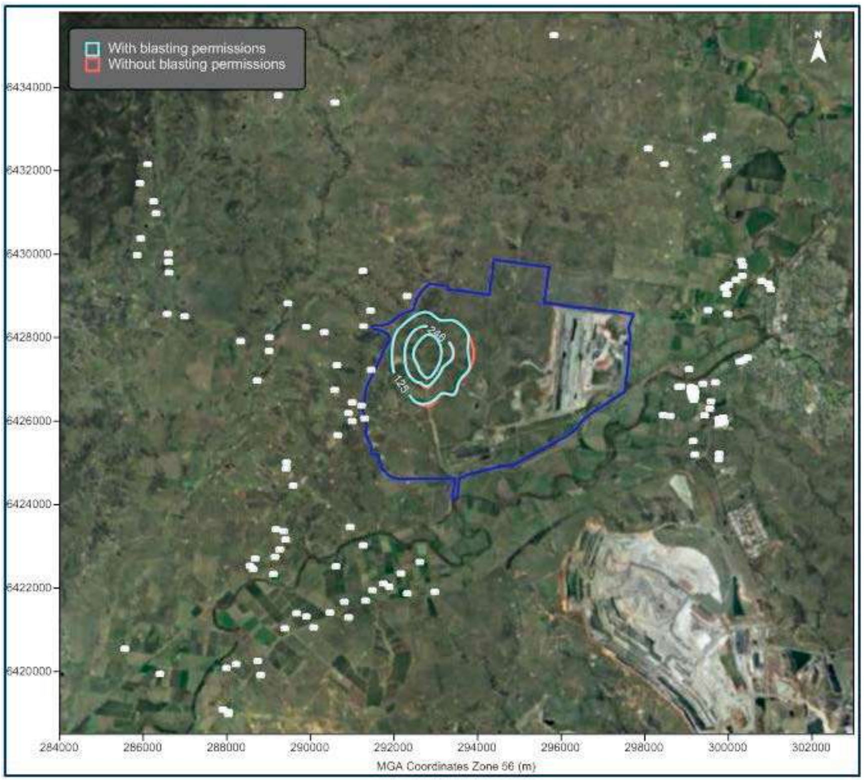

Figure H-48: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 10:00 (NO_2 concentrations µg/m³)

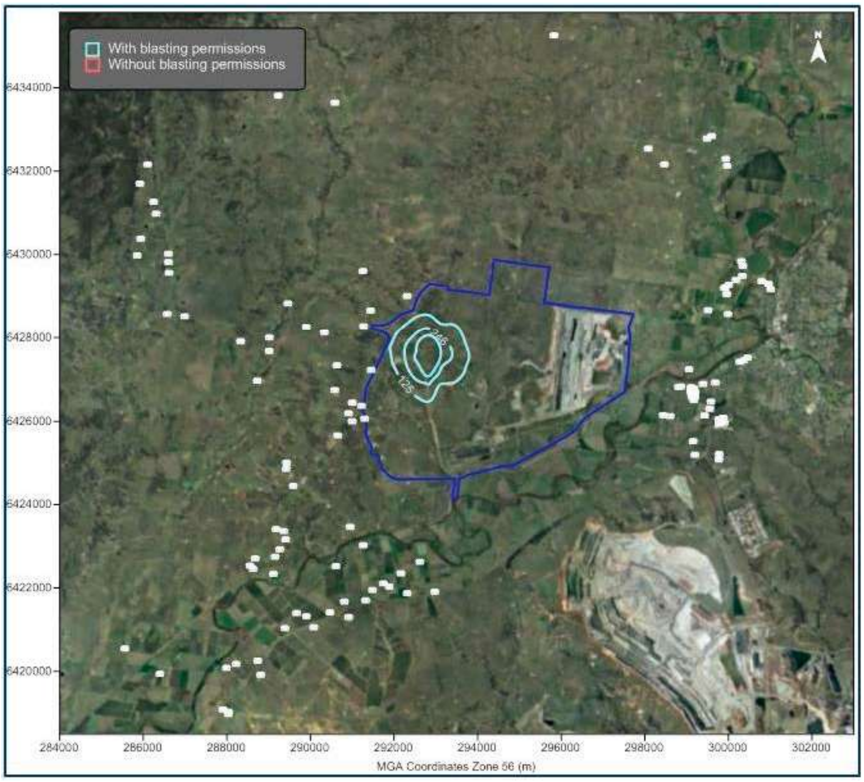

Figure H-49: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 11:00 (NO_2 concentrations µg/m³)

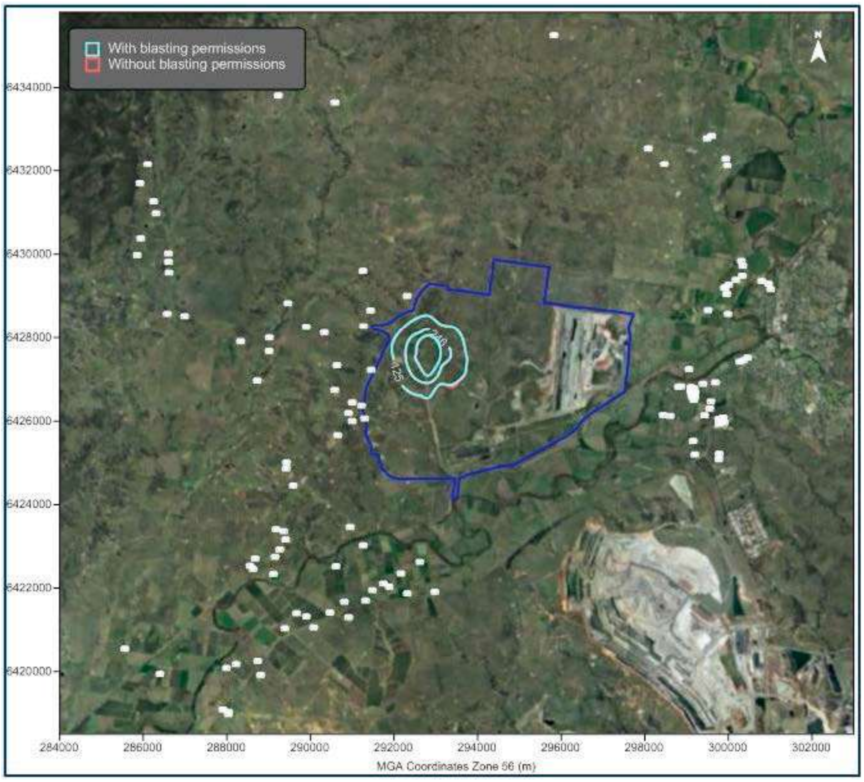

Figure H-50: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 12:00 (NO_2 concentrations µg/m³)

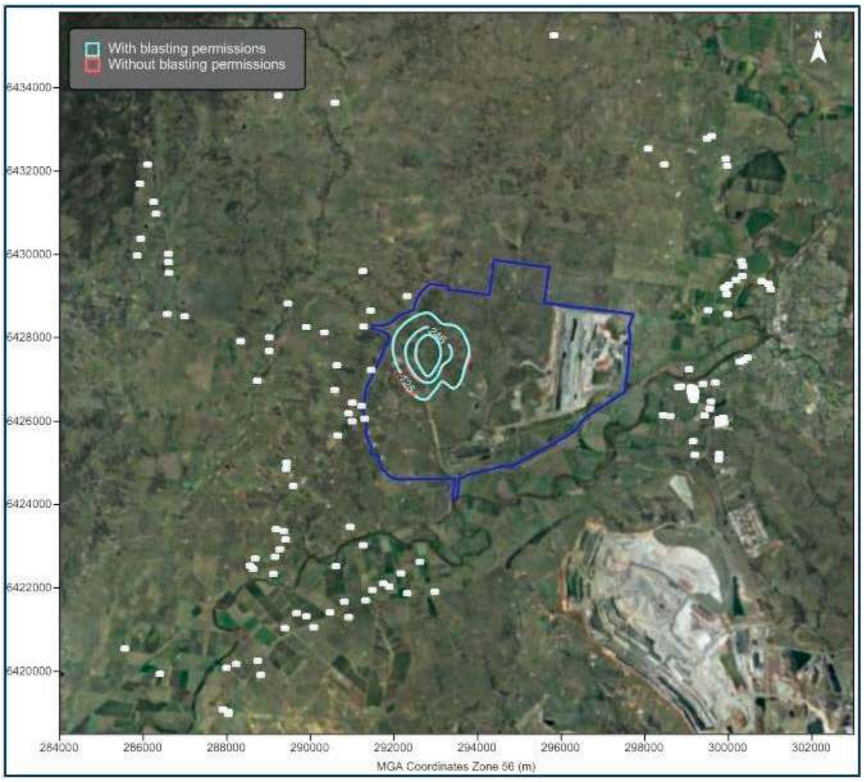

Figure H-51: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 13:00 (NO_2 concentrations µg/m³)

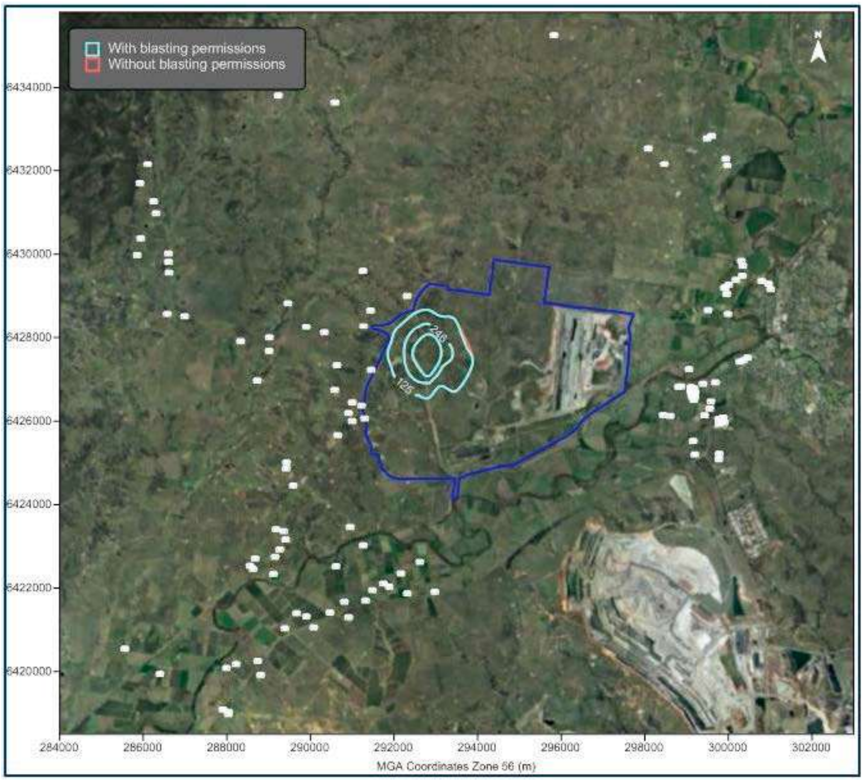

Figure H-52: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 14:00 (NO_2 concentrations µg/m³)

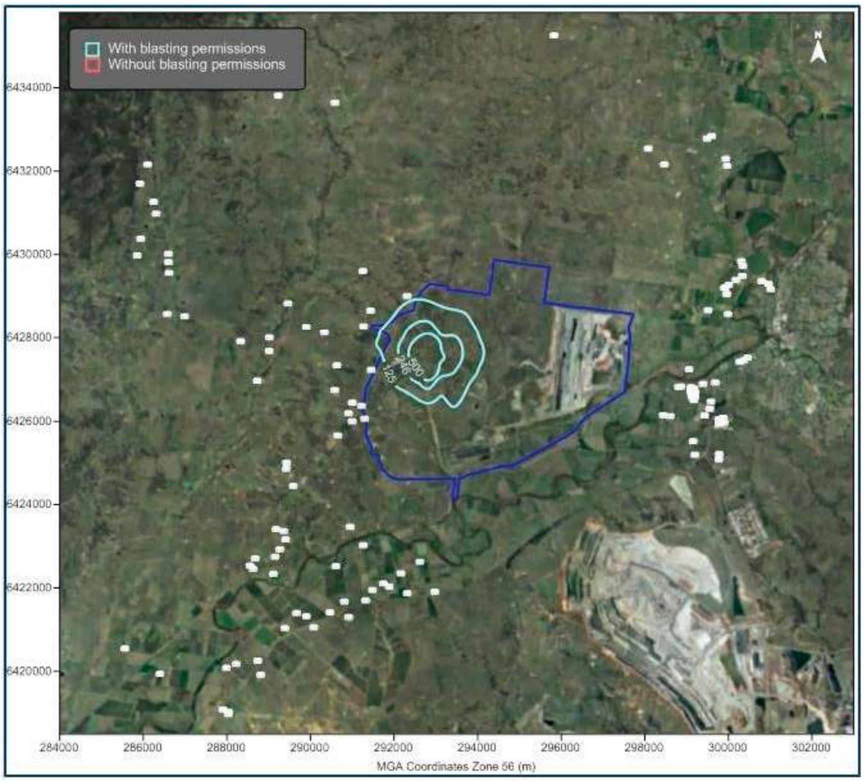

Figure H-53: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 15:00 (NO_2 concentrations µg/m³)

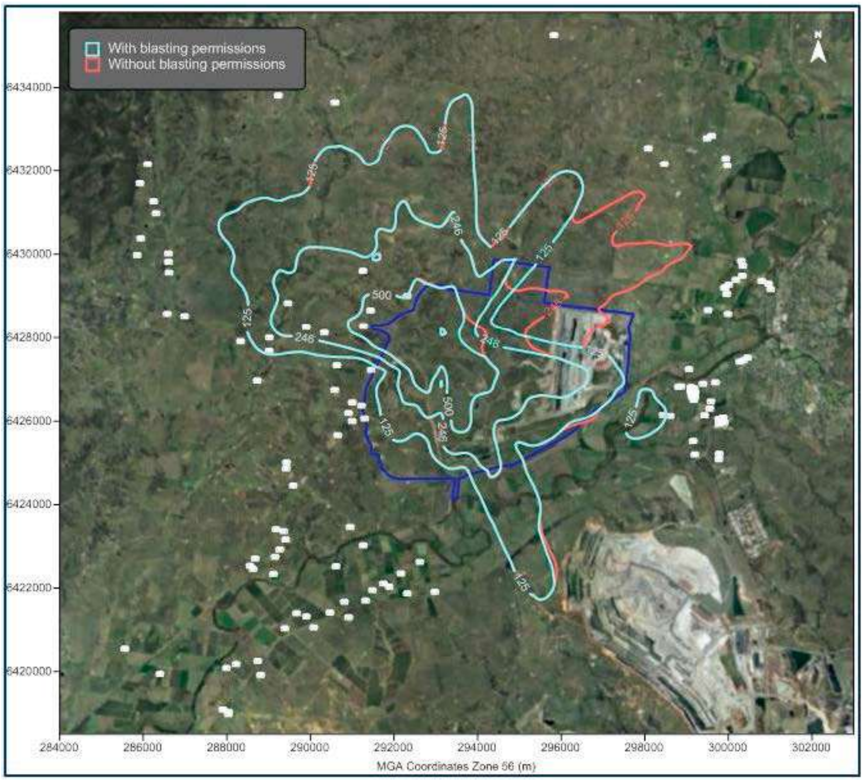

Figure H-54: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 16:00 (NO_2 concentrations µg/m³)

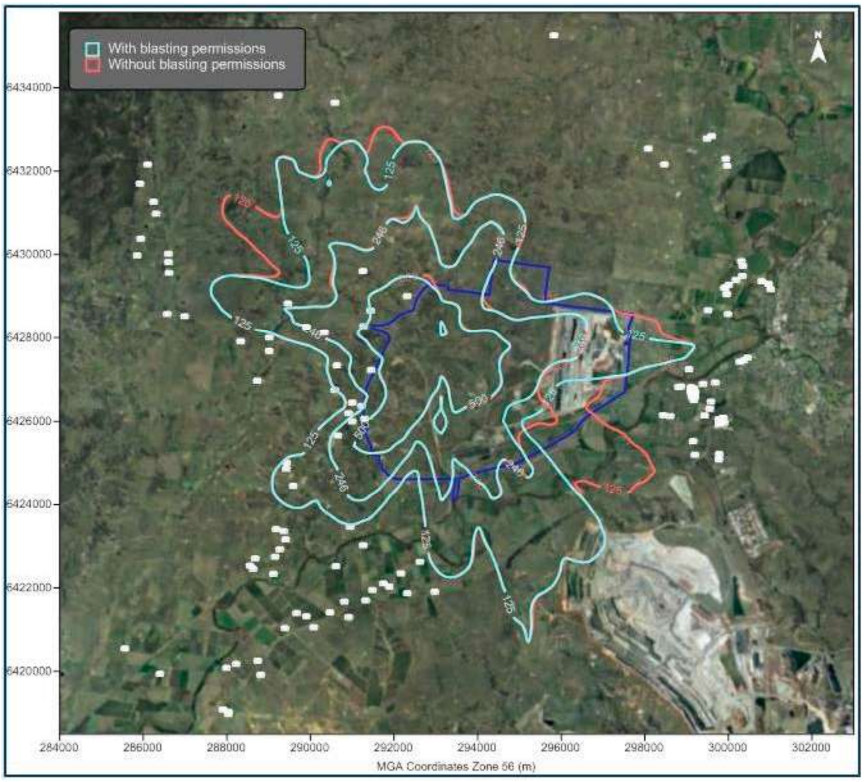

Figure H-55: Predicted maximum 1-hour average blast emissions from the Project in Year 24 - 17:00 (NO_2 concentrations µg/m³)