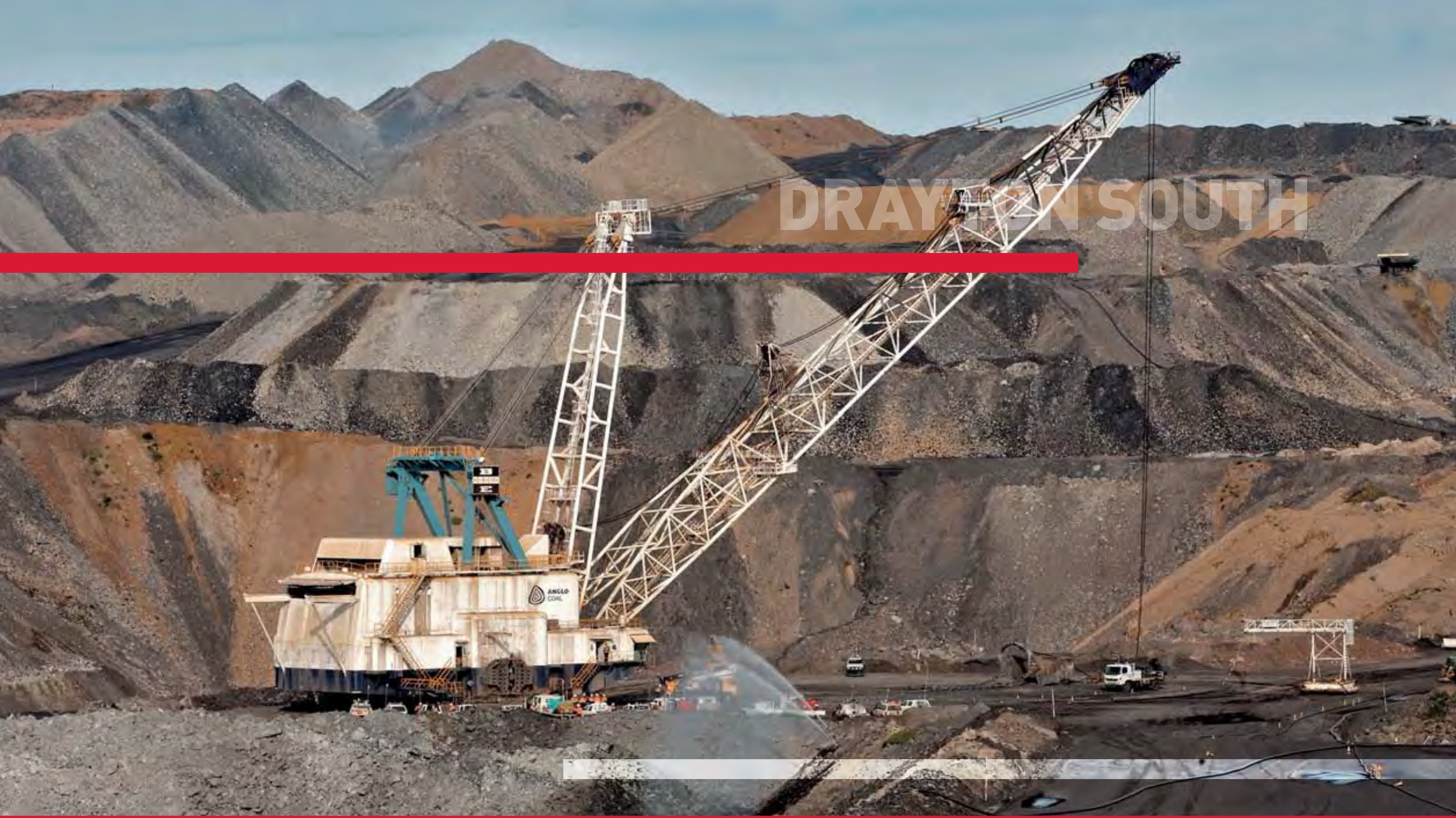

Air Quality and Greenhouse Gas Impact Assessment

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FINAL

DRAYTON SOUTH AIR QUALITY AND GREENHOUSE GAS IMPACT ASSESSMENT

For
Hansen Bailey on behalf of Anglo American Metallurgical Coal

Job No: 3617B

25 October 2012

PROJECT TITLE:	Drayton South Air Quality and Greenhouse Gas Impact Assessment
JOB NUMBER:	**3617B**
PREPARED FOR:	Daniel Sullivan Hansen Bailey on behalf of Anglo American Metallurgical Coal
PREPARED BY:	Khalia Hill
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ES1 EXECUTIVE SUMMARY

Anglo American is seeking Project Approval under Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act) to facilitate the extraction of coal by both open cut and highwall mining methods within Exploration Licence (EL) 5460 for a period of 27 years. The Project Application Boundary (Project Boundary) is shown on **Figure 2-1**.

The Project will allow for the continuation of mining at Drayton Mine by the development of open cut and highwall mining operations within the Drayton South mining area while continuing to utilise the existing infrastructure and equipment from Drayton Mine.

The Project generally comprises:

- The continuation of operations at Drayton Mine as presently approved with minor additional mining areas within the East, North and South Pits.
- The development of an open cut and highwall mining operation extracting up to 7 million tonnes per annum (Mtpa) of ROM coal over a period of 27 years.
- The utilisation of the existing Drayton Mine workforce and equipment fleet (with an addition of a highwall miner and coal haulage fleet).
    - The Drayton Mine fleet includes a dragline, excavators, fleet of haul trucks, dozers, graders, water carts and associated supporting equipment.
- The use of Drayton Mine's existing voids for rejects and tailings disposal and water storage to allow for the optimisation of the Drayton Mine final landform.
- The utilisation of the existing Drayton Mine infrastructure including the Coal Handling and Preparation Plant (CHPP), rail loop and associated load out infrastructure, workshops, bath houses and administration offices.
- The construction of a transport corridor between Drayton South and Drayton Mine infrastructure.
- The utilisation of the Antiene Rail Spur off the Main Northern Railway to transport product coal to the Port of Newcastle for export.
- The realignment of a section of Edderton Road.
- The installation of water management and power reticulation infrastructure at Drayton South.

This report deals with air quality issues that will arise from this development and focuses on the following:

- The impacts likely to arise from emissions of dust from the proposed open cut operations and the associated surface activities.
- The cumulative impacts likely to arise from emissions of dust from the Project considered in combination with emissions from nearby mining operations at Mt. Arthur Coal, Mt. Pleasant, Bengalla, Hunter Valley Operations, Mangoola, Muswellbrook Coal Mine and Drayton Mine.
- An assessment of the greenhouse gas emissions likely to arise from the Project.

Emission inventories were developed for six operating years of the Project and an additional scenario to capture the construction of the visual bund. An alternative transport option of a conveyor between Drayton South mine areas and the Drayton CHPP has also been investigated for the operational year with the largest total ROM coal mined. These years have been selected to represent the potential worst-case air quality impacts that the Project will have on different areas around the Project Boundary throughout its lifetime.

The air dispersion modelling conducted for this assessment is based on an advanced modelling system using the models TAPM and CALMET/CALPUFF. This system overcomes some of the limitations of steady-state Gaussian plume models such as AUSPLUME and ISC.

The dispersion conditions for the area were characterised based on regional and local meteorological data, generated using a diagnostic meteorological modelling system known as CALMET. The annual winds predicted by CALMET correlate well with the windroses presented for the Saddlers Creek meteorological station in 2005 and nearby meteorological station at Macleans Hill.

CALPUFF was used to predict the maximum 24-hour PM_{10}, annual average PM_{10}, annual average TSP and annual average dust deposition (insoluble solids) over an area extending approximately 30 km (east-west) and 36 km (north-south). The modelling has been undertaken to show both the effects of the Project only and the cumulative effects of the Project with neighbouring mines and other sources of dust.

The assessment follows the Environmental Protection Authority (EPA) *'Approved Methods for the assessment of air pollution sources using dispersion models'*.

In summary, six private residences, owned by two landowners are anticipated to be impacted by dust levels exceeding the relevant criteria.

Construction activities associated with the Project will have negligible emissions.

Spontaneous combustion is not anticipated to be an issue, however if it is then the same management and monitoring measures currently employed at Drayton Mine will be applied to ensure minimal impact.

The CO_2 emissions released during the mining operations are small compared to the CO_2 emissions released during the combustion of the coal proposed for extraction. Anglo American is committed to reviewing and monitoring Greenhouse Gas emissions and the activities that lead to GHG emissions, to ensure that these emissions are kept to the minimum practicable level and will attempt to keep the ratio of greenhouse gas emissions per tonne of coal produced as low as possible.

TABLE OF CONTENTS

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LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

PAEHolmes has been engaged by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Anglo American Metallurgical Coal Pty Ltd (Anglo American) to complete an air quality and greenhouse gas impact assessment for the Drayton South Coal Project (the Project). The purpose of the assessment is to form part of an Environmental Assessment (EA) being prepared by Hansen Bailey to support an application for a contemporary Project Approval under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act) to facilitate the continuation of Drayton Mine by the development of an open cut and highwall coal mining operation and associated infrastructure within the Drayton South area.

In October 2011, Part 3A of the EP&A Act was repealed. However, the Project has been granted the benefit of transitional provisions and as such, is a development to which Part 3A applies.

The objectives of the air quality and greenhouse gas assessment are as follows:

- To understand meteorological conditions of the project site and surrounding areas.
- To characterize current air quality and baseline air quality issues.
- To estimate the emissions of particulate matter (as PM_{10}, TSP and Depositional Dust) for representative worst case stages of the Project.
- To apply state-of-the-art regulatory dispersion models to predict future ambient air quality at the site for up to seven stages of the mine's development.
- To recommend air quality management measures.
- To estimate greenhouse gas emissions and evaluate climate change.

1.1 Related Studies

The studies which are to be read in conjunction with this assessment include the following:

- The EA horse health assessment.
- The EA agricultural land use impact assessment.
- The EA geochemistry impact assessment.
- The EA economic impact assessment.

2 PROJECT DESCRIPTION

Drayton Mine is managed by Anglo Coal (Drayton Management) Pty Ltd which is owned by Anglo American. Drayton Mine commenced production in 1983 and currently holds Project Approval 06_0202 (dated 1 February 2008) that expires in 2017.

The Project will allow for the continuation of mining at Drayton Mine by the development of open cut and highwall mining operations within the Drayton South mining area while continuing to utilise the existing infrastructure and equipment from Drayton Mine.

The Project is located approximately 10 km north-west of the village of Jerry's Plains and approximately 13 km south of the township of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW). The Project is predominately situated within the Muswellbrook Shire Local Government Area (LGA), with the south-west portion falling within the Singleton LGA. **Figure 2-1** illustrates the location of the Project. The Project is located adjacent to two thoroughbred horse studs, two power stations and several existing coal mines.

The Project will extend the life of Drayton Mine by a further 27 years ensuring the continuity of employment for its workforce, the ongoing utilisation of its infrastructure and the orderly rehabilitation of Drayton Mine's completed mining areas.

Anglo American is seeking Project Approval under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) to facilitate the extraction of coal by both open cut and highwall mining methods within Exploration Licence (EL) 5460 for a period of 27 years. The Project Application Boundary (Project Boundary) is shown on **Figure 2-1**.

The Project generally comprises:

- The continuation of operations at Drayton Mine as presently approved with minor additional mining areas within the East, North and South Pits.
- The development of an open cut and highwall mining operation extracting up to 7 million tonnes per annum (Mtpa) of ROM coal over a period of 27 years;
- The utilisation of the existing Drayton Mine workforce and equipment fleet (with an addition of a highwall miner and coal haulage fleet);
    - The Drayton Mine fleet includes a dragline, excavators, fleet of haul trucks, dozers, graders, water carts and associated supporting equipment.
- The use of Drayton Mine's existing voids for rejects and tailings disposal and water storage to allow for the optimisation of the Drayton Mine final landform;
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- The utilisation of the Antiene Rail Spur off the Main Northern Railway to transport product coal to the Port of Newcastle for export;
- The realignment of a section of Edderton Road; and
- The installation of water management and power reticulation infrastructure at Drayton South.

The conceptual layout of the Project is shown in **Figure 2-2.**

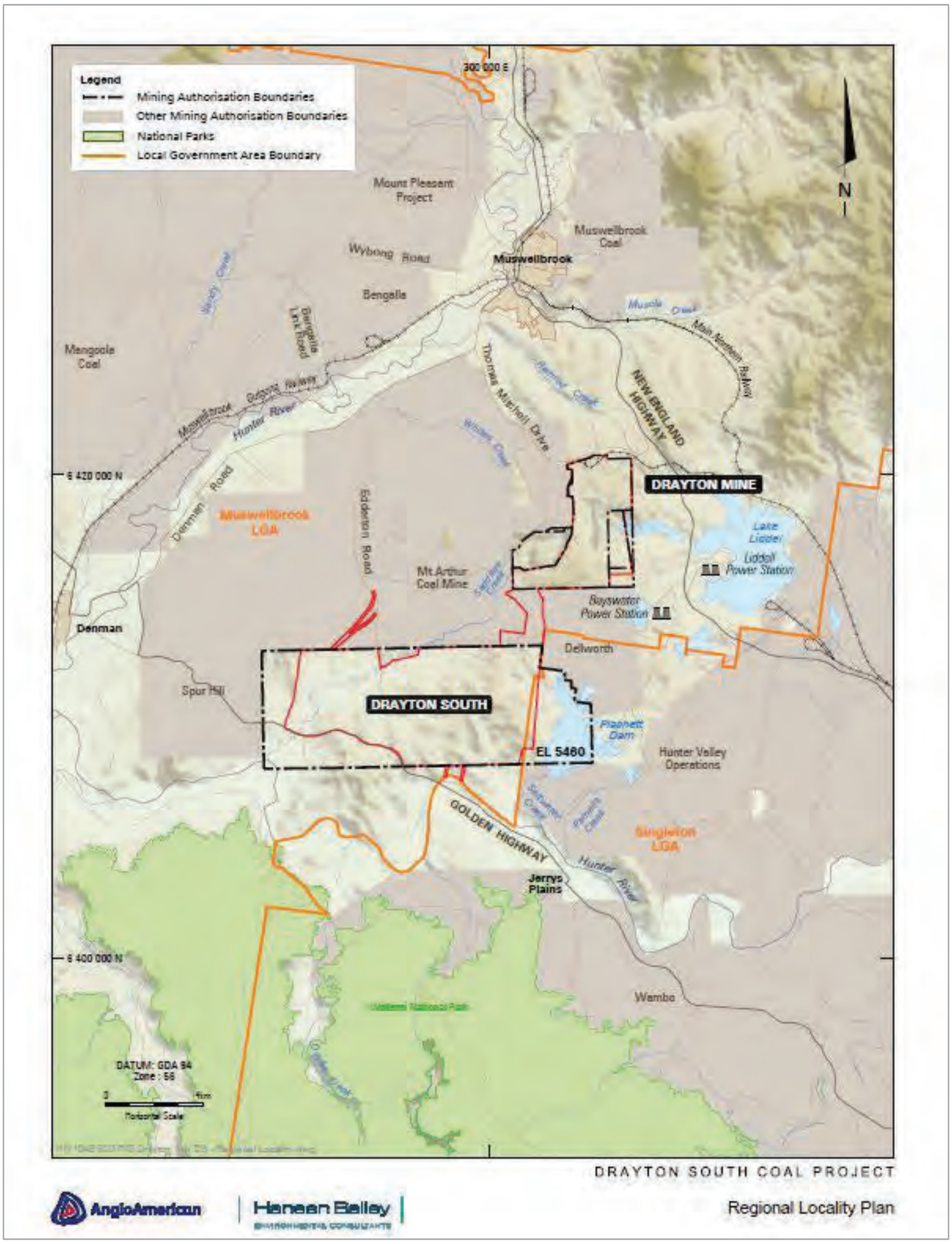

Figure 2-1: Regional Locality Plan

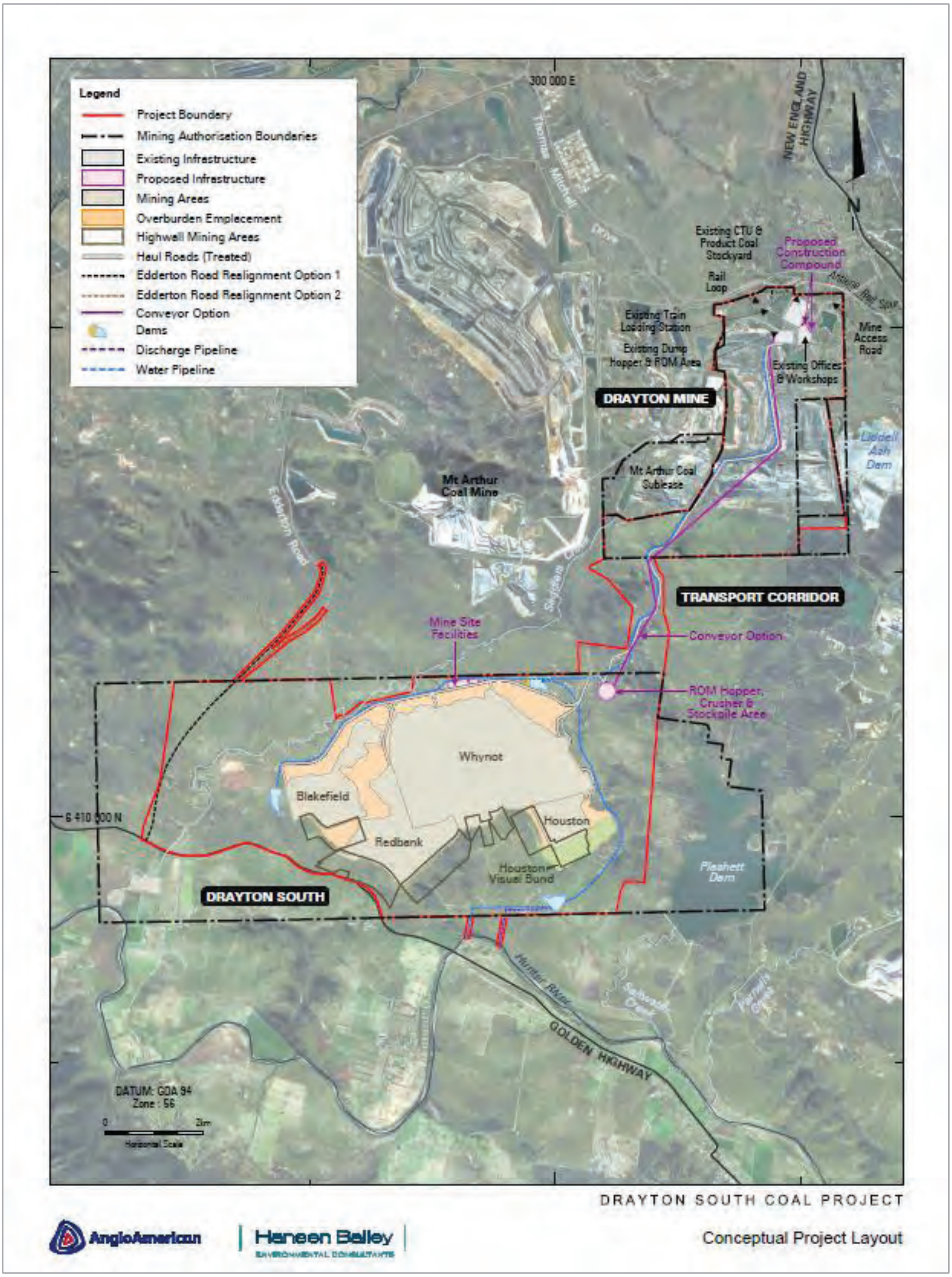

Figure 2-2: Conceptual Project Layout

3 LEGISLATIVE SETTING

3.1 Introduction

Project mining activities described in **Section 2** have the potential to generate fugitive dust emissions in the form of particulate matter described as total suspended particulate matter (TSP), particulate matter with an equivalent aerodynamic diameter of 10 micrometres (μm) or less (PM_{10}) and deposited dust emissions. In addition, combustion engines of generators and vehicles release emissions through engine exhausts including carbon monoxide (CO), minor quantities of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). Diesel combustion also results in the emission of fine particulate matter which is accounted for in the estimates of fugitive emissions presented in this report, which include diesel particles as well as particles derived from the materials being handled.

The low sulphur content of Australian diesel, in combination with the fact that mining equipment (including generators) is widely dispersed over mine sites; is such that the SO_2 goals would not be exceeded, even in mining operations that use large quantities of diesel. For this reason, no detailed study is required to demonstrate that emissions of SO_2 from the Project would not significantly affect ambient SO_2 concentrations. Similarly, NO_2 and CO emissions from the mining activities are limited and too widely dispersed to require a detailed modelling assessment. For this reason these emissions are not considered further in this report.

Other emissions to air from the Project include greenhouse gases (GHG) such as fugitive methane (CH_4) from exposed coal, carbon dioxide (CO_2) from the combustion of fuel in combustion engines, blasting and indirect GHG emissions from the combustion of coal produced on-site. GHG emissions are assessed in **Section 10**.

The following sections provide information on the air quality criteria used to assess the impact of dust and particulate emissions. To assist in interpreting the significance of predicted concentration and deposition levels some background discussion is also provided.

3.2 Director-General's Requirements

The Air Quality and Greenhouse Gas Assessment is guided by the Director-General's Requirements (DGRs), outlined in **Table 3-1**. Assessment requirements have also been outlined by the NSW Environment Protection Authority[1] (EPA) and are provided in **Table 3-2**.

The Air Quality and Greenhouse Gas Assessment has been prepared in accordance with the DGRs, NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods) (**DEC, 2005**) and in consideration of the EPA's agency comments in **Table 3-2**.

[1] The EPA exists as a legal entity operated within the NSW Office of Environment and Heritage (OEH) which came into existence in 2011. The OEH was previously part of the NSW Department of Environment, Climate Change and Water (EPAW). The EPAW was also recently known as the NSW Department of Environment and Climate Change (EPA), and prior to that the NSW Department of Environment and Conservation (DEC). The terms EPA, OEH, EPAW, EPA and DEC are essentially interchangeable in this report.

Table 3-1: Director-General's Requirements

Discipline	Requirement
Air Quality	▪ *including a quantitative assessment of the potential air quality and odour impacts of the project on both people and livestock*
Greenhouse Gases	▪ *including:* – *a quantitative assessment of the potential Scope 1, 2 and 3 greenhouse gas emissions from the project* – *a qualitative assessment of the potential impacts of these emissions on the environment* – *an assessment of the reasonable and feasible measures to minimise the greenhouse gas emissions and ensure energy efficiency*

Table 3-2: EPA agency Comments

Comment	Report Section
Assess the risk associated with potential discharges of fugitive and point source emissions for <u>all stages</u> of the proposal. Assessment of risk relates to environmental harm, risk to human health and amenity *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,* *c. type and quantity of pollutants emitted.*	**Entire report**
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: *a. Meteorology and climate,* *b. Topography,* *c. Surrounding land use, receptors and* *d. Ambient air quality.*	**Sections 2 and 4**
Include a 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 <u>all emissions</u> must be provided.	**Sections 2 and 7**
Include a consideration of 'worse case' emission scenarios and impacts at proposed emission limits.	**Section 8**
Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.	**Sections 8**
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 of the Modelling and Assessment of Air Pollutants in NSW (2005). *http://www.environment.nsw.qov.au/resources/air/ammodellinq05361.pdf.*	
Demonstrate the proposals ability to comply with the relevant regulatory framework specifically the Protection of the Environment Operations (POEO) Act (1997) and the POEO (Clean Air) Regulation (2002) [now *POEO (Clean Air) Regulation (2010)*].	**Section 3.9**
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.	**Section 3.7**
Detail emission control techniques/practices that will be employed by the proposal.	**Section 6 and Appendix C**

Comment	Report Section
The EA should include a comprehensive assessment of, and report on, the project's predicted greenhouse gas emissions (tCO_2-e). Emissions should be reported broken down by: - *direct emissions (scope 1 as defined by the Greenhouse Gas Protocol),* - *indirect emissions from electricity (scope 2), and* - *upstream and downstream emissions (scope 3).*	**Section 10**
before and after implementation of the project, including annual emissions for each year of the project (construction, operation and decommissioning).	
The EA should include an estimate of the greenhouse emissions intensity (per unit of production). Emissions intensity should be compared with best practice if possible.	
The emissions should be estimated using an appropriate methodology, in accordance with NSW, Australian and international guidelines.	
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.	

3.3 Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use.

Part 3A of the EP&A Act provides an approvals regime for all 'major projects'. Major projects are defined under Schedule 1 of the State Environmental Planning Policies (Major Development) 2005 (SEPP (Major Development)) and are identified by way of declaration as a listed project in the SEPP (Major Development) or by notice in the NSW Government Gazette. The Minister is the consent authority for all projects to which Part 3A applies. Under Part 3A, the Minister was able to issue a project approval or a concept approval following consultation with the community and relevant State Government agencies. The requirement for certain other permits and licences is removed under Part 3A.

In October 2011, Part 3A of the EP&A Act was repealed. However, the Project has been granted the benefit of transitional provisions and as such, is a development to which Part 3A applies.

This impact assessment has been prepared in accordance with Part 3A of the EP&A Act. The EP&A Act requires that environmental impacts including air quality impacts be assessed and mitigated where necessary.

3.4 Particulate Matter and its Health Significance

Particulate matter has the capacity to affect health and to cause nuisance effects, and is categorised by size and/or by chemical composition. The potential for harmful effects depends on both. The particulate size ranges are commonly described as:

- TSP – refers to all suspended particles in the air. In practice, the upper size range is typically 30 μm to 50 μm.
- PM_{10} – refers to all particles with equivalent aerodynamic diameters of less than 10 μm, that is, all particles that behave aerodynamically in the same way as spherical particles with diameters less than 10 μm and with a unit density. PM_{10} are a sub-component of TSP.
- $PM_{2.5}$ – refers to all particles with equivalent aerodynamic diameters of less than 2.5 μm diameter (a subset of PM_{10}). These are often referred to as the fine particles and are a sub-component of PM_{10}.
- $PM_{2.5-10}$ – defined as the difference between PM_{10} and $PM_{2.5}$ mass concentrations. These are often referred to as coarse particles.

Evidence suggests that health effects from exposure to airborne particulate matter are predominantly related to the respiratory and cardiovascular systems. The human respiratory system has in-built defensive systems that prevent larger particles from reaching the more sensitive parts of the respiratory system. Particles larger than 10 μm, while not able to affect health, can soil materials and generally degrade aesthetic elements of the environment. For this reason air quality goals make reference to measures of the total mass of all particles suspended in the air, this is referred to as TSP. In practice particles larger than 30 to 50 μm settle out of the atmosphere too quickly to be regarded as air pollutants. The upper size range for TSP is usually taken to be 30 μm.

Both natural and anthropogenic processes contribute to the atmospheric load of particulate matter. Coarse particles ($PM_{2.5-10}$) are derived primarily from mechanical processes resulting in the suspension of dust, soil, or other crustal[2] materials from roads, farming, mining and dust storms. Coarse particles also include sea salts, pollen, mould, spores, and other plant parts. Mining dust is likely to be composed of predominantly coarse particulate matter (and larger).

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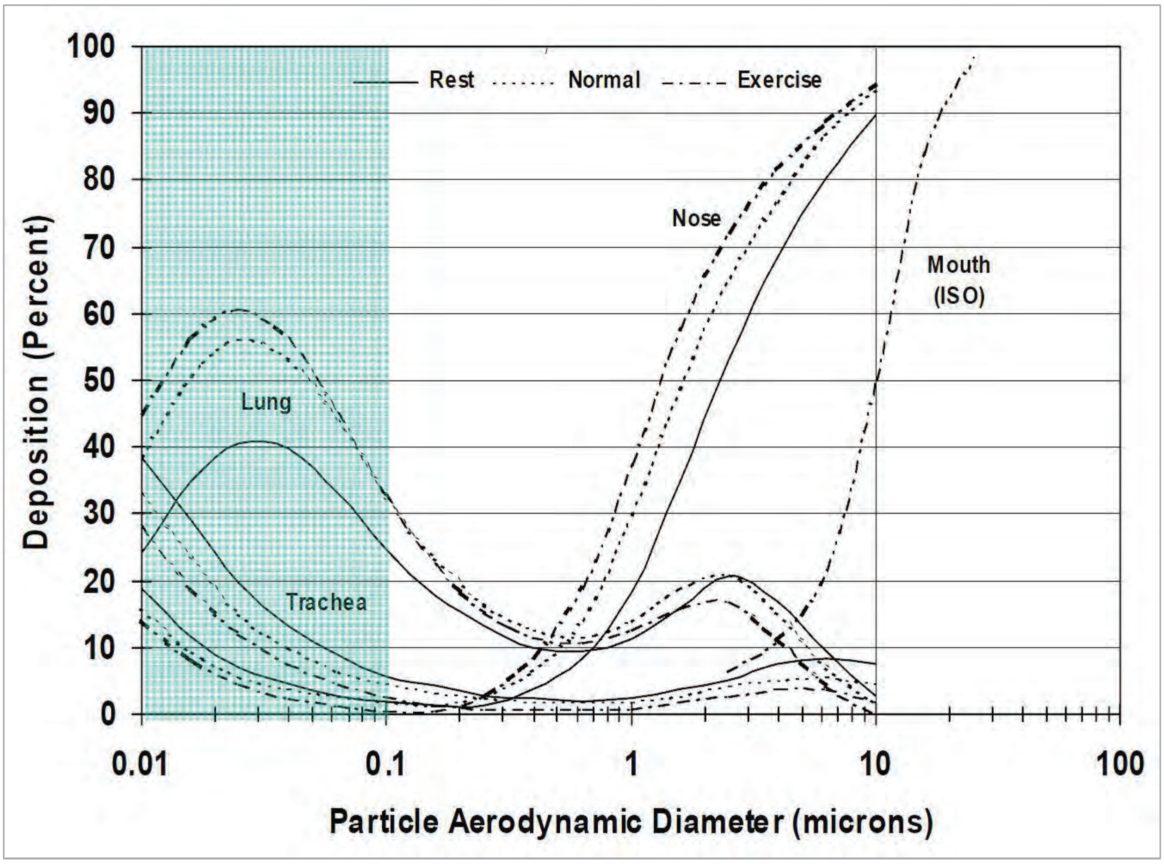
2 Crustal dust refers to dust generated from materials derived from the earth's crust.

Fine particles or $PM_{2.5}$ are derived primarily from combustion processes, such as vehicle emissions, wood burning, coal burning for power generation and natural processes such as bush fires. Fine particles also consist of transformation products, including sulphate and nitrate particles, and secondary organic aerosol from volatile organic compound emissions. $PM_{2.5}$ may penetrate beyond the larynx and into the thoracic respiratory tract and evidence suggests that particles in this size range are more harmful than the coarser component of PM_{10}.

The size of particles determine their behaviour in the respiratory system, including how far the particles are able to penetrate, where they deposit, and how effective the body's clearance mechanisms are in removing them. This is demonstrated in **Figure 3-1**, which shows the relative deposition by particle size within various regions of the respiratory tract. Additionally, particle size is an important parameter in determining the residence time and spatial distribution of particles in ambient air; key considerations in assessing exposure.



Source: **Phalen et al, 1991**

Figure 3-1: Particle Deposition within the Respiratory Track

The health-based assessment criteria used by the EPA have, to a large extent, been developed by reference to epidemiological studies undertaken in urban areas with large populations where the primary pollutants are the products of combustion (**EPA**, **1998**; **National Environment Protection Council** [**NEPC**], **1998a**; **NEPC**, **1998b**). This means that, in contrast to dust of crustal origin, the particulate matter from urban areas would be composed of smaller particles and would generally contain acidic and carcinogenic substances that are associated with combustion.

3.5 EPA Impact Assessment Criteria

The Approved Methods specify air quality assessment criteria relevant for assessing impacts from air pollution (**DEC, 2005**). The air quality goals relate to the total dust burden in the air and not just the dust from the Project. In other words, consideration of background dust levels needs to be made when using these goals to assess potential impacts. These criteria are health-based (i.e. they are set at levels to protect against health effects).

These criteria are consistent with the National Environment Protection Measures for Ambient Air Quality (referred to as the Ambient Air-NEPM) (**NEPC, 1998a**). However, the EPA's criteria includes averaging periods, which are not included in the Ambient Air-NEPM, and also references other measures of air quality, namely dust deposition and TSP.

Table 3-3 summarises the air quality goals for concentrations of particulate matter that are relevant to this study. It is important to note that the criteria are applied to the cumulative impacts due to the Project and other sources.

Table 3-3: EPA Air Quality Criteria for Particulate Matter Concentrations

Pollutant	Averaging period	Standard/Goal	Agency
TSP	Annual mean	90 $\mu g/m^3$	National Health and Medical Research Council
PM_{10}	24-hour maximum	50 $\mu g/m^3$	EPA impact assessment criteria; Ambient Air-NEPM reporting goal, allows five exceedances per year for bushfires and dust storms;
	Annual mean	30 $\mu g/m^3$	EPA impact assessment criteria;

Notes: $\mu g/m^3$ – micrograms per cubic metre.

In May 2003, the NEPC released a variation to the Ambient Air-NEPM (**NEPC, 2003**) to include advisory reporting standards for particulate matter with an equivalent aerodynamic diameter of 2.5 μm or less ($PM_{2.5}$), as shown in Table 3.4 . The purpose of the variation was to gather sufficient data nationally to facilitate the review of the Ambient Air-NEPM, which is currently underway. The variation includes a protocol setting out monitoring and reporting requirements for $PM_{2.5}$ particles. It is noted that the Ambient Air-NEPM $PM_{2.5}$ advisory reporting standards are not impact assessment criteria.

Notwithstanding the above, in the absence of any other relevant standard/goal, the advisory reporting standards have been used in this report for comparison against dispersion modelling results (**Section 8**).

Table 3.4: EPA Advisory Reporting Standards for $PM_{2.5}$

Pollutant	Averaging period	Standard/Goal	Agency
$PM_{2.5}$	Annual Mean	8 $\mu g/m^3$	Ambient Air-NEPM Advisory Reporting Standard
	24-hour average	25 $\mu g/m^3$	

Notes: $\mu g/m^3$ – micrograms per cubic metre.

In addition to health impacts, airborne dust also has the potential to cause nuisance effects by depositing on surfaces, including vegetation. Larger particles do not tend to remain suspended in the atmosphere for long periods of time and will fallout relatively close to source. Dust fallout can soil materials and generally degrade aesthetic elements of the environment, and are assessed for nuisance or amenity impacts.

Table 3-5 shows the maximum acceptable increase in dust deposition over the existing dust levels from an amenity perspective. These criteria for dust fallout levels are set to protect against nuisance impacts (**DEC, 2005**).

Table 3-5: EPA Criteria for Dust (Insoluble Solids) Fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Notes: g/m^2/month – grams per square metre per month.

3.6 Strategic Regional Land Use Plan for the Upper Hunter

The NSW government released the Strategic Regional Land Use Plan (hereafter referred to as SRLUP) for the Upper Hunter region in September 2012. The Plan represents a component of the government's broader Strategic Regional Land Use Policy which comprises initiatives to address land use conflicts in areas such as the Upper Hunter and with a particular focus on managing coal and coal seam gas issues.

The SRLUP will aim to support growth, protect the environment and respond to competing land uses over the next 25 years and will introduce a new decision making scheme. The process would ensure that mining and coal seam gas development does not occur in areas where there would be unacceptable impacts on agricultural resources and industries.

The SRLUP outlines seven key challenges (as listed below) facing the Upper Hunter region and lists actions to address these. The SRLUP has been developed in consultation with a range of stakeholders including local government and will be reviewed every five years and adjusted as necessary.

- Balancing Agricultural and Resource Development.
- Infrastructure.
- Economic Development and Employment.
- Housing and settlement.
- Community health and amenity.
- Natural Environment.
- Natural Hazards and Climate Change.
- Cultural Heritage.

The SRLUP highlights the impact of air pollution, in particular dust, on health and amenity as a major community issue in the region. The SRLUP proposes that any new coal mine must not cause exceedance of health based goals for dust and other relevant pollutants in the NEPM at large towns such as Singleton and Muswellbrook. There are suggestions for mitigating emissions through the following measures:

- Establishing buffer zones and buying affected properties.
- Implementing real time monitoring and the use of meteorological forecasts.
- Provisions for modifying operations on site to ensure compliance.
- Implementing best practice controls and entering into the Pollution Reduction Programs.

The way that Anglo American proposes to address these suggestions are addressed in this assessment in **Section 6 (Overview of Best Practice Dust Control)** and **Section 9 (Monitoring and Management Measures).**

3.7 Action for Air

The NSW State Plan identifies cleaner air and progress on GHG reductions as priorities. In 1998, the NSW Government implemented a 25 year air quality management plan, Action for Air, for Sydney, Wollongong and the Lower Hunter (**EPAW, 2009**). Action for Air is a key strategy for implementing the State Plan's cleaner air goals.

Action for Air seeks to provide long-term ongoing emission reductions. It does not target acute and extreme exceedances from events such as bushfires. The aim of Action for Air includes:

- meeting the national air quality standards for six pollutants as identified in the Ambient Air-NEPM; and
- reducing the population's exposure to air pollution, and the associated health costs.

The six pollutants in the Ambient Air-NEPM include CO, NO_2, SO_2, lead, ozone and PM_{10}. The main pollutant from the Project that is relevant to the Action for Air is PM_{10}. Action for Air aims to reduce air emissions to enable compliance with the Ambient Air-NEPM targets to achieve the aims described above, with a focus on motor vehicle emissions.

Whilst the Drayton South Coal Project is not located within the areas relevant to the Action for Air plan (i.e. Sydney, Wollongong and the Lower Hunter), the Project generally addresses the aims of the Action for Air Plan in the following ways:

- PAEHolmes have reviewed potential mitigation measures with reference to best practice and a range of measures have been adopted for the Project (**Section 6**).
- Air quality emissions potentially associated with the Project have been quantified (**Section 7**).
- Dispersion modelling has been conducted by PAEHolmes to predict the impact of these emissions on nearby receivers and assess the effect of the emissions on ambient concentrations which can then be compared with the Ambient Air-NEPM goals (**Section 8**).

3.8 The Best Practice Report

The NSW EPA commissioned *the NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (**Donnelly et al., 2011**) (the Best Practice Report). This report is a review of the coal mining activities in the Greater Metropolitan region of NSW.

The Best Practice report provides a guidance of controls for reducing emissions are benchmarked on the international best practice for the following activities:

- Haul roads.
- Wind erosion of exposed materials and stockpiles.
- Bulldozing.
- Blasting.
- Drilling.
- Draglines.
- Loading and dumping overburden.
- Loading and dumping ROM coal.
- Monitoring, proactive and reactive management.

The full set of potential best practice control measures for each of these activities, along with the controls to be adopted by the Project, have been summarised in **Table 6-2** (see **Section 6**). Anglo American is currently in the process of responding to the Pollution Reduction Program and will incorporate any additional measures to control dust that are identified through this process.

3.9 Protection of the Environment Operations Act 1997

In addition, the NSW *POEO (Clean Air) Regulation 2010* prescribes requirements for domestic solid fuel heaters, control of burning, motor vehicle emissions and industrial emissions (such as Volatile Organic Carbons). Motor vehicle emissions would be addressed by regular maintenance of all vehicles associated with the Project.

In addition, burning on-site would be avoided to minimise potential for smoke impacts on neighbouring receivers.

4 EXISTING ENVIRONMENT

4.1 Air Quality

Air quality standards and goals refer to pollutant levels that include the contribution from specific projects and existing sources. To fully assess impacts against all the relevant air quality standards and goals (see **Section 3**) it is necessary to have information or estimates on existing dust concentration and deposition levels in the area in which the Project is likely to contribute. It is important to note that the existing air quality conditions (that is, background conditions) are influenced by the existing mining operations in the area.

Dust deposition and dust concentration (TSP and PM_{10}) is monitored in the vicinity of the Project. The locations of the monitoring sites are shown in **Figure 4-1**. A total of eleven dust deposition gauges have been measuring the monthly average of deposited dust since 1998, with five gauges currently active. High volume air samplers (HVAS) measure 24-hour average concentrations of TSP (or PM_{10}) every sixth day. There is currently one HVAS measuring TSP only (HV5), and two HVASs measuring 24-hour average concentrations of TSP and PM_{10} (HV2a and HV4).

The following sections discuss the dust deposition, TSP and PM_{10} monitoring results.

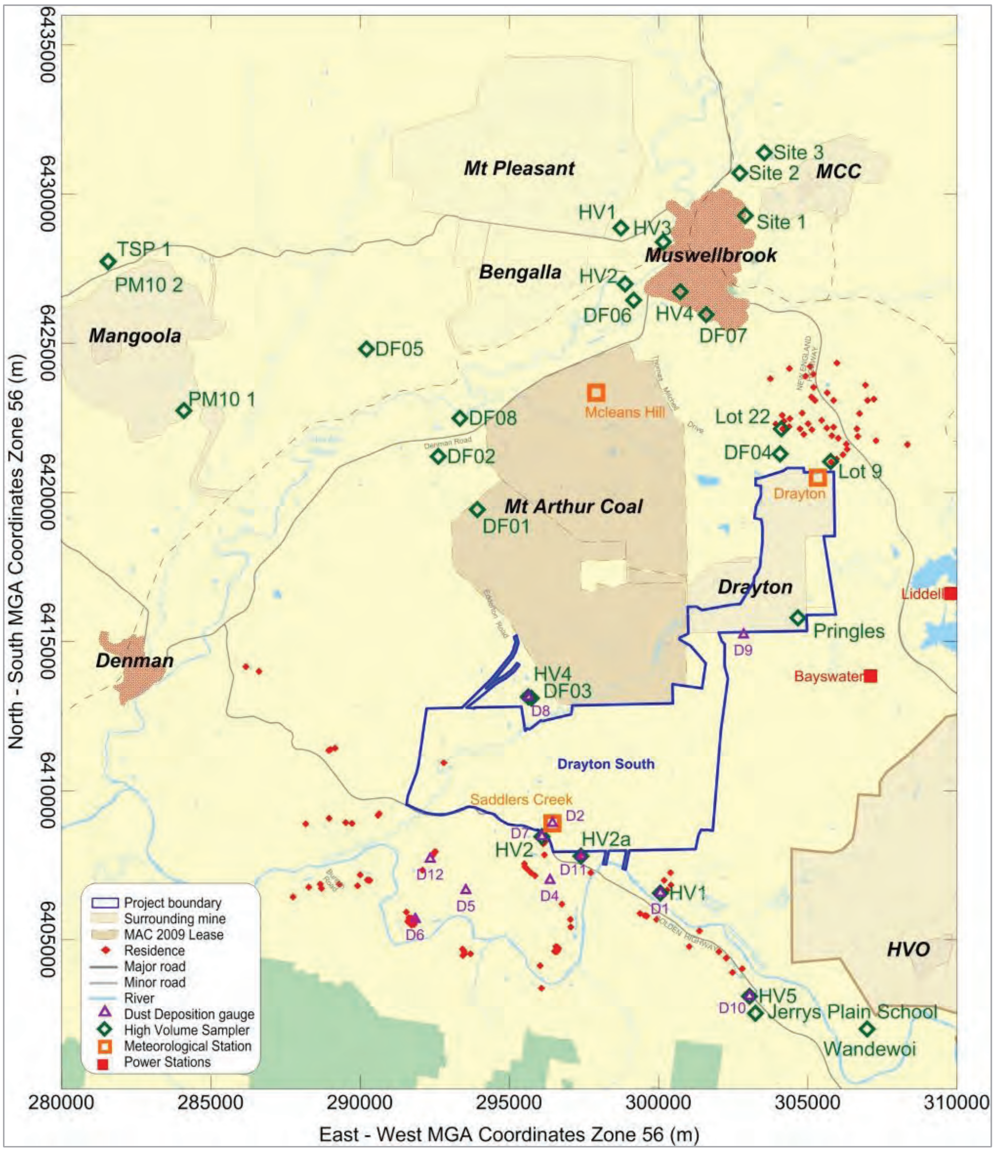


Figure 4-1: Site location, monitoring sites and residences

4.1.1 Dust deposition data

Figure 4-1 shows the locations of the 11 dust deposition gauges analysed in this assessment. The annual averages (excluding contaminated data) are summarised in **Table 4-1**. Highlighted cells indicate an exceedance of the EPA's annual average assessment criterion of 4 g/m^2/month for insoluble solids.

Table 4-1: Annual average Dust deposition data (insoluble solids) – 1998 to 2011 (g/m^2/month)

Year	D1	D2	D4	D5	D6	D7	D8	D9	D10	D11	D12
1998	1.1	0.7	-	0.8	1.8	2.6	1.2	2.7	-	-	-
1999	1.4	1.1	2.4	1.2	1.2	0.8	2.1	2.6	-	-	-
2000	1.1	**4.1**	-	1.0	1.3	2.7	1.6	3.4	-	0.8	-
2001	1.2	1.8	-	1.2	1.0	-	1.0	2.6	0.9	0.9	0.7
2002	-	-	-	-	-	-	1.5	**4.1**	1.3	1.0	1.8
2003	-	-	-	-	-	-	0.8	2.3	0.9	0.9	0.8
2004	-	-	-	-	-	-	1.4	2.9	1.1	1.5	1.3
2005	-	-	-	-	-	-	0.8	2.5	0.9	0.9	0.9
2006	-	-	-	-	-	-	1.1	2.9	0.9	1.0	1.5
2007	-	-	-	-	-	-	1.1	2.4	0.9	1.4	1.1
2008	-	-	-	-	-	-	0.9	2.9	1.0	1.1	0.7
2009	-	-	-	-	-	-	1.1	3.8	1.5	1.6	2.1
2010	-	-	-	-	-	-	0.9	3.2	0.9	1.6	1.6
2011	-	-	-	-	-	-	1.0	-	1.6	2.3	2.2

Figure 4-2 shows that since 2003, all dust gauges have recorded annual average deposition levels lower than the EPA's annual average assessment criterion of 4 g/m^2/month for insoluble solids. It is noted that these observations include the effects of existing operations from other mines in the surrounding area as well as all other sources of PM (e.g. traffic, and emissions from industrial, agricultural and domestic activities). The elevated level at D09 during 2009 is associated with dust storms during September that year.

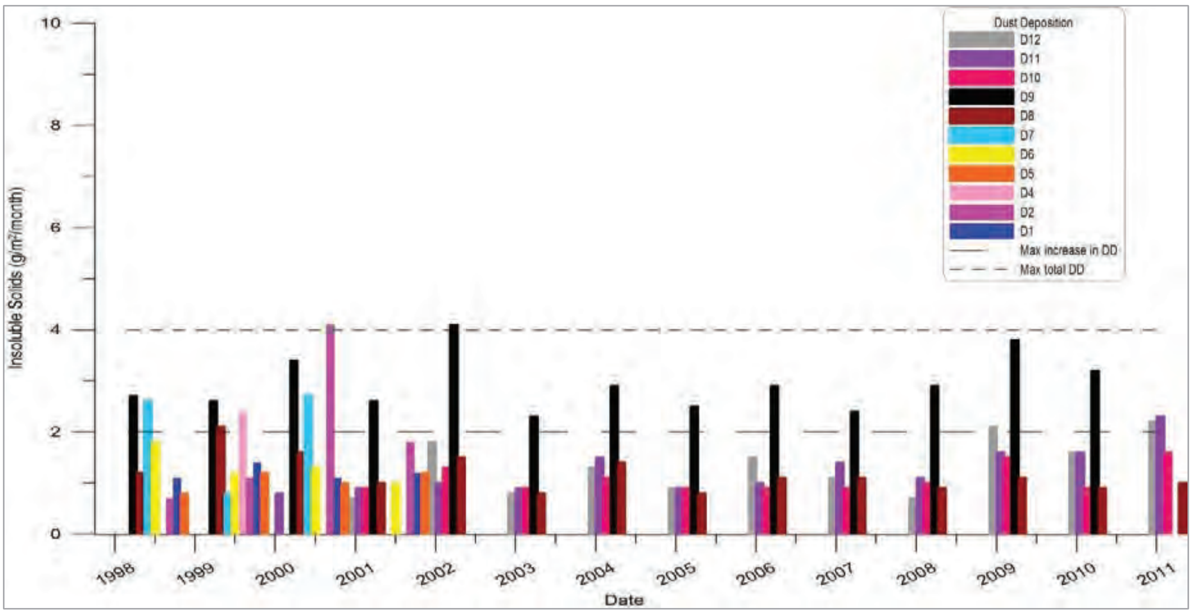


Figure 4-2: Dust Deposition Gauges (g/m^2/month) 1998-2011

4.1.2 TSP and PM_{10} concentrations

The main sources of particulate matter in the area include nearby mines, coal-fired power stations, with minor emissions from traffic on sealed and unsealed roads, local building, construction and agricultural activities.

The locations of the HVASs are shown in **Figure 4-1**. There is currently one HVAS measuring TSP only (HV4), and two HVASs measuring 24-hour average concentrations of TSP and PM_{10} (HV2a and HV5) in the locality of the Project. In addition there are 3 monitoring locations for Drayton coal mine measuring PM_{10} (Lot 9) and TSP (Pringles and LOT 22).

A summary of annual average data collected at Drayton and Drayton South since 1998 is presented in **Table 4-2**. This demonstrates that the annual average TSP concentrations are below the EPA criteria of 90 $\mu g/m^3$. Elevated levels are present in 2006 and 2009 at all HVASs, however they are still well below the EPA TSP criterion.

Most of the annual average PM_{10} concentrations are at or below the 30 $\mu g/m^3$ EPA criteria, however from 2002 to 2006 the annual average PM_{10} concentrations at HV2a were above the criteria. This monitor was located near a cultivated farming paddock and has since been moved to a more suitable location. In 2003, the annual average PM_{10} concentration at HV5 was above the EPA criteria. Some of the higher readings coincide with events such as extensive drought conditions, dust storms and bushfires; however, it is not possible to distinguish between mine dust and dust from other sources during such events. Since 2007, all data have been below the annual average criteria for PM_{10}.

Table 4-2: TSP and PM_{10} annual average concentrations ($\mu g/m^3$)

Year	Edderton (HV4)	Llanillo (HV2a)		Jerry's Plains School (HV5)		LOT 9	LOT 9
	TSP	TSP	PM_{10}	TSP	PM10	PM10	TSP
1998	31	-	-	-	-	-	-
1999	32	-	-	-	-	-	-
2000	30	38	17	-	-	-	-
2001	35	44	15	32	19	-	-
2002	44	53	**39**	49	22	-	-
2003	46	58	**31**	42	**31**	-	-
2004	42	43	**32**	38	25	-	-
2005	45	46	**37**	42	14	21	50
2006	61	59	**42**	52	15	27	-
2007	43	51	20	49	18	31	68
2008	50	43	16	58	17	23	52
2009	45	49	24	55	15	26	63
2010	37	35	14	42	15	-	50
2011	35	32	12	38	13	-	44
Average all data	**41**	**46**	**25**	**45**	**17**	**26**	**54**

Note: shading indicates exceedances above EPA annual average assessment criterion

Figure 4-3, **Figure 4-4** and **Figure 4-5** are a graphical representative of the TSP monitoring data, expressed as a rolling annual average, at HVAS sites HV4, HV2a and HV5 respectively. Lot 22 TSP monitoring data is shown in **Figure 4-6**.

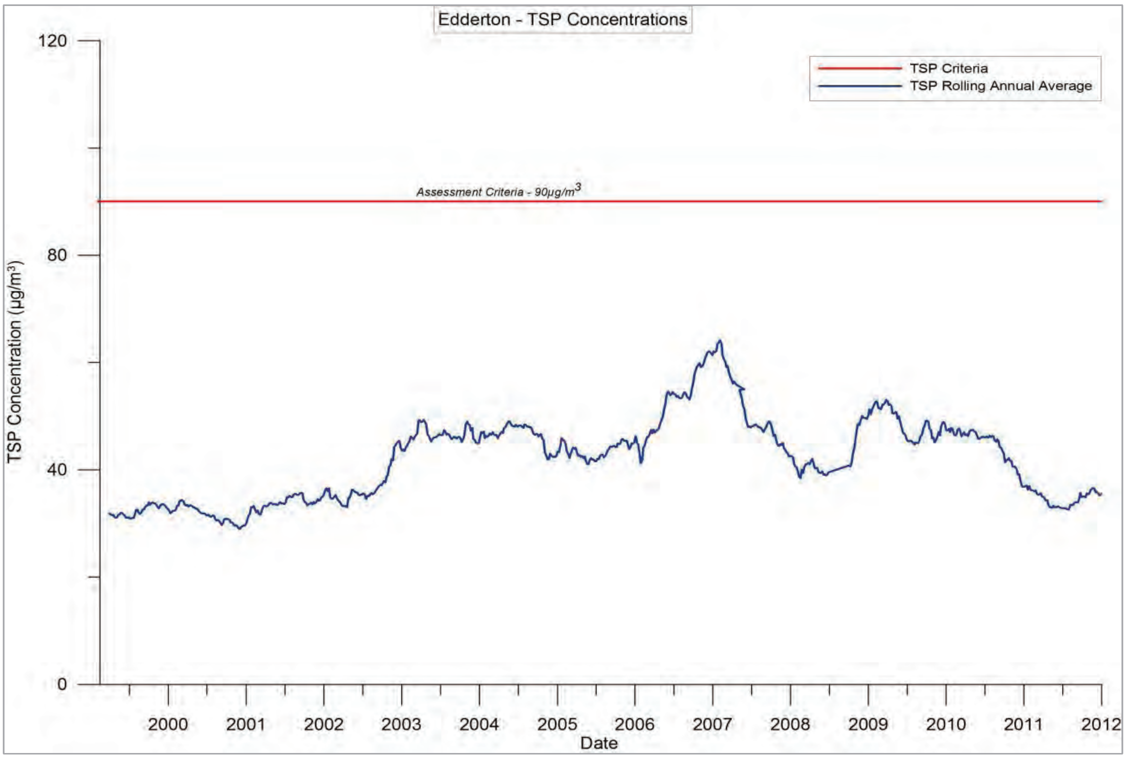


Figure 4-3: TSP Concentration at Edderton (HV4), 1998-2011.

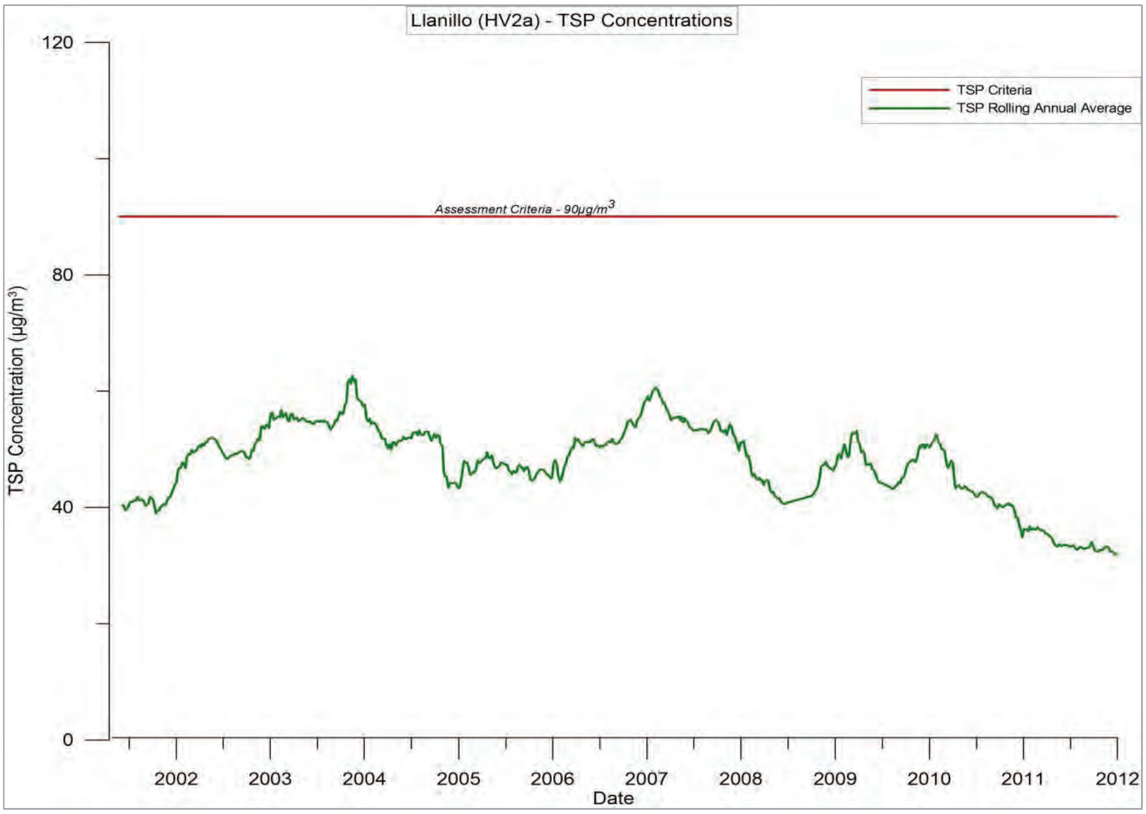


Figure 4-4: TSP Concentration at Llanillo (HV2a), 2000-2011.

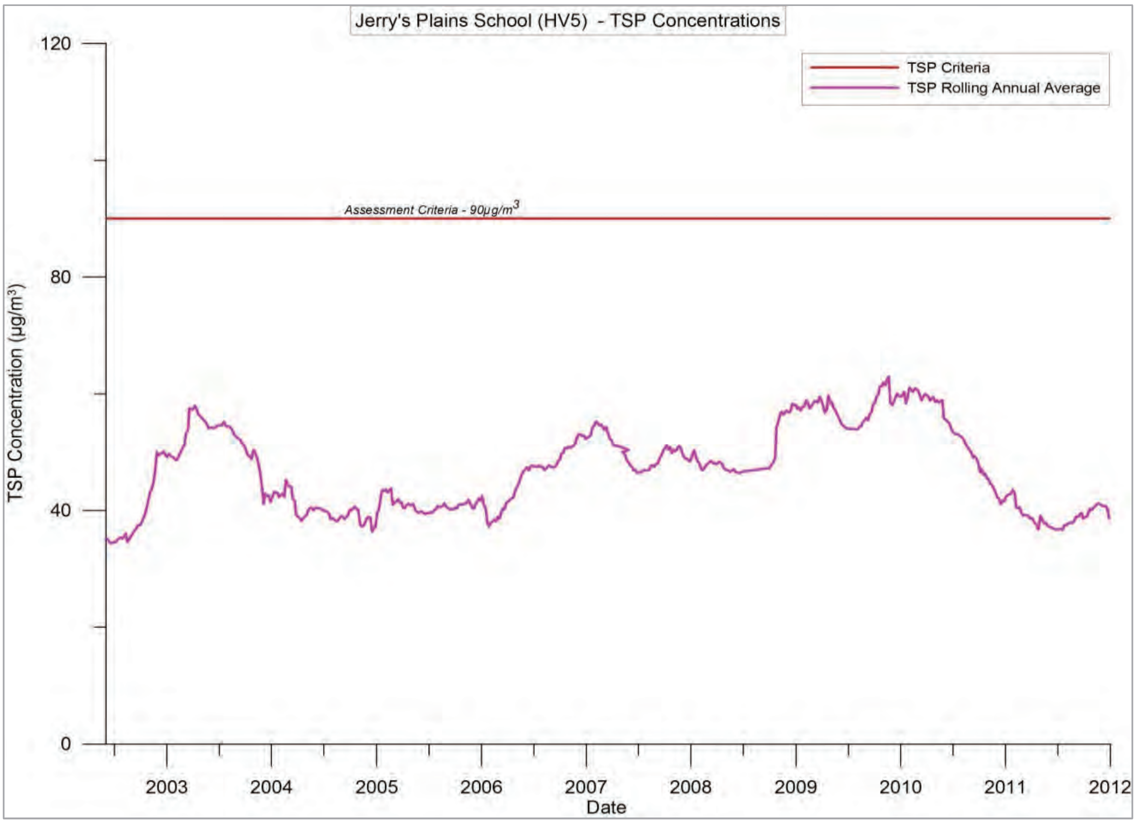


Figure 4-5: TSP Concentration at Jerry's Plain School (HV5), 2001-2011.

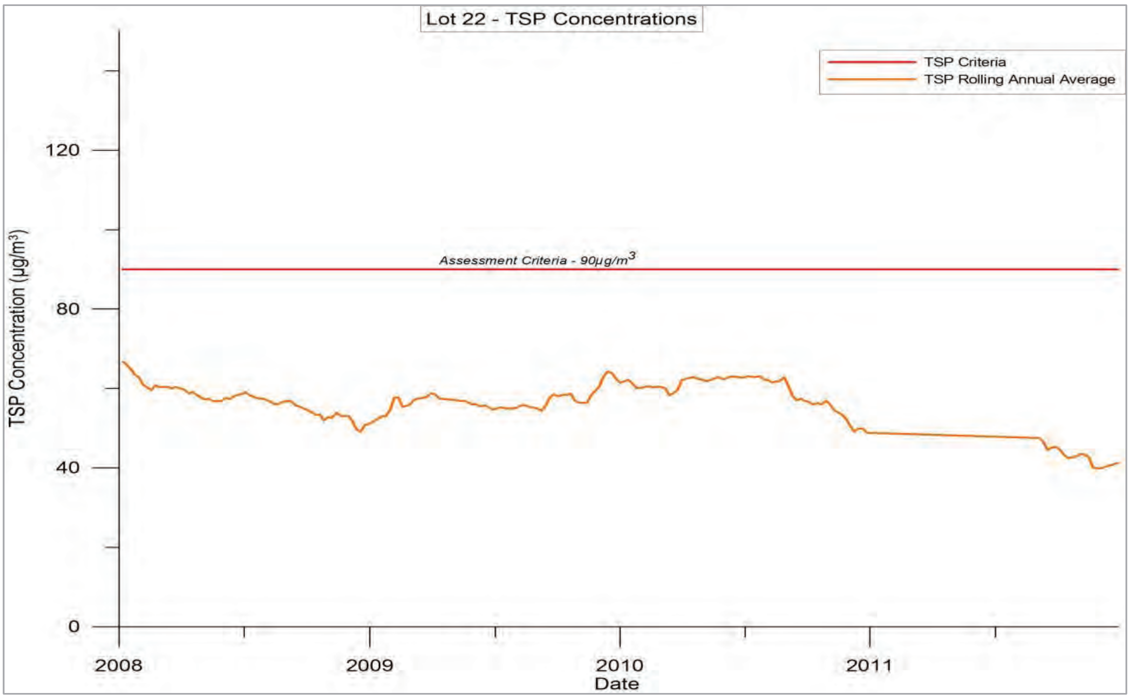


Figure 4-6: TSP Concentration at Lot 22, 2008-2011.

Figure 4-7 and **Figure 4-8** present a graphical representation of PM_{10} monitoring data at HVAS sites HV2a and HV5 respectively. The graphs show that at HV2a there have been a number of exceedances of the 24 hour criteria during monitoring runs and an exceedance of the rolling annual average criteria from 2002 to 2006. At HV5 the most frequent exceedance of the 24 hour criteria was during 2003 and during that year the annual average criteria was also exceeded.

The data suggests that in general higher 24-hour concentrations are recorded at HV2a. It is our understanding that the Llanillo (HV2a) monitor is located near a cultivated paddock and has since been moved to a more representative location.

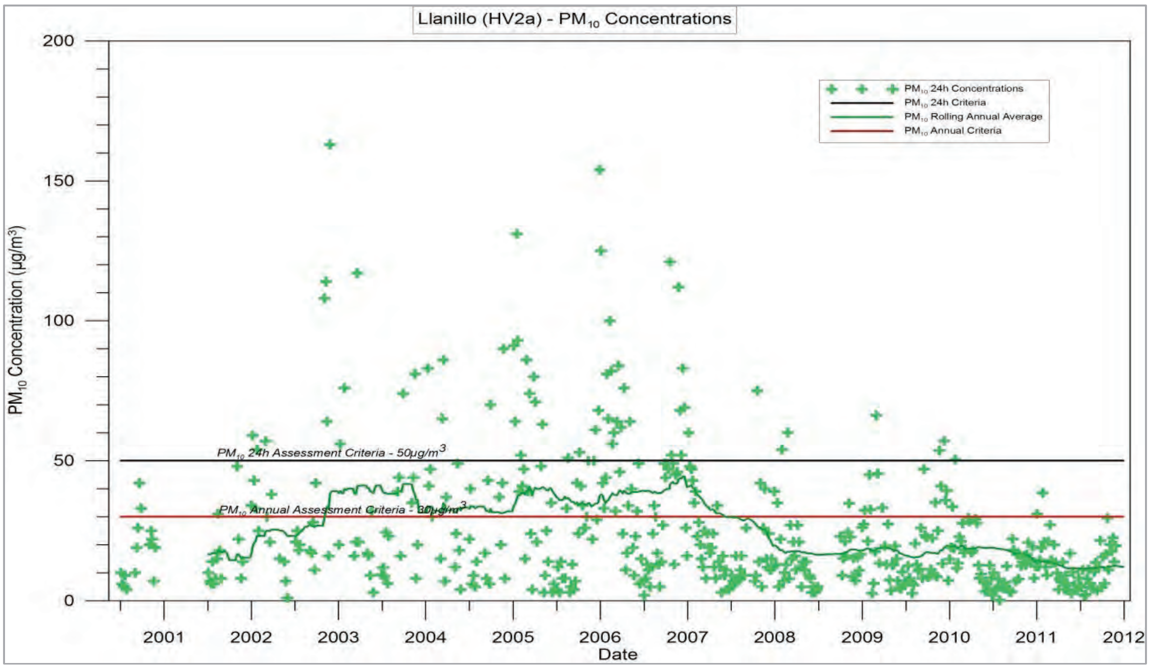


Figure 4-7: PM$_{10}$ Concentration at Llanillo (HV2a), 2000-2011.

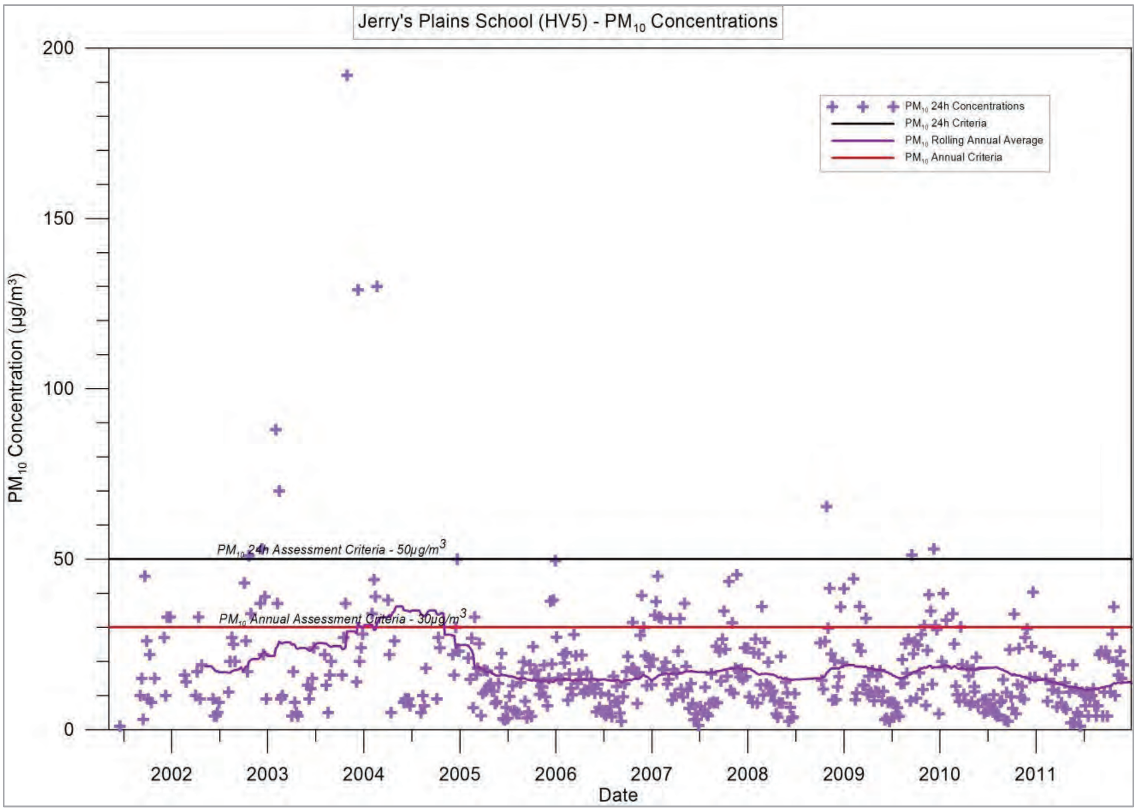


Figure 4-8: PM$_{10}$ Concentration at Jerry's Plain School (HV5), 2001-2011.

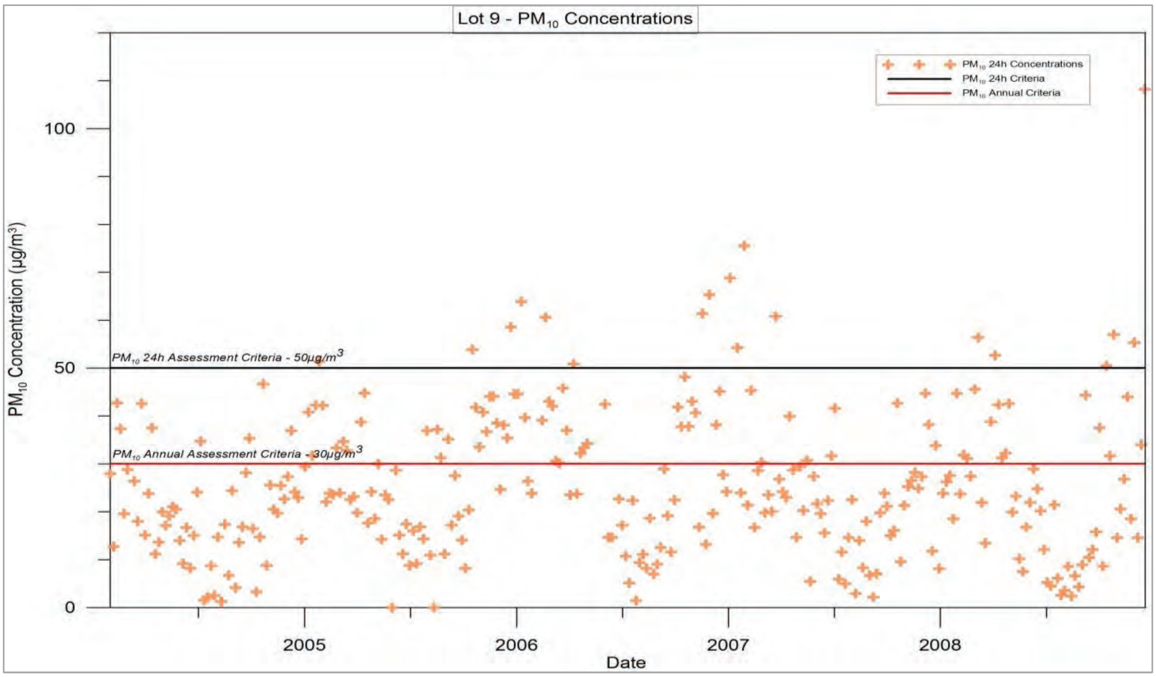


Figure 4-9: PM_{10} Concentration at Lot 9 – Drayton Coal Mine, 2005-2011.

4.2 Local Meteorology

4.2.1 Prevailing winds

Anglo American has operated a meteorological station at Saddlers creek since March 1998. An analysis of all meteorological data collected at Saddlers Creek between 2002 and 2011 shows that since 2006 there has been an increase in the percentage of measured calm periods (wind speeds less than 0.5 m/s). The sensitivity of weather stations to record lower wind speeds can deteriorate with time as the bearings in the anemometer wear and result in stalling as well as higher re-starting thresholds. A new meteorological station was installed at the same location in November 2010.

There are significantly more calms in the Saddlers Creek data when compared with the nearby Macleans Hill data (see locations in **Figure 4-1**) for the period April 2007 to March 2008, as shown in **Table 4-4**.

On the basis of this analysis, 2005 was chosen as the modelling year. This period is representative of wind patterns across all years and seasons (refer to **Appendix A**) and does not exhibit some of the inconsistencies in calm conditions noted in later datasets. The 2005 data for Saddlers Creek are >90% complete and therefore suitable for dispersion modelling.

Table 4-3: Percentage of calm periods in Saddlers Creek meteorological data

Period	Saddlers creek data									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
All	1.9%	2.3%	2.2%	2.8%	5.4%	9.9%	6.1%	11.6%	25.3%	1.2%
Summer	0.9%	1.5%	1.8%	2.3%	3.7%	6.5%	6.2%	11.6%	15.5%	0.6%
Autumn	3.8%	2.8%	3.1%	4.5%	4.4%	13.1%	7.6%	N/A	30.6%	0.6%
Winter	1.4%	2.6%	1.9%	2.0%	7.7%	9.1%	5.1%	N/A	32.4%	1.6%
Spring	1.6%	2.3%	1.7%	2.6%	5.3%	10.9%	2.1%	N/A	18.2%	1.9%

Table 4-4: Percentage of calm periods in Saddlers Creek compared to Macleans Hill

Period	Saddlers Creek Apr-07 to March 2008	Macleans Hill Apr-07 to March 2008
All	10%	1%
Summer	8%	1%
Autumn	14%	2%
Winter	9%	1%
Spring	11%	1%

Note: This comparison is based on data made available from Macleans Hill

4.2.2 Local climatic conditions

The Bureau of Meteorology (BoM) collects climatic information in the vicinity of the Project. A range of climatic information collected from the Jerry's Plain Post office weather station (located approximately 6 km southeast of the Project) are presented in **Table 4-5** (**BoM, 2012**). Temperature and humidity data consist of monthly averages of 9.00 am and 3.00 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consists of mean monthly rainfall and the average number of rain days per month.

Table 4-5: Climate Information for Jerry's Plain Post Office meteorological station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9.00 am Mean Dry-bulb and Wet-bulb Temperatures (ºC) and Relative Humidity (%)													
Dry-bulb	23.4	22.7	21.2	18.0	13.6	10.6	9.4	11.4	15.3	19.0	21.1	23.0	17.4
Humidity	67	72	72	72	77	80	78	71	65	59	60	61	70
3.00 pm Mean Dry-bulb and Wet-bulb Temperatures (ºC) and Relative Humidity (%)													
Dry-bulb	29.8	28.9	27.2	24.1	20.1	17.1	16.4	18.2	21.2	24.2	26.9	29.0	23.6
Humidity	47	50	49	49	52	54	51	45	43	42	42	42	47
Mean Maximum Temperature (ºC)													
Mean	31.7	30.9	28.9	25.3	21.3	18.0	17.4	19.4	22.9	26.2	29.1	31.2	25.2
Mean Minimum Temperature (ºC)													
Mean	17.2	17.1	15.0	11.0	7.4	5.3	3.8	4.4	7.0	10.3	13.2	15.7	10.6
Rainfall (mm)													
Mean	76.7	72.8	58.8	44.3	40.9	48.1	43.5	36.5	42.0	52.2	61.1	67.9	645.4
Raindays (Number)													
Mean	6.5	6.0	5.8	4.9	4.9	5.5	5.2	5.2	5.2	5.9	6.2	6.4	67.7

Source: **BOM (2012)**
ºC = degrees Celsius
mm = millimetres
Climate averages for Station: 061086; Commenced: 1884, Last record: 2012; Latitude: 32.50 °S; Longitude: 150.91 °E.

The annual average maximum and minimum temperatures experienced at Jerry's Plain are 25.2°C and 10.6°C respectively. On average January is the hottest month, with an average maximum temperature of 31.7°C. July is the coldest month, with average minimum temperature of 3.8°C.

The annual average relative humidity reading collected at 9.00 am from the Jerry's Plain site is 70% and at 3.00 pm the annual average is 47%. The month with the highest relative humidity on average is June with 9.00 am averages of 80%. The months with the lowest relative humidity are October, November and December with 3.00 pm averages of 42%.

Rainfall data collected at Jerry's Plain shows that January is the wettest month, with an average rainfall of 76.7 mm over 6.5 rain days. The average annual rainfall is 645.4 mm with an average of 67.7 rain days.

5 METHODOLOGY

5.1 Approach to Assessment

The overall approach to the assessment follows the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW DEC, 2005**) using the Level 2 assessment methodology. The Approved Methods specify how assessments based on the use of air dispersion models should be completed. They include guidelines for the preparation of meteorological data to be used in dispersion models and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the proposal. The approach taken in this assessment follows as closely as possible the approaches suggested by the guidelines.

The air dispersion modelling conducted for this assessment is based on an advanced modelling system using the models TAPM and CALMET/CALPUFF (see

Figure 5-1). This system overcomes some of the limitations of steady-state Gaussian plume models such as AUSPLUME and ISC.

The modelling system works as follows:

- TAPM is a prognostic meteorological model that generates gridded three-dimensional meteorological data for each hour of the model run period.
- CALMET, the meteorological pre-processor for the dispersion model CALPUFF, calculates fine resolution three-dimensional meteorological data based upon observed ground and upper level meteorological data, as well as observed or modelled upper air data generated for example by TAPM.
- CALPUFF then calculates the dispersion of plumes within this three-dimensional meteorological field.

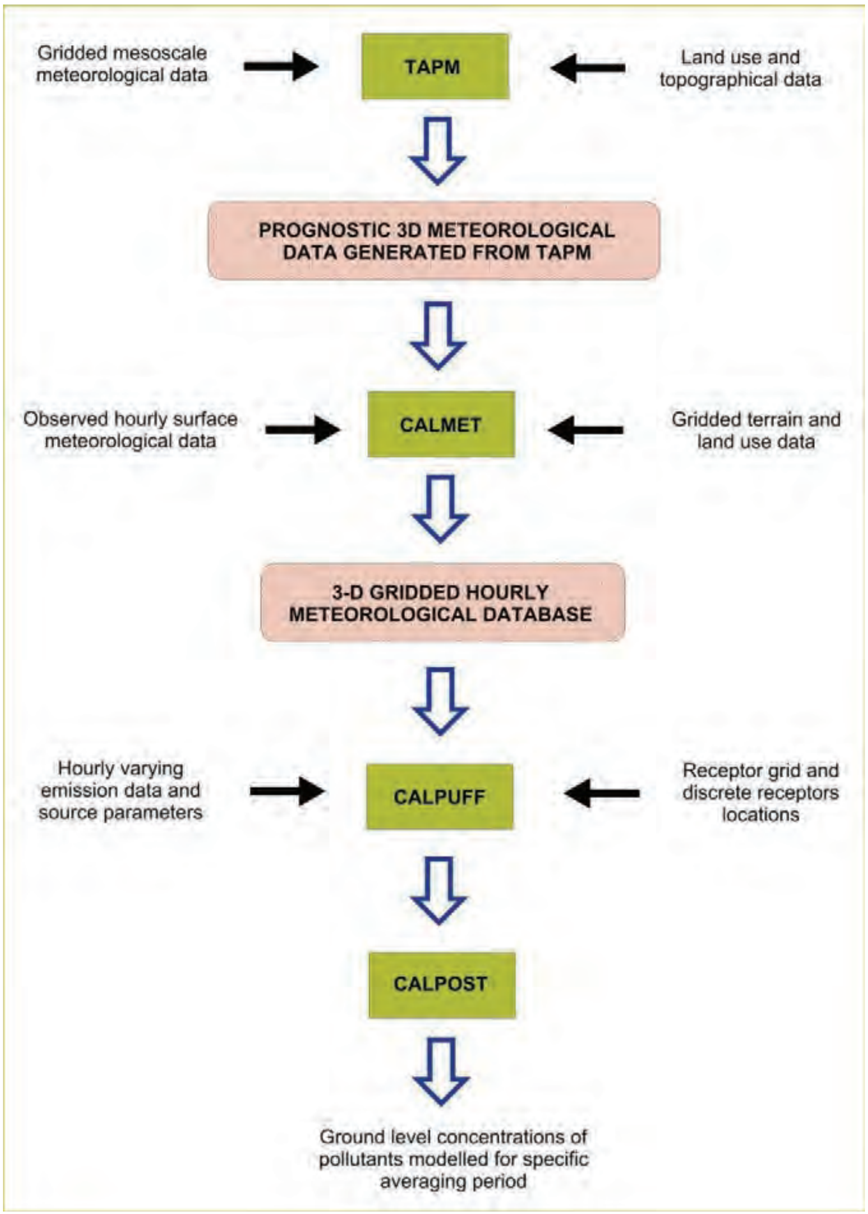


Figure 5-1: Modelling methodology used in this study

Output from TAPM, plus regional observational weather station data were entered into CALMET, a meteorological pre-processor endorsed by the US EPA and recommended by the NSW EPA for use in non-steady state conditions. From this, a 1-year representative meteorological dataset suitable for use in the 3-dimensional plume dispersion model, CALPUFF, was compiled. Details on the model configuration and data inputs are provided in the following sections.

A summary of the TAPM and CALMET model set up and inputs can be found in **Appendix F**.

5.2 TAPM

The Air Pollution Model, or TAPM, is a three dimensional meteorological and air pollution model developed by the CSIRO Division of Atmospheric Research. Detailed description of the TAPM model and its performance can be found in **Hurley (2008)** and **Hurley, Edwards et al. (2009)**.

TAPM utilises fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses.

For the Project Assessment, TAPM was set up with 3 domains, composed of 42 grids along both the X and the Y axes, centred on -32° 21' Latitude and 151° 18' Longitude (340km, 6432km), to capture both the inner and outer modelling domains. Each nested domain had a grid resolution of 30 km, 10 km, 3 km and 1 km respectively.

Default TAPM terrain values are based on a global 30-second resolution (approximately 1 km) dataset provided by the US Geological Survey, Earth Resources Observation Systems (EROS). Default land use and soils data sets for TAPM were used.

TAPM was used to generate gridded prognostic data (3D.dat) for the CALMET modelling domain.

5.3 CALMET

The choice of the CALMET/CALPUFF modelling system for this study is based on the fact that simple Gaussian dispersion models such as ISC assumes that the meteorological conditions are uniform spatially over the entire modelling domain for any given hour. While this may be valid for some applications, in complex flow situations, such as areas with complex terrain, the meteorological conditions may be more accurately simulated using a wind field model such as CALMET.

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

CALMET was run with an outer domain covering a 120 km x 120 km area, with the origin (SW corner) at 280 km Easting and 6360 km Northing (UTM Zone 56S). This consisted of 48 x 48 grid points, with a 2.5 km resolution along both the X and Y axes.

Observed hourly surface wind speed, wind direction, temperature and relative humidity data from the Saddlers Creek, Macleans Hill and Drayton weather stations, as well as four Bureau of Meteorology (BoM) Automatic Weather Stations (AWS), were used as input for CALMET (see **Figure 5-2** for locations). The outer domain was chosen to incorporate the cloud amount and cloud heights observations at the Williamtown station.

Together, the seven surface stations and the three-dimensional data file generated by TAPM were used as input to CALMET to create a coarse resolution three-dimensional meteorological field for the region.

The CALMET generated meteorological parameters from the outer grid were then used as input into a finer resolution inner grid to provide better resolution closer to the site. The origin for the inner domain was 280 km Easting and 6400 km Northing (UTM Zone 56 S). This consisted of 120 x 120 grid points, with a 0.25 km resolution along both the X and Y axes. Land use for the domain was determined by aerial photography from Google Earth. **Figure 5-2** presents the inner and outer modelling domains used in this study.

Terrain for this area was derived from 90 m DEM data sourced from NASA.

The Saddlers Creek, Macleans Hill and Drayton weather station data were again used as input for CALMET, the same as for the outer grid. Upper air data were also extracted from the 3 km TAPM to provide the necessary upper air files. CALMET uses the meteorological inputs in combination with land use and geophysical information for the modelling domain to generate a fine resolution three-dimensional wind field the region.

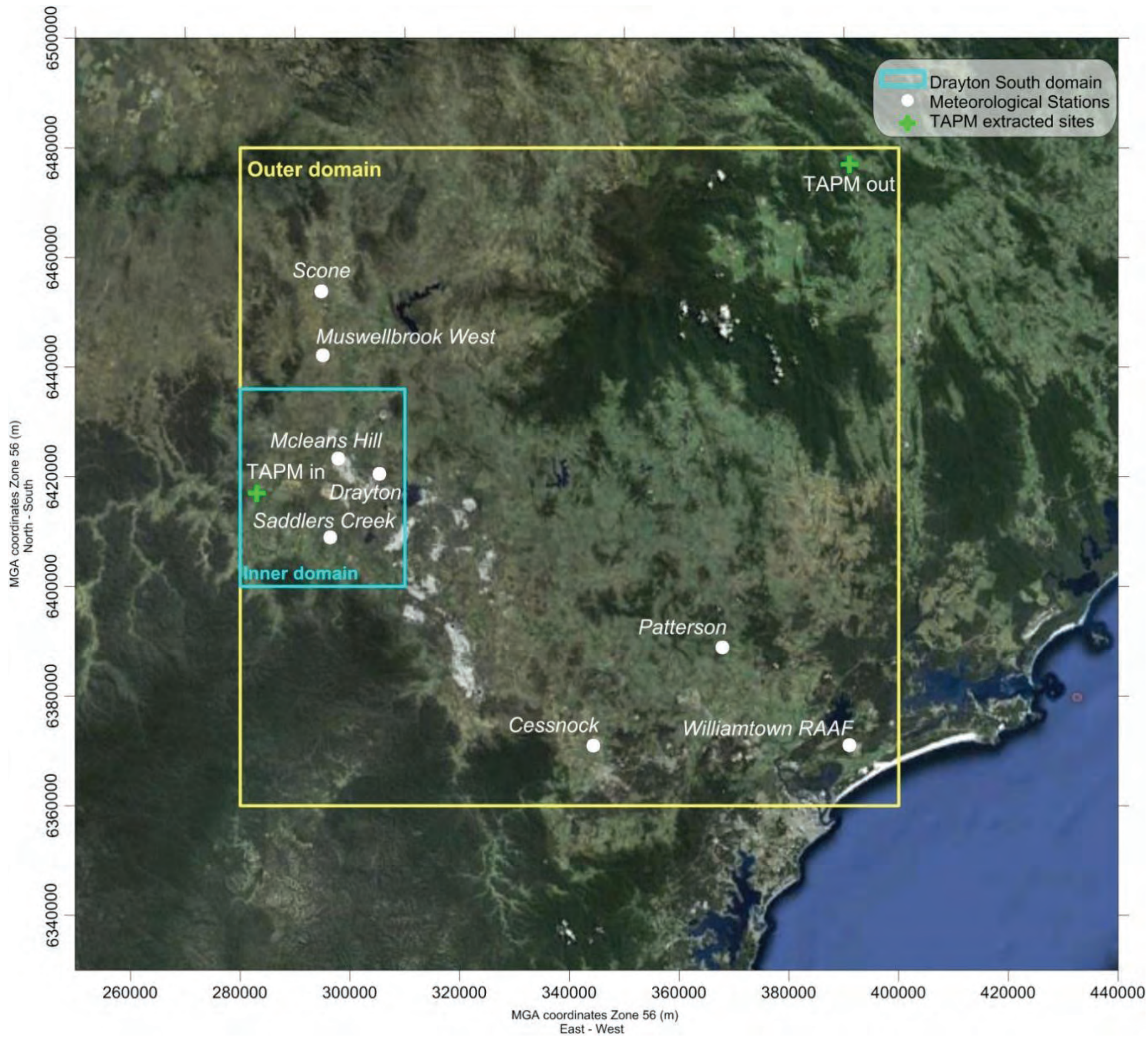


Figure 5-2: CALMET modelling domains and meteorological station locations

5.4 Wind Speed and Direction

Seasonal and annual windroses from the Saddlers Creek weather station for 2005 are presented in **Figure 5-3**. These data represent the surface station inputs used within the CALMET modelling as discussed in **Section 5.3**. On an annual basis, winds are predominantly from the southeast and the northwest quadrant. Summer, spring and autumn also reflect this pattern. The predominant wind direction in winter is from the northwest and to a lesser extent west-northwest, north-northwest and southeast.

As discussed in **Section 5.3,** a CALMET data file was generated for the modelling domain. To compare the wind field produced by the model with observed data, a meteorological dataset was extracted for a point in the middle of the Project Boundary. Windroses for this CALMET generated file is shown in **Figure 5-4**. The CALMET generated windroses show very similar patterns to the Saddlers creek data (see **Figure 5-3**). The annual percentage of calms for the CALMET data is 3.9%, which is approximately 2% higher than measured at the Saddlers Creek weather station.

For comparison **Figure 5-5** and **Figure 5-6** present wind vectors generated by CALMET on two different days and hours across the modelled year. These vector plots illustrate that the CALMET wind field captures the influence from local terrain.

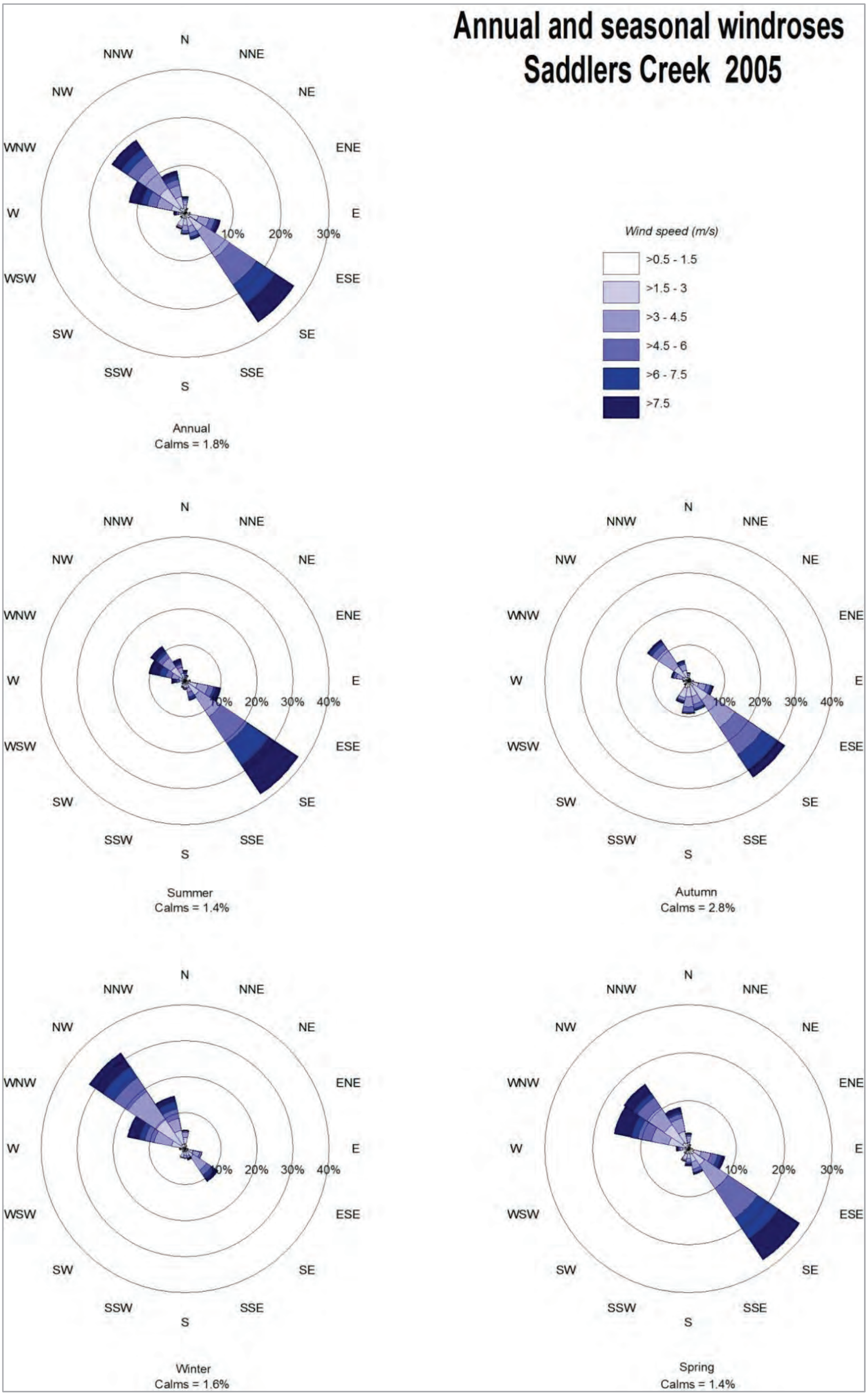


Figure 5-3: Windroses at Saddlers Creek Meteorological station for 2005.

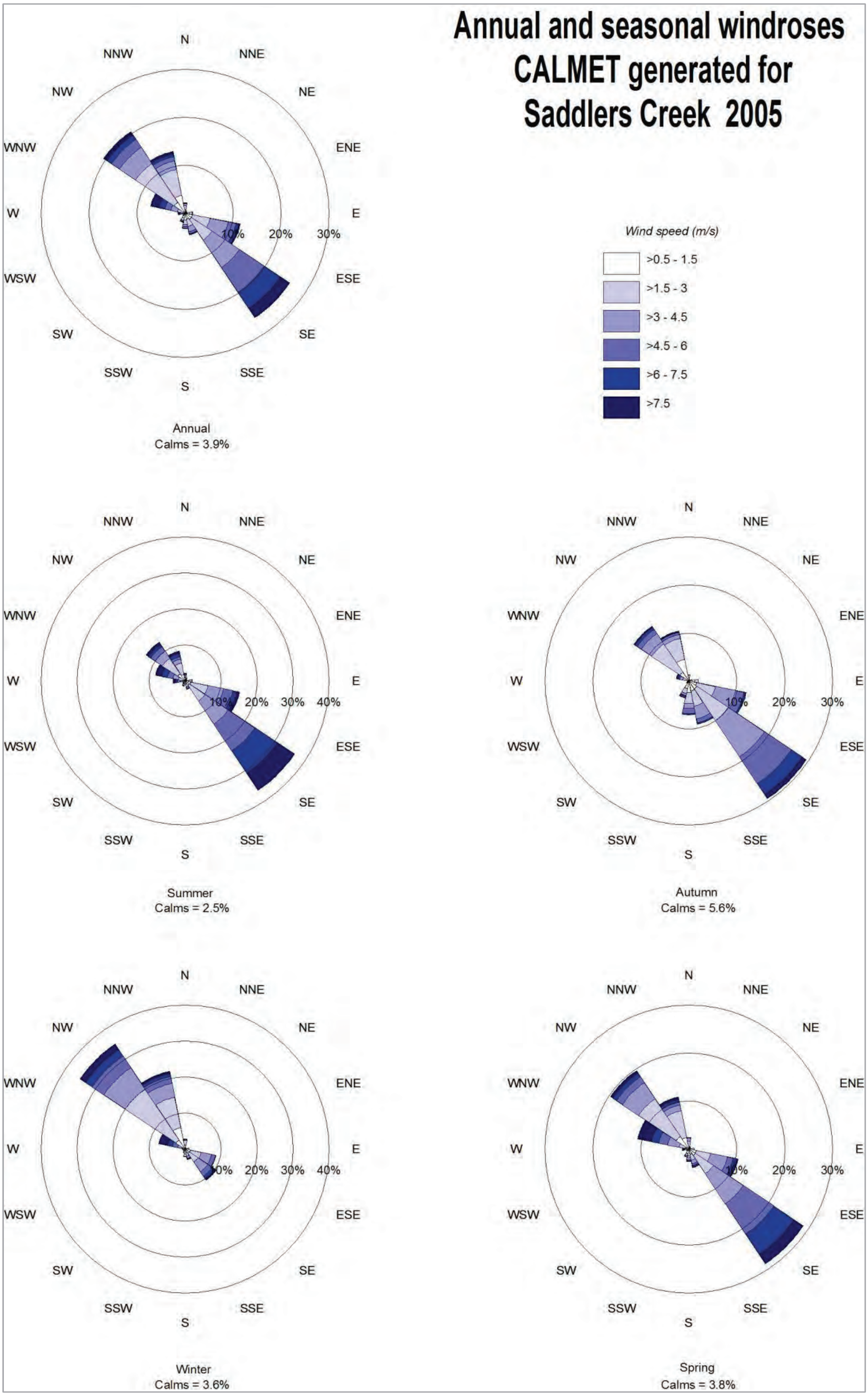


Figure 5-4: CALMET generated windroses at Saddlers Creek.

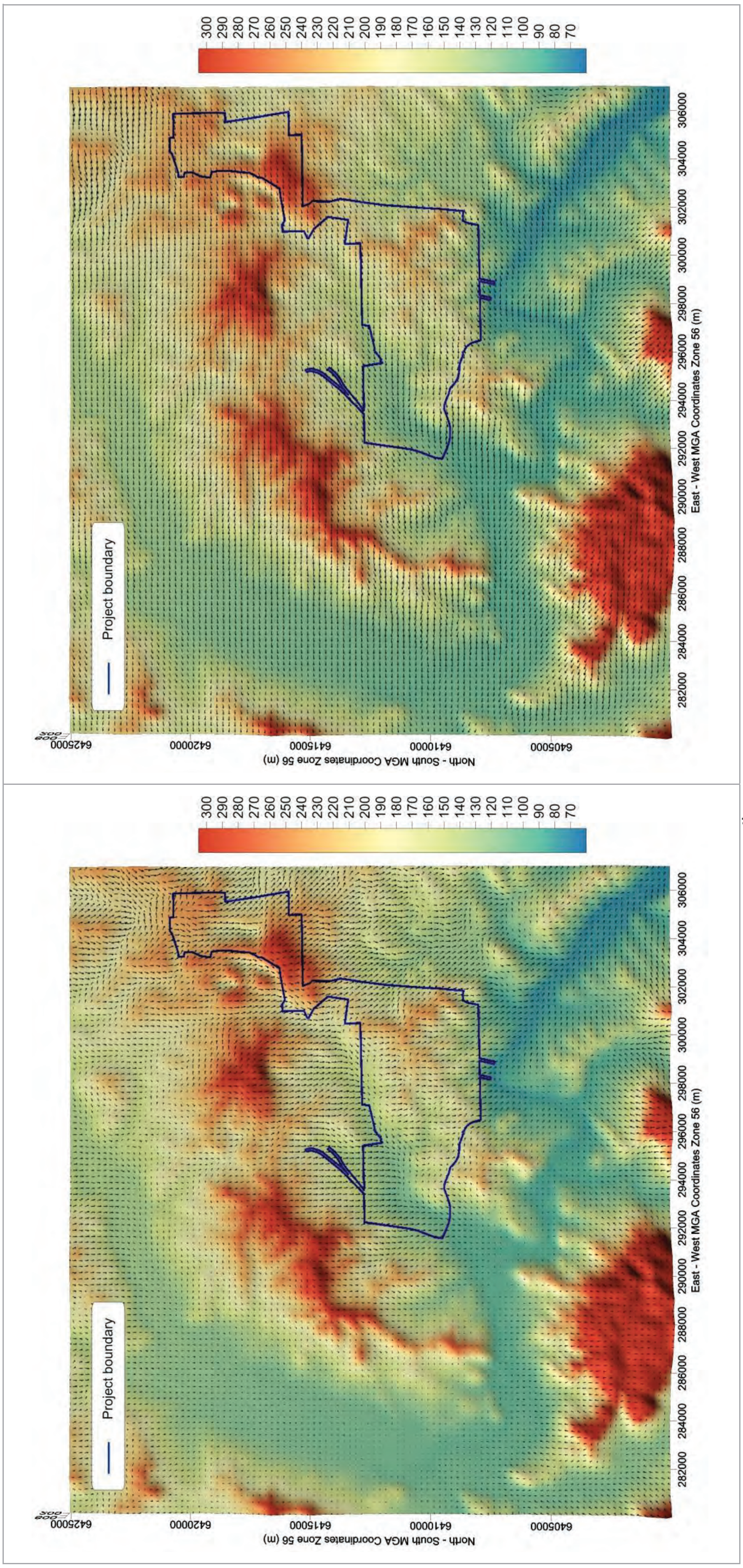


Figure 5-5: CALMET generated vectors for 15th March 2005 (left) 06:00 and (right) 18:00

Hansen Bailey

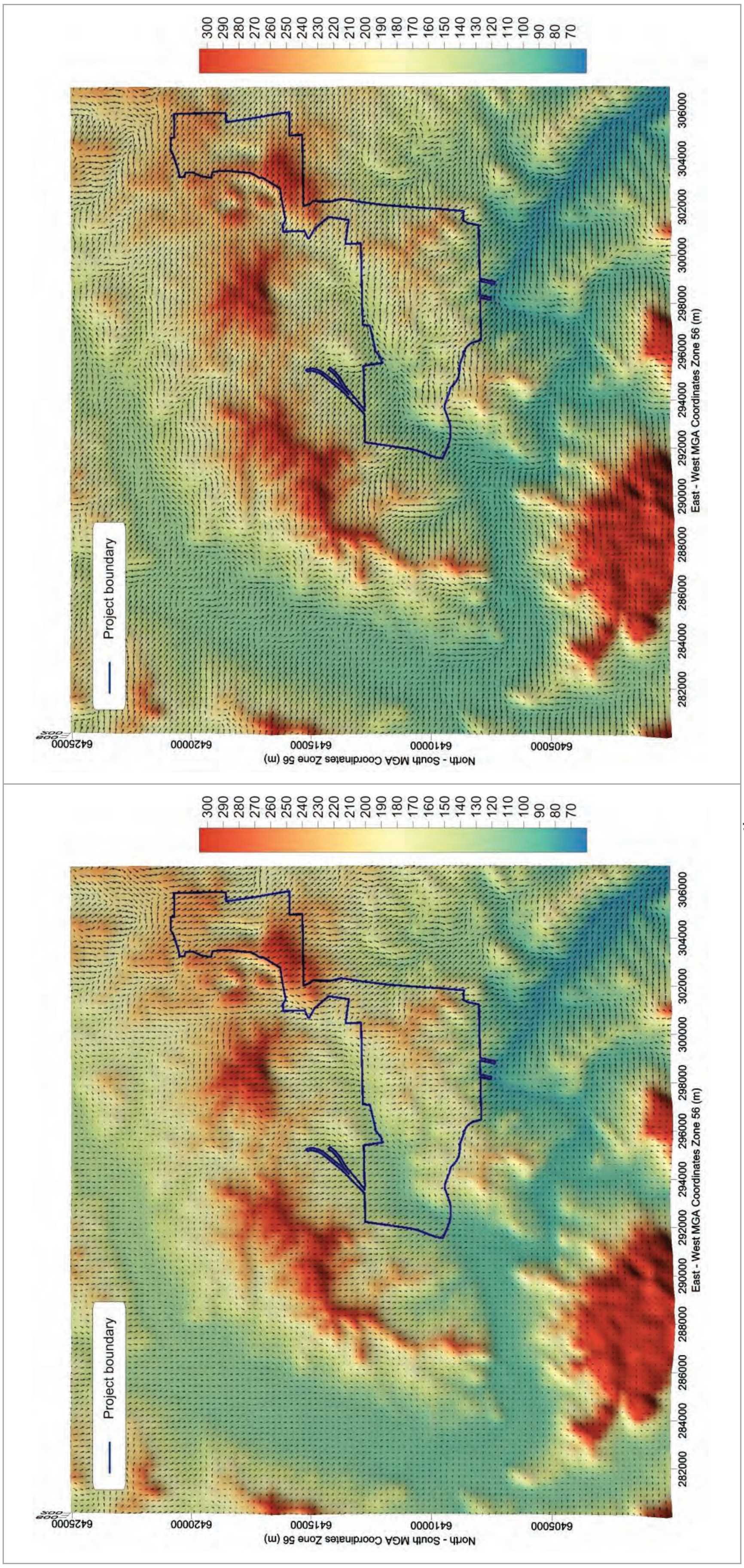


Figure 5-6: CALMET generated vectors for 15th August 2005 (left) 06:00 and (right) 18:00

5.5 Atmospheric Stability

An important aspect of plume dispersion is the level of turbulence in the atmosphere near the ground. Turbulence acts to dilute or diffuse a plume by increasing the cross-sectional area of the plume due to random motion. As turbulence increases, the rate of plume dilution or diffusion increases. Weak turbulence limits diffusion and is a critical factor in causing high plume concentrations downwind of a source. Turbulence is related to the vertical temperature gradient, the condition of which determines what is known as stability, or thermal stability. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe the dispersion conditions in the atmosphere.

The best known stability classification is the Pasquill-Gifford scheme, which denotes stability classes from A to F. Class A is described as highly unstable and occurs in association with strong surface heating and light winds, leading to intense convective turbulence and much enhanced plume dilution. At the other extreme, class F denotes very stable conditions associated with strong temperature inversions and light winds, such as those that commonly occur under clear skies at night and in the early morning, especially during the cooler months. Under these conditions plumes can remain relatively undiluted for considerable distances downwind. Intermediate stability classes grade from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are closely associated with clear skies, class D is linked to windy and/or cloudy weather, and short periods around sunset and sunrise when surface heating or cooling is small.

The CALMET-generated meteorological data can be used to extract stability class for the site and the frequency distribution of estimated stability classes is presented in **Figure 5-7.** The data shows the conditions experienced are largely class F conditions (~32% of hours).

It is noted that a turbulence based scheme within CALPUFF was used in the modelling and the Pasquill-Gifford (PG) stability class frequency is shown for information only. The use of turbulence based dispersion coefficients is recommended in modelling guidance prepared for the NSW EPA (**TRC, 2010**) for the same reasons that the US EPA has replaced PG-based dispersion with a turbulence-based approach in their regulatory model (AERMOD) and is in accordance with best science practice and model evaluation studies.

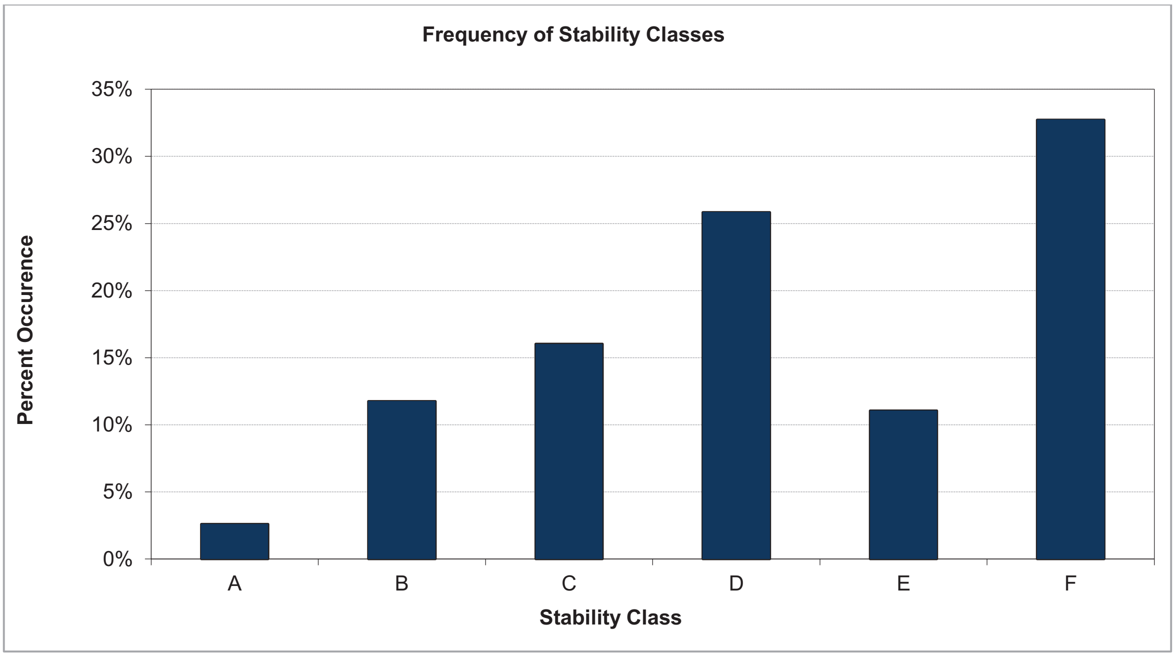


Figure 5-7: Stability class frequency (CALMET 2005)

5.6 Mixing Height

Mixing height is defined as the height above ground of a temperature inversion or statically stable layer of air capping the atmospheric boundary layer. It is often associated with, or measured by, a sharp increase in temperature with height, a sharp decrease of water-vapour, a sharp decrease in turbulence intensity and a sharp decrease in pollutant concentration. Mixing height is variable in space and time, and typically increases during fair-weather daytime over land from tens to hundreds of metres around sunrise, up to 1–3 km in the mid-afternoon, depending on the location, season and day-to-day weather conditions. Sea breezes may, however, introduce complexities to the mixing height. The onset of a sea breeze at a particular location will often bring a reduction in the mixing height.

Mixing heights show diurnal variation and can change rapidly after sunrise and at sunset. Diurnal variation in the minimum, maximum and average mixing depths, based on the CALMET-generated meteorological data for the site, is shown in **Figure 5-8**. As expected, mixing heights begin to grow following sunrise with the onset of vertical convective mixing with maximum heights reached in mid to late afternoon.

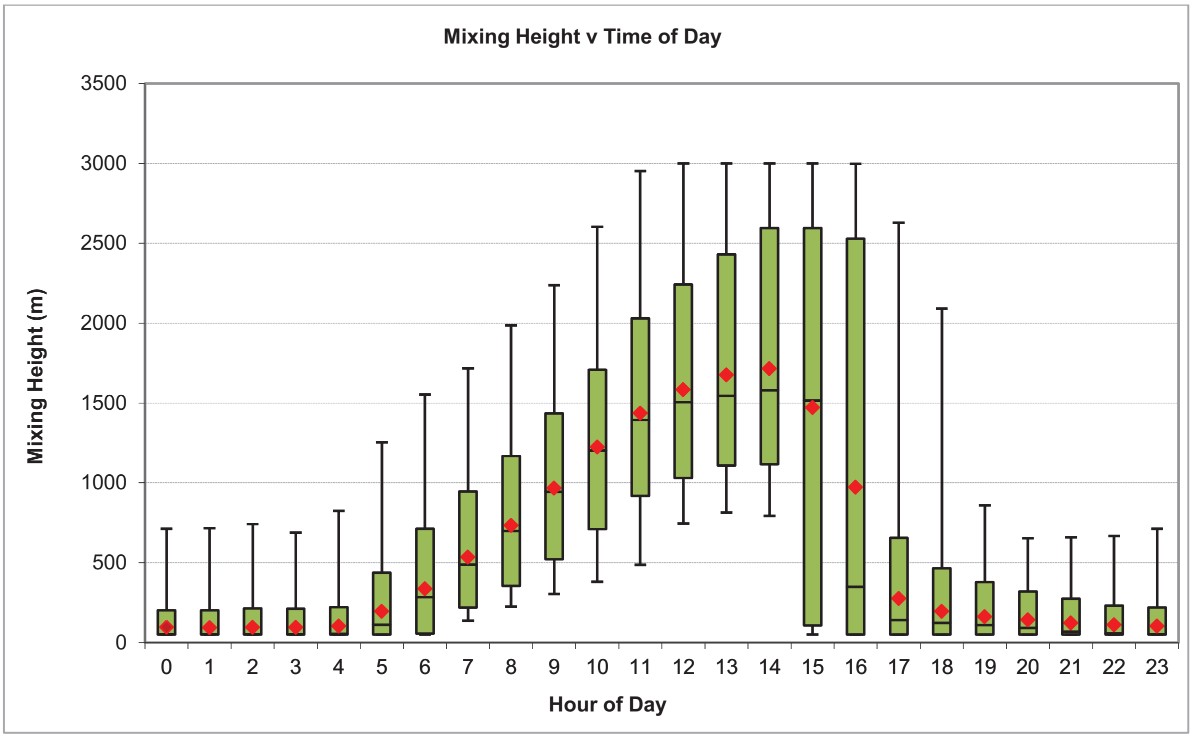


Figure 5-8: Average daily diurnal variation in mixing layer depth (CALMET 2005)

6 OVERVIEW OF BEST PRACTICE DUST CONTROL

Existing air quality management measures at the Drayton Coal Mine are described in the Drayton Air Quality Management Plan (Drayton AQMP) (**Drayton, 2011**) and presented in **Table 6-1**.

The proposed controls for the Project are based on existing air quality management measures and recommendations of the *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (**Donnelly *et al.*, 2011**) (the Best Practice Report), a study that was commissioned by the NSW EPA.

Table 6-2 provides an overview of the applicable best practice management measures recommended by EPA and those adopted for the assessment. When preparing the Emission inventory for modelling the relevant percentage controls for the best practice measures adopted are shown in **Table 6-2**.

Table 6-1: Existing Drayton Air quality control measures (AQMP Table 5)

Measure	Current Status
Implement available measures to keep visible dust as low as possible from offsite at all times	Implemented and ongoing.
Topsoil clearing restricted to a single strip ahead of mining, where practical	Implemented and ongoing.
Overburden drills are equipped with equipment to minimise dust generation (water injections facilities or dust collection facility)	Drills fitted with dust suppression.
Water tankers to be utilised at all times to minimise dust emissions from roads and work areas	Water trucks in use. Volumes of water applied collected monthly and reported in AEMR.
Overburden is dumped in low level lifts, with outer berms maintained by dozers	Implemented and ongoing.
Dragline operations are conducted to minimise dumping height so there is minimal free-fall of material	Implemented and ongoing.
Blasting is carried out using gravel stemming or crushed coal, which contains blast within the ground and minimises dust	Implemented and ongoing.
The CHPP is operated with dust suppression sprays at the dump hopper and transfer points as well as coal stockpiles	Implemented and ongoing. Volumes applied are reported in the AEMR.
Rehabilitation of mined areas is progressively achieved	Rehabilitation targets set annually based on MOP and internal requirements. Areas reported in AEMR.
In known or suspected high dust areas, production processes are modified to ensure effective management of visible dust levels	Implemented and ongoing. Mining Coordinators actively manage air quality emissions daily.
Monitoring of air quality emissions	Monitoring program underway. Data and analysis reported in AEMR.

Table 6-2: Overview of EPA best practice emission reduction measures

OEH best practice		Mining Activity	Best Practice Control		Applied at site (Y/N/Other)	Comments	Control Applied for modelling
Section	Table						
		Prestrip	Application of water		Yes		50
			Revegetation of topsoil stockpiles		No		
			Minimise prestrip exposed areas		No		
9.2	66	Hauling on Unsealed Roads	Vehicle restrictions	Speed reduction from 75 km/h to 50 km/h	No		
				Speed reduction from 65 km/h to 30 km/h	No		
				Grader speed reduction from 16 km/h to 8 km/h	Yes	Grader speed assumed to be 8km/h	
			Surface improvements	Pave the surface	No		
				Low silt aggregate	No		
				Oil and double chip surface	No		
			Surface treatments	Watering (standard procedure)	Yes	On in-pit roads	75
				Watering Level 1 (2 L/m2/h)	No		
				Watering Level 2 (>2 L/m2/h)	No		
				Watering grader routes	No		
				Watering twice a day for industrial unpaved road	No		
				Dust suppressants (please specify)	Yes	On out-of-pit roads - Dust-A-Side	85
			Other	Use of larger vehicles	Yes	From Year 10 onwards	
				Conveyors	No		
9.3	71	Wind Erosion on Exposed Areas & Overburden Emplacements	Avoidance	Minimise pre-strip	Yes	Minimise pre-strip exposed area	0
			Surface stabilisation	Watering	Yes		50
				Chemical suppressants	No		
				Paving and cleaning	No		
				Application of gravel to stabilise disturbed open areas	No		
				Rehabilitation goals	No		
			Wind speed reduction	Fencing, bunding, shelterbelts or in-pit dump	No		
				Vegetative ground cover	Yes		
9.3	72	Wind Erosion and Maintenance - Coal Stockpiles	Avoidance	Bypassing stockpiles	No		
			Surface stabilisation	Water sprays	Yes		50
				Chemical wetting agents	No		
				Surface crusting agent	No		
				Carry over wetting from load in	No		
			Enclosure	Silo with bag house	No		
				Cover storage pile with a tarp during high winds	No		
			Wind speed reduction	Vegetative windbreaks	Yes		30
				Reduced pile height	No		
				Wind screens/fences	No		
				Pile shaping/orientation	No		
				Erect 3-sided enclosure around storage piles	No		

OEH best practice		Mining Activity	Best Practice Control		Applied at site (Y/N/Other)	Comments	Control Applied for modelling
Section	Table						
9.4	76	Bulldozers on OB	Minimise travel speeds and distance		No		
			Travel routes and material kept moist		No		
9.5	81	Blasting and drilling	Blasting	Delay shot to avoid unfavourable weather conditions	No		
				Minimise area blasted	No		
	82		Drilling	Fabric filters	No		
				Cyclone	No		
				Water injection while drilling	Yes		70
9.6	85	Draglines	Minimise drop height		Yes		
			Modify activities in windy conditions		No		
			Water sprays		No		
			Minimise side casting		No		
9.7	90	Loading and dumping overburden	Excavator	Minimise drop height	No		
			Truck dumping	Minimise drop height	No		
				Water application	Yes		
				Modify activities in windy conditions	No		
9.8	95	Loading and dumping ROM coal	Avoidance	Bypass ROM stockpiles	No		
			Truck or loader dumping coal	Minimise drop height	No		
				Water sprays on ROM pad	No		
			Truck or loader dumping to ROM bin	Water sprays on ROM bin or ROM pad	No		
				Three sided and roofed enclosure of ROM bin	Yes	3 sides and no roof	70
				Three sided and roofed enclosure of ROM bin + water sprays	No		
				Enclosure with control device	No		
9.9	96	Conveyors and transfers	Conveyors	Applicaton of water at transfers	Yes	Application of water at transfers	70
				Wind shielding - roof OR side wall	No		
				Wind shielding - roof AND side wall	No		
				Belt cleaning and spillage minimisation	No		
			Transfers	Enclosure	No		
9.10	97	Stacking and reclaiming product coal	Avoidance	Bypass coal stockpiles	No		
			Loading coal stockpiles	Variable height stack	Yes		25
				Boom tip water sprays	No		
				Telescopic chute with water sprays	No		
			Unloading coal stockpiles	Bucket-wheel, portal or bridge reclaimer with water application	Yes		50
9.11	-	Train and truck load out and transportation	Limit load size to ensue coal is below sidewalls		No		
			Maintain a consisten profile		No		
			Use bedliners to minimise seepage		No		
			Cover load with tarpaulin		No		
			Utilise truck wheel wash		No		

7 Emissions to Air

7.1 Introduction

This section discusses the calculation of the emissions for the assessment. Emissions have been calculated for the following:

- The surface operations from the Project; and
- Approved operations at other mines in the area.

7.2 Particle Size Categories

The modelling has been based on the use of three particle-size categories (0 to 2.5 μm - referred to as fine particles [FP] or $PM_{2.5}$, 2.5 to 10 μm - referred to as coarse matter [CM] and 10 to 30 μm - referred to as the Rest). The distribution of particles in each particle size range is as follows (**SPCC [1986]**):

- $PM_{2.5}$ (FP) is 0.0468 of the TSP.
- $PM_{2.5-10}$ (CM) is 0.3440 of TSP.
- PM_{10-30} (Rest) is 0.6090 of TSP.

Emission rates of TSP have been calculated using emission factors developed both within NSW and by the US EPA (see **Appendix C**). Modelling was undertaken for each size fractions which are assumed to emit according to the distribution above and deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mass mean of the particle size range.

The resultant predicted concentrations are then combined as follows to determine the concentrations of each size fraction:

- $PM_{2.5}$ = FP.
- PM_{10} = FP + CM.
- TSP = FP +CM+ Rest.

7.3 Emissions from Project Operations

The mine plans for the Project were analysed and detailed emissions inventories were prepared for six representative operational years, which includes two scenarios for year three to capture the construction of the visual bund south of the Houston mine area. A brief description of each modelling year is presented in **Table 7-1**. These modelled years are considered to be representative of worst-case operations; for example where coal and waste production are highest, where extraction or wind erosion areas are largest or where operations are located closest to receivers. In addition, the years where highwall mining in each mine area is at its most intensive has been included in the inventories of the closest modelled years, which is a conservative approach.

Table 7-1: Description of the Projects modelling years

Operation Year	Nominal Year	Operation description and notes
3A	2016	All mining areas are actively mined. This modelling scenario captures the conditions before the visual bund is completed south of the Houston mining area. Drayton Mine is operational.
3B		All mining areas are actively mined and the completed visual bund to the south of Houston. Drayton Mine is operational.
5	2018	All mining areas are actively mined, plus the inclusion of year 7 highwall mining in Houston.
10	2023	All mining areas are actively mined, except for Houston which is inactive during this period. Larger trucks replace the existing in-pit haul trucks. Year 8 Redbank is used to capture worst case ROM mined amounts.
15	2028	All mining areas are actively mined.
20	2033	Mining in Whynot and Houston, while only Highwall mining occurs in Redbank and Blakefield (actually Y18 mining).
27	2040	Actively mining Whynot only, while the most of remaining mining areas are completely rehabilitated.

The information used for developing the inventories has been based on the operational descriptions and mine plan drawings. These have been used to determine haul road distances and routes, stockpile and mining areas, activity operating hours, truck sizes and other details that are necessary to estimate dust emissions.

The mine plans presented in this report were developed in an iterative process. Preliminary modelling predicted unacceptable impacts for certain mine plans and scheduling. Several of the worst impacted years are compared with the current mine plan impacts in **Appendix E**, highlighting the predicted reductions achieved by modifications to the mine plans. Changes to mine plans included reducing the intensity of mining in certain areas and increasing the in-pit haul truck size when the equipment is due for replacement.

7.3.1 Emission estimates

Table 7-2 summarises the ROM coal and waste production schedule used to calculate the emissions from operations. This information includes the different highwall mining years which were selected to capture the worst case scenarios.

Table 7-2: Open cut and highwall ROM coal and waste production schedule

Pit ID	Material removed		Year 3	Year 5	Year 10	Year 15	Year 20	Year 27
Whynot	Waste (Mbcm)	Dragline	10.41	7.14	11.01	10.29	11.51	7.04
		Excavator	2.81	9.81	10.05	8.62	17.79	0
		Partings	0.34	0.46	0.66	0.54	0.86	0.07
		Total	13.56	17.41	21.72	19.45	30.15	7.11
	ROM coal (Kt)	Total	1,553	2,002	3,072	2,369	3,938	551
Blakefield	Waste (Mbcm)	Dragline	5.52	9.31	4.59	2.2	0	0
		Excavator	0.05	0.56	0.32	0	0	0
		Partings	0.07	0.08	0.04	0.03	0	0
		Total	5.64	9.96	4.95	2.20	0	0
	ROM coal (Kt)	Total	722	815	292	98	564	0
Redbank	Waste (Mbcm)	Dragline	0	0	0	0	0	0
		Excavator	6.20	6.63	9.31	10	0	0
		Partings	0.32	0.38	0.36	0.34	0	0
		Total	6.53	7.02	9.66	10.71	0	0
	ROM coal (Kt)	Total	1,226	1,436	2,480	1,389	900	0
Houston	Waste (Mbcm)	Dragline	0	0	0	2.77	3.18	0
		Excavator	11.43	3.66	0	1.64	2.81	0
		Partings	0.16	0.08	0	0.07	0.12	0
		Total	11.59	3.74	0	4.48	6.12	0
	ROM coal (Kt)	Total	2,069	1,610	0	754	989	0
Total Waste (Mbcm)			**37.32**	**38.13**	**36.33**	**36.85**	**36.27**	**7.11**
Total ROM (kT)			**5,570**	**5,863**	**5,845**	**4,610**	**6,391**	**551**

Table 7-4 presents the emission estimates for each year modelled. Detailed emission estimates are provided in **Appendix C.**

Figure C-1 to **Figure C-8** (in **Appendix C**) show the general progression of mining and the associated dust generating activities over the life of the Project, together with numbered locations that represent dust sources assumed in the modelling. The activities associated with each of the numbered locations are identified in the table alongside each figure.

A 75% dust control on mining area haul roads was assumed which is typically use in modelling assessments for mine sites and is generally considered to represent control via > Level 2 watering. On haul routes used for coal haulage between Drayton South and the Drayton Mine coal processing facilities an 85% control is based on the assumption that a dust suppressant would be applied to these haul roads. The supplier of the dust suppressant claims that greater than 90% control can be achieved but as no data are available to validate this, a level of 85% control was assumed in accordance with the Best Practice report (**Donnelly *et al.*, 2011**).

As presented in **Table 7-3**, silt and moisture content values are consistent with values used in air quality assessments for other mines in the area, and are also consistent with pre-feasibility assessments completed for the Project. These values will be confirmed once the Project is established and operational.

Table 7-3: Silt and Moisture Contents

Mine	Material	Silt (%)	Moisture (%)
Drayton South (the Project)	Overburden	10	2.5
	ROM coal	5	7.5
Mt Arthur Coal[(a)]	Overburden	10	2
	ROM coal	5	8
Muswellbrook Coal[(b)]	Overburden	10	4
	ROM coal	8	4
Bengalla[(c)]	Overburden	10	2
	ROM coal	5	6

(a) PAEHolmes (2009)
(b) Todoroski Air Sciences (2012)
(c) PAEHolmes (2010a)

Table 7-4: Summary of estimated TSP emissions from the Project (kg/y)

ACTIVITY	TSP emissions (kg/y)						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
WHYNOT							
Topsoil Removal & Site preparation - Dozers on Whynot	17,998	17,998	22,829	30,319	26,181	39,407	-
Topsoil removal - Sh/Ex/FELs loading topsoil - Whynot	249	251	234	174	119	186	-
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	2,513	2,513	2,875	2,499	1,586	2,930	-
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	2,132	2,132	2,567	1,666	1,052	1,670	-
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	497	502	469	349	238	371	-
OB - Drilling - Whynot	3,241	3,241	3,283	4,596	3,571	6,156	3,938
OB - Blasting - Whynot	11,254	11,254	22,795	30,981	18,590	32,537	7,356
OB - Dozers on Dragline OB in-pit - Whynot	32,026	32,026	26,037	40,707	31,819	29,219	24,434
OB - Dragline removal of OB - Whynot	309,391	309,391	212,061	327,232	305,709	341,927	209,200
OB - Dozers on excavator OB in-pit - Whynot	19,795	19,795	68,533	36,851	60,308	124,659	-
OB - Excavator loading OB to haul truck - Whynot	9,192	9,288	32,089	33,197	28,513	59,702	-
OB - Hauling excavator OB to emplacement area (east) - Whynot	63,508	63,508	269,007	325,304	259,230	643,783	-
OB - Hauling excavator OB to emplacement area (west) - Whynot	53,870	53,870	240,226	216,831	171,878	366,842	-
OB - Dozers on OB haul roads (east) - Whynot	4,489	4,489	15,541	16,713	13,676	28,268	-
OB - Dozers on OB haul roads (west) - Whynot	4,489	4,489	15,541	16,713	13,676	28,268	-
OB - Emplacing excavator OB at emplacement area - Whynot	9,192	9,288	32,089	33,197	28,513	59,702	-
OB - Dozers on OB emplacement area - Whynot	51,822	51,822	94,570	77,558	92,128	153,878	24,434
OB - Dozers in-pit ancillary tasks - Whynot	40,247	40,247	55,308	89,698	74,194	97,568	144,449
OB - Dozers ripping/pushing/clean-up Partings - Whynot	17,538	17,538	23,575	32,241	24,386	36,735	4,056
OB - Loading partings to haul trucks - Whynot	1,110	1,122	1,516	2,175	1,787	2,882	241
OB - Hauling partings to emplacement area (east) - Whynot	7,672	7,672	12,711	21,313	16,244	31,081	2,435
OB - Hauling partings to emplacement area (west) - Whynot	6,508	6,508	11,351	14,206	10,770	17,711	717
OB - Emplacing Partings at emplacement area - Whynot	1,110	1,122	1,516	2,175	1,787	2,882	241
CL - Highwall transfer point - Whynot	-	-	-	-	-	-	128
CL - Highwall conveyor - Whynot	-	-	-	-	-	-	17
CL - Drilling coal - Whynot	1,617	1,617	1,688	2,410	2,517	2,698	-
CL - Blasting coal - Whynot	6,496	6,496	4,982	1,257	2,038	6,048	-
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	58,257	58,257	76,106	116,553	88,164	129,003	51,483
CL - Sh/Ex/FCLs loading open coal to trucks - Whynot	64,492	64,492	83,142	127,591	98,394	163,526	44,625
CL - Hauling open coal in-pit roads (east) - Whynot	17,539	17,539	23,329	53,618	43,269	92,505	18,585
CL - Hauling open coal to ROM pad (east) - Whynot	99,999	99,999	123,618	197,781	126,527	211,073	63,736
CL - Hauling open coal in-pit roads (middle) - Whynot	14,888	14,888	20,630	32,041	25,559	54,171	10,897
CL - Hauling open coal to ROM pad (middle) - Whynot	91,283	91,283	133,702	209,433	168,644	285,526	81,802
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	4,659	4,659	6,006	9,217	23,694	11,813	3,224
CL - Handle coal at CHPP - Whynot	326	326	420	645	497	826	225
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	1,553	1,553	2,002	3,072	2,369	3,938	1,075

ACTIVITY	TSP emissions (kg/y)						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
BLAKEFIELD							
Topsoil removal & site preparation - Dozers on Blakefield	7,537	7,537	12,532	5,989	2,654	-	-
Topsoil removal - Sh/Ex/FELs loading topsoil - Blakefield	65	65	135	65	10	-	-
Topsoil removal - Hauling (25% in Year 5) topsoil to emplacement area - Blakefield (east)	1,057	1,057	447	1,062	117	-	-
Topsoil removal - Hauling (75% in Year 5) topsoil to emplacement area - Blakefield (west)	-	-	2,043	-	-	-	-
Topsoil removal - Emplacing topsoil at emplacement area - Blakefield	129	131	40	131	21	-	-
OB - Drilling - Blakefield	1,424	1,424	2,014	1,039	415	-	-
OB - Blasting for excavator removal - Blakefield	4,946	4,946	13,981	7,002	2,160	-	-
OB - Dozers on Dragline OB in-pit - Blakefield	16,743	16,743	23,132	8,349	4,153	-	-
OB - Dragline removal of OB - Blakefield	163,950	163,950	276,789	136,395	64,652	-	-
OB - Dozers on Excavator OB in-pit - Blakefield	367	367	3,935	1,185	-	-	-
OB - Excavator loading OB to haul truck - Blakefield	170	172	1,843	1,067	-	-	-
OB - Hauling excavator (25% in Year 5) OB to emplacement area - Blakefield (east)	1,901	1,901	4,169	11,847	-	-	-
OB - Hauling excavator (75% in Year 5) OB to emplacement area - Blakefield (west)	-	-	19,050	-	-	-	-
OB - Dozers on OB haul roads - Blakefield (east)	166	166	892	1,075	-	-	-
OB - Dozers on OB haul roads - Blakefield (west)	-	-	4,828	-	-	-	-
OB - Emplacing at emplacement area - Blakefield	170	172	1,843	1,067	-	-	-
OB - Dozers on OB emplacement area - Blakefield	17,110	17,110	27,067	9,534	4,153	-	-
OB - Dozers in-pit ancillary tasks - Blakefield	18,720	18,720	22,513	8,525	3,074	-	-
OB - Dozers ripping/pushing/clean-up Partings - Blakefield	603	603	1,251	461	546	-	-
OB - Loading partings to trucks - Blakefield	229	231	265	134	94	-	-
OB - Hauling (25% in Year 5) partings to emplacement area - Blakefield (east)	2,553	2,553	599	1,482	736	-	-
OB - Hauling (75% in Year 5) partings to emplacement area - Blakefield (west)	-	-	2,739	-	-	-	-
OB - Emplacing partings at emplacement area - Blakefield	229	231	53	134	94	-	-
CL - Highwall transfer point - Blakefield (Y18)	-	-	-	-	-	118	-
CL - Highwall conveyor - Blakefield (Y18)	-	-	-	-	-	17	-
CL - Drilling coal - Blakefield	752	752	687	229	104	-	-
CL - Blasting coal - Blakefield	3,021	3,021	2,028	119	84	-	-
CL - Dozers ripping/pushing/clean-up ROM in-pit - Blakefield	12,496	12,496	17,422	5,923	2,452	-	-
CL - Sh/Ex/FCLs loading open coal to trucks - Blakefield	29,997	29,997	33,844	12,126	4,076	23,442	-
CL - Hauling open (25% in Year 5) coal in-pit roads - Blakefield (east)	8,220	8,220	4,370	5,849	1,320	13,591	-
CL - Hauling open (25% in Year 5) coal to ROM pad - Blakefield (east)	107,765	107,765	30,745	50,177	16,700	93,117	-
CL - Hauling open (75% in Year 5) coal in-pit roads - Blakefield (west)	-	-	13,111	-	-	-	-
CL - Hauling open (75% in Year 5) coal to ROM pad - Blakefield (west)	-	-	101,651	-	-	-	-
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	2,167	2,167	2,445	876	982	1,693	-
CL - Handle coal at CHPP - Blakefield	152	152	171	61	21	118	-
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	722	722	815	292	98	564	-

ACTIVITY	TSP emissions (kg/y)						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
REDBANK							
Topsoil removal - Dozers/Excavators stripping topsoil - Redbank	3,886	7,772	8,176	11,928	13,220	-	-
Topsoil removal - Sh/Ex/FELs loading topsoil - Redbank	273	276	107	89	76	-	-
Topsoil removal - Hauling topsoil to emplacement area (north) - Redbank	3,044	3,044	1,287	1,767	1,464	-	-
Topsoil removal - Hauling topsoil to emplacement area (south) - Redbank	843	843	381	700	601	-	-
Topsoil removal - Emplacing topsoil at emplacement area - Redbank	546	551	213	178	153	-	-
OB - Drilling for excavator removal - Redbank	1,326	1,326	1,160	1,814	1,814	-	-
OB - Blasting for excavator removal - Redbank	4,606	4,606	8,054	12,227	9,442	-	-
OB - Dozers on Excavator OB in-pit - Redbank	43,696	43,696	46,345	34,145	72,556	-	-
OB - Excavator loading OB to haul truck - Redbank	20,289	20,502	21,700	30,759	34,303	-	-
OB - Hauling to emplacement area (north) - Redbank	154,706	154,706	179,061	416,599	449,777	-	-
OB - Hauling to emplacement area (south) - Redbank	42,832	42,832	53,070	164,914	184,735	-	-
OB - Dozers on OB haul roads (north) - Redbank	9,909	9,909	10,510	15,486	15,517	-	-
OB - Dozers on OB haul roads (south) - Redbank	9,909	9,909	10,510	15,486	15,517	-	-
OB - Emplacing at emplacement area - Redbank	20,289	20,502	21,700	30,759	34,303	-	-
OB - Dozers on OB emplacement area -Redbank	43,696	43,696	46,345	34,145	72,556	-	-
OB - Dozers in-pit ancillary tasks - Redbank	31,778	31,778	39,666	46,138	43,486	-	-
OB - Dozers ripping/pushing/clean-up Partings - Redbank	14,178	14,178	17,161	12,912	9,217	-	-
OB - Loading partings to trucks - Redbank	1,062	1,073	1,254	1,178	1,115	-	-
OB - Hauling partings to emplacement area (north) - Redbank	8,098	8,098	10,347	15,958	14,614	-	-
OB - Hauling partings to emplacement area (south) - Redbank	2,242	2,242	3,067	6,317	6,002	-	-
OB - Emplacing partings at emplacement area - Redbank	1,062	1,073	1,254	1,178	1,115	-	-
CL - Highwall transfer point - Redbank (Y8/Y20)	-	-	-	206	-	189	-
CL - Highwall conveyor - Redbank (Y8/Y20)	-	-	-	17	-	17	-
CL - Drilling coal - Redbank	1,277	1,277	1,211	1,240	1,475	-	-
CL - Blasting coal - Redbank	5,129	5,129	3,573	646	1,194	-	-
CL - Dozers ripping/pushing/clean-up ROM in-pit - Redbank	41,392	41,392	50,472	50,472	41,423	-	-
CL - Sh/Ex/FCLs loading open coal to trucks - Redbank	50,920	50,920	59,628	103,004	57,670	37,375	-
CL - Hauling open coal in-pits roads - Redbank	36,604	36,604	50,384	214,592	111,553	30,570	-
CL - Hauling open coal to ROM pad - Redbank	180,114	180,114	210,672	362,812	207,755	134,642	-
CL - Unloading ROM to ROM stockpiles/hopper - Redbank	3,679	3,679	4,308	7,441	4,166	2,700	-
CL - Handle coal at CHPP - Redbank	257	257	301	520	291	189	-
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	1,226	1,226	1,436	2,480	1,389	900	-

ACTIVITY	TSP emissions (kg/y)						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
HOUSTON							
Topsoil Removal - Dozers/Excavators stripping topsoil - Houston	14,930	14,930	4,700	-	6,181	8,829	-
Topsoil removal - Sh/Ex/FELs loading topsoil - Houston	157	158	93	-	29	18	-
Topsoil removal - Hauling topsoil to emplacement area (east) - Houston	2,304	2,304	1,728	-	128	38	-
Topsoil removal - Hauling topsoil to emplacement area (west) - Houston	-	-	-	-	154	82	-
Topsoil removal - Emplacing topsoil at emplacement area - Houston	313	317	185	-	59	37	-
OB - Drilling for excavator removal - Houston	2,444	2,444	639	-	836	1,374	-
OB - Blasting for excavator removal - Houston	8,486	8,486	4,440	-	4,353	7,262	-
OB - Dragline removal of OB - Houston	-	-	-	-	8,293	11,572	-
OB - Dozers on Excavator OB in-pit - Houston	-	-	-	-	82,210	94,616	-
OB - Dozers on Excavator OB in-pit - Houston	80,503	80,503	25,548	-	11,497	19,702	-
OB - Excavator loading OB to haul truck - Houston	37,381	37,772	11,962	-	5,436	9,436	-
OB - Hauling to emplacement area (east) - Houston	375,562	375,562	152,496	-	16,188	13,414	-
OB - Hauling to emplacement area (west) - Houston	-	-	-	-	19,571	28,863	-
OB - Dozers on OB haul roads (east) - Houston	36,511	36,511	11,587	-	2,607	8,936	-
OB - Dozers on OB haul roads (west) - Houston	-	-	-	-	2,607	-	-
OB - Emplacing at emplacement area - Houston	37,381	37,772	11,962	-	5,436	9,436	-
OB - Dozers on OB emplacement area - Houston	80,503	80,503	25,548	-	19,790	31,274	-
OB - Dozers in-pit ancillary tasks - Houston	53,616	53,616	26,874	-	23,607	24,493	-
OB - Dozers ripping/pushing/clean-up Partings - Houston	9,285	9,285	4,806	-	4,146	6,883	-
OB - Loading partings to trucks - Houston	531	537	276	-	242	172	-
OB - Hauling partings to emplacement area (east) - Houston	5,335	5,335	3,520	-	721	245	-
OB - Hauling partings to emplacement area (west) - Houston	-	-	-	-	872	527	-
OB - Emplacing partings at emplacement area - Houston	531	537	276	-	242	172	-
CL - Highwall transfer point - Houston (Y7)	-	-	145	-	-	-	-
CL - Highwall conveyor - Houston (Y7)	-	-	17	-	-	-	-
CL - Dozers ripping/pushing/clean-up ROM in-pit - Houston	82,989	82,989	39,758	-	32,124	38,467	-
CL - Sh/Ex/FCLs loading open coal to trucks - Houston	85,913	85,913	66,864	-	31,307	41,051	-
CL - Hauling open coal in-pits roads (east) - Houston	18,108	18,108	13,905	-	7,668	20,402	-
CL - Hauling open coal in-pits roads (west) - Houston	13,577	13,577	10,027	-	4,454	-	-
CL - Hauling open coal to ROM pad (east) - Houston	128,743	128,743	98,022	-	45,818	120,481	-
CL - Hauling open coal to ROM pad (west) - Houston	136,628	136,628	106,259	-	50,000	-	-
CL - Unloading ROM to ROM stockpiles/hopper - Houston	6,206	6,206	4,830	-	2,262	2,966	-
CL - Handle coal at CHPP - Houston	434	434	338	-	158	207	-
CL - Rehandle ROM coal at stockpiles/hopper - Houston	2,069	2,069	1,610	-	754	989	-

ACTIVITY	TSP emissions (kg/y)						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
ROM/REJECTS HANDLING							
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	81,371	81,371	81,371	81,371	81,371	81,371
CL - Loading rejects	-	-	-	-	-	-	-
CL - Transporting rejects	68,280	68,280	71,868	71,644	56,510	78,337	13,172
CL - Unloading rejects	-	-	-	-	-	-	-
PRODUCT COAL							
CL - Loading product stockpile	405	405	689	417	408	533	-
CL - Loading product coal to trains	540	540	919	556	545	711	-
WIND EROSION							
WE - OB dump & disturbed area - Uncontrolled	-	-	-	1,202,360	1,306,674	1,065,361	1,159,429
WE - OB dump & disturbed area - Controlled	-	-	-	66,798	72,593	59,187	64,413
WE - OB dump & disturbed area - Whynot - Uncontrolled	221,206	221,206	284,833	-	-	-	-
WE - OB dump & disturbed area - Whynot - Controlled	12,289	12,289	15,824	-	-	-	-
WE - OB dump& disturbed area - Blakefield - Uncontrolled	56,404	56,404	159,847	-	-	-	-
WE - OB dump& disturbed area - Blakefield - Controlled	3,134	3,134	8,880	-	-	-	-
WE - OB dump& disturbed area - Redbank - Uncontrolled	205,960	205,960	304,573	-	-	-	-
WE - OB dump& disturbed area - Redbank - Controlled	11,442	11,442	16,921	-	-	-	-
WE - OB dump& disturbed area - Houston - Uncontrolled	212,828	99,034	158,947	-	-	-	-
WE - OB dump& disturbed area - Houston- Controlled	11,824	5,502	8,830	-	-	-	-
WE - Open mining area - Whynot	122,477	122,477	281,582	420,545	397,444	759,293	192,750
WE - Open mining area - Blakefield (Y18 mining area for Y20 modelling)	31,900	31,900	162,239	157,717	34,361	24,610	-
WE - Open mining area - Redbank	134,430	134,430	128,052	215,110	254,412	-	-
WE - Open mining area - Houston	77,224	77,224	111,292	86,880	97,717	74,636	-
WE - ROM stockpiles	7,358	7,358	7,358	7,358	7,358	7,358	7,358
WE - Product stockpiles	52,560	52,560	52,560	52,560	52,560	52,560	52,560
TOTAL	**4,705,253**	**4,590,510**	**5,620,149**	**6,343,931**	**6,036,547**	**6,114,634**	**2,268,350**

7.4 Emissions from Neighbouring Mines

Modelling of the background conditions in the surrounding regions for the cumulative assessment was completed and includes activities from the following nearby mining operations (see locations in **Figure 4-1**).

The cumulative assessment was completed for each year of the Project. The neighbouring mines that are likely to still be operational throughout the operational period of the Project given their current consents are listed below.

- Drayton
- Mt Arthur Coal
- Mt-Pleasant
- Mangoola
- Bengalla
- Hunter Valley Operations.

The modelling of emissions from each mine is based on the most recent publically available estimates of emissions from the following Environmental Impact Statements (EISs):

- Drayton
  - Emissions were calculated based on the mine plan and schedule for 2016. These emissions are summarised in **Table 7-6**. The same assumptions that were applied to Drayton South were applied to Drayton Mine.
- Mount Pleasant (MTP)
  - Air quality impact assessment completed in 1997 (**ERM Mitchell McCotter, 1997**). It is important to note the Mount Pleasant EIS does not present predicted impacts for PM_{10} as there was no regulatory requirement to assess PM_{10} concentrations at that time.
  - It was assumed that MTP operations will start in 2014 and each closest modelled year to the equivalent Drayton South proposed operational years were chosen.
- Mangoola
  - Air quality impact assessment completed in 2006 (**Holmes Air Sciences, 2006**). The closest modeled year to the equivalent Drayton South proposed operational years were chosen.
- Mt. Arthur Coal (MAC)
  - Air quality impact assessment completed in 2009 (**PAEHolmes, 2009**). Modelled year 16 emissions data were used as these are the maximum predicted emissions from the operations.
- Bengalla
  - Air quality impact assessment completed in 2010 (**PAEHolmes, 2010a**). The closest modelled year to the equivalent Drayton South proposed operational years were chosen.
- Hunter Valley Operations (HVO)
  - Air quality impact assessment completed in 2010 (**PAEHolmes, 2010b**). The closest modelled year to the equivalent Drayton South proposed operational years were chosen.

In this cumulative modelling assessment, each neighbouring mine has been treated as a number of volume sources. These have been located at the apparent points of major emission sources determined from the known locations of the mining areas and/or major dust sources on the mine or facility (see **Figure 7-1**).

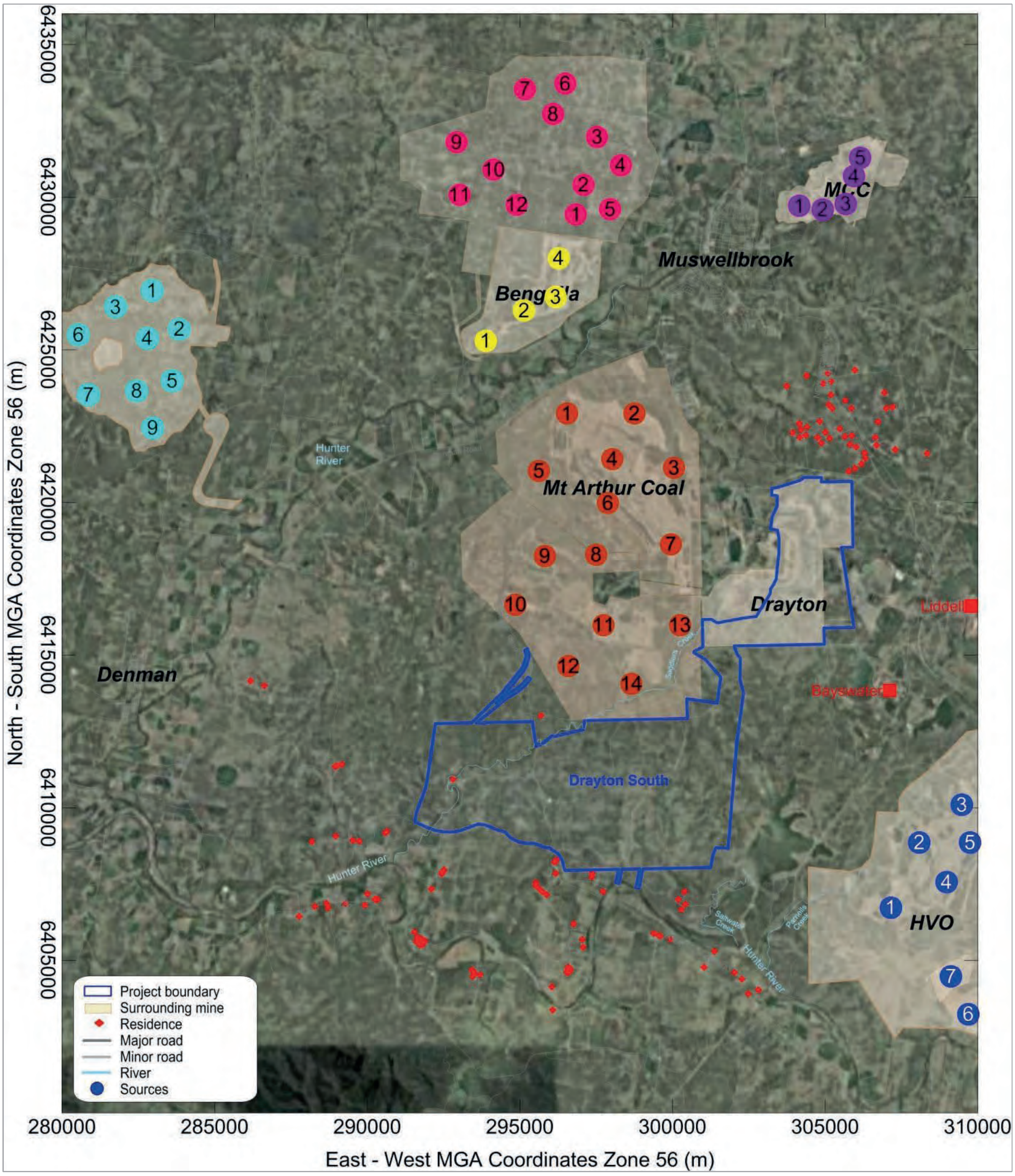


Figure 7-1: Source locations for neighbouring mines included in cumulative assessment

Sources have been considered in three classes covering all dust emission sources for which there are emission factor equations for open cut mines.

1. Wind erosion sources where emissions vary with the hourly average wind speed according to the cube of the wind speed.
2. Loading and dumping operations where emissions vary with wind speed to the power of 1.3.
3. All other sources where emissions are assumed to be independent of wind speed.

For neighbouring mines, the proportion of emissions in each of these categories has been assumed to be:

- 0.732 for emissions independent of wind speed;
- 0.135 for emissions that depend on wind speed (such as loading and dumping); and
- 0.133 for wind erosion sources.

These factors are based on a detailed analysis of mine dust inventories undertaken as part of the Mt Arthur North EIS (**URS, 2000**), and have subsequently been accepted as appropriate and routinely applied to subsequent air quality impact assessments for mining operations over the past eleven years. **Table 7-5** presents a summary of the estimated emissions for each mine for the cumulative assessment.

Table 7-5: Summary of estimated TSP dust emissions from neighbouring mines (kg/y)

Mine	Y3	Y5	Y10	Y15	Y20	Y26
	2016	**2018**	**2023**	**2028**	**2033**	**2039**
MTP - WI	4,656,618	5,063,171	8,348,460	8,296,122	7,813,441	-
MTP - WS	858,803	933,782	1,539,675	1,530,023	1,441,004	-
MTP - WE	846,080	919,948	1,516,865	1,507,356	1,419,655	-
Mangoola - WI	2,692,086	2,759,904	2,205,812	1,668,755	-	-
Mangoola - WS	496,491	508,999	406,810	307,762	-	-
Mangoola - WE	400,783	400,783	400,783	400,783	-	-
HVO - WI	7,642,639	7,642,639	7,642,639	-	-	-
HVO - WS	1,409,503	1,409,503	1,409,503	-	-	-
HVO - WE	1,388,621	1,388,621	1,388,621	-	-	-
Bengalla - WI	6,248,237	-	-	-	-	-
Bengalla - WS	1,152,339	-	-	-	-	-
Bengalla - WE	1,135,267	-	-	-	-	-
MAC - WI	18,983,058	18,983,058	18,983,058	18,983,058	-	-
MAC - WS	3,500,974	3,500,974	3,500,974	3,500,974	-	-
MAC - WE	3,449,107	3,449,107	3,449,107	3,449,107	-	-

WI = Wind insensitive emissions; WS = Wind sensitive emissions; WE = Wind erosion emissions

Table 7-6 presents the emission estimates for the 2016 Drayton mine integration year which is a representative year when both Drayton Mine and Drayton South will be in operation. Further detail on the emission estimates and illustration of the source allocation are provided in **Appendix C,** as well as the mine plan and source allocations.

Table 7-6: Summary of estimated TSP emissions from Drayton mine 2016 (kg/y)

ACTIVITY	TSP emissions (kg/y)
NORTH PIT	
OB - Drilling - North Pit	1,933
OB - Blasting - North Pit	9,804
OB - Dozers on OB - North Pit	89,491
OB - Excavator/FELS loading OB to haul truck - North Pit	29,679
OB - Hauling excavator OB to emplacement area - North Pit	267,292
OB - Emplacing excavator OB at emplacement area - North Pit	29,679
CL - Drilling coal - North Pit	42
CL - Blasting coal - North Pit	211
CL - Dozers ripping/pushing/clean-up ROM in-pit - North Pit	9,018
CL - Sh/Ex/FCLs loading open coal to trucks - North Pit	19,321
CL - Hauling open coal in-pit roads - North Pit	4,843
CL - Hauling open coal to ROM pad - North Pit	2,624
CL - Unloading ROM to ROM stockpiles/hopper - North Pit	1,396
CL - Handle coal at CHPP - North Pit	106
CL - Rehandle ROM coal at stockpiles/hopper - North Pit	465
Grading - North Pit	7,675
EAST PIT	
OB - Drilling - East Pit	911
OB - Blasting - East Pit	4,617
OB - Dozers on OB - East Pit	61,217
OB - Excavator loading OB to haul truck - East Pit	13,978
OB - Hauling to emplacement area (north) - East Pit	78,309
OB - Hauling to emplacement area (south) - East Pit	87,870
OB - Emplacing at emplacement area - East Pit	13,978
CL - Drilling coal - East Pit	28
CL - Blasting coal - East Pit	144.47
CL - Dozers ripping/pushing/clean-up ROM in-pit - East Pit	6,169
CL - Sh/Ex/FCLs loading open coal to trucks - East Pit	13,217
CL - Hauling open coal in-pits roads (north) - East Pit	1,397
CL - Hauling open coal in-pits roads (south) - East Pit	1,995
CL - Hauling open coal to ROM pad - East Pit	6,540
CL - Unloading ROM to ROM stockpiles/hopper - East Pit	955
CL - Handle coal at CHPP - East Pit	73
CL - Rehandle ROM coal at stockpiles/hopper - East Pit	318
Grading - East Pit	5,250
SOUTH PIT	
OB - Drilling - South Pit	930
OB - Blasting - South Pit	4,716
OB - Dozers on OB - South Pit	339,844
OB - Excavator loading OB to haul truck - South Pit	14,278
OB - Hauling to emplacement area in-pit - South Pit	178,265
OB - Hauling to emplacement area (dust-a-side) - South Pit	246,297
OB - Emplacing at emplacement area - South Pit	14,278
CL - Drilling coal - South Pit	158
CL - Blasting coal - South Pit	802
CL - Dozers ripping/pushing/clean-up ROM in-pit - South Pit	34,248
CL - Sh/Ex/FCLs loading open coal to trucks - South Pit	73,374
CL - Hauling open coal in-pits roads - South Pit	30,314
CL - Hauling open coal to ROM pad - South Pit	51,858
CL - Unloading ROM to ROM stockpiles/hopper - South Pit	5,301
CL - Handle coal at CHPP - South Pit	404
CL - Rehandle ROM coal at stockpiles/hopper - South Pit	1,767
Grading - South Pit	29,144
ROM/REJECTS HANDLING	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371
CL - Loading rejects	-
CL - Transporting rejects	12,306
CL - Unloading rejects	-
PRODUCT COAL	
CL - Loading product stockpile	245
CL - Loading product coal to trains	326
WIND EROSION	
WE - OB dump & disturbed area - Uncontrolled	570,582
WE - OB dump & disturbed area - Controlled	31,699
WE - Open mining area - North Pit	115,175
WE - Open mining area - East and South Pit	405,083
WE - ROM stockpiles	7,358
WE - Product stockpiles	52,560
TOTAL TSP EMISSIONS	**3,073,231**

7.5 Estimated Emissions from Distant Mines and Other Sources

In addition to the mines identified in **Section 7.4** distant mines and other sources will also contribute to dust levels in the area. Estimating the background allowance for distant mines and non-mining sources is difficult and depends on local land use and the associated emission sources, as well as climate, soil type, etc.

In previous assessments, the approach taken has been to compare the predicted impacts due to the Project and other mines at nearby monitoring locations. From this an estimate of the contribution by non-modelled sources was made and a single figure estimate of annual average background PM_{10} and TSP concentrations was added to all the predicted impacts.

However, it is recognised, that there is in reality, spatial variation in the contribution that non-modelled sources make to the ambient concentrations of annual average PM_{10} and TSP where open cut mining and other emission sources (e.g. residential roads, power stations) are located compared with areas where open cut mining is not active.

For this assessment, a grid of annual average PM_{10} and TSP concentrations due to non-mining sources has been created to make allowance for the spatial variability that occurs in the PM_{10} and TSP concentrations due to sources that are not explicitly included in the modelling.

The approach taken was to model (as accurately as possible) the actual operations that took place at surrounding mines for 2005 in combination with the meteorological data for this year. This modelling year was a representative year in terms of meteorology and existing environment (as discussed in **Section 4**) and additionally 2005 was during an extended period of drought that affected NSW (**Watkins, 2005**), therefore making this a more conservative choice. This was then compared to all available monitoring data in the modelling domain. The background from other sources was taken as the difference between the predicted and measured annual average concentrations of PM_{10} and TSP over the modelling domain.

The source of the emission data for the modelling is listed below:

- Mt-Arthur Coal (MAC)
  - Air quality impact assessment completed in 2000 (**URS, 2000**). Modelled year 5 emissions data were used as this was the closest year to modelled background year of 2005.
- Drayton
  - Air quality impact assessment completed in 2002 (**Holmes Air Sciences, 2002a**). Year 8 (nominally 2008) emissions data were used as this was the closest year to modelled background year of 2005.
- Muswellbrook Coal (MCC)
  - Air quality impact assessment completed in 2002 (**Holmes Air Sciences, 2002**). Year 4 (nominally 2006) emissions data were used as this was the closest year to modelled background year of 2005.
- Bengalla
  - Air quality impact assessment completed in 2006 (**Holmes Air Sciences, 2007b**). Modelled current year 2004 emissions data were used as this was the closest year to modelled background year of 2005.
- Hunter Valley Operations (HVO)
  - Air quality impact assessment completed in 2010 (**Holmes Air Sciences, 2005**). The closest modelled year to the equivalent Drayton South proposed operational years were chosen.

In addition, the Bayswater and Liddell power stations are located within 6 km of the Project. The particulate matter emitted from these power stations are captured by the current monitoring network used in this assessment. A new 2000 megawatts (MW) power station (Bayswater B) was conceptually approved in January 2010. The air quality impact assessment (**Katestone, 2009**) predicted that the maximum 24-hour average PM_{10} concentrations at sensitive receivers were 0.13 $\mu g/m^3$, that is, less than 0.5% of the EPA assessment criteria of 50 $\mu g/m^3$. Maximum predicted annual average PM_{10} concentrations at sensitive receiver were 0.004 $\mu g/m^3$ - approximately 0.01% of the EPA assessment criteria of 30 $\mu g/m^3$. Given the extremely low predicted impacts from the operation of Bayswater B, it was not considered necessary to include this in the cumulative assessment.

The source locations for all neighboring mines are shown in **Figure 7-2**.

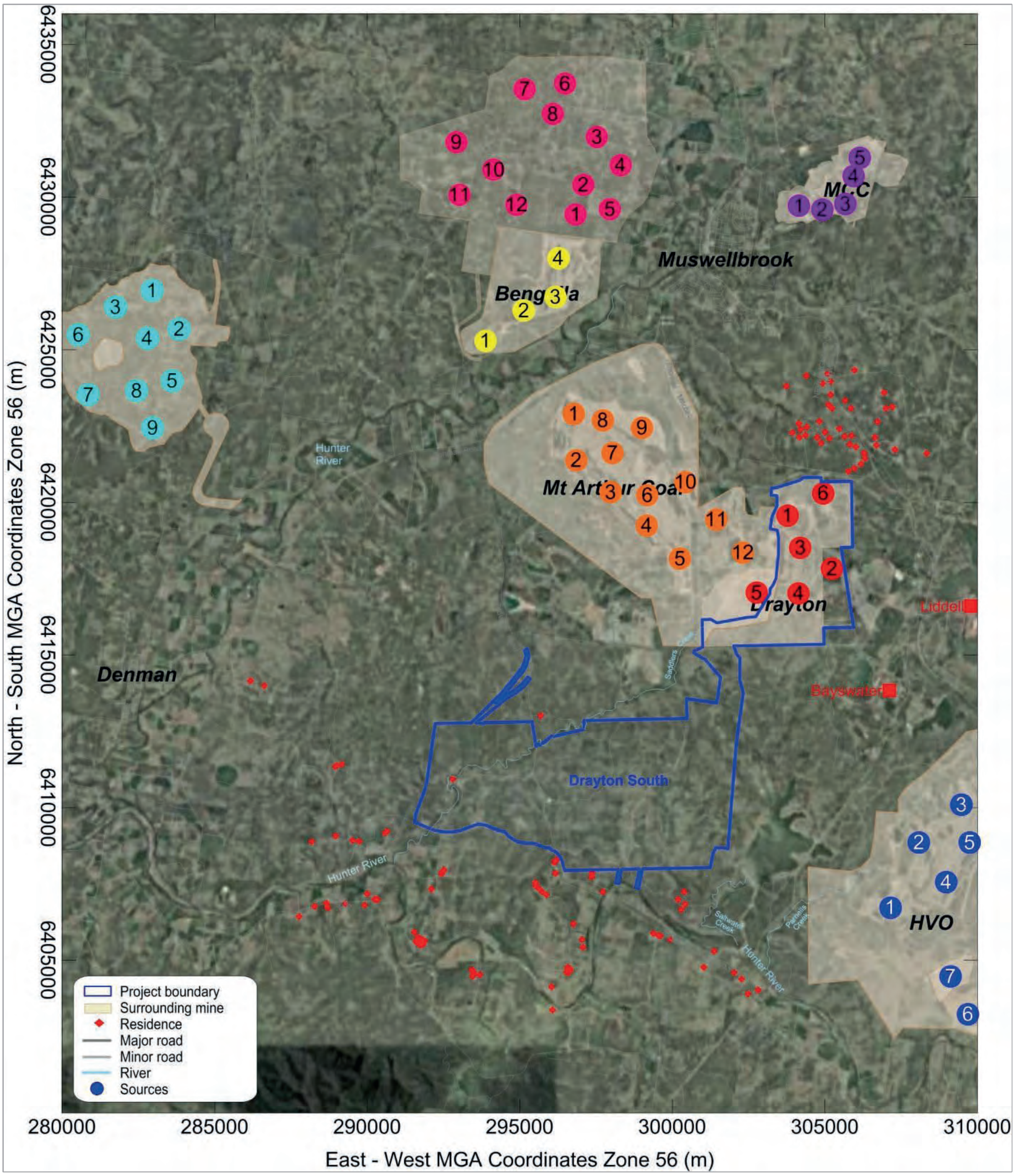


Figure 7-2: Source locations for neighbouring mines included in variable background assessment

Table 7-7 presents a summary of the estimated emissions for each mine for the variable background assessment.

Table 7-7: Summary of estimated TSP emissions from nearby mines operational in 2005

Mine	Background
	2005
Drayton	4,896,063
MAC	11,686,621
MCC	909,393
Bengalla	4,163,185
HVO	13,074,538

All available PM_{10} and TSP air quality monitoring data covering as much of the modelling domain as possible, were used for this assessment (see **Figure 4-1** for monitor locations).

A variable grid of background emissions were taken as the difference between the predicted and measured annual average concentrations of PM_{10} and TSP over the modelling domain. This was then added to the predicted impacts from Drayton South and approved nearby mining operations to determine the total cumulative impact.

Table 7-8 and **Table 7-9** present the measured, predicted and background PM_{10} and TSP concentrations, respectively. The locations of these monitoring stations are shown in **Figure 4-1.**

Table 7-8: PM_{10} concentrations (µg/m^3)

Monitor ID	Monitor Owner	Measured Concentrations	Predicted Concentrations	Background Concentrations (i.e. measured minus modelled)
Lot 9	Drayton	17	9	8
HV2a	Drayton South	**37***	4	34
HV5	Drayton South	14	3	12
PM10-1	Mangoola	17	5	12
PM10-2	Mangoola	14	4	10
DF01	MAC	16	11	5
DF02	MAC	16	16	0
DF03	MAC	14	6	8
DF04	MAC	19	42	-23*
DF05	MAC	16	15	1
DF06	MAC	21	15	7
DF07	MAC	22	7	15
DF08	MAC	18	32	-14*
HV2	Bengalla	23	14	9
HV4	Bengalla	20	8	13
Site 1	MCC	13	4	9
Site 2	MCC	16	7	10
Site 3	MCC	16	5	11
Wandewoi	HVO	17	5	11
Jerry's Plain School	HVO	14	3	12

* HV2a (Llanillo) was removed from the background analysis due to its location near a cultivated paddock, as discussed in **Section 4.1.2**.

* This negative value indicates a slight over prediction by the model at the TEOM sites. For the purposes of developing the spatially varying background grid, these differences have not been included.

Note that there were a number of sites where the difference between the measured PM_{10} or TSP and predicted was negative which indicates that the model has over predicted at these mine sites and these values were removed from the grid.

Table 7-9: TSP concentrations (μg/m³)

Monitor ID	Monitor Owner	Measured Concentrations	Predicted concentrations	Background Concentrations (i.e. measured minus modelled)
Lot 22	Drayton	44	30	13
Pringles	Drayton	67	91	-24*
HV2a	Drayton South	46	10	36
HV4	Drayton South	45	15	30
HV5	Drayton South	42	7	34
TSP-1	Mangoola	35	11	24
HV2	Bengalla	51	36	15
HV4	Bengalla	40	20	21
HV1	Bengalla	45	22	23
HV3	Bengalla	39	16	22
Site 1	MCC	31	11	20
Site 2	MCC	33	18	15
Site 3	MCC	32	14	18
Wandewoi	HVO	42	13	29
Jerry's Plain School	HVO	42	6	35

* This negative value indicates a slight over prediction by the model at TEOM site Pringle. For the purposes of developing the spatially varying background grid, the difference has not been included.

The monitoring locations are sparsely located and in order to create a grid of spatially varying concentrations it was necessary to make some assumptions about concentrations at the edge of the modelling domain. The annual average PM_{10} and TSP concentrations on the edges of the modelling domain are shown in **Table 7-10** and were based on measurements from monitors closest to each boundary.

The annual average PM_{10} concentrations on the west to northwest boundaries are assumed to be 14 μg/m³ where there were little contributions from other mines. To the southwest, where there are significant non-modelled mining sources (such as HVO North and South Operations), the annual average PM_{10} model boundary levels have been assumed to be 17 μg/m³. The annual average TSP concentrations at the modelling domain boundaries were set to values between 32 μg/m³ and 44 μg/m³, following the same methodology as PM_{10}.

The annual average quantity of deposited dust contributed by these other sources has been assumed as 1 g/m²/month.

Table 7-10: PM_{10} and TSP concentrations (μg/m³) at the model boundary

Modelling domain edge	PM_{10} μg/m³	TSP μg/m³
N	16	32
NE	16	32
E	17	44
SE	17	42
S	17	42
SW	17	42
W	14	35
NW	14	35

Figure 7-3 and **Figure 7-4** show the grids created for PM_{10} and TSP, respectively. These demonstrate that closer to the modelled mines the majority of the measured PM_{10} and TSP concentrations are due to the operations at these mines, with small contributions from distant mines and other sources. As you move away from each mine, the contribution of distant mines and other sources to the total measured concentrations increase.

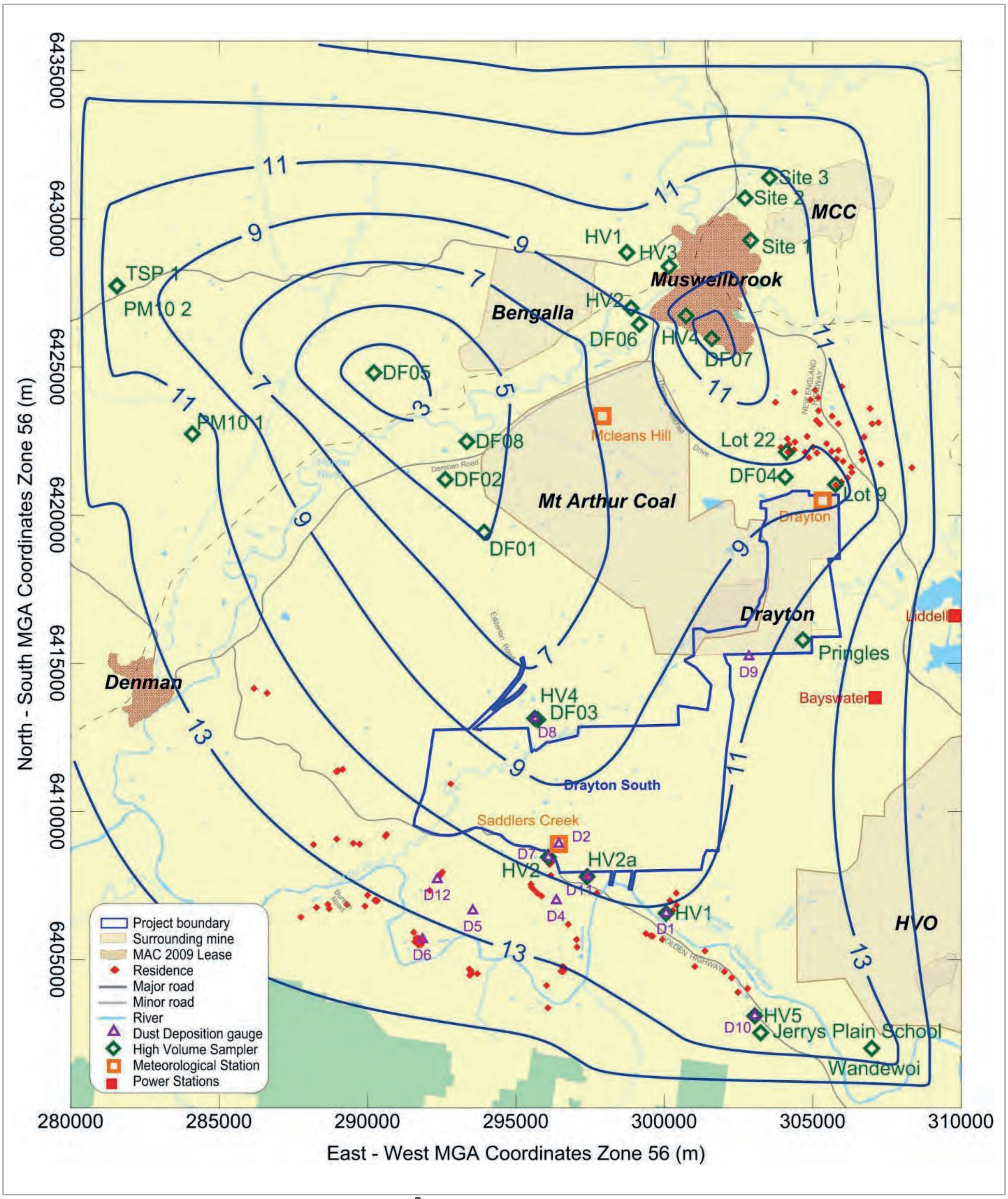


Figure 7-3: Annual average PM_{10} ($\mu g/m^3$) concentrations due to distant mines and other sources

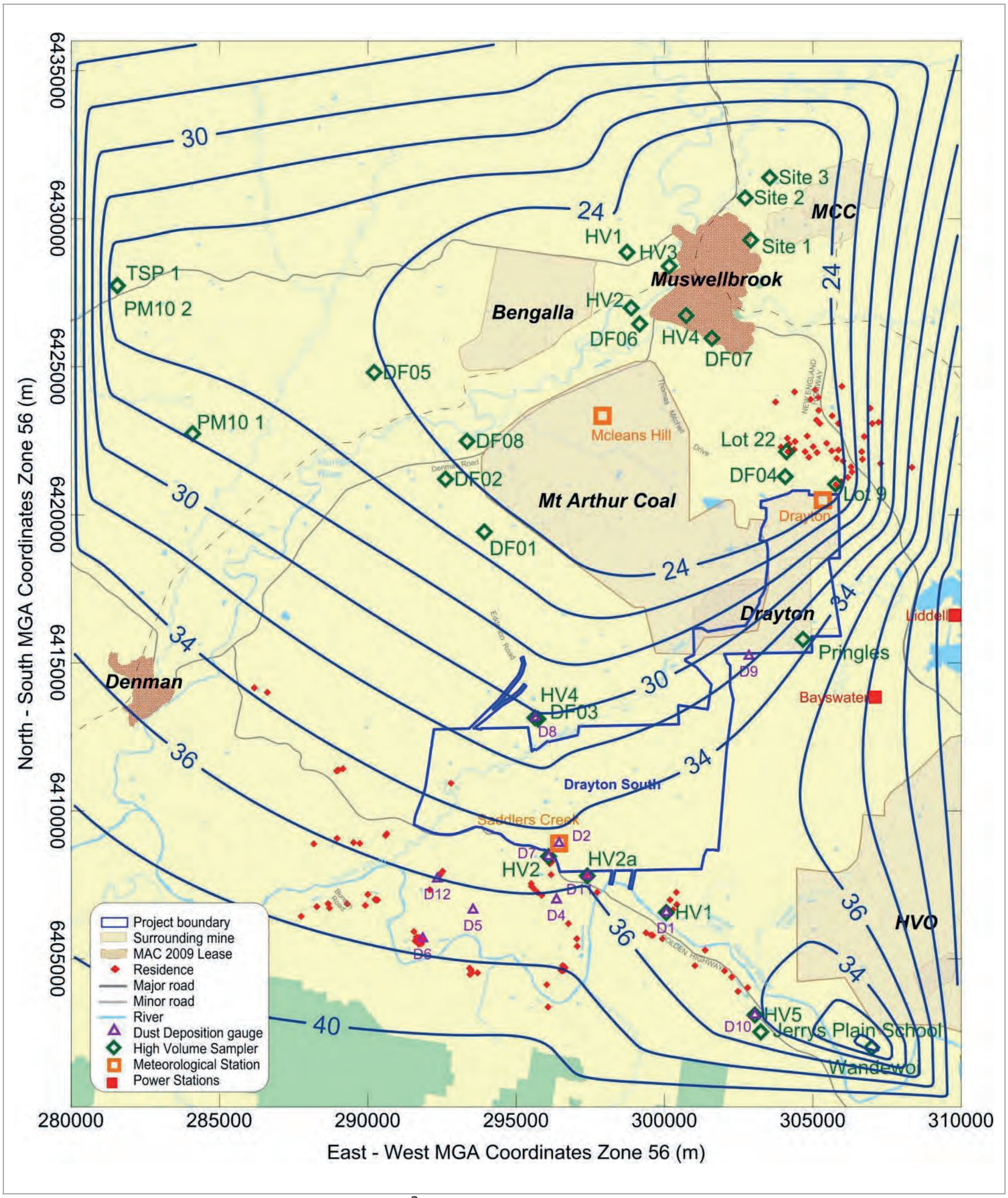


Figure 7-4: Annual average TSP (μg/m³) concentrations due to distant mines and other sources

8 ASSESSMENT OF IMPACTS – PARTICULATE MATTER

8.1 Assessment Approach

The annual average concentrations, dust concentrations and deposition rates for the selected years of assessment have been presented as isopleth diagrams showing the following:

- Predicted 24 hour PM_{10} concentrations from the Project alone and with other sources;
- Predicted annual average PM_{10} concentrations from the Project alone and with other sources;
- Predicted annual average TSP concentrations from the Project alone and with other sources; and
- Predicted annual average dust deposition concentrations from the Project alone and with other sources.

Rather than provide a detailed discussion of each isopleth figure, the results have been summarised in tabular form for each year. The nearby residences are listed, with those that are predicted to experience particulate matter deposition or concentration levels above the NSW EPA's assessment criteria highlighted. The contour plots of dust concentrations and deposition levels show the areas of land that are affected by dust at different levels. However, concentration and deposition levels at residences are of particular interest. The locations of neighbouring properties (and where applicable, residences) are shown in each contour plot and in **Figure 4-1.**

Whilst there are currently no impact assessment criteria for $PM_{2.5}$, **Appendix D** provides an assessment compared with the advisory reporting standard**.**

8.2 PM_{10} 24-hour Predictions

Figure 8-1 to **Figure 8-7** present contour plots for the predicted maximum 24-hour PM_{10} concentrations for the Project-only for each modelled scenario. The isopleth for the 24-hour average assessment criterion of 50 µg/m^3 is shown in red. It is important to note that the EPA impact assessment criterions are applied to the cumulative impacts of the Project and other sources, as presented in **Section 8.3.**

The 24-hour PM_{10} contours presented in **Figure 8-1** to **Figure 8-7** do not represent a single worst case day, but rather represent the potential worst case 24-hour PM_{10} concentration that could be reached at any particular location across the entire modelling year.

A summary of the predicted particulate concentrations at each of the individual residences are provided in **Table 8-1**. The residences that are predicted to experience 24-hour average PM_{10} levels above the assessment criterion of 50 µg/m^3 are highlighted in bold red.

Table 8-1: 24-hour PM_{10} concentrations (µg/m^3) for each modelling year due to Project only

ID	Project Only Maximum 24-hour average PM_{10} (µg/m^3) *Assessment Criterion[a] = 50 µg/m^3*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	16	16	16	16	16	16	3
3	16	16	17	17	16	16	3
24A	21	21	23	22	18	19	4
24B	21	21	23	22	18	19	4
25	22	21	23	23	19	19	4
172	20	19	15	18	18	18	6
207	20	19	13	17	16	19	5
209	24	22	16	21	21	24	6
211	22	21	16	20	20	22	6

ID	Project Only						
	Maximum 24-hour average PM_{10} (µg/m³)						
	Assessment Criterion[a] = 50 µg/m³						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
217A	29	28	19	27	26	32	6
217B	28	26	16	21	20	30	7
219A	30	28	21	24	28	32	6
219B	37	34	22	27	29	39	6
219C	31	29	21	25	29	33	6
219D	27	25	21	23	28	29	6
226A	39	35	**55**	**94**	**90**	37	13
226B	41	37	**58**	**106**	**102**	38	14
226C	40	36	**56**	**100**	**96**	37	13
226D	34	31	44	**72**	**71**	31	11
227A	27	26	35	43	41	27	7
227B	27	25	34	42	39	26	7
227C	26	25	33	42	40	26	7
227D	26	24	32	42	40	25	7
227E	26	24	32	42	41	24	7
227F	29	26	29	**52**	**55**	36	9
228A	18	16	22	33	29	23	6
228B	18	16	22	33	29	23	6
228C	18	16	22	33	29	23	6
228D	18	16	22	34	30	23	6
228E	18	16	22	34	30	23	6
228F	18	17	22	34	31	24	6
228G	18	17	23	34	31	24	6
228H	18	17	23	35	31	24	6
228I	16	15	19	27	24	19	5
228J	18	16	22	34	30	23	6
228K	21	18	26	43	38	29	7
228L	22	19	28	47	41	31	8
228M	23	21	31	**54**	48	33	9
230	14	13	16	22	20	16	4
238A	14	14	17	18	16	13	3
238B	14	13	16	17	15	13	3
238C	14	14	17	18	15	13	3
238D	14	14	17	18	15	13	3
238E	14	14	17	18	15	13	3
238F	14	14	17	18	15	13	3
239A	15	14	16	17	15	14	3
239B	16	15	17	18	16	15	3
239C	16	15	16	18	15	15	3
239D	16	15	16	18	15	15	3
239E	16	15	16	18	15	15	3
239F	15	14	16	17	15	14	3
239G	15	15	16	17	15	15	3
239H	16	15	17	18	16	15	3
239I	16	16	17	19	16	16	3
240A	22	21	24	26	22	21	4
240B	24	24	28	30	26	24	4
240C	25	24	28	30	26	24	5
240D	25	24	28	30	26	24	5
240E	24	23	27	29	25	23	4
250A	27	27	31	30	26	24	5
250B	27	27	32	31	26	24	5
253	20	19	21	22	19	18	3
254A	20	19	21	22	19	18	3
254B	20	19	21	22	19	18	3
254C	20	19	21	22	19	18	3
255	19	18	20	20	17	17	3
279	16	16	17	17	15	15	3
284	18	17	19	19	17	16	3
285	17	16	18	18	15	15	3
287	17	16	18	18	16	15	3
288	15	14	15	16	13	13	2
298A	23	23	26	26	22	21	4

ID	Project Only Maximum 24-hour average PM_{10} ($\mu g/m^3$) *Assessment Criterion[a] = 50 µg/m³*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
298B	22	22	25	25	21	20	4
299	21	20	23	23	19	19	4
306	19	18	20	20	17	17	3
Drayton Mine							
384	16	16	7	7	6	8	2
385	23	22	7	8	7	9	3
386	22	21	9	9	8	10	3
387	32	30	11	11	9	13	5
390	43	41	14	14	13	17	7
398	39	37	13	13	12	16	5
399	33	31	11	11	10	14	4
400	29	28	10	10	9	12	4
401	31	29	10	10	9	12	4
402	34	33	11	11	10	14	5
403	38	36	12	12	11	14	5
411	31	30	23	23	20	23	9
418	30	28	21	22	19	22	8
419	26	24	19	19	17	19	7
420	24	22	18	18	16	18	7
421	22	21	15	15	12	14	5
423	23	22	12	12	9	11	4
424	22	21	10	10	8	10	4
425	21	20	11	11	9	10	3
427	23	22	8	8	7	9	4
429	23	21	7	8	7	9	3
432	20	19	6	6	6	7	3
433A	18	17	6	6	5	7	2
433B	17	17	5	5	5	6	2
435	16	15	5	5	5	6	2
438	12	12	8	7	6	6	2
440	16	16	9	9	7	8	2
441	11	11	7	7	5	6	2
443	13	13	10	10	8	9	3
444	16	15	13	13	11	12	4
446A	16	16	13	13	11	13	4
446B	15	14	7	7	6	8	3
451	11	10	5	5	4	5	1
455	11	10	5	5	5	6	2
456	11	10	6	6	5	5	1
460	16	15	8	8	6	7	2
Mine owned residences							
57	**52**	**52**	**66**	**69**	**64**	**55**	11
58A	35	30	38	**79**	**101**	47	13
58B	33	29	36	**69**	**84**	43	11
60	**81**	**79**	**75**	**61**	**52**	**67**	30
145A	**53**	48	26	31	32	**51**	9
145B	**71**	**63**	31	31	34	**58**	13
145C	**56**	**51**	28	35	35	**54**	10
145D	45	42	24	33	34	**52**	9
388	36	34	12	12	11	15	5
389	42	40	14	14	13	16	6
404	32	30	10	10	9	11	4
410	34	32	23	23	20	23	8

[a] 50 µg/m³ refers to the cumulative criterion and should not be applied to Project alone results. This is shown here for reference only.

Residences to the northwest of the Project (57, 58A, 58B and 60) are predicted to experience an exceedance of the 24-hour average PM_{10} criterion during several years throughout the life of the mine. As presented in **Table 8-2**, during years 10 and 15 there are up to 26 days when the 24-hour average PM_{10} assessment criterion is predicted to be exceeded (see **Table 8-2**). Note also that these four residences are mine owned.

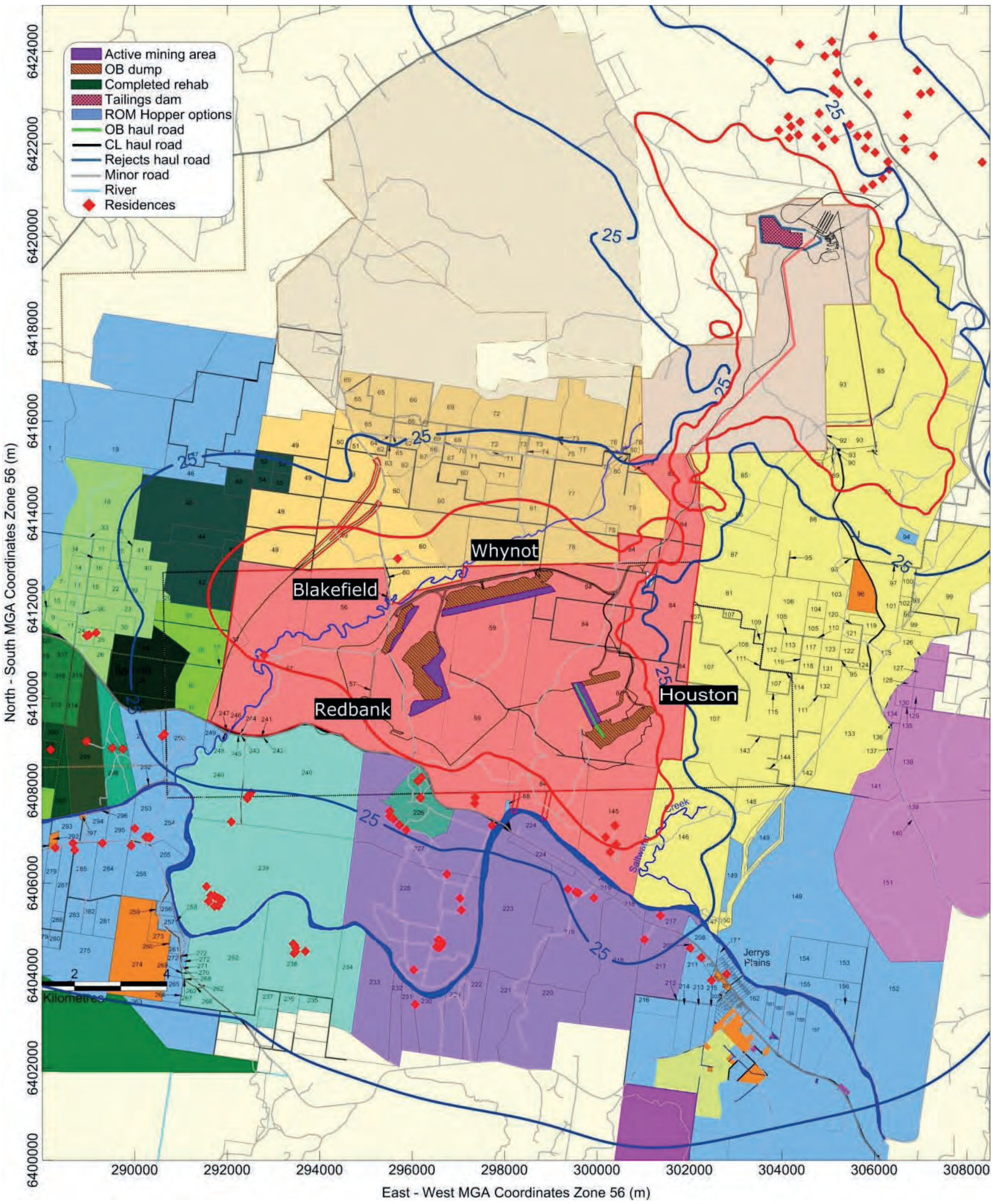
To the southeast of the Project residences 145 (A-D) experience exceedances of the 24-hour PM_{10} assessment criterion during Year 3 and Year 20, when Houston is fully operational. These residences are also owned by Anglo American and predicted to exceed the criteria for between 1 and 3 days of the year.

Residences 226 (A-D) are predicted to experience exceedances of the 24-hour PM_{10} assessment criterion during years 5, 10 and 15 of the Project operations. Residences 227F and 228M are also predicted to exceed during years 10 and 15 of the Project. The number of days over the 24-hour average PM_{10} criteria at each of these residences (227F and 228M) is predicted to be 1 day during the year for each of year 10 and 15. It is proposed that the impacts at these locations would be managed via a real-time and/or predictive monitoring system where operations could be modified (or temporarily shut down in extreme cases) under certain meteorological conditions (refer to **Section 9**) to minimise the impacts. No other residences are predicted to experience 24-hour average PM_{10} concentrations above the assessment criterion, due to emissions from the Project alone.

Table 8-2: Number of days exceeding 24-hour PM_{10} assessment criterion for each modelling year

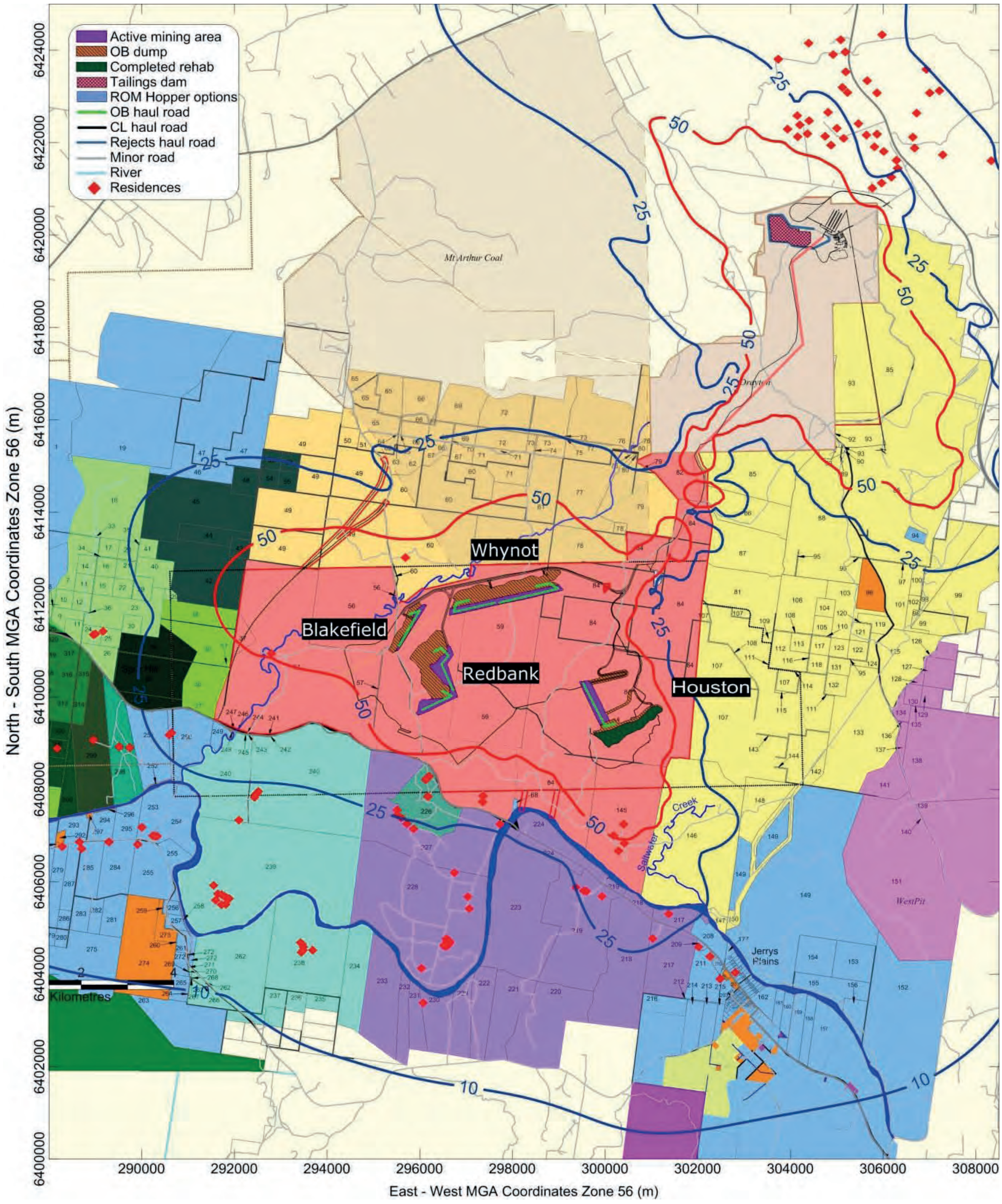
ID	Number of days exceeding criteria Maximum 24-hour average PM_{10} (µg/m^3) *Assessment Criterion[a] = 50 µg/m^3*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
226A	0	0	**1**	**13**	**10**	0	0
226B	0	0	**1**	**23**	**19**	0	0
226C	0	0	**1**	**17**	**12**	0	0
226D	0	0	0	**3**	**3**	0	0
227F	0	0	0	**1**	**1**	0	0
228M	0	0	0	**1**	0	0	0
Mine owned residences							
57	**2**	**2**	**5**	**4**	**1**	**1**	0
58A	0	0	0	**11**	**26**	0	0
58B	0	0	0	**4**	**9**	0	0
60	**15**	**15**	**19**	**9**	**1**	**4**	0
145A	**1**	0	0	0	0	**1**	0
145B	**1**	**1**	0	0	0	**2**	0
145C	**1**	**1**	0	0	0	**1**	0
145D	0	0	0	0	0	**1**	0

[a] 50 µg/m^3 refers to the cumulative criterion and should not be applied to Project alone results. This is shown here for reference only.



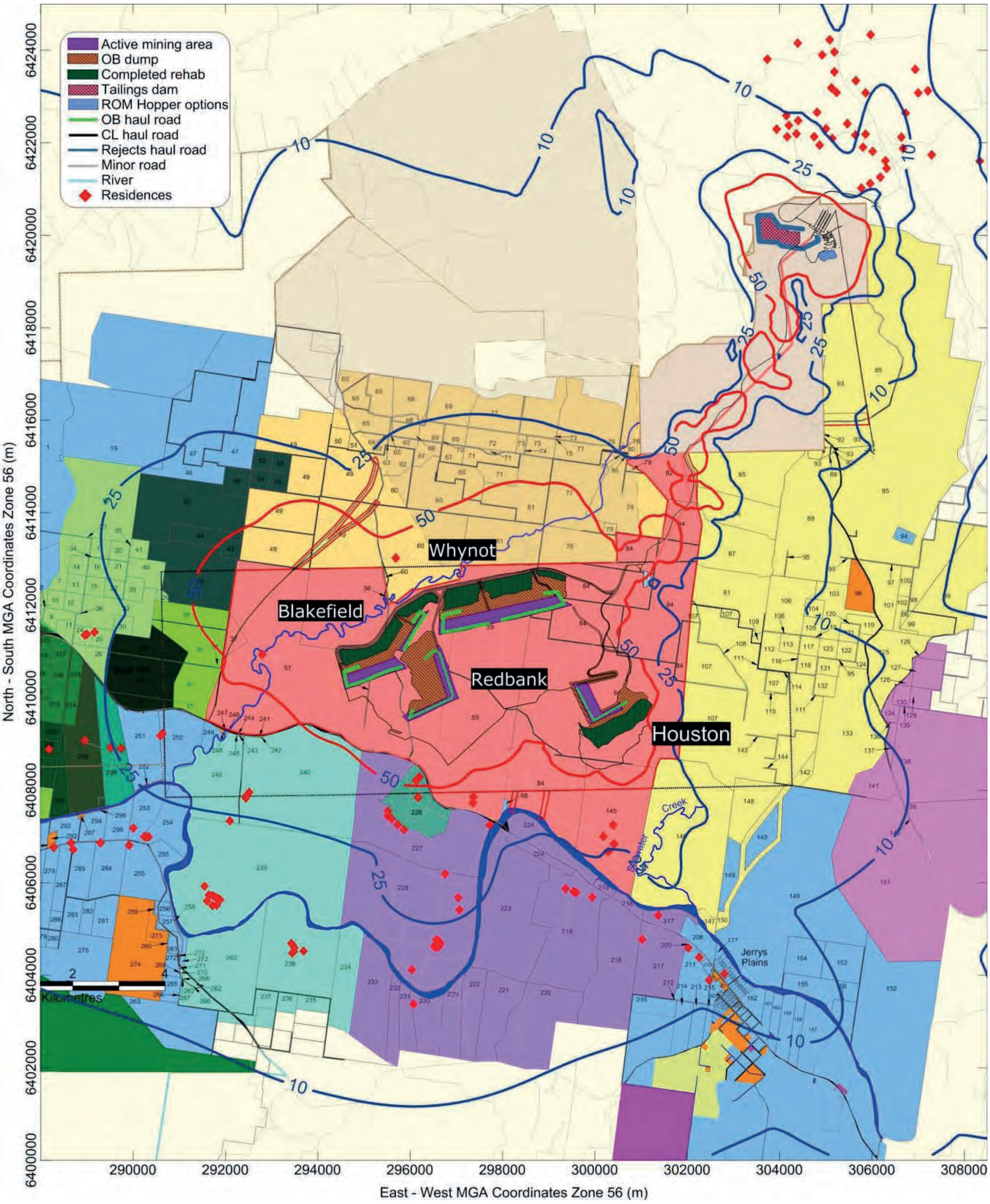
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 3A (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	DP&I =50 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-1: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 3A



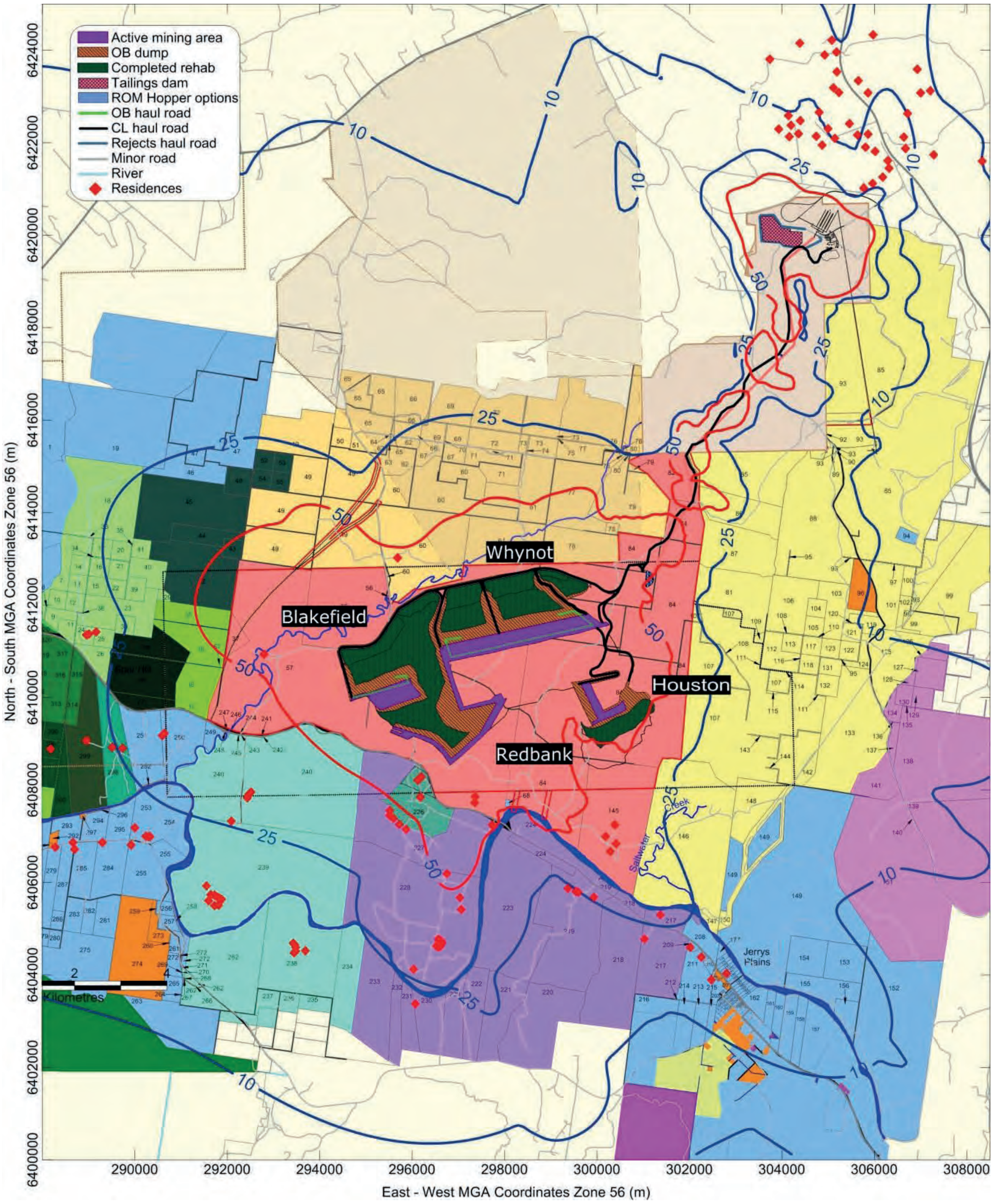
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 3B (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	μg/m³	DP&I =50 μg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-2: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 3B



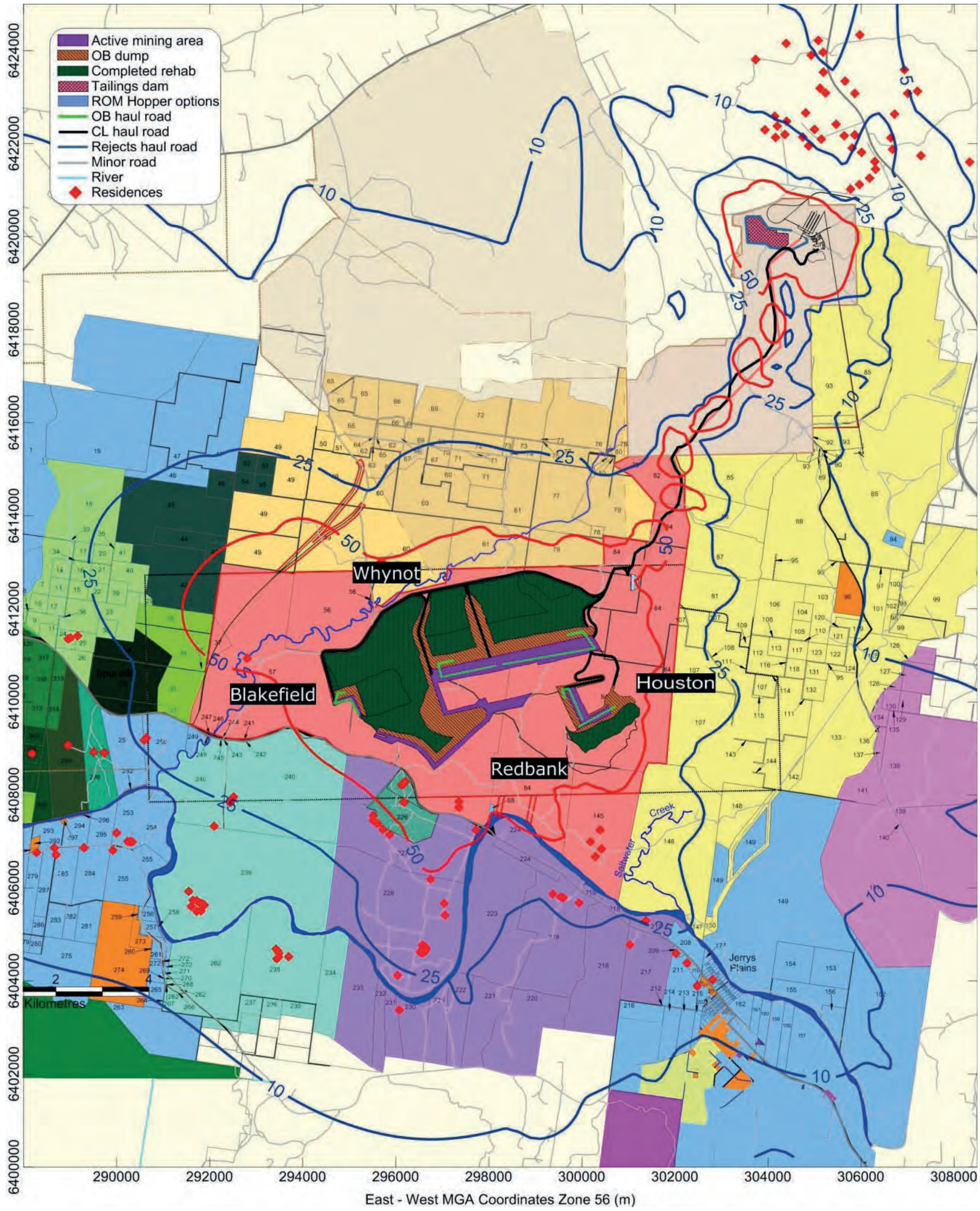
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 5 (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	DP&I =50 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-3: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 5



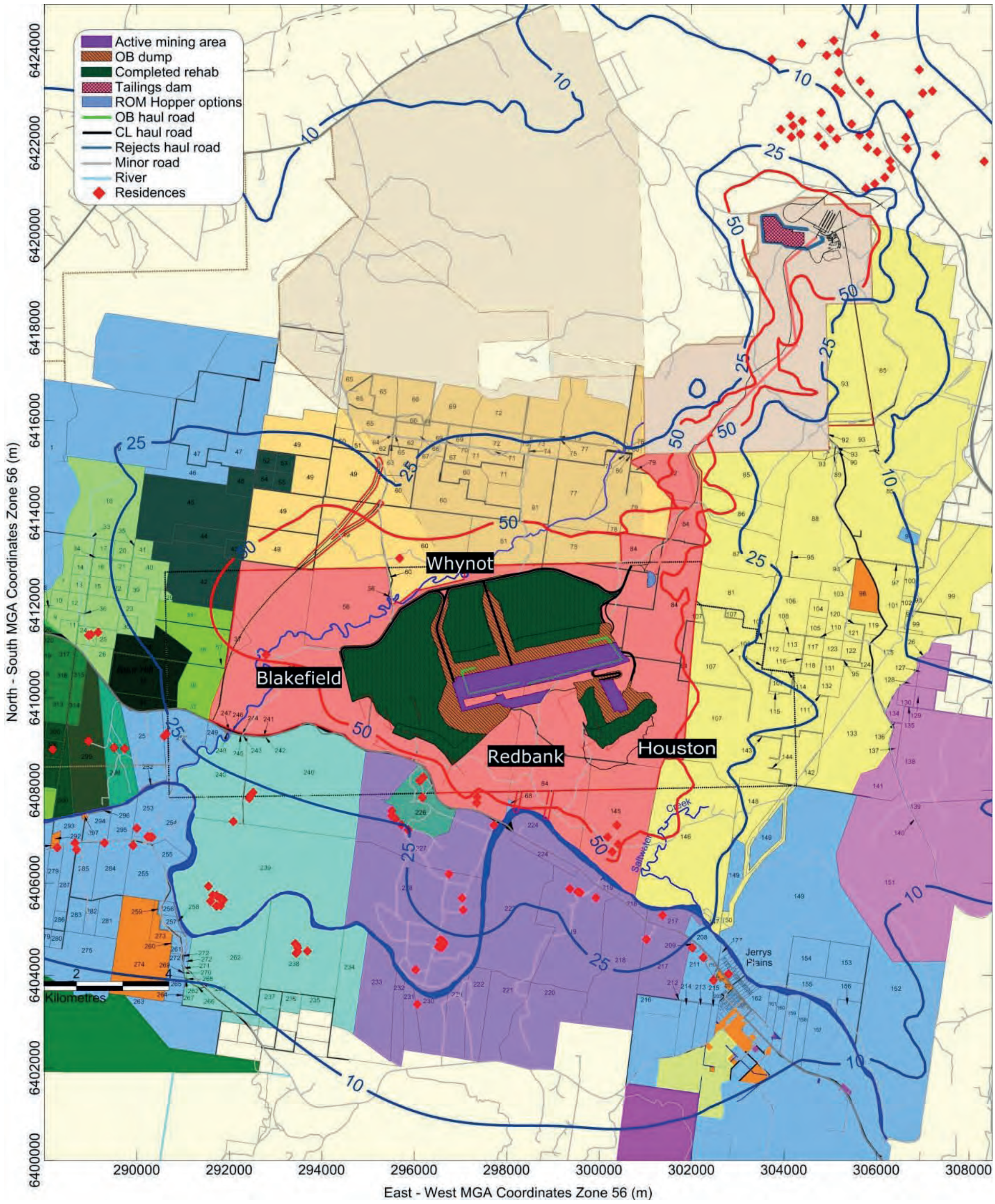
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 10 (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	DP&I =50 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-4: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 10



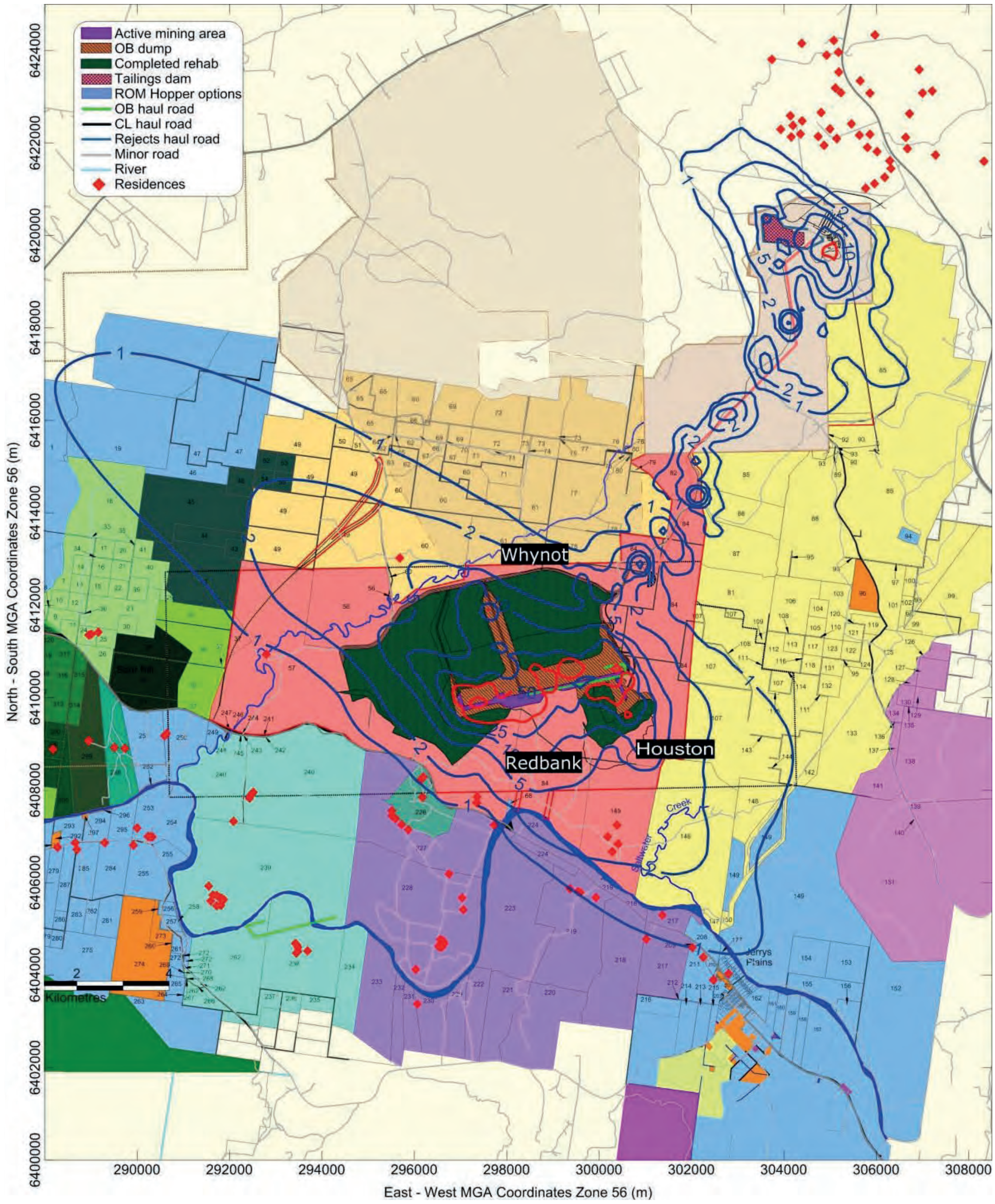
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 15 (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	DP&I =50 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-5: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 15



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 20 (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	DP&I =50 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-6: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 27 (The Project only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	DP&I =50 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-7: Maximum predicted 24-hour average PM_{10} concentrations due to emissions from Drayton South only - Year 27

8.3 Cumulative 24-hour Average PM_{10} Impacts

8.3.1 Introduction

The EPA describes two methods for assessing cumulative air quality effects (see Section 11.2 of **DEC, 2005**).

- A Level 1 assessment (suitable for a screening assessment) requires the highest predicted concentration from the proposal be added to the highest observed concentration in a data set which provides measurements of PM_{10} concentrations representative of conditions at the site being assessed. If this results in exceedances of the PM_{10} impact assessment criteria, a Level 2 assessment is required.
- A Level 2 assessment provides a more rigorous approach when background levels are elevated and requires (1) that the highest ten observed 24-hour PM_{10} concentrations (below criteria) are added to the predicted concentrations for the same days; and (2) the ten highest predicted 24-hour PM_{10} concentrations are added to the observed concentrations for the same days.

Both the Level 1 and Level 2 assessments require continuous background ambient monitoring data. The Level 2 assessment works well when there are ambient monitoring data available for each day that coincide with the period of time of predicted impacts, and the data are representative of the site being assessed.

There are no available continuous 24-hour PM_{10} data for the area that match the year of meteorological data year (2005). HVAS data are available every sixth day, however, these data are insufficient to provide a representative background for each day of the model simulation.

Therefore, an alternative statistical approach (using a Monte Carlo Simulation) is presented, to achieve the objectives of a Level 2 Assessment. The cumulative assessment focuses on representative receivers in key areas in the vicinity of the Project. Thirteen locations were selected to provide an indication of worst case cumulative 24-hour PM_{10} concentrations (see **Figure 8-8**) from these key areas:

- South/south-west of Drayton South – receivers 57, 58A, 145A, 226B, 226D, 227A, 227F, 240A and 250A;
- South-east of proposed Drayton South – receivers 209 and 217; and
- North-east of existing Drayton – receivers 410 and 411.

8.3.2 Level 2 assessment based on Monte Carlo simulation

The Monte Carlo Simulation is a statistical modelling approach that combines the frequency distribution of one data set (in this case background 24-hour PM_{10} concentration) with the frequency distribution of another data set (the Project's modelled impacts at a given point). This is achieved by repeatedly randomly sampling and combining values with the two data sets to create a third, 'cumulative' data set and associated frequency distribution.

As discussed in **Section 4.1**, there are a number of monitors operating in the area. **Figure 8-8** shows the location of the monitors deemed to be representative of the key areas selected.

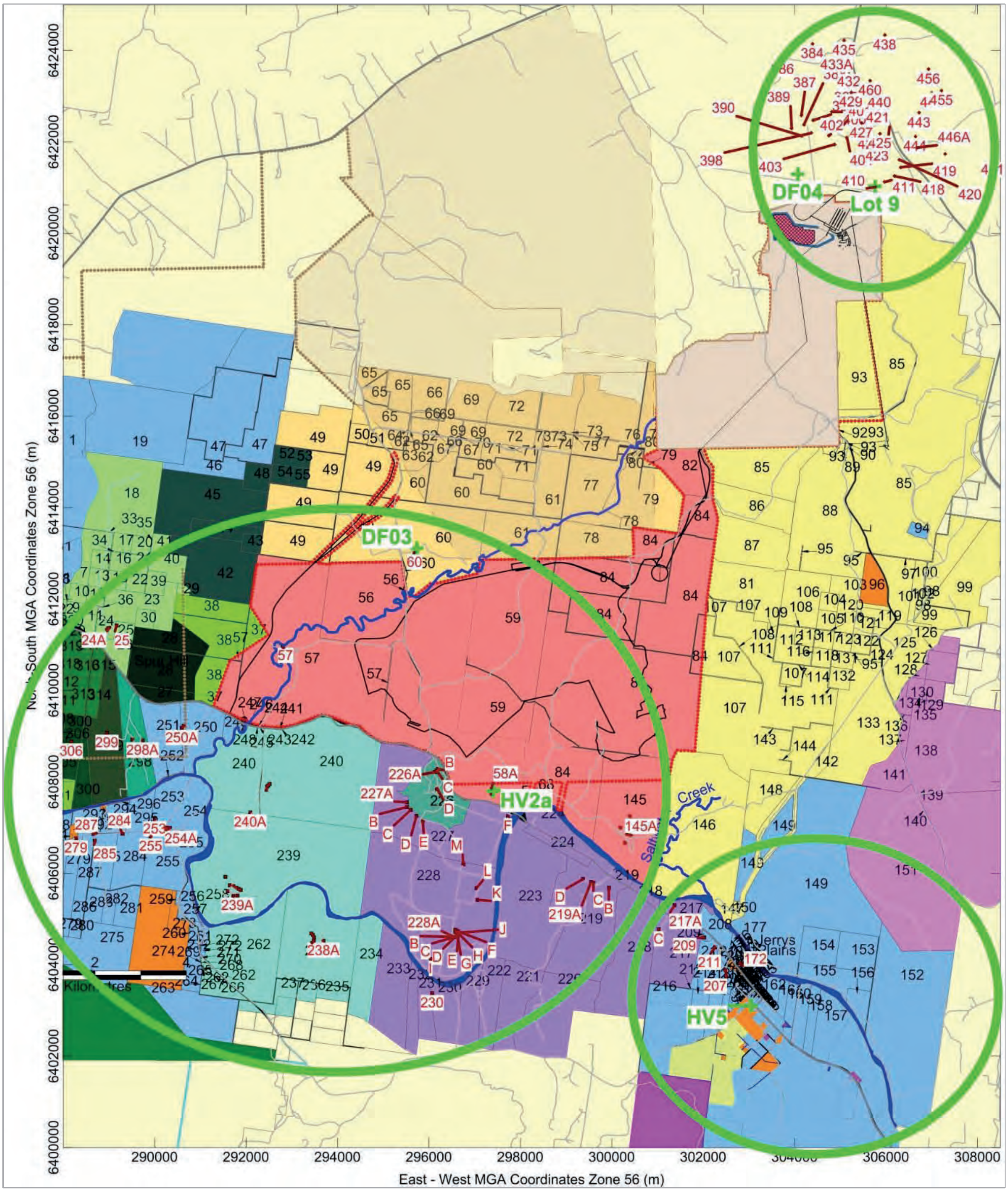


Figure 8-8: Representative receivers and monitoring locations – cumulative 24-hour PM_{10} assessment

A summary of the available data and which receiver the monitoring locations are representative of is provided in **Table 8-3**.

Table 8-3: Monitoring data availability – cumulative 24-hour assessment

Monitoring Location ID	Monitoring Period	No. of daily 24-hour average concentrations	Data source	Representative of Receiver ID
Mt Arthur Coal Edderton (DF04)	2002 - 2010	530	PAEHolmes (2009) BHP Billiton (2009) BHP Billiton (2010)	410 & 411
Anglo American Lot 9	2005 – 2009	288	Anglo American	
Mt Arthur Coal Windmill (DF03)	2002 - 2010	528	PAEHolmes (2009) BHP Billiton (2009) BHP Billiton (2010)	57, 58A, 145A, 226B, 226D, 227A, 227F, 240A and 250A
Anglo American HV2a	2000-November 2011	502	Anglo American	
Anglo American HV5	May 2001 – November 2011	477	Anglo American	209 & 217

The process assumes that a randomly selected background value from the real dataset would have a chance equal to that of any other background value from the dataset of occurring on the given 'model day'. Over sufficient time this would yield a good statistical estimate of the combined and independent effects of varying background and Project contributions to total PM_{10}.

To generate greater confidence in the statistical robustness of the results, the Monte Carlo Simulation was repeated 250,000 times for each of the receptors. In other words, the same 1-year set of predicted (modelled) 24-hour PM_{10} concentrations due to the Project were added to 250,000 variations of the randomly selected background concentrations at each representative receiver (i.e. a different random background concentration is selected each time).

The 24-hour PM_{10} cumulative analysis for these 13 receptors has been completed for year 10 as this modelled year has the largest predicted impacts for the Project alone.

The results of this analysis are presented graphically in **Figure 8-9** to **Figure 8-11**, for groups based on the monitored background used i.e. south/south west and measurements at DF03 and HV2a. The plots show the number of days that the predicted 24-hour PM_{10} cumulative concentrations would likely reach a certain ground level concentration. For comparison the number of days that the '*Background Only'* would reach a certain concentration is shown with the *'Mine plus Background'* probability.

The results show varying degrees of impact from the Project emissions depending on the location. At all sites, the statistics indicate some probability of days per year with PM_{10} concentrations above 50 µg/m³. This is the case for both 'B*ackground Only'* (because the background data already has values above this level) and the *'Mine plus Background'*.

Table 8-4 presents a summary of the number of days exceeding the EPA criteria for each of the selected receptors for both the project alone and cumulative.

It is also noted that the actual number of exceedances per year cannot be predicted precisely and will depend on actual Project activities, weather conditions, implementation of real-time controls and predictive meteorological forecasting and background levels in the future.

The greatest increase above background is expected at receivers close to the southern boundary of the Project. From **Figure 8-9** it is apparent that at receivers 58A, 226, 226D and 227F PM_{10} is likely to exceed 50 µg/m^3 for a number of days due to cumulative impacts. Whilst the actual number of exceedances per year cannot be predicted with certainty, the analysis shows that when cumulative impacts are considered, the probability of exceedance for the south-south-western receptors ranges from approximately 27 to 44 days. It is important to note that the maximum predicted 24-hour PM_{10}

concentrations due to the Project alone are greater than 50 µg/m³ at all these locations, as discussed in **Section 8.2**.

When locations further south are considered, (see 227A and 240A), the predicted number of days with cumulative concentrations greater than 50 µg/m³ decreases (coming closer to the '*background only*' estimations). The same applies to residences to the south-east (see **Figure 8-10)** and those to the north of the existing Drayton Mine (see **Figure 8-11**).

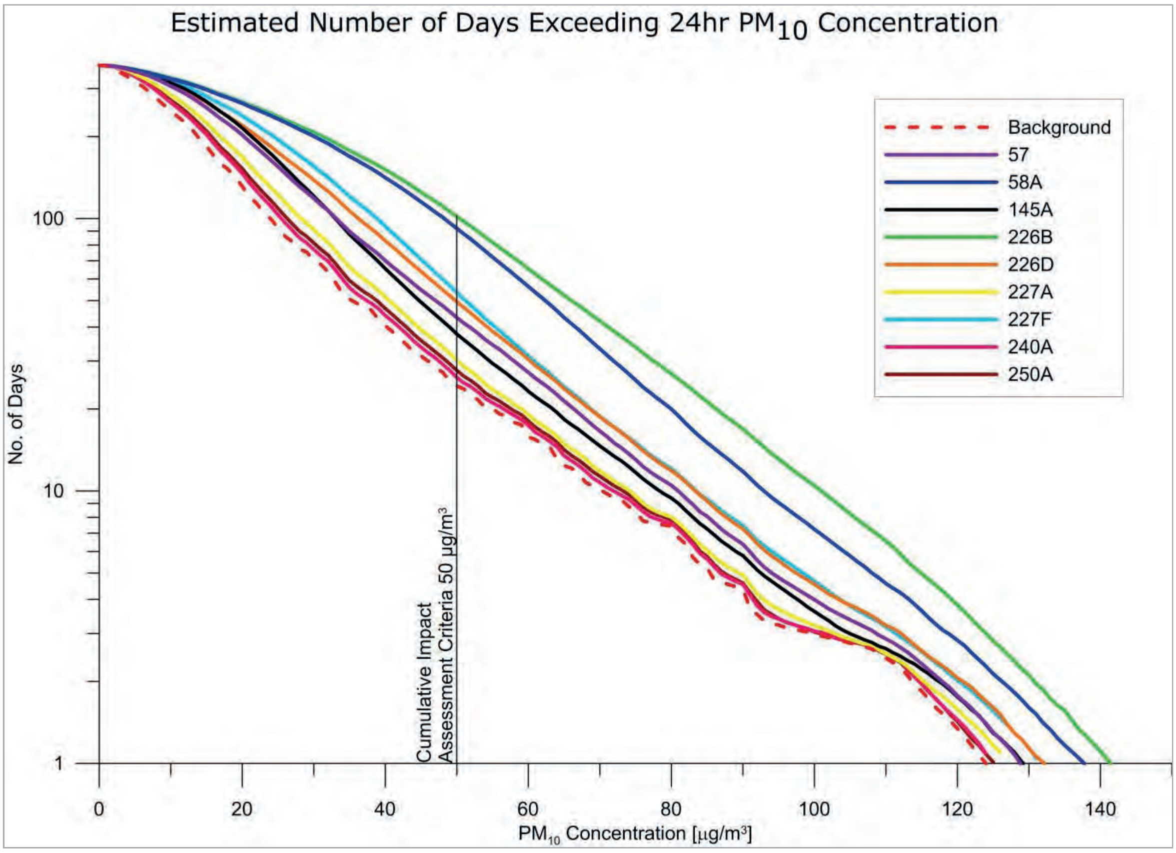


Figure 8-9: Year 10 – Number of days likely to exceed cumulative maximum 24-hr average PM_{10} concentration (50 µg/m³) for south/south-west residences

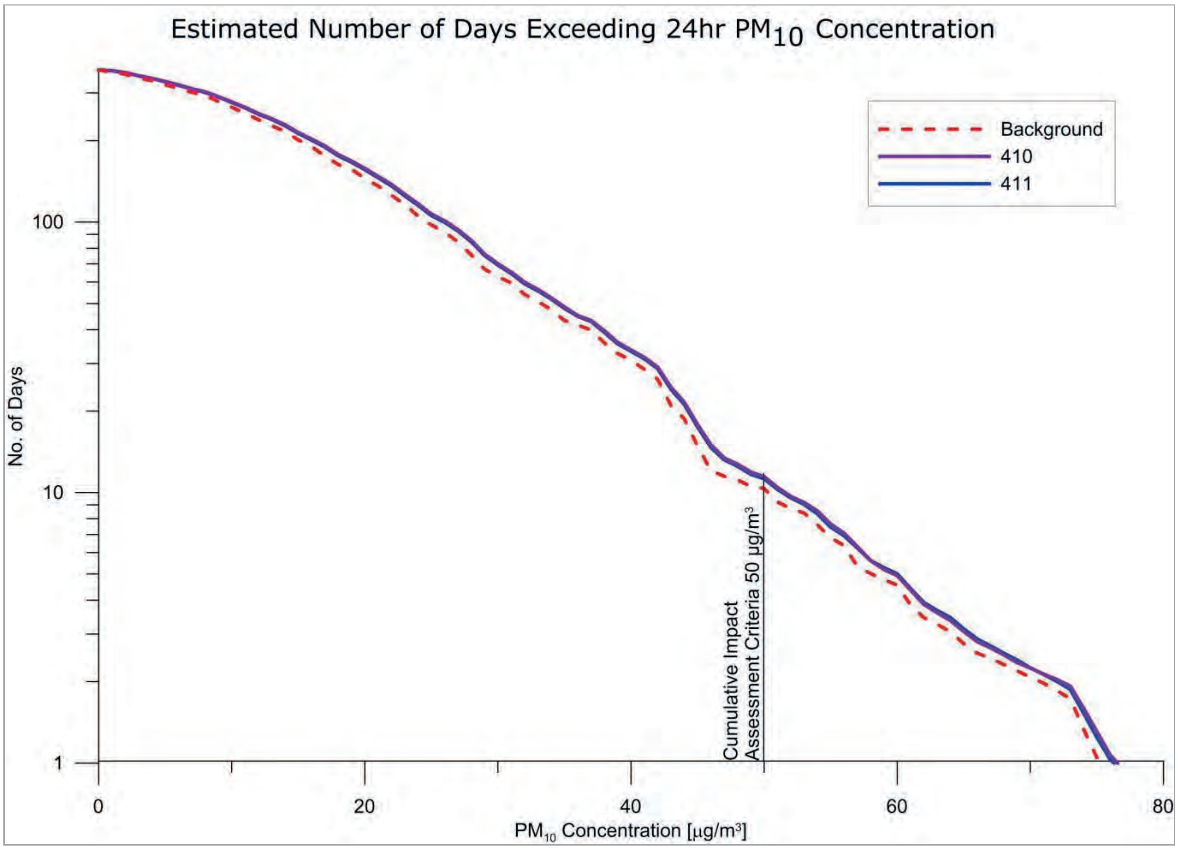


Figure 8-10: Year 10 – Number of days likely to exceed cumulative maximum 24-hr average PM_{10} concentration (50 µg/m³) for residences north east of Drayton Mine

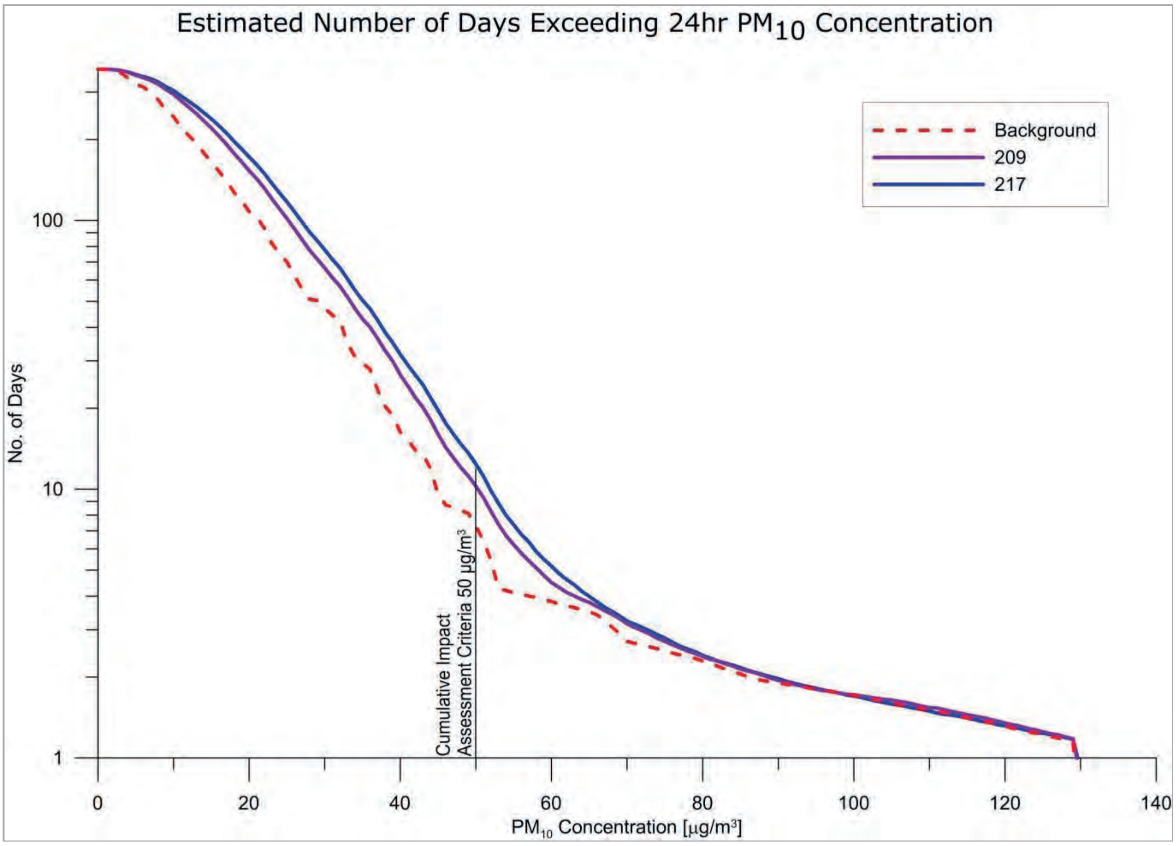


Figure 8-11: Year 10 – Number of days likely to exceed cumulative maximum 24-hr average PM_{10} concentration (50 µg/m³) for south east residences

Table 8-4: Summary of days exceeding 50 µg/m³ – Year10 project alone and cumulative

Receptor ID	Maximum predicted PM_{10} 24-hour concentrations	Predicted number of days exceeding 50 µg/m³ cumulative criteria		days exceeding 150 µg/m³ Acquisition criteria
	Project Alone	Project Alone	Cumulative	Cumulative
Units	µg/m³	Number of days	Number of days	Number of days
57	69	4	43	0
58A	79	11	92	0
145A	31	0	38	0
226B	106	23	102	1
226D	72	3	50	0
227A	43	0	30	0
227F	52	1	53	0
240A	26	0	26	0
250A	30	0	28	0
209	21	0	10	0
217A	27	0	12	0
410	23	0	11	0
411	23	0	11	0

8.4 Project Only PM_{10} Predictions

A summary of the Project-only predicted PM_{10} concentrations at each of the individual residences are provided in **Table 8-5**.

There are no privately owned residences that are predicted to experience annual average PM_{10} concentrations above the assessment criteria, due to emissions from the Project-only.

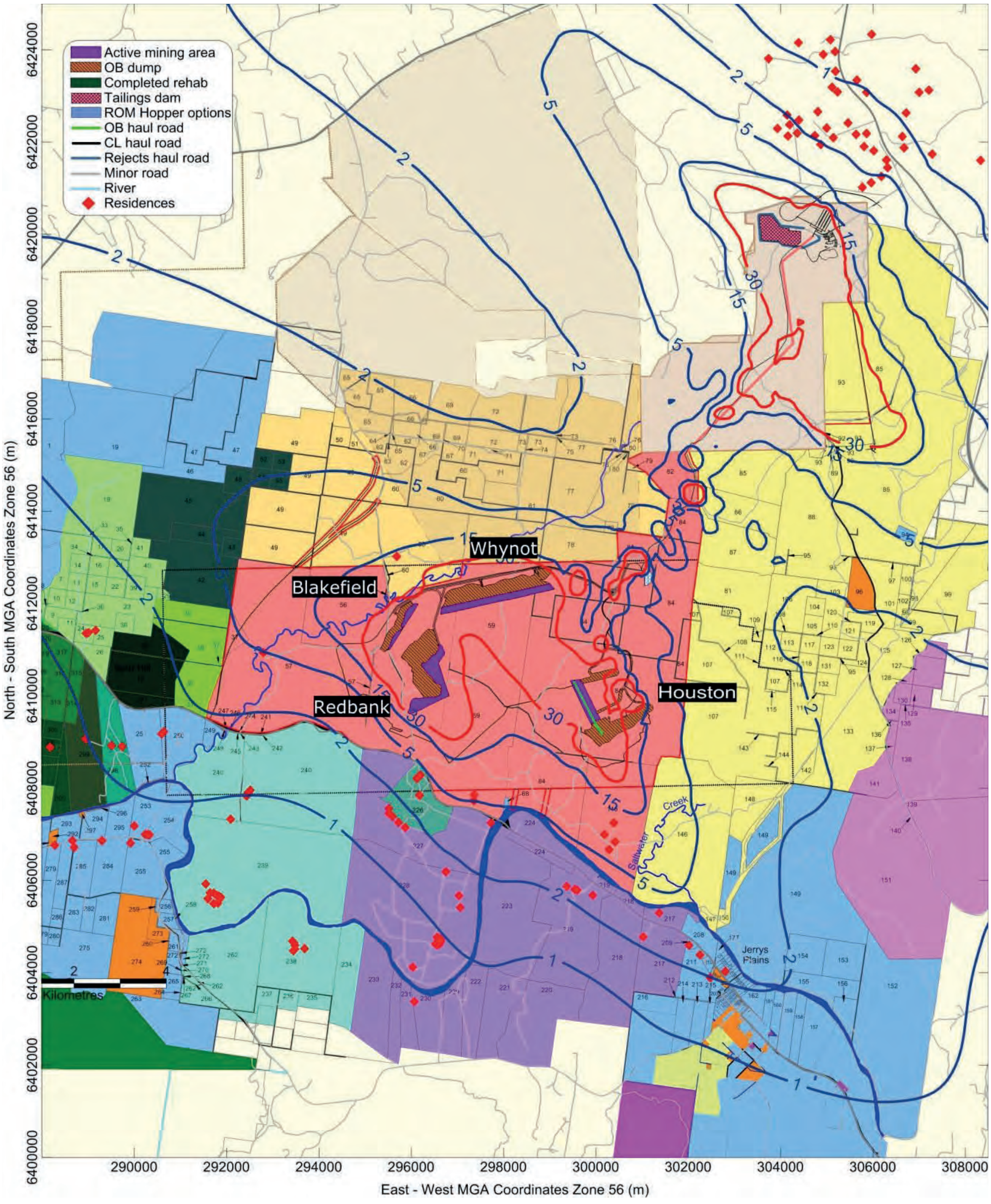
The Project-only contributions to annual average PM_{10} concentrations are presented in **Figure 8-12** to **Figure 8-18** for each modelled year.

Table 8-5: Annual PM_{10} concentrations (µg/m³) at nearby residences for each modelling year – Project Only

ID	Project Only – Annual Average PM_{10} (µg/m³) – *EPA Assessment criteria = N/A*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	1	1	1	1	1	1	0
3	1	1	1	2	1	1	0
24A	1	1	1	1	1	1	0
24B	1	1	1	1	1	1	0
25	1	1	1	2	1	1	0
172	2	2	2	3	3	3	1
207	2	2	2	3	3	3	1
209	3	3	3	3	4	4	1
211	2	2	2	3	3	3	1
217A	4	3	3	5	5	*5*	1
217B	2	2	2	3	3	3	1
219A	2	2	3	5	4	4	1
219B	3	3	3	5	5	4	1
219C	3	2	3	5	5	4	1
219D	2	2	3	4	4	3	1
226A	3	4	7	15	13	3	1
226B	4	4	8	19	16	4	1
226C	4	4	7	17	15	3	1

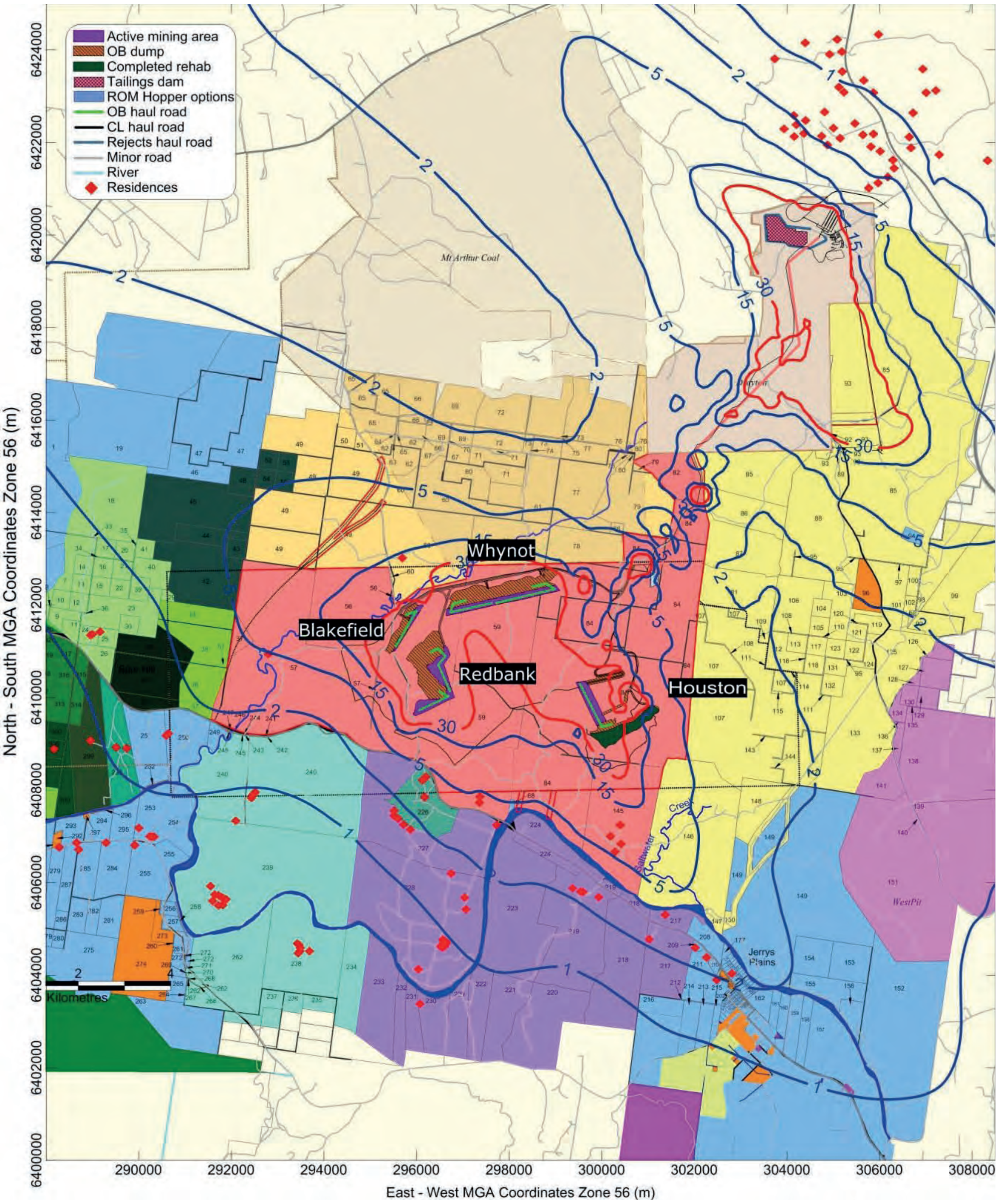
ID	Project Only						
	Annual Average PM_{10} ($\mu g/m^3$)						
	EPA Assessment criteria = N/A						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
226D	3	3	5	9	8	3	1
227A	2	2	2	3	3	2	0
227B	2	2	2	3	3	2	0
227C	2	2	2	3	3	2	0
227D	2	2	2	3	3	2	0
227E	2	2	2	3	3	2	0
227F	4	3	5	10	10	3	1
228A	1	1	1	1	1	1	0
228B	1	1	1	1	1	1	0
228C	1	1	1	1	1	1	0
228D	1	1	1	1	1	1	0
228E	1	1	1	1	1	1	0
228F	1	1	1	1	1	1	0
228G	1	1	1	1	1	1	0
228H	1	1	1	1	1	1	0
228I	1	1	1	1	1	1	0
228J	1	1	1	1	1	1	0
228K	1	1	2	2	2	1	0
228L	1	1	2	3	3	1	0
228M	2	2	2	3	3	2	0
230	1	1	1	1	1	1	0
238A	1	1	1	1	1	1	0
238B	1	1	1	1	1	1	0
238C	1	1	1	1	1	1	0
238D	1	1	1	1	1	1	0
238E	1	1	1	1	1	1	0
238F	1	1	1	1	1	1	0
239A	1	1	1	1	1	1	0
239B	1	1	1	1	1	1	0
239C	1	1	1	1	1	1	0
239D	1	1	1	1	1	1	0
239E	1	1	1	1	1	1	0
239F	1	1	1	1	1	1	0
239G	1	1	1	1	1	1	0
239H	1	1	1	1	1	1	0
239I	1	1	1	1	1	1	0
240A	1	1	1	1	1	1	0
240B	1	1	1	1	1	1	0
240C	1	1	1	1	1	1	0
240D	1	1	1	1	1	1	0
240E	1	1	1	1	1	1	0
250A	1	1	2	2	2	1	0
250B	1	1	2	2	2	1	0
253	1	1	1	1	1	1	0
254A	1	1	1	1	1	1	0
254B	1	1	1	1	1	1	0
254C	1	1	1	1	1	1	0
255	1	1	1	1	1	1	0
279	1	1	1	1	1	1	0
284	1	1	1	1	1	1	0
285	1	1	1	1	1	1	0
287	1	1	1	1	1	1	0
288	1	1	1	1	1	1	0
298A	1	1	1	1	1	1	0
298B	1	1	1	1	1	1	0
299	1	1	1	1	1	1	0
306	1	1	1	1	1	1	0
Drayton Mine							
384	1	1	0	0	0	0	0
385	1	1	0	0	0	0	0
386	1	1	0	0	0	1	0
387	2	2	1	1	1	1	0
390	3	3	1	1	1	1	0

ID	Project Only						
	Annual Average PM_{10} ($\mu g/m^3$)						
	EPA Assessment criteria = N/A						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
398	2	2	1	1	1	1	0
399	2	2	1	1	1	1	0
400	1	1	0	0	0	1	0
401	2	2	1	1	0	1	0
402	2	2	1	1	1	1	0
403	2	2	1	1	1	1	0
411	2	2	1	1	1	1	0
418	2	2	1	1	1	1	0
419	2	2	1	1	1	1	0
420	2	2	1	1	1	1	0
421	2	2	1	1	0	1	0
423	2	2	1	1	0	1	0
424	2	1	1	0	0	1	0
425	1	1	0	0	0	1	0
427	1	1	0	0	0	0	0
429	1	1	0	0	0	0	0
432	1	1	0	0	0	0	0
433A	1	1	0	0	0	0	0
433B	1	1	0	0	0	0	0
435	1	1	0	0	0	0	0
438	1	1	0	0	0	0	0
440	1	1	0	0	0	0	0
441	1	1	0	0	0	0	0
443	1	1	0	0	0	0	0
444	1	1	0	0	0	0	0
446A	1	1	0	0	0	1	0
446B	1	1	0	0	0	0	0
451	1	1	0	0	0	0	0
455	1	1	0	0	0	0	0
456	1	1	0	0	0	0	0
460	1	1	0	0	0	0	0
Mine owned residences							
57	5	5	7	7	6	4	1
58A	6	5	7	17	17	4	1
58B	5	4	6	13	14	4	1
60	17	17	18	14	12	14	5
145A	7	6	6	7	7	9	2
145B	10	9	6	7	8	11	3
145C	7	7	6	8	8	9	3
145D	6	5	5	7	7	8	2
388	2	2	1	1	1	1	0
389	3	3	1	1	1	1	0
404	2	2	1	1	0	1	0
410	3	3	1	1	1	1	0



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 3A (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

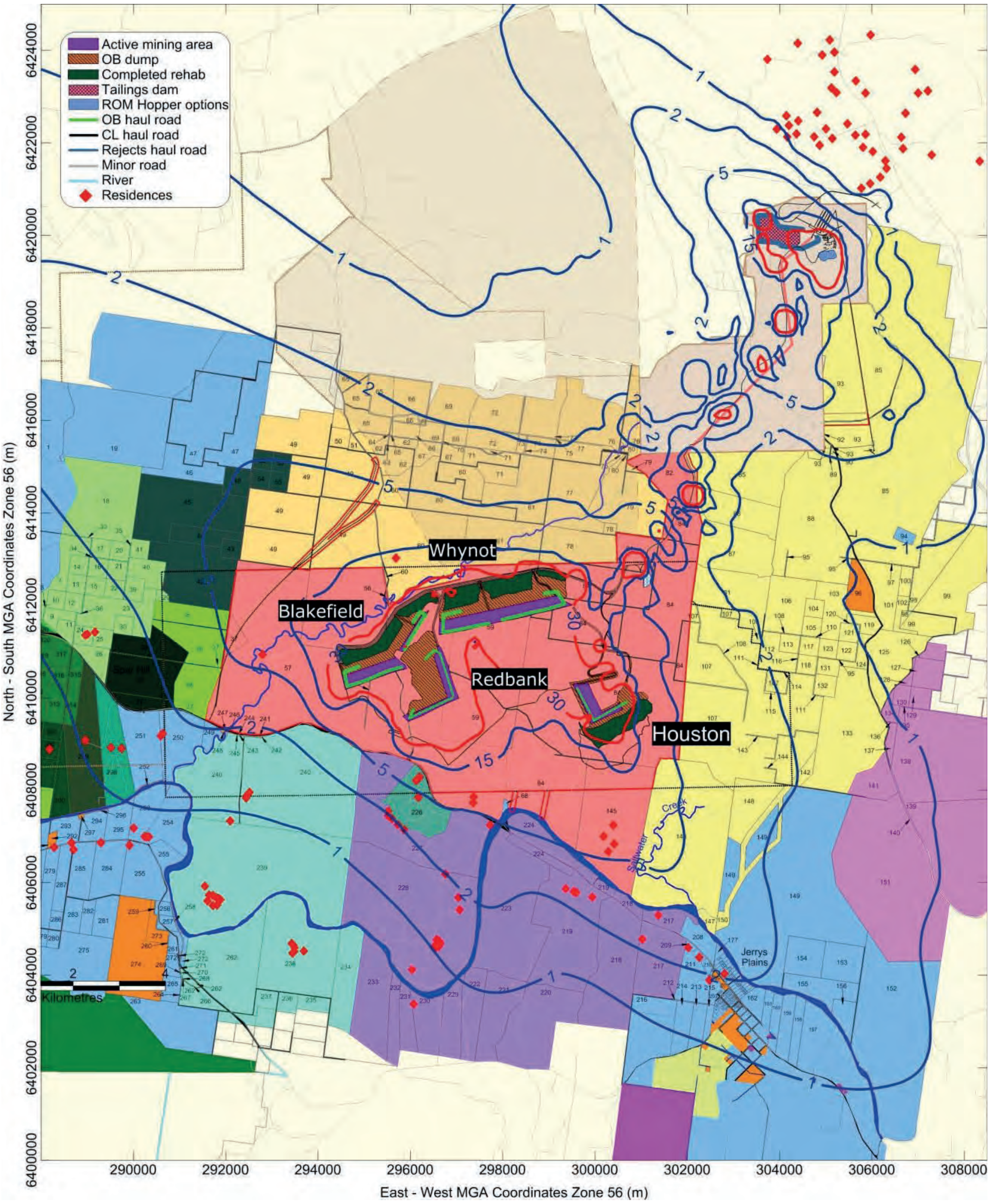
Figure 8-12: Predicted annual average PM_{10} concentrations due to emissions from Drayton South only - Year 3A



Species: PM_{10}	**Location:** Drayton South	**Scenario:** Year 3B (The Project only)	**Percentile:**	**Averaging Time:** Annual
Model Used: CALPUFF	**Units:** µg/m³	**Guideline:** N/A	**Met Data:** CALMET	**Plot:** K. Hill

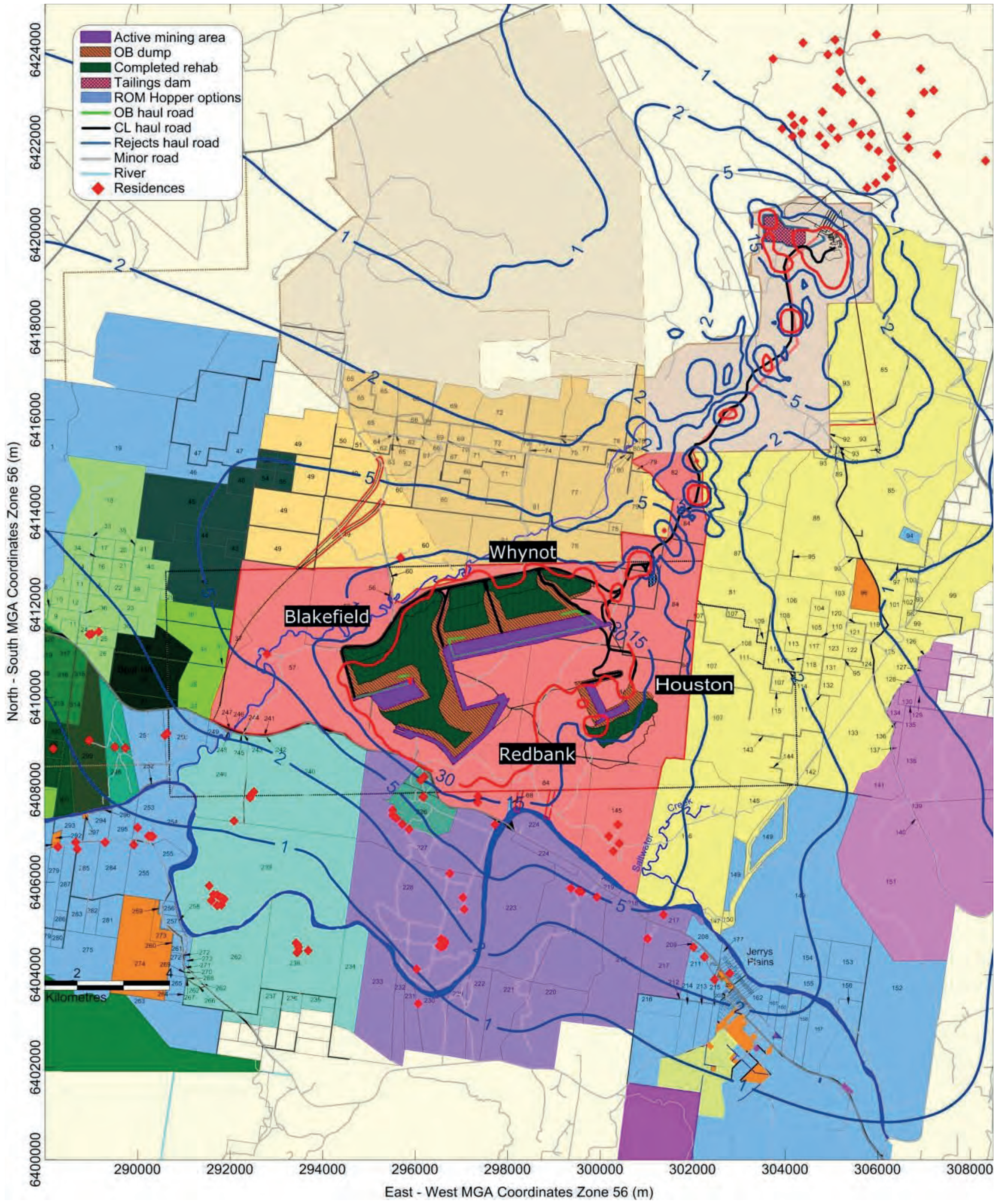
Figure 8-13: Predicted annual average PM_{10} concentrations due to emissions from Drayton South only - Year 3B

pae holmes



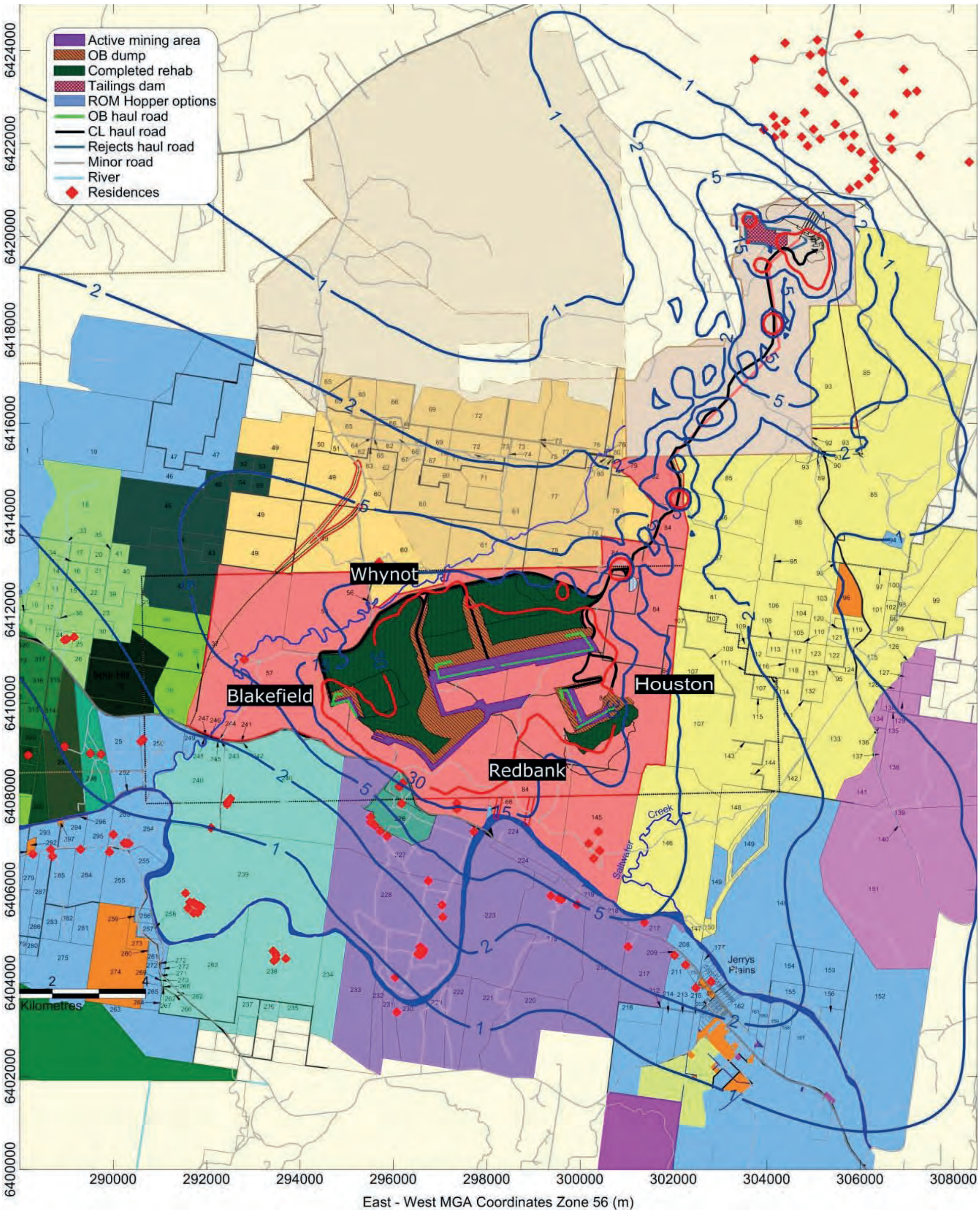
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 5 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	μg/m³	N/A	CALMET	K. Hill

Figure 8-14: Predicted annual average PM_{10} concentrations due to emissions from Drayton South only - Year 5



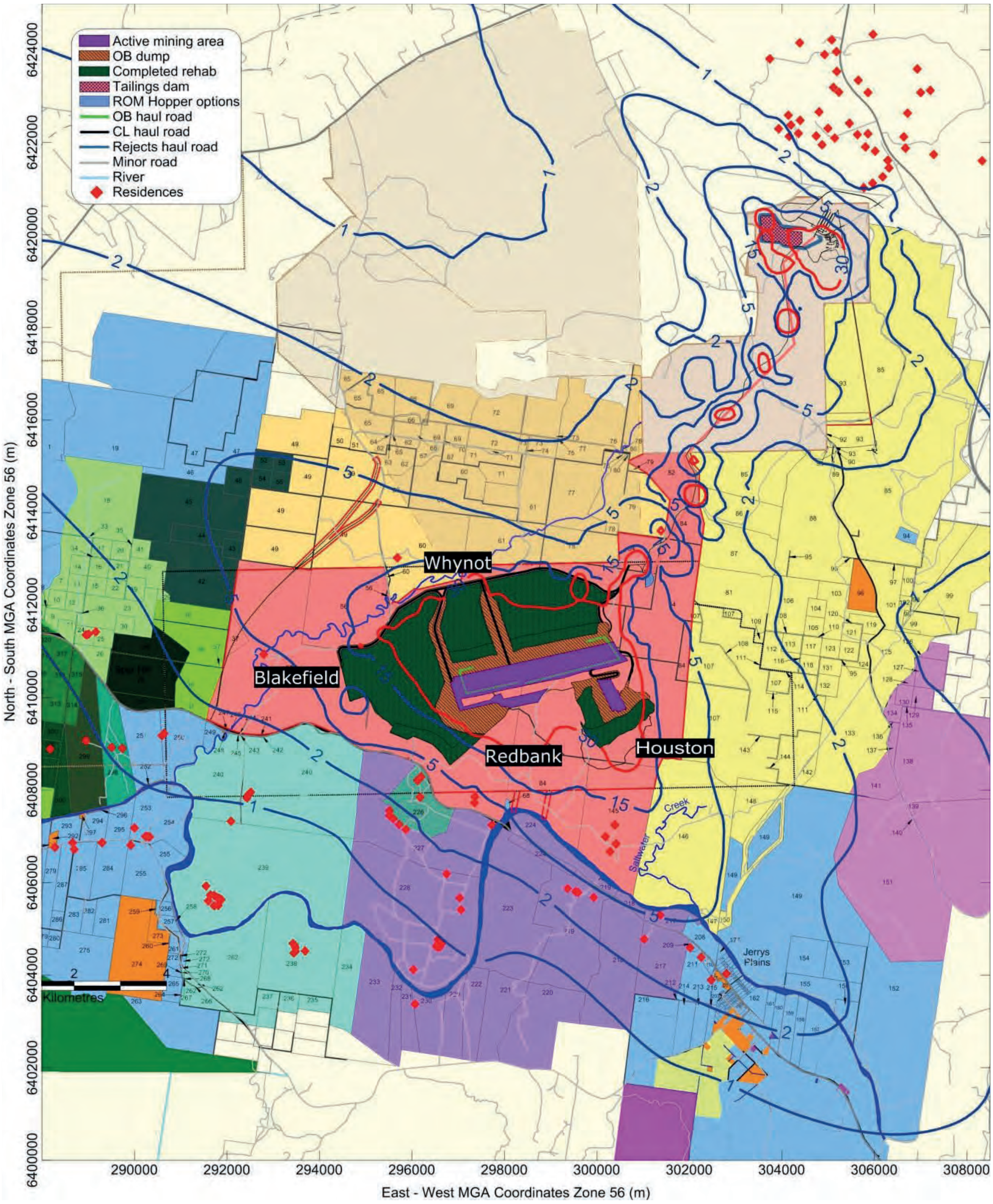
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 10 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-15: Predicted annual average PM_{10} concentrations due to emissions from Drayton South only - Year 10



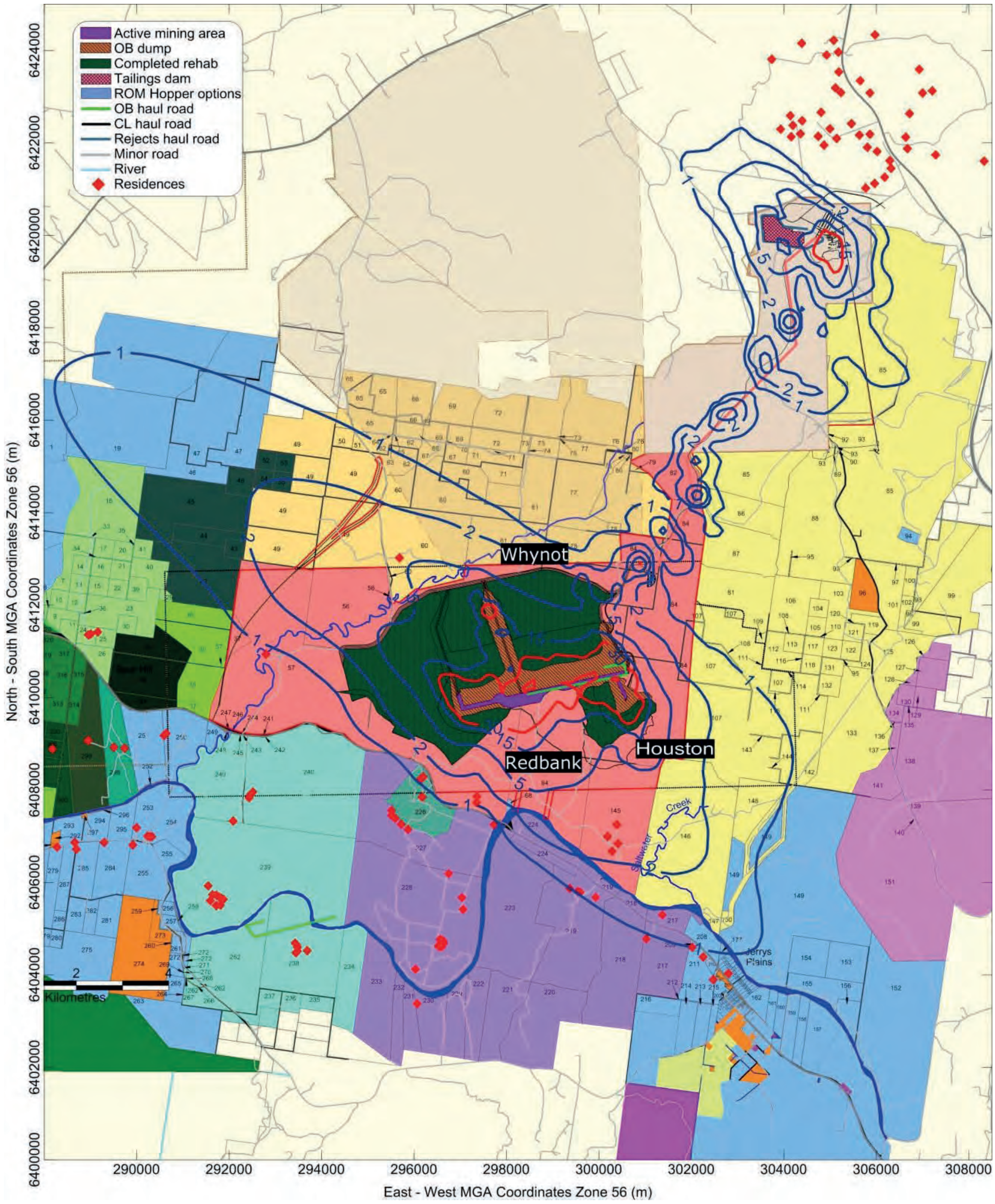
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 15 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-16: Predicted annual average PM_{10} concentrations due to emissions from Drayton South only - Year 15



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 20 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-17: Predicted annual average PM_{10} concentrations due to emissions from Drayton South only - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 27 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-18: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 27

8.5 Cumulative PM_{10} Predictions

A summary of the cumulative predicted PM_{10} concentrations at each of the individual residences are provided in **Table 8-6**.

Privately owned residences 226A, B and C are predicted to experience annual average PM_{10} concentrations above the assessment criteria (highlighted in red) in Year 10 and Year 15, due to emissions from the Project plus background concentrations or cumulative sources.

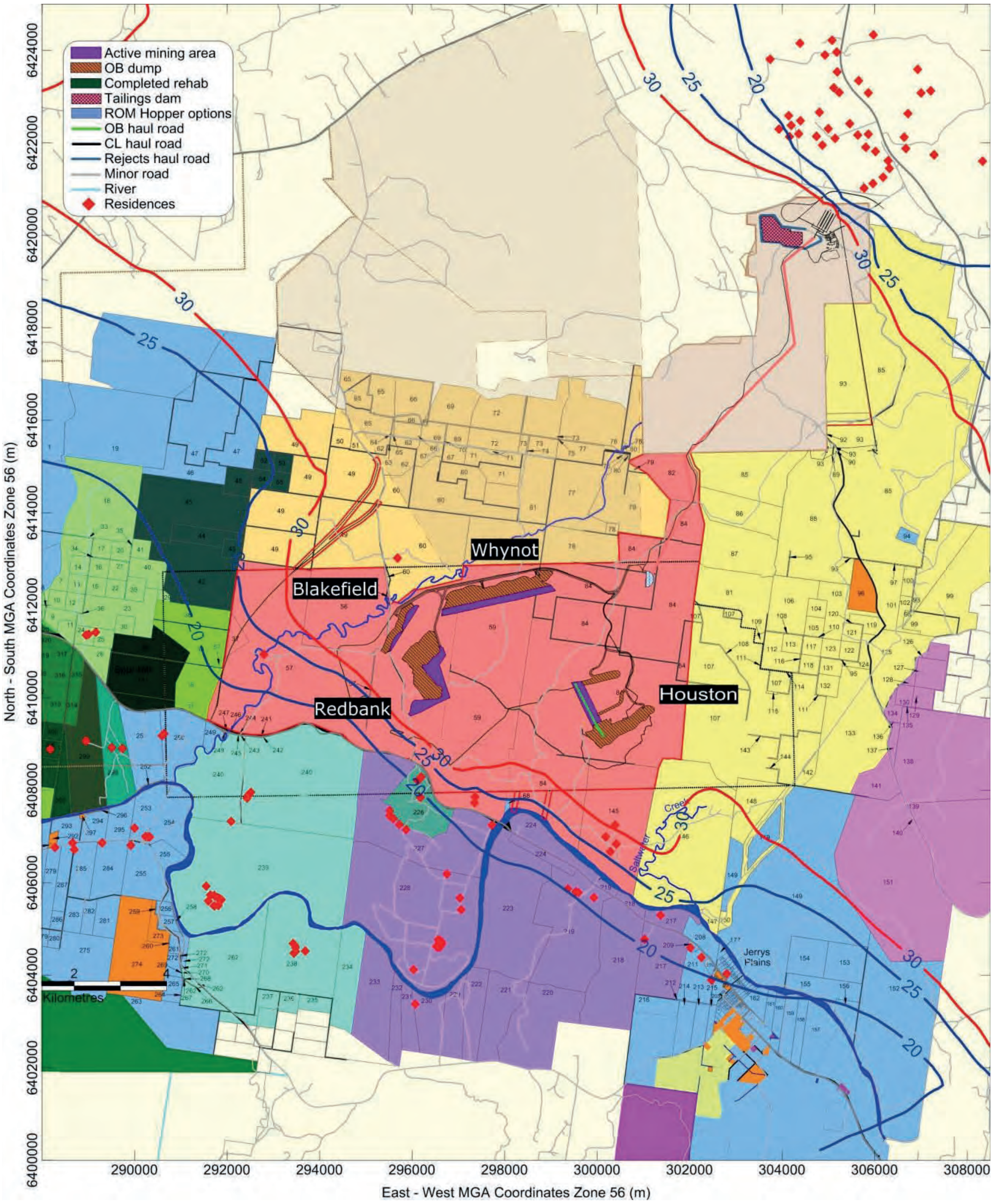
The Cumulative annual average PM_{10} concentrations are presented in **Figure 8-19** to **Figure 8-25** for each modelled year.

Table 8-6: Annual PM_{10} concentrations (µg/m³) at nearby residences for each modelling year – Cumulative

ID	Cumulative Annual Average PM_{10} (µg/m³) *EPA Assessment criteria = 30 µg/m³*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	19	19	18	19	18	14	12
3	19	19	18	19	17	14	12
24A	18	18	17	18	17	13	12
24B	18	18	17	18	17	13	12
25	18	18	18	18	17	13	12
172	21	21	20	20	19	15	12
207	20	20	19	20	18	15	12
209	21	21	21	22	20	16	12
211	21	21	20	21	19	15	12
217A	23	23	22	23	21	17	13
217B	20	21	20	21	19	15	12
219A	20	20	20	22	20	15	12
219B	21	21	21	23	21	16	13
219C	20	20	20	22	20	16	12
219D	20	20	20	22	20	15	12
226A	21	21	24	**32**	29	15	12
226B	21	21	25	**36**	**32**	15	12
226C	21	21	24	**34**	**30**	15	12
226D	20	20	21	25	23	14	12
227A	18	18	18	19	18	14	12
227B	18	18	18	19	18	14	12
227C	18	18	18	19	18	14	12
227D	18	18	18	19	18	14	12
227E	18	18	18	19	18	14	12
227F	22	21	22	28	25	15	12
228A	18	18	18	18	17	14	13
228B	18	18	18	18	17	14	13
228C	18	18	18	18	17	14	13
228D	18	18	18	18	17	14	13
228E	18	18	18	18	17	14	13
228F	18	18	18	18	17	14	13
228G	18	18	18	18	17	14	13
228H	18	18	18	18	17	14	13
228I	18	18	17	18	17	15	14
228J	18	18	18	18	17	14	13
228K	18	18	18	19	18	14	13
228L	18	18	18	19	18	14	13
228M	18	18	19	20	18	14	12
230	18	18	18	18	17	15	14
238A	17	17	17	17	16	15	14
238B	17	17	17	17	16	15	14
238C	17	17	17	17	16	15	14
238D	17	17	17	17	16	15	14
238E	17	17	17	17	16	15	14
238F	17	17	17	17	16	15	14

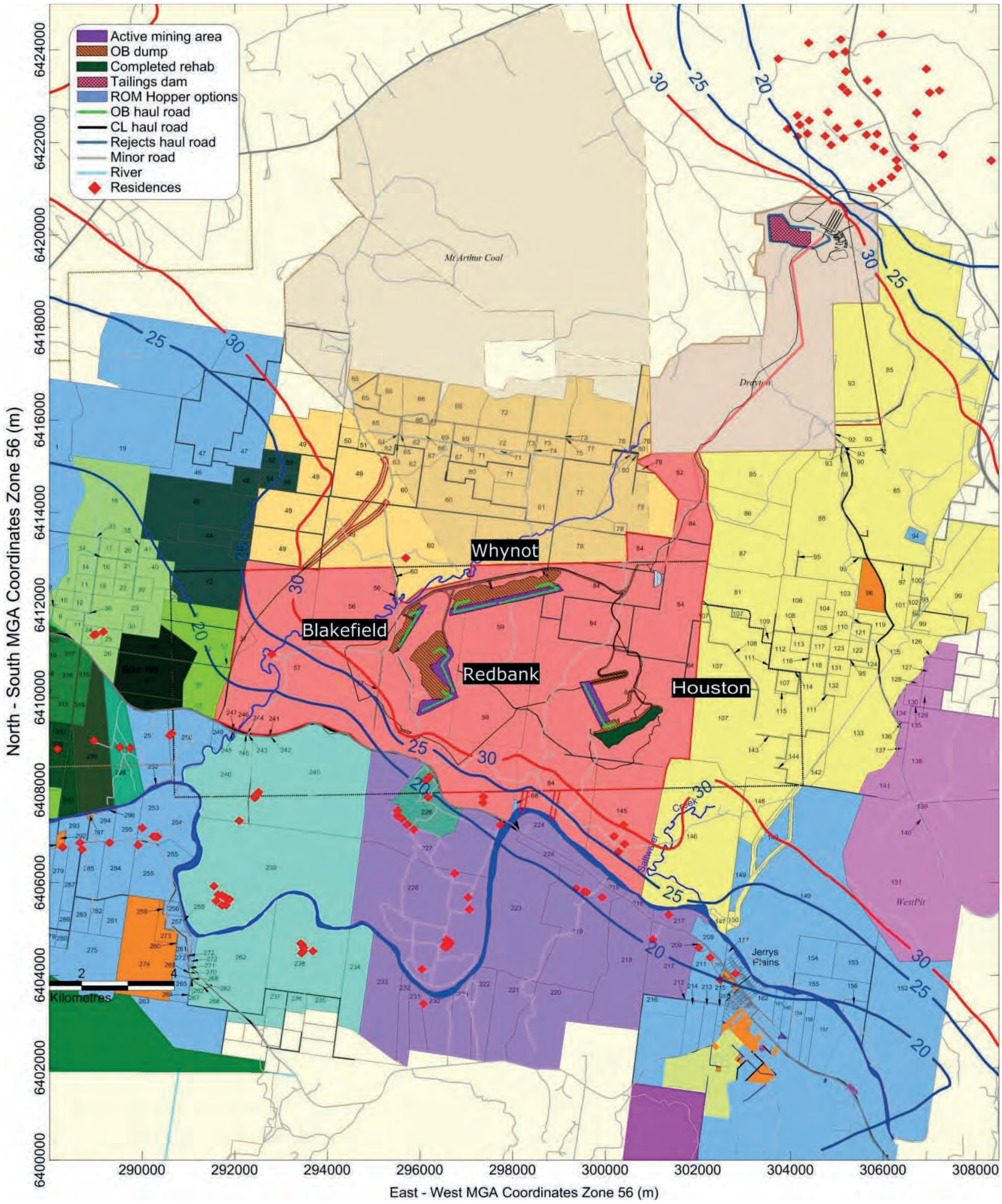
ID	Cumulative Annual Average PM_{10} ($\mu g/m^3$) *EPA Assessment criteria = 30 $\mu g/m^3$*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239A	17	17	17	17	16	14	14
239B	17	17	17	17	16	14	14
239C	17	17	17	17	16	14	14
239D	17	17	17	17	16	14	14
239E	17	17	17	17	16	14	14
239F	17	17	17	17	16	14	14
239G	17	17	17	17	16	14	14
239H	17	17	17	17	16	14	14
239I	17	17	17	17	16	14	13
240A	17	17	17	18	16	14	13
240B	18	17	17	18	17	14	12
240C	18	17	17	18	17	14	12
240D	18	17	17	18	17	14	12
240E	18	17	17	18	17	14	12
250A	18	18	18	18	17	14	12
250B	18	18	18	18	17	14	12
253	18	18	17	17	17	14	13
254A	18	18	17	17	17	14	13
254B	18	18	17	17	17	14	13
254C	18	18	17	17	17	14	13
255	17	17	17	17	17	14	13
279	17	17	17	17	17	15	14
284	17	17	17	17	17	15	14
285	17	17	17	17	17	15	14
287	17	17	17	17	17	15	14
288	17	17	17	17	17	15	14
298A	18	18	18	18	17	14	13
298B	18	18	17	18	17	14	13
299	18	18	17	17	16	14	13
306	17	17	17	17	16	14	13
Drayton Mine							
384	17	17	15	15	14	12	10
385	16	16	14	15	14	12	10
386	19	19	16	17	16	13	11
387	19	19	16	16	15	12	10
390	20	20	16	17	15	12	10
398	19	19	16	16	15	12	10
399	18	18	15	16	15	12	10
400	17	17	14	15	14	11	9
401	17	17	14	15	14	11	9
402	18	18	15	15	14	11	9
403	18	18	15	15	14	11	9
411	17	17	14	15	13	11	9
418	17	17	15	15	14	11	9
419	17	17	15	15	14	11	10
420	17	17	15	15	14	12	10
421	17	17	14	15	14	11	10
423	17	17	14	15	14	11	9
424	17	17	14	15	14	11	9
425	17	16	14	15	14	11	10
427	16	16	14	15	14	11	9
429	16	16	14	15	14	12	10
432	16	16	14	15	14	12	10
433A	16	16	14	15	14	12	10
433B	16	16	14	15	14	12	10
435	16	16	14	15	14	12	10
438	16	16	15	15	14	13	11
440	16	16	14	15	14	12	10
441	16	16	15	16	15	13	12
443	17	16	15	15	15	13	11
444	17	17	15	15	14	12	11
446A	17	17	15	15	14	12	11
446B	17	17	16	16	15	13	12

ID	Cumulative Annual Average PM_{10} (µg/m³) *EPA Assessment criteria = 30 µg/m³*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
451	18	18	17	17	16	15	14
455	17	17	15	16	15	13	12
456	16	16	15	16	15	13	12
460	16	16	14	15	14	12	10
Mine owned residences							
57	23	23	24	25	22	15	11
58A	24	22	24	**34**	**33**	15	12
58B	23	21	23	**31**	29	15	12
60	**54**	**54**	**53**	**49**	**45**	22	12
145A	27	27	26	27	24	20	13
145B	**31**	**31**	27	27	25	23	14
145C	28	27	26	27	24	21	14
145D	26	26	25	27	24	20	13
388	19	19	16	16	15	12	10
389	20	20	17	17	16	13	10
404	17	17	14	15	14	11	9
410	17	17	14	15	13	10	8



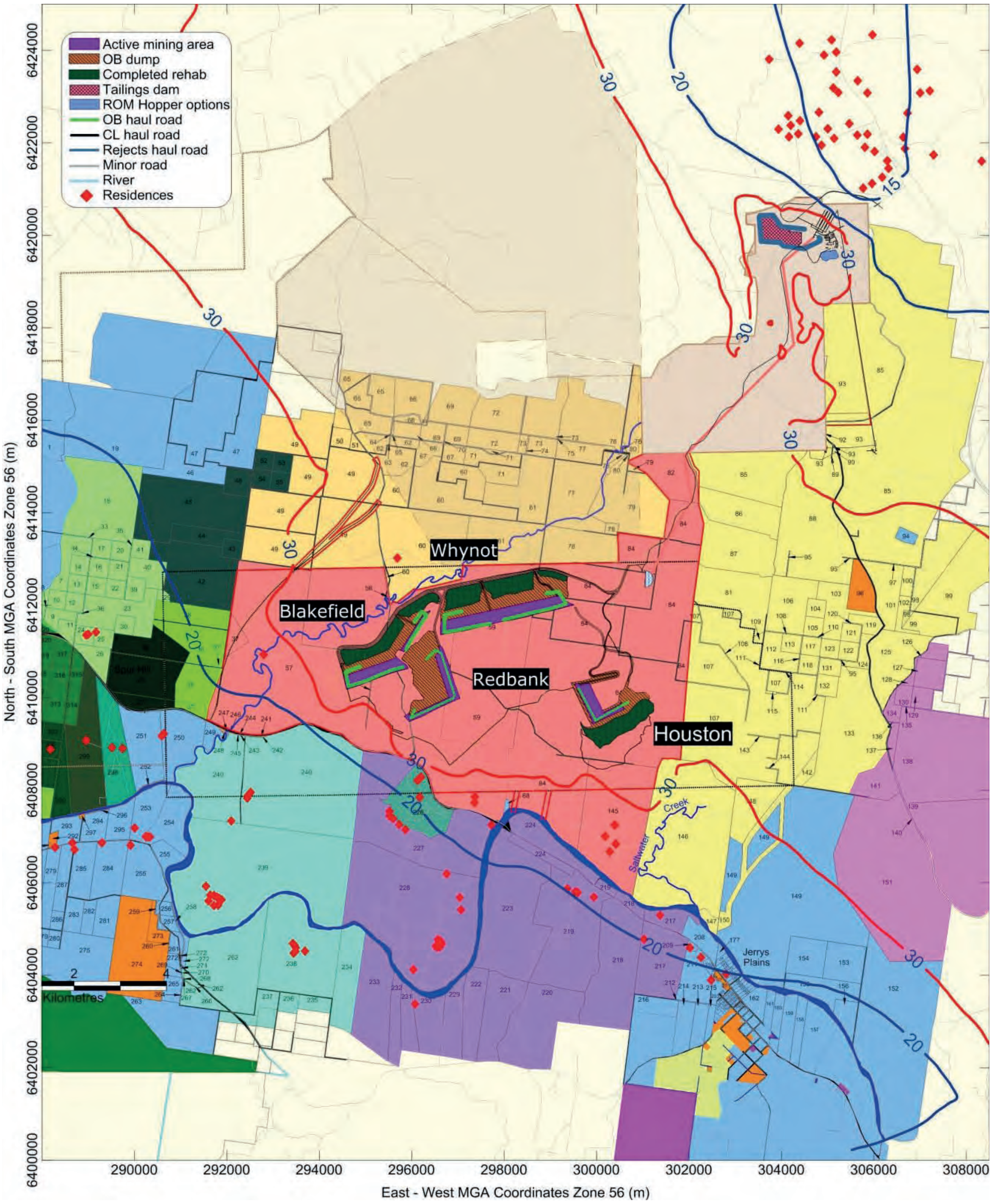
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 3A (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =30 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-19: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 3A



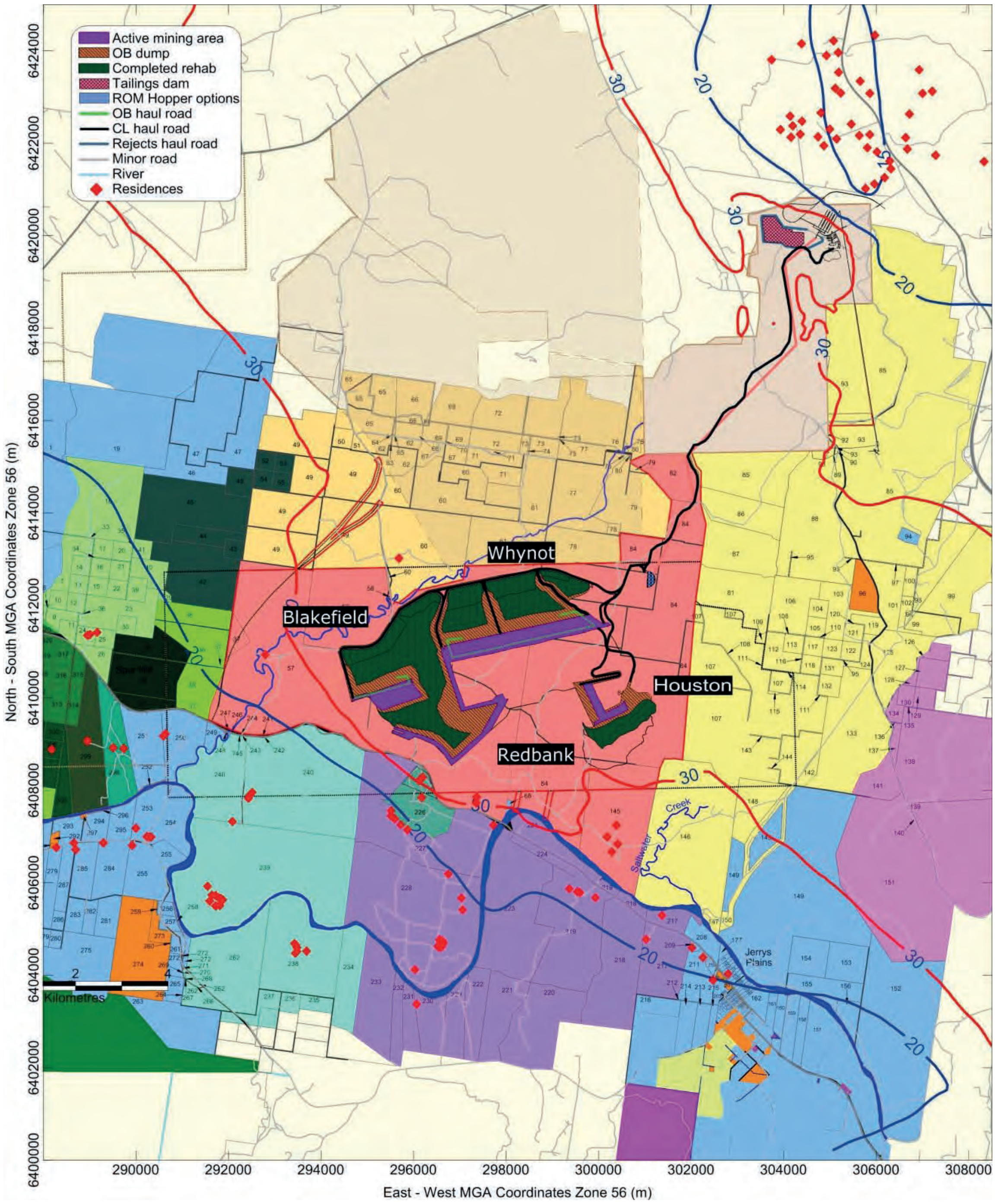
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 3B (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =30 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-20: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 3B



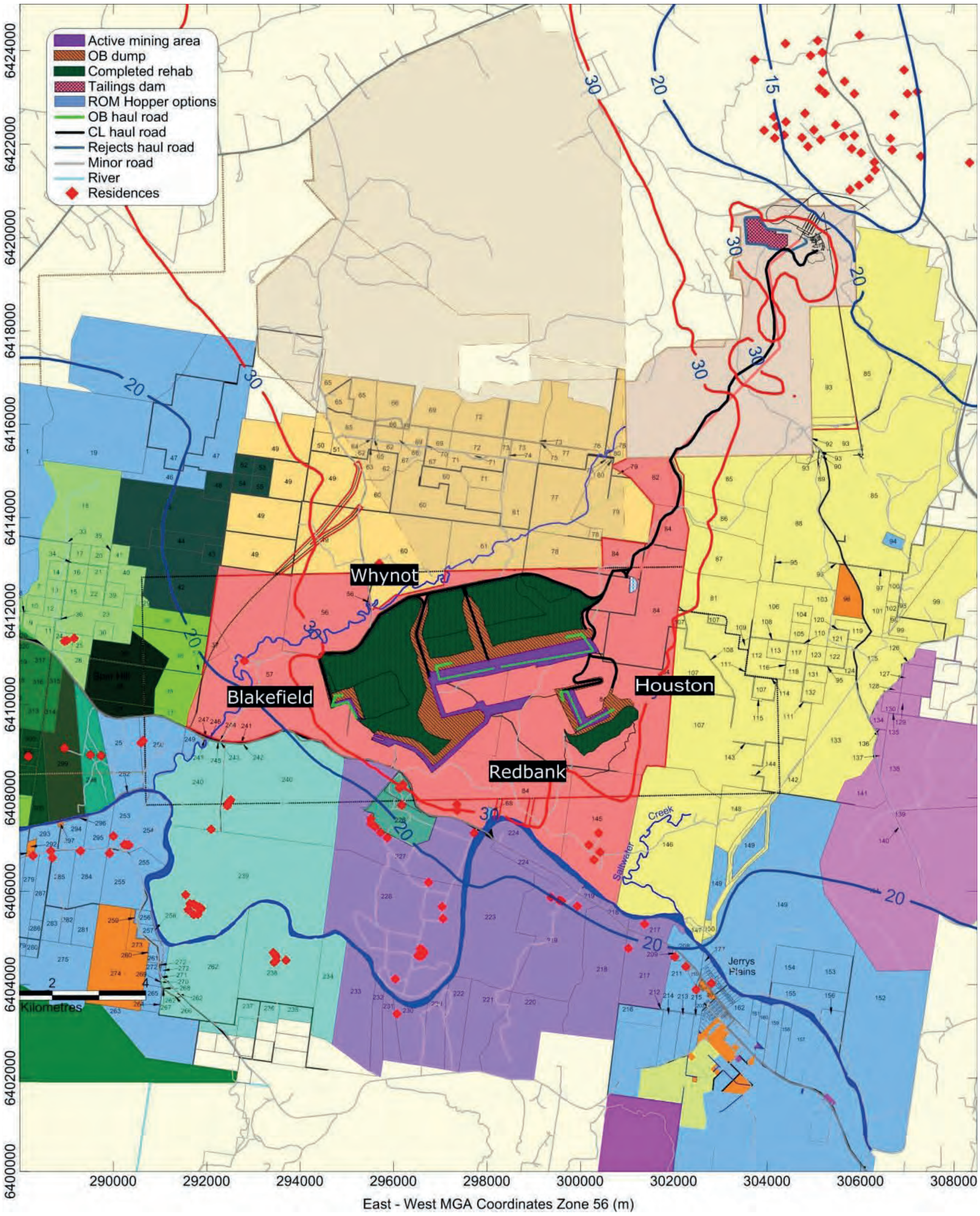
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 5 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =30 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-21: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 5



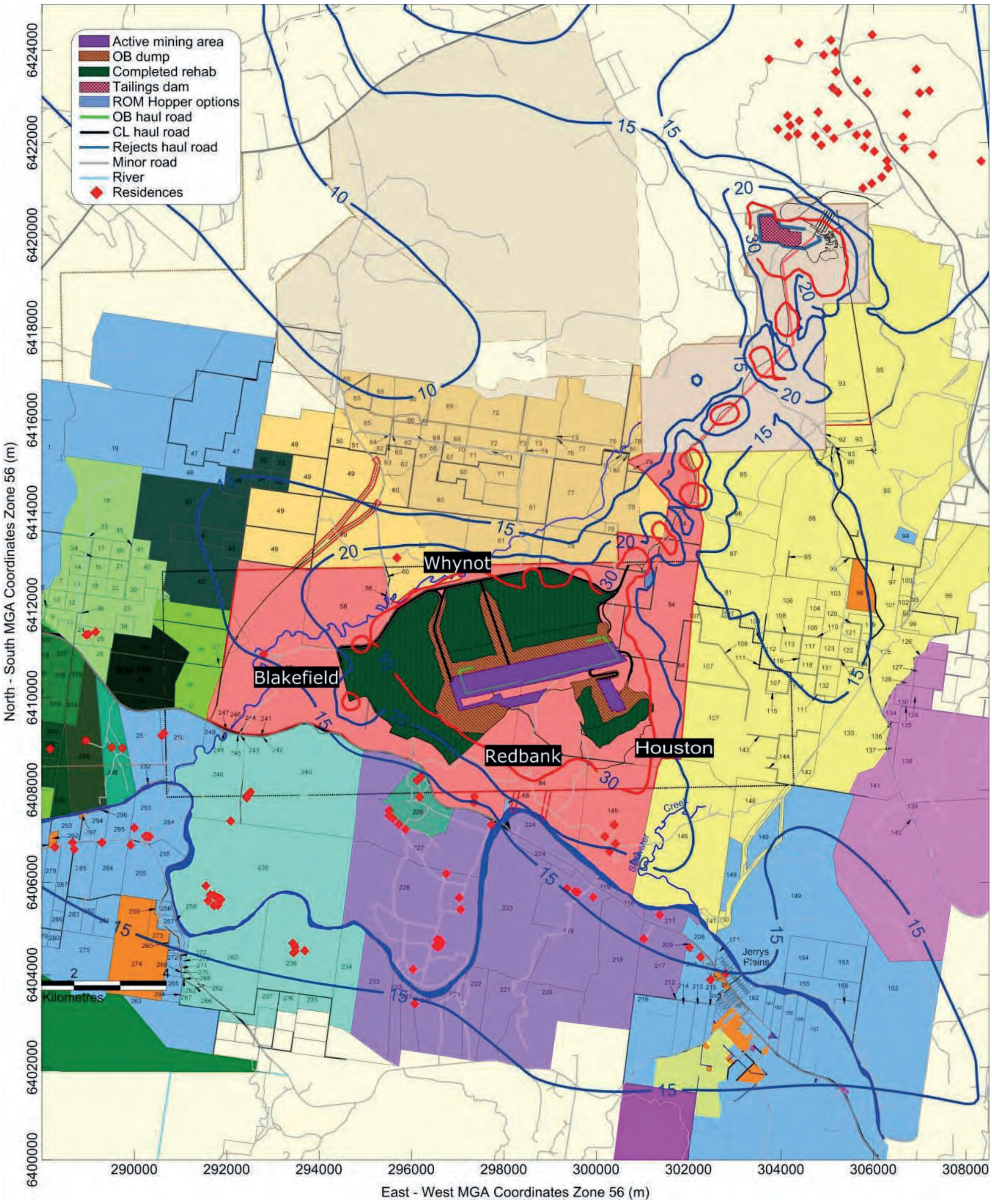
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 10 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =30 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-22: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 10



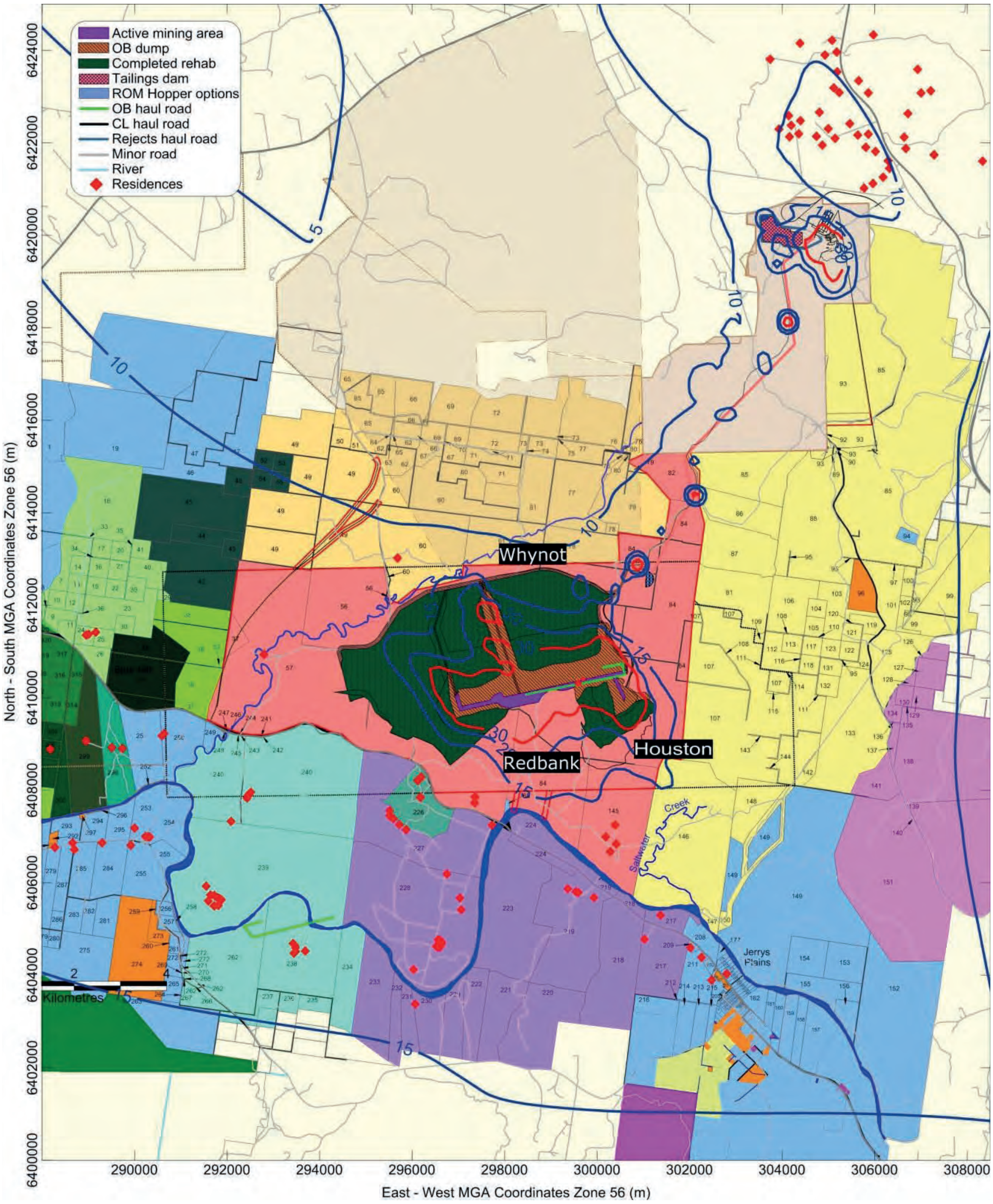
Species: PM$_{10}$	Location: Drayton South	Scenario: Year 15 (Cumulative)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	**Units:** µg/m³	**Guideline:** EPA =30 µg/m³ (shown as a bold red line)	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-23: Predicted annual average PM$_{10}$ concentrations due to emissions from Drayton South and other sources - Year 15



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 20 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =30 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-24: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 27 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =30 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-25: Predicted annual average PM_{10} concentrations due to emissions from Drayton South and other sources - Year 27

8.6 Project Only TSP Predictions

A summary of the Project-only predicted TSP concentrations at each of the individual residences is provided in **Table 8-7**.

There are no privately owned residences that are predicted to experience annual average TSP concentrations above the assessment criteria, due to emissions from the Project-only.

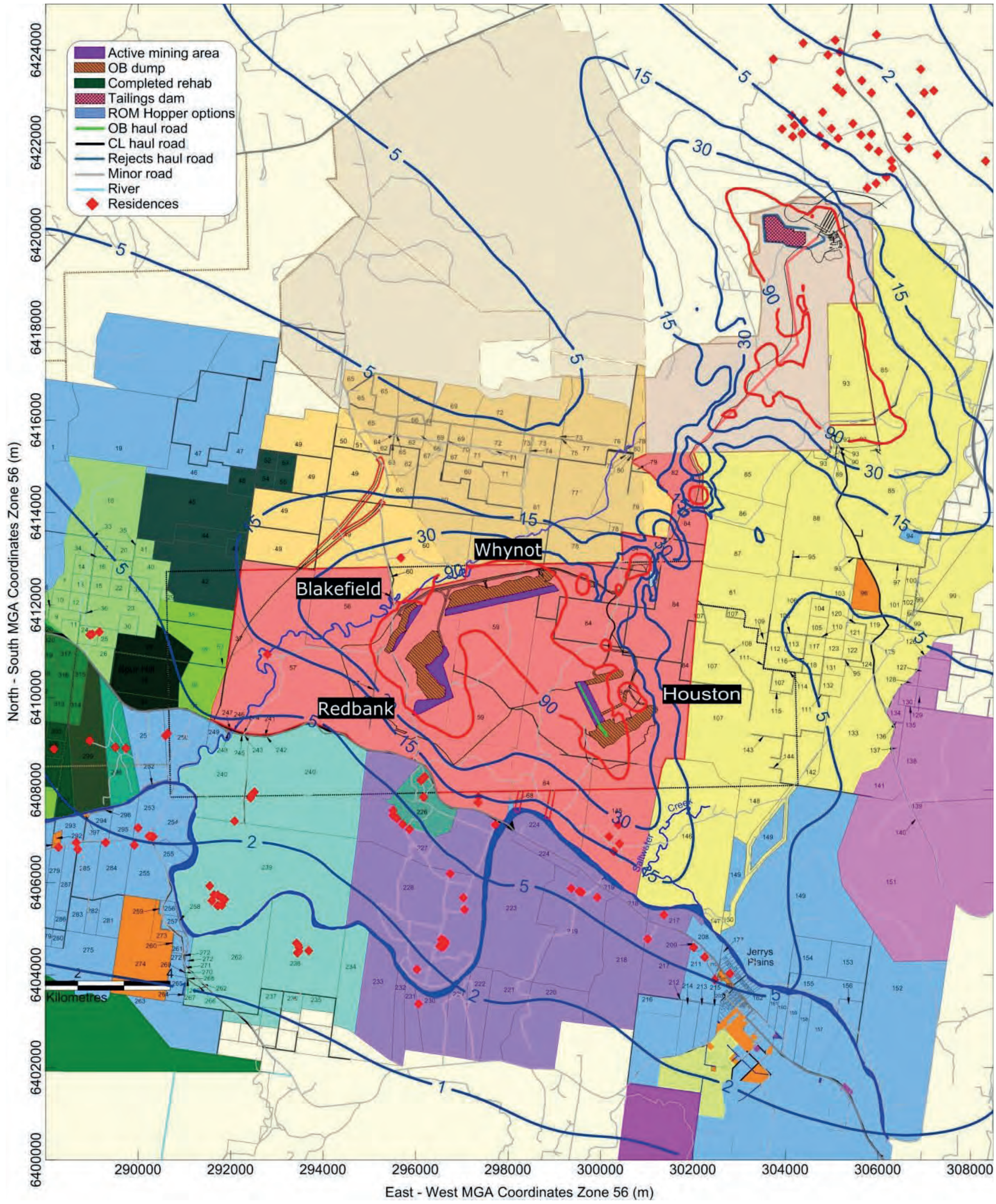
The Project-only contributions to annual average TSP concentrations are presented in **Figure 8-26** to **Figure 8-32** for each modelled year.

Table 8-7: Annual TSP concentrations (µg/m³) at nearby residences for each modelling year – Project Only

ID	Project Only						
	Annual Average TSP (µg/m³)						
	EPA Assessment criteria = N/A						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	3	3	3	4	4	3	1
3	3	3	3	4	4	3	1
24A	3	3	3	4	4	3	1
24B	3	3	3	4	4	3	1
25	3	3	4	4	4	3	1
172	6	6	5	7	7	8	2
207	5	5	5	6	6	7	2
209	7	7	7	9	9	10	3
211	6	6	6	8	8	9	2
217A	9	9	9	12	12	13	3
217B	6	6	6	9	9	9	2
219A	6	6	7	12	11	9	3
219B	7	7	8	13	13	11	3
219C	6	6	7	12	12	10	3
219D	6	6	7	11	11	9	3
226A	9	10	18	38	34	8	3
226B	10	10	20	48	42	9	3
226C	10	10	19	43	38	9	3
226D	7	8	12	22	21	7	2
227A	4	4	5	8	8	4	1
227B	4	4	5	7	7	4	1
227C	4	4	5	7	7	4	1
227D	4	4	5	7	7	4	1
227E	4	4	5	8	8	4	1
227F	10	8	12	27	25	8	2
228A	2	2	3	4	3	2	1
228B	2	2	3	4	3	2	1
228C	2	2	3	4	3	2	1
228D	2	2	3	4	4	2	1
228E	2	2	3	4	4	2	1
228F	2	2	3	4	4	3	1
228G	2	2	3	4	4	3	1
228H	2	2	3	4	4	2	1
228I	2	2	2	3	2	2	0
228J	2	2	3	4	4	2	1
228K	3	3	4	6	6	3	1
228L	4	4	5	7	7	4	1
228M	4	4	5	8	7	4	1
230	2	2	2	2	2	2	0
238A	1	1	1	2	2	1	0
238B	1	1	1	2	2	1	0
238C	1	1	1	2	2	1	0
238D	1	1	1	2	2	1	0
238E	1	1	1	2	2	1	0
238F	1	1	1	2	2	1	0
239A	1	1	2	2	2	1	0

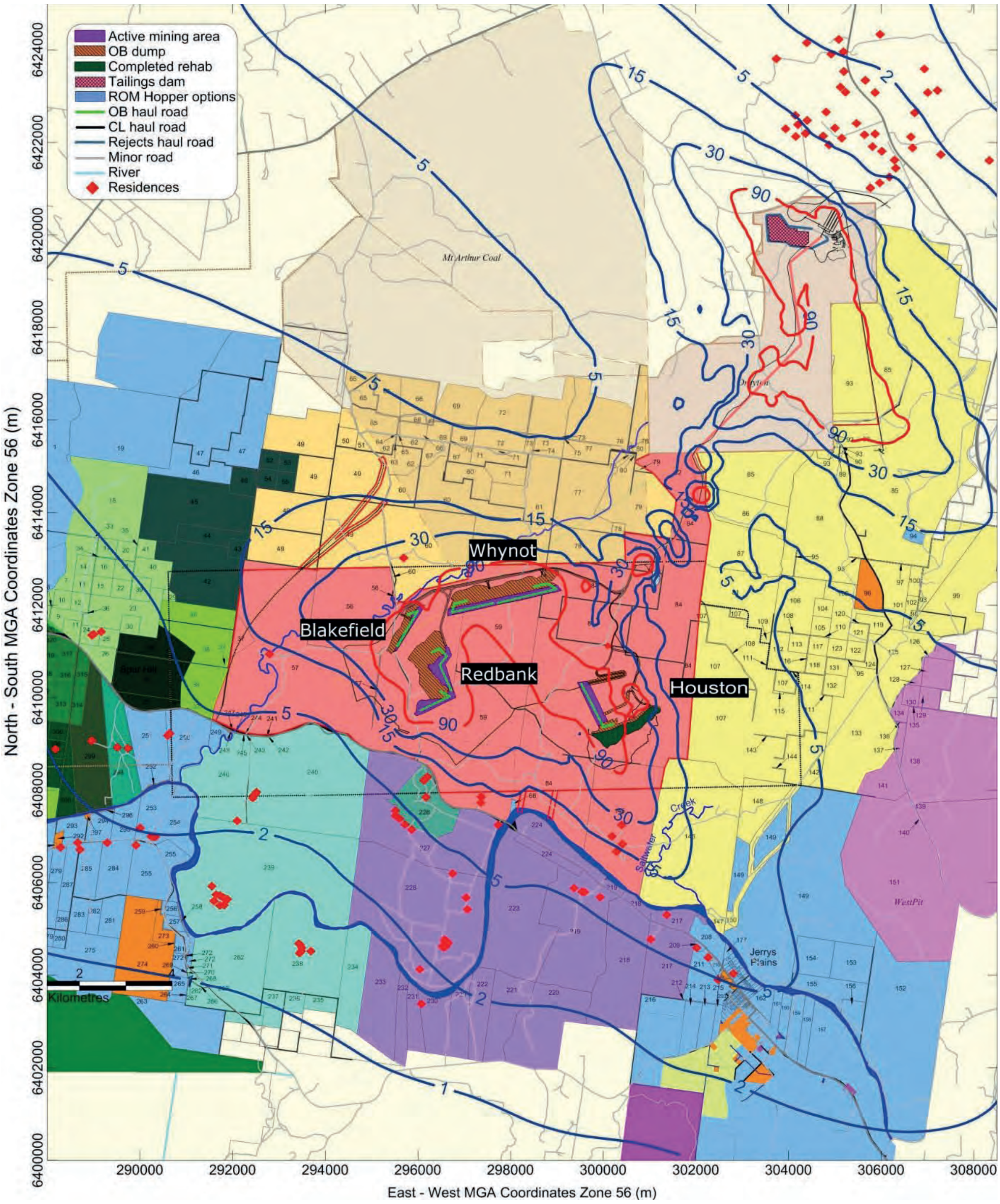
ID	Project Only Annual Average TSP (µg/m³) *EPA Assessment criteria = N/A*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239B	2	1	2	2	2	2	0
239C	2	1	2	2	2	1	0
239D	2	1	2	2	2	1	0
239E	2	1	2	2	2	1	0
239F	1	1	2	2	2	1	0
239G	1	1	2	2	2	1	0
239H	2	1	2	2	2	2	0
239I	2	2	2	2	2	2	0
240A	2	2	2	3	3	2	0
240B	3	2	3	3	3	3	1
240C	3	2	3	3	3	3	1
240D	3	2	3	3	3	3	1
240E	3	2	3	3	3	3	1
250A	4	4	4	4	4	3	1
250B	4	4	4	4	4	4	1
253	2	2	2	2	2	2	0
254A	2	2	2	2	2	2	0
254B	2	2	2	2	2	2	0
254C	2	2	2	2	2	2	0
255	2	2	2	2	2	2	0
279	2	2	2	2	2	2	0
284	2	2	2	2	2	2	0
285	2	2	2	2	2	2	0
287	2	2	2	2	2	2	0
288	2	1	1	2	1	1	0
298A	3	3	3	3	3	3	1
298B	3	3	3	3	3	3	1
299	3	2	3	3	3	2	1
306	2	2	2	2	2	2	0
Drayton Mine							
384	2	2	1	1	1	1	0
385	3	3	1	1	1	1	0
386	3	3	1	1	1	1	0
387	5	5	2	2	2	2	1
390	7	7	3	3	2	3	1
398	6	6	2	2	2	2	1
399	5	5	2	2	1	2	1
400	4	4	1	1	1	1	0
401	4	4	1	1	1	1	0
402	5	5	2	2	1	2	1
403	5	5	2	2	1	2	1
411	6	6	2	2	2	2	1
418	5	5	2	2	2	2	1
419	5	4	2	2	2	2	1
420	4	4	2	2	1	2	1
421	4	4	1	1	1	1	0
423	4	4	1	1	1	1	0
424	4	4	1	1	1	1	0
425	4	4	1	1	1	1	0
427	4	4	1	1	1	1	0
429	3	3	1	1	1	1	0
432	2	2	1	1	1	1	0
433A	2	2	1	1	1	1	0
433B	2	2	1	1	1	1	0
435	2	2	1	1	1	1	0
438	2	2	1	1	1	1	0
440	3	3	1	1	1	1	0
441	2	2	1	1	1	1	0
443	2	2	1	1	1	1	0
444	3	3	1	1	1	1	0
446A	3	3	1	1	1	1	0
446B	2	2	1	1	1	1	0
451	2	1	1	1	1	1	0

ID	Project Only						
	Annual Average TSP ($\mu g/m^3$)						
	EPA Assessment criteria = N/A						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
455	1	1	1	1	1	1	0
456	1	1	1	1	1	1	0
460	2	2	1	1	1	1	0
Mine owned residences							
57	13	12	18	17	16	11	2
58A	15	12	17	43	45	11	3
58B	13	10	15	34	35	9	3
60	44	43	46	37	30	35	12
145A	18	17	14	18	18	23	6
145B	26	24	16	18	19	29	8
145C	19	17	15	20	20	24	7
145D	15	14	13	19	19	21	6
388	6	6	2	2	2	2	1
389	8	8	3	3	2	3	1
404	4	4	1	1	1	1	0
410	7	7	2	2	2	3	1



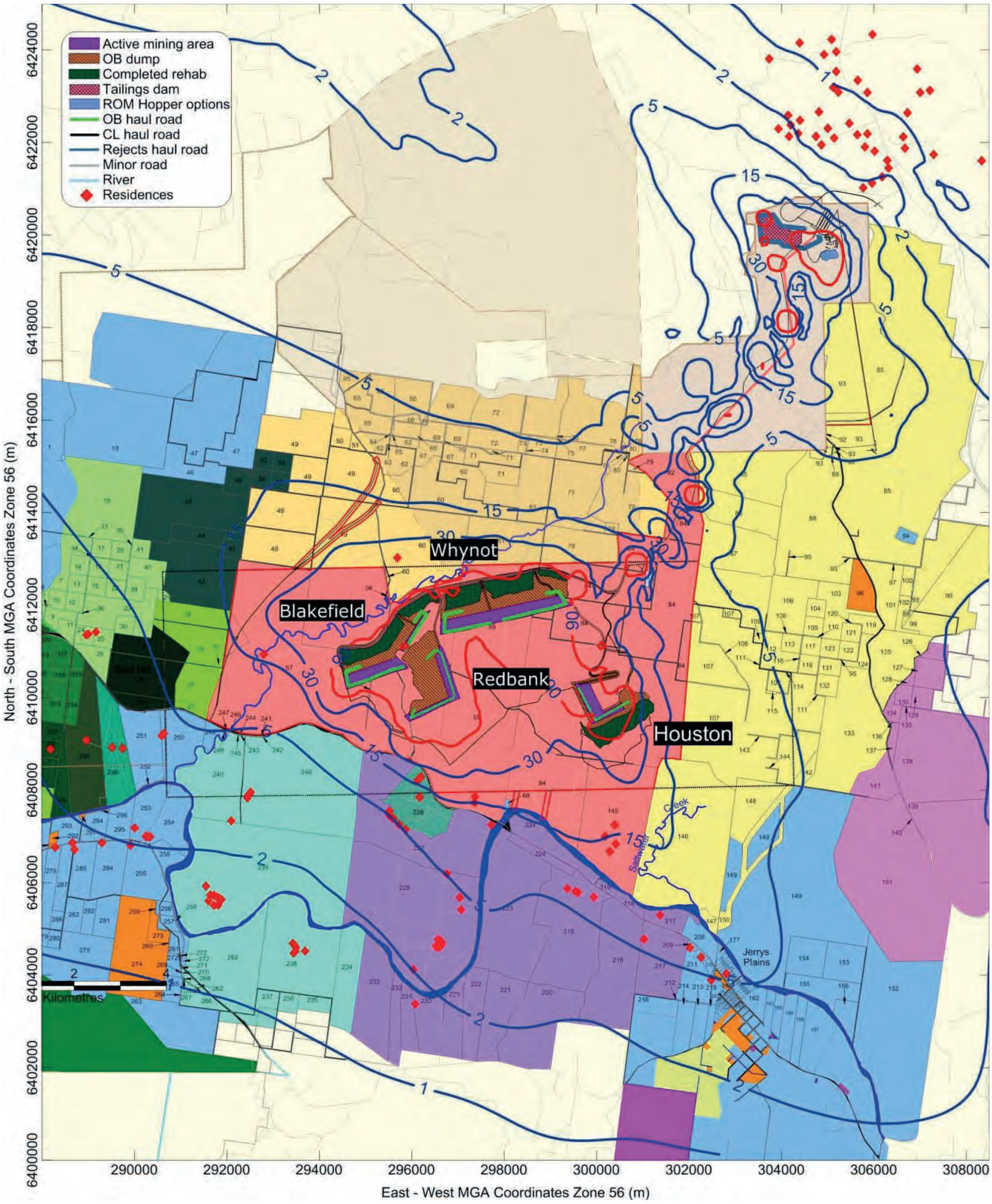
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 3A (Drayton Mine + the Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-26: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 3A



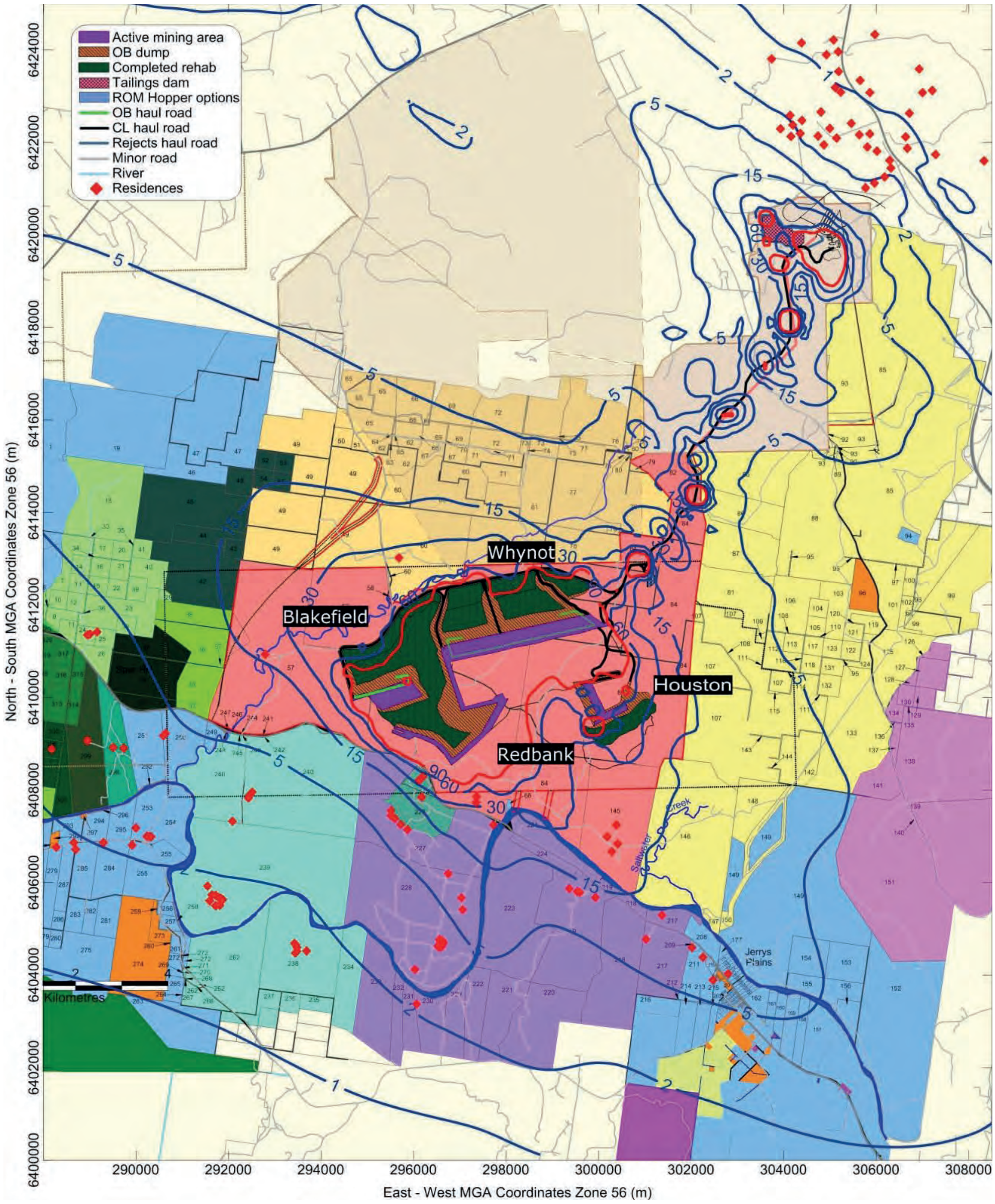
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 3B (Drayton Mine + the Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-27: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 3B



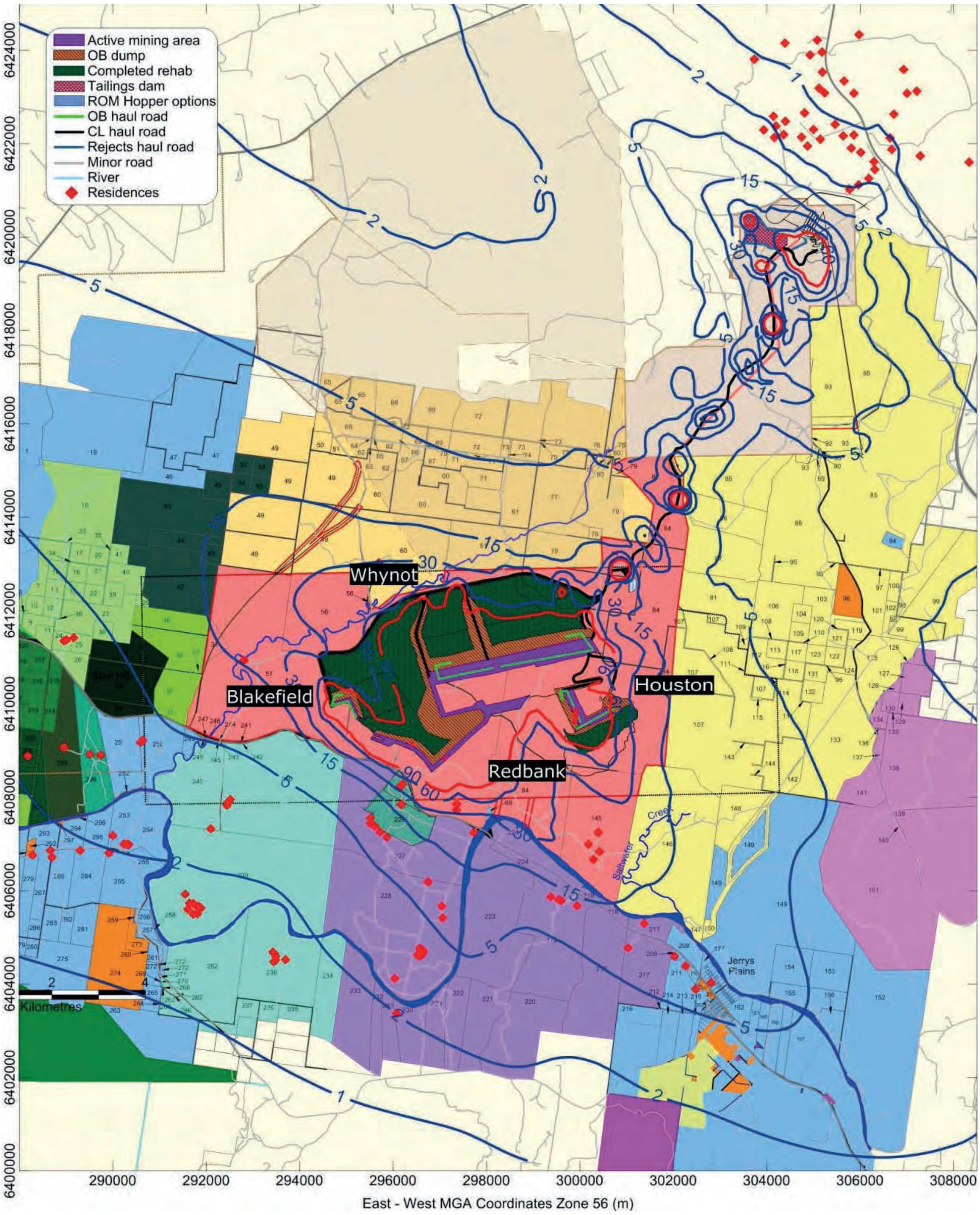
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 5 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-28: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 5



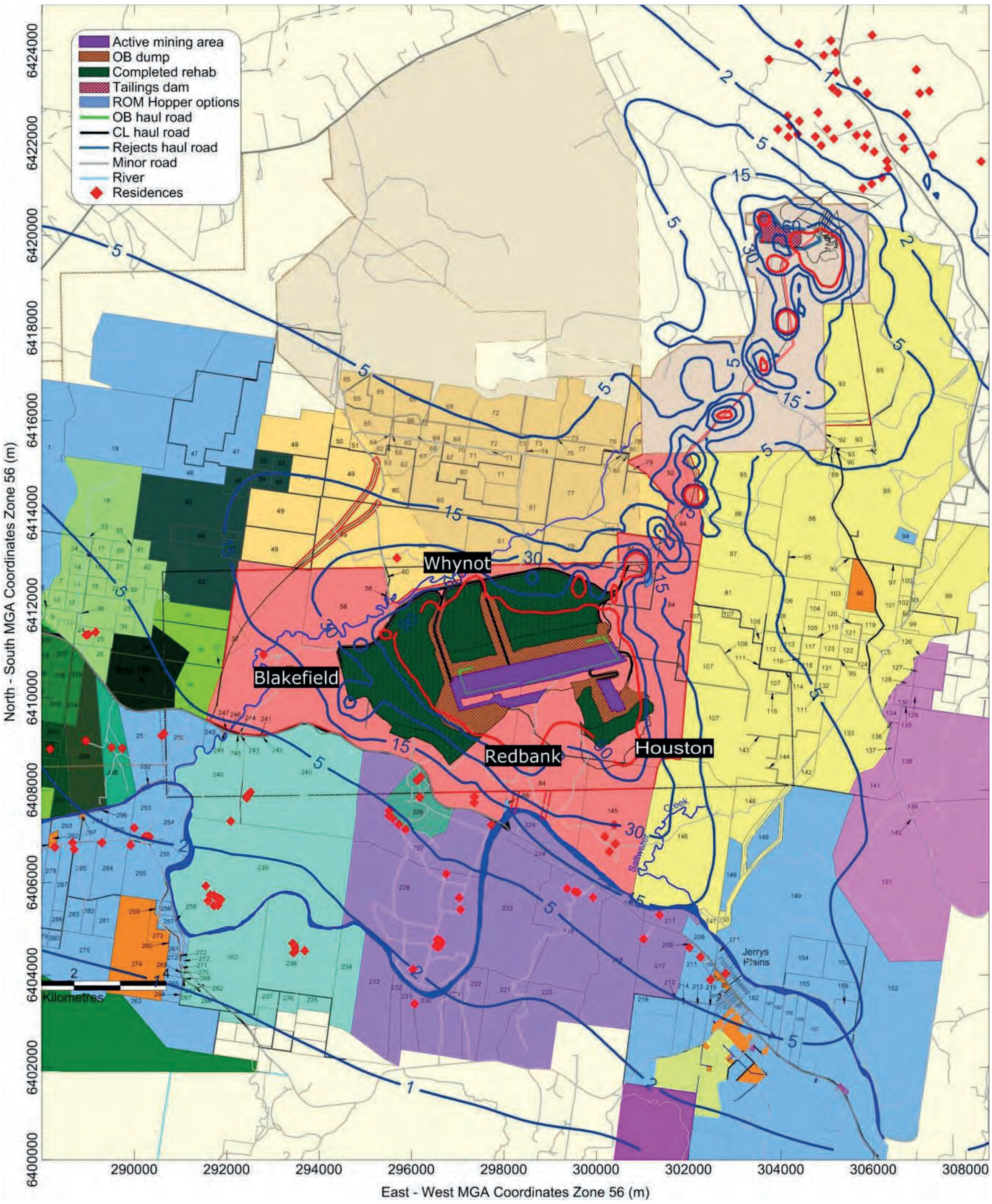
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 10 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-29: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 10



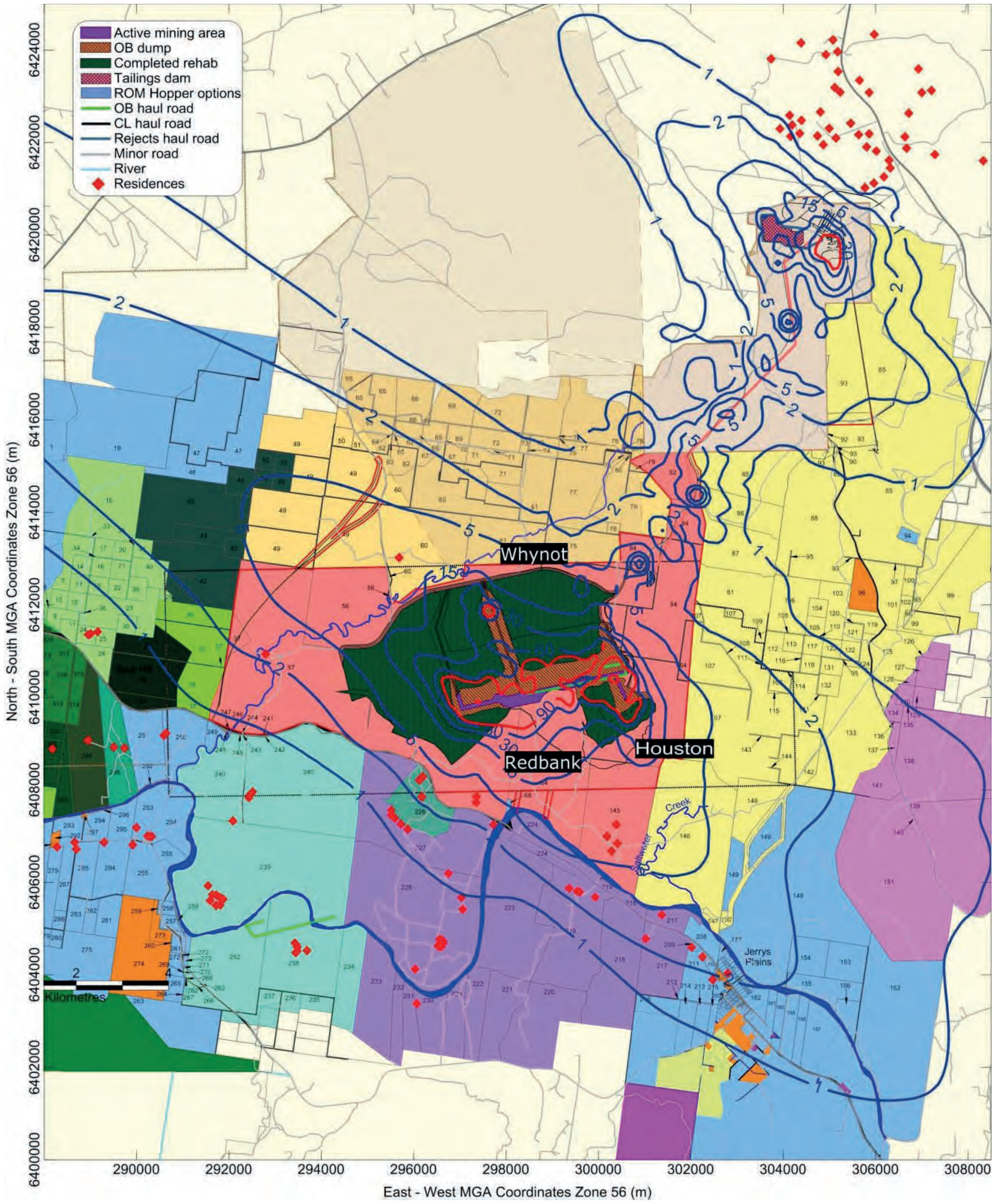
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 15 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-30: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 15



Species: TSP	Location: Drayton South	Scenario: Year 20 (The Project only)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	**Units:** µg/m³	**Guideline:** N/A	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-31: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 27 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	N/A	CALMET	K. Hill

Figure 8-32: Predicted annual average TSP concentrations due to emissions from Drayton South only - Year 27

8.7 Cumulative TSP Predictions

A summary of the Cumulative predicted TSP concentrations at each of the individual residences are provided in **Table 8-8**.

Privately owned residences 226B and C are predicted to experience annual average TSP concentrations above the assessment criteria (highlighted in red) in Year 10 and Year 15, due to emissions from the Project plus background concentrations or cumulative sources.

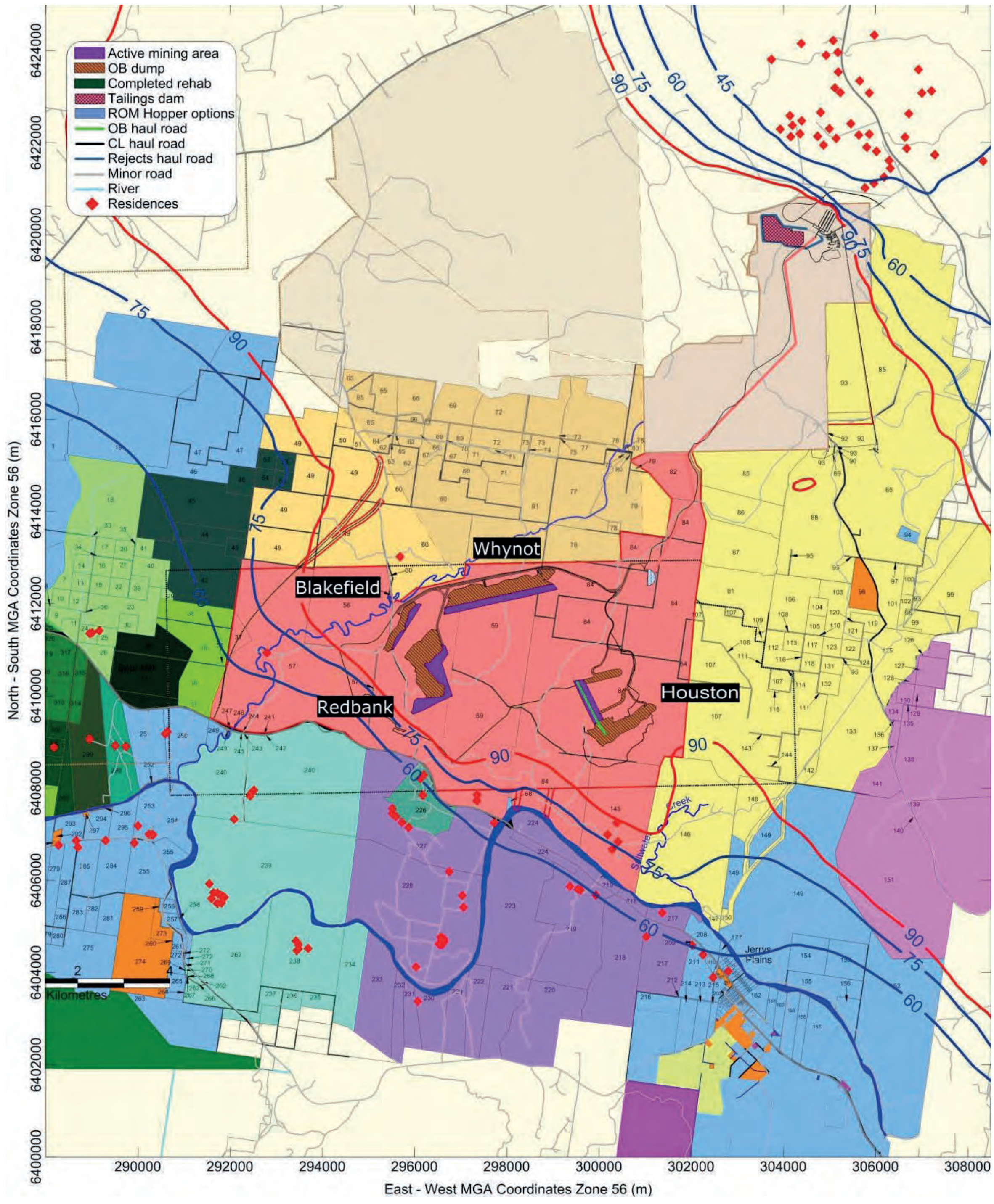
The Cumulative annual average TSP concentrations are presented in **Figure 8-33** to **Figure 8-39** for each modelled year.

Table 8-8: Annual TSP concentrations (µg/m^3) at nearby residences for each modelling year - Cumulative

ID	Cumulative Annual Average TSP (µg/m^3) *EPA Assessment criteria = 90 µg/m^3*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	52	40	51	52	48	39	35
3	52	40	51	52	49	39	35
24A	50	41	50	50	47	39	35
24B	50	41	50	50	47	39	35
25	51	41	50	51	48	39	35
172	58	46	56	57	53	43	36
207	56	44	55	56	52	43	36
209	60	48	59	61	55	46	37
211	59	47	58	59	54	45	37
217A	65	53	63	66	60	50	39
217B	58	47	57	60	55	45	38
219A	59	48	59	63	58	46	38
219B	60	49	60	65	59	47	39
219C	59	48	59	63	58	46	38
219D	58	47	58	63	58	46	38
226A	60	54	69	88	81	45	38
226B	62	56	72	**99**	90	45	38
226C	61	55	70	**94**	85	45	38
226D	58	50	62	72	67	44	38
227A	53	44	54	56	53	41	37
227B	52	44	53	56	52	41	37
227C	52	44	53	56	52	41	37
227D	53	44	53	56	52	41	37
227E	53	45	53	56	53	42	37
227F	63	53	64	79	73	45	38
228A	50	43	50	51	48	41	39
228B	50	43	50	51	48	41	39
228C	50	43	50	51	48	41	39
228D	50	43	50	51	48	41	39
228E	50	43	50	51	48	41	39
228F	50	43	50	51	48	41	39
228G	50	43	50	51	48	41	39
228H	50	43	50	51	48	41	39
228I	49	42	48	49	47	41	39
228J	50	43	50	51	48	41	39
228K	52	44	52	55	51	42	38
228L	53	44	53	56	52	42	38
228M	53	45	54	57	53	42	38
230	48	42	48	48	46	41	39
238A	47	41	47	47	45	41	39
238B	47	41	47	47	45	41	39
238C	47	41	47	47	45	41	39
238D	47	41	47	47	45	40	39
238E	47	41	47	47	45	40	39
238F	47	41	47	47	45	40	39

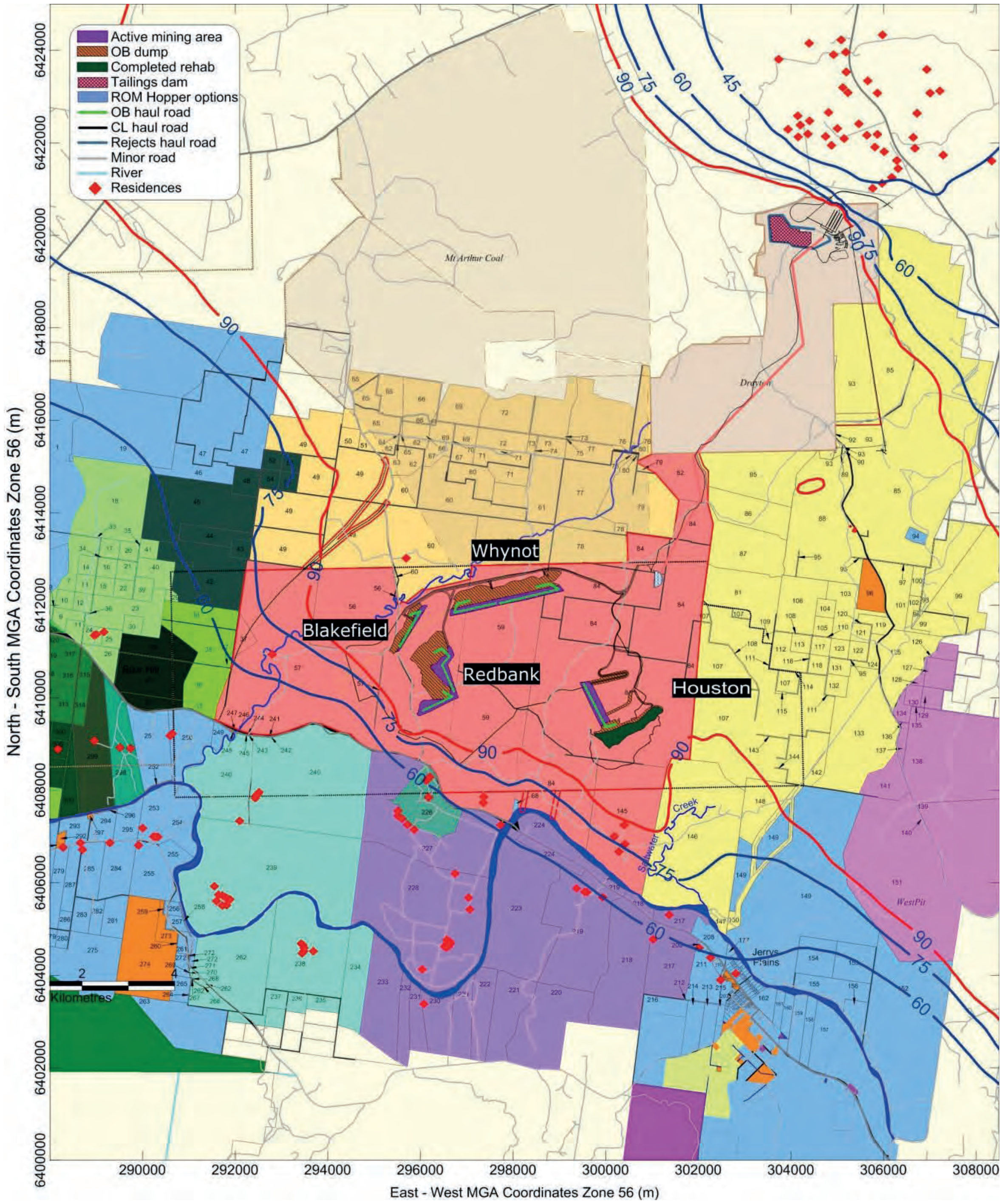
ID	Cumulative Annual Average TSP (μg/m³) EPA Assessment criteria = 90 μg/m³						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239A	47	41	47	47	45	40	38
239B	47	40	47	47	45	40	38
239C	47	40	47	47	45	40	38
239D	47	40	47	47	45	40	38
239E	47	40	47	47	45	40	38
239F	47	41	47	47	45	40	38
239G	47	41	47	47	45	40	38
239H	47	41	47	47	45	40	38
239I	48	40	47	48	45	40	38
240A	49	41	49	49	47	40	37
240B	50	41	50	50	48	40	36
240C	50	41	50	50	48	40	36
240D	50	41	50	51	48	40	36
240E	50	41	49	50	47	40	36
250A	51	42	51	51	48	40	36
250B	51	43	51	51	48	40	36
253	48	41	48	48	46	40	37
254A	48	41	48	48	46	40	37
254B	48	41	48	48	46	40	37
254C	48	41	48	48	46	40	37
255	48	41	47	48	46	40	38
279	47	41	46	47	45	40	38
284	48	41	47	47	45	40	38
285	47	41	47	47	45	40	38
287	47	41	47	47	45	40	38
288	47	41	46	46	45	40	38
298A	50	41	49	49	47	40	36
298B	49	41	49	49	47	40	36
299	49	41	48	49	46	40	36
306	48	40	47	48	45	40	37
Drayton Mine							
384	35	23	30	32	30	24	19
385	38	26	32	34	31	26	21
386	37	22	30	32	29	23	17
387	38	25	31	32	29	21	16
390	41	28	31	33	29	21	15
398	39	26	31	33	29	21	16
399	38	25	31	33	29	22	17
400	38	26	32	33	30	24	19
401	39	27	33	34	31	24	19
402	39	27	32	34	30	23	18
403	40	28	33	34	31	23	18
411	45	35	39	40	36	29	24
418	45	35	39	40	36	30	25
419	44	34	38	39	36	30	26
420	43	33	38	39	36	30	26
421	42	32	37	38	35	28	24
423	42	31	36	37	34	28	23
424	41	30	35	36	33	27	23
425	41	30	35	37	34	28	24
427	40	28	34	35	32	26	22
429	38	27	33	34	32	26	21
432	37	26	32	34	31	26	21
433A	36	25	31	33	31	25	21
433B	36	25	32	33	31	26	22
435	36	25	31	33	31	26	22
438	37	28	34	35	33	29	25
440	39	29	34	36	33	28	24
441	40	32	37	38	36	32	29
443	41	32	37	38	36	31	28
444	42	33	38	39	36	31	27
446A	43	33	38	39	36	31	27
446B	43	34	40	41	38	33	30

ID	Cumulative Annual Average TSP (μg/m³) *EPA Assessment criteria = 90 μg/m³*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
451	45	38	43	43	41	37	35
455	41	32	38	39	37	33	30
456	40	31	36	38	36	32	28
460	38	28	33	35	33	27	23
Mine owned residences							
57	66	58	70	70	65	46	36
58A	69	59	70	**94**	**92**	48	39
58B	67	56	68	87	84	47	39
60	**149**	**117**	**146**	**136**	**125**	67	42
145A	77	69	73	75	68	60	42
145B	87	84	76	77	70	66	43
145C	78	70	74	77	70	61	42
145D	73	63	71	75	68	58	41
388	39	26	31	33	29	21	15
389	42	29	32	34	30	21	15
404	40	28	33	35	32	25	20
410	46	36	39	40	36	29	24



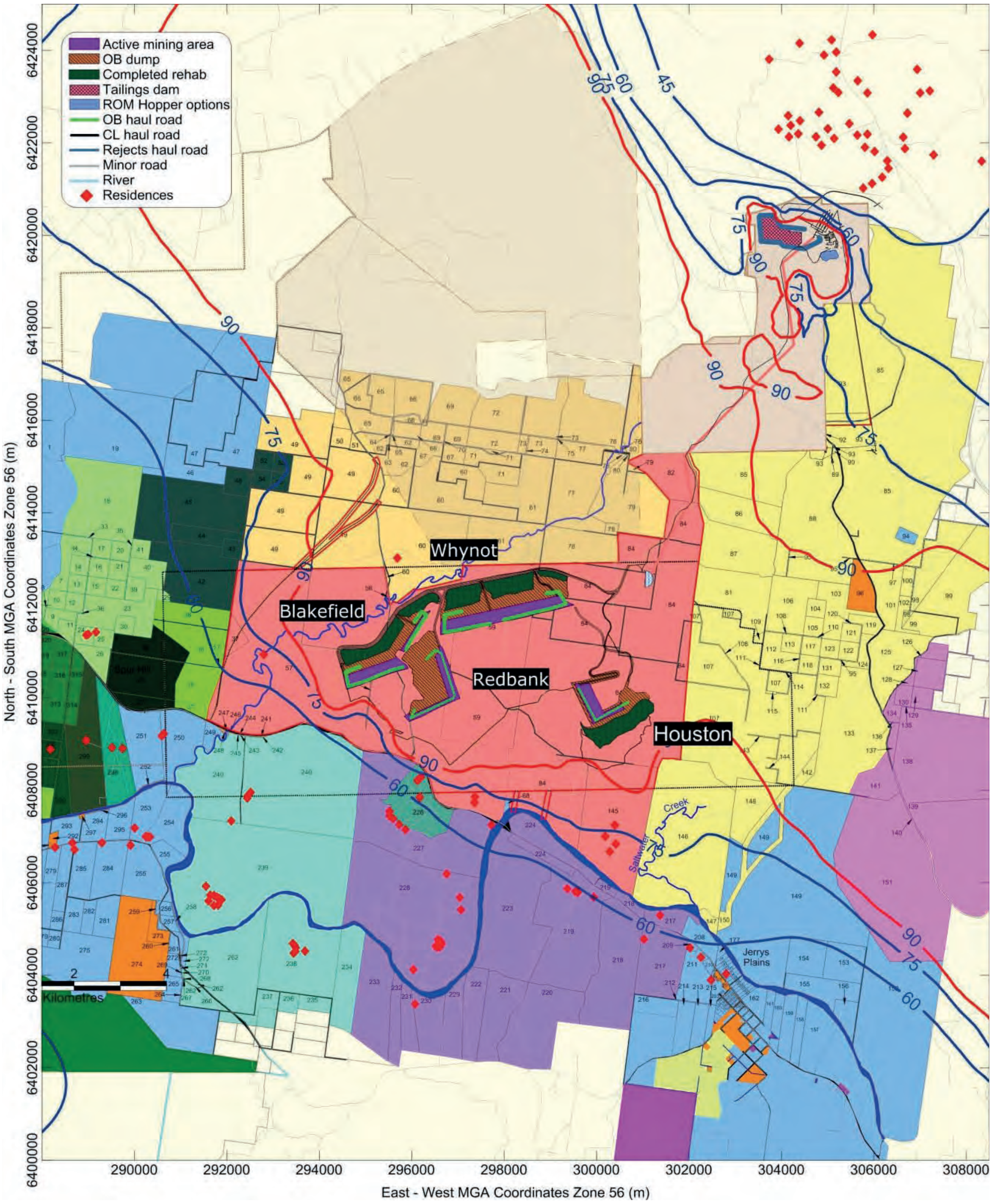
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 3A (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =90 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-33: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 3A



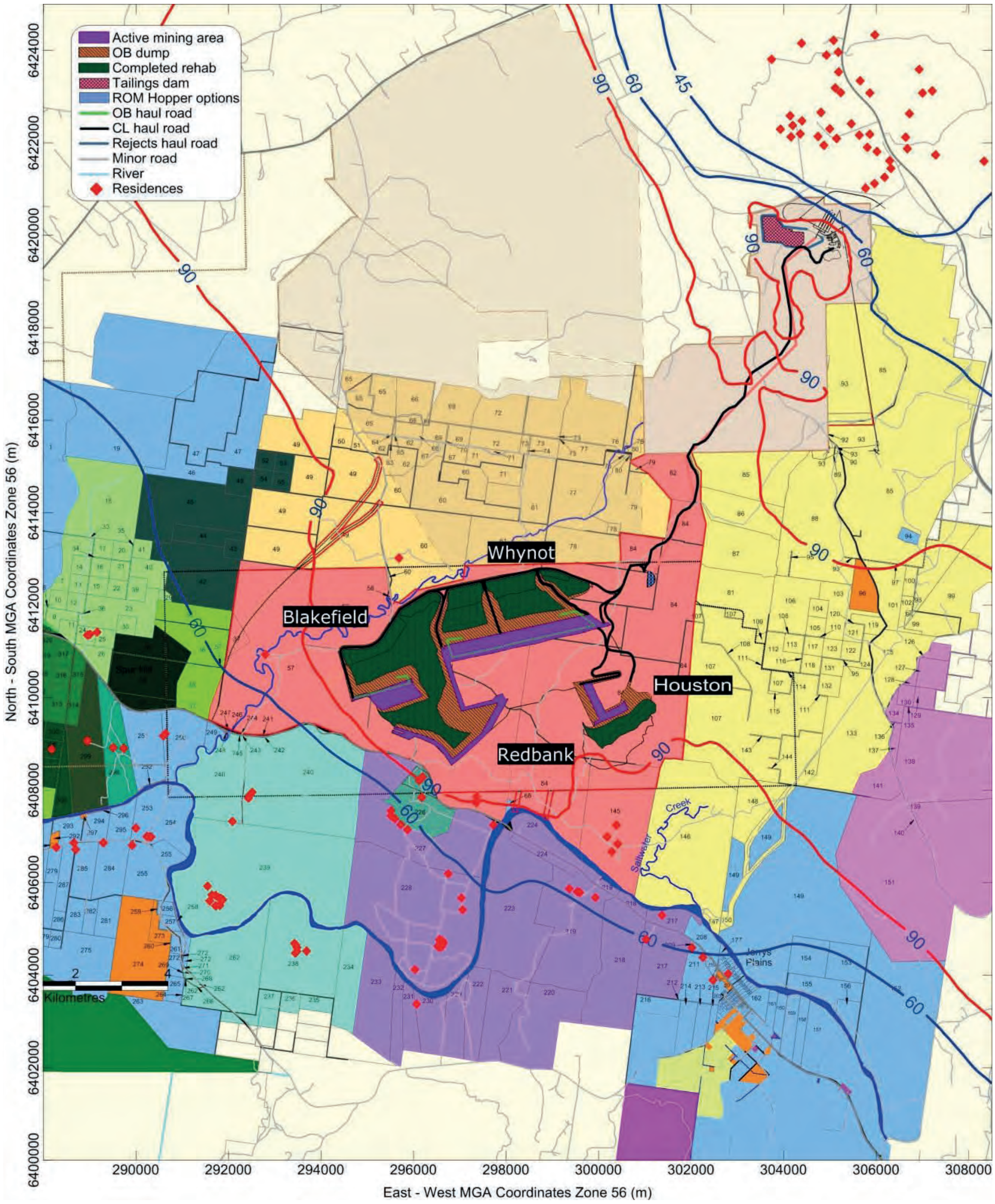
Species: TSP	Location: Drayton South	Scenario: Year 3B (Cumulative)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	**Units:** µg/m³	**Guideline:** EPA =90 µg/m³ (shown as a bold red line)	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-34: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 3B



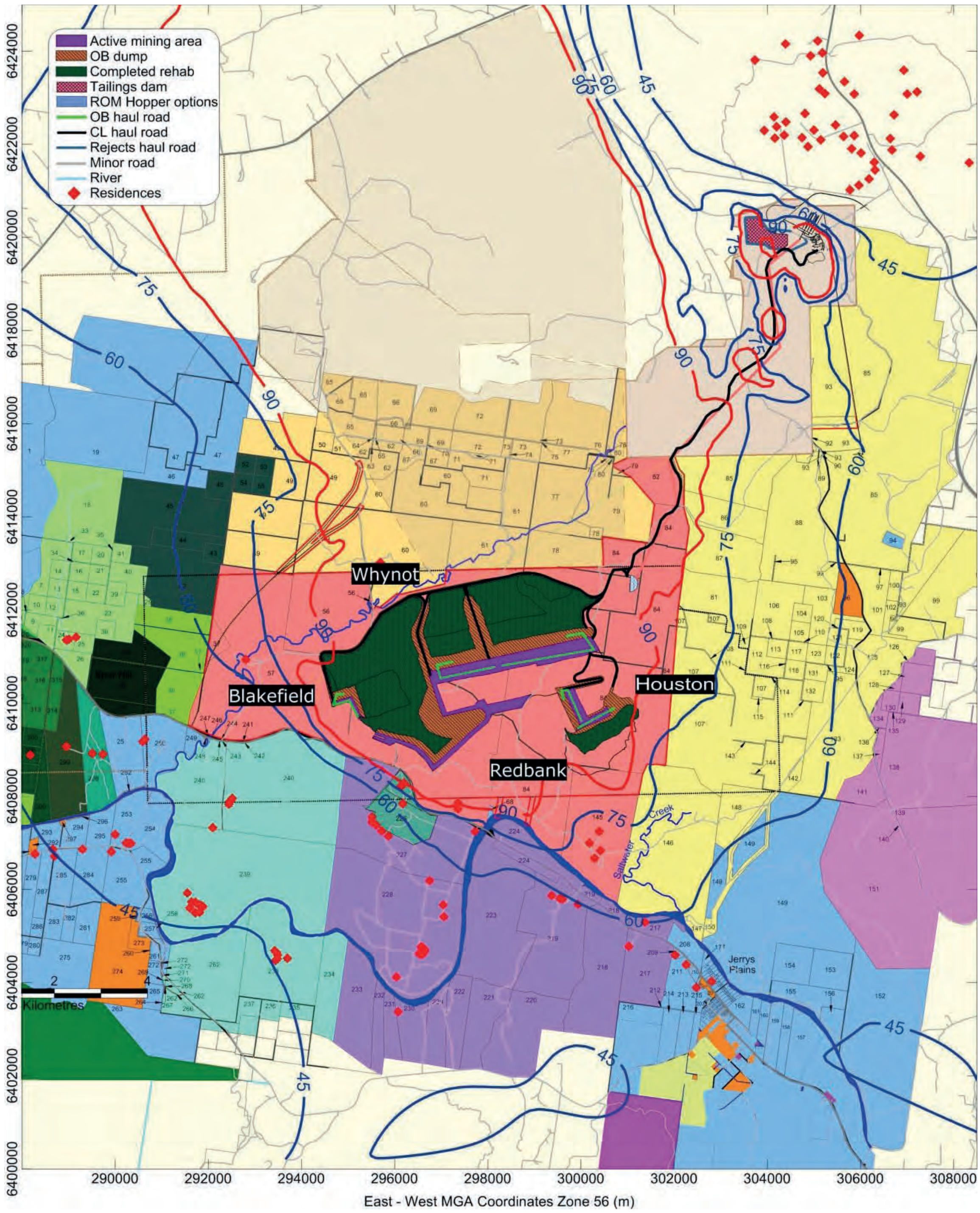
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 5 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =90 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-35: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 5



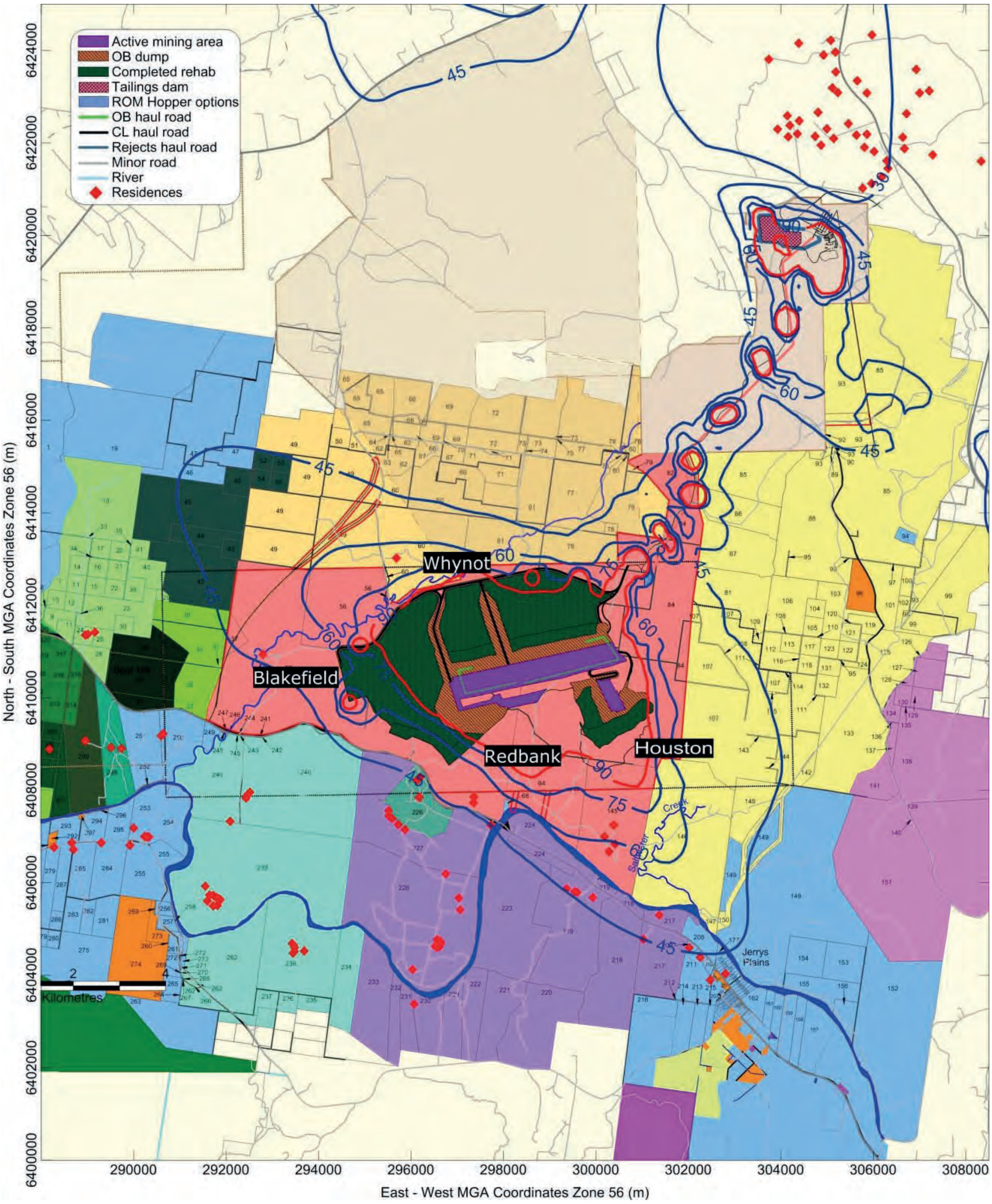
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 10 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =90 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-36: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 10



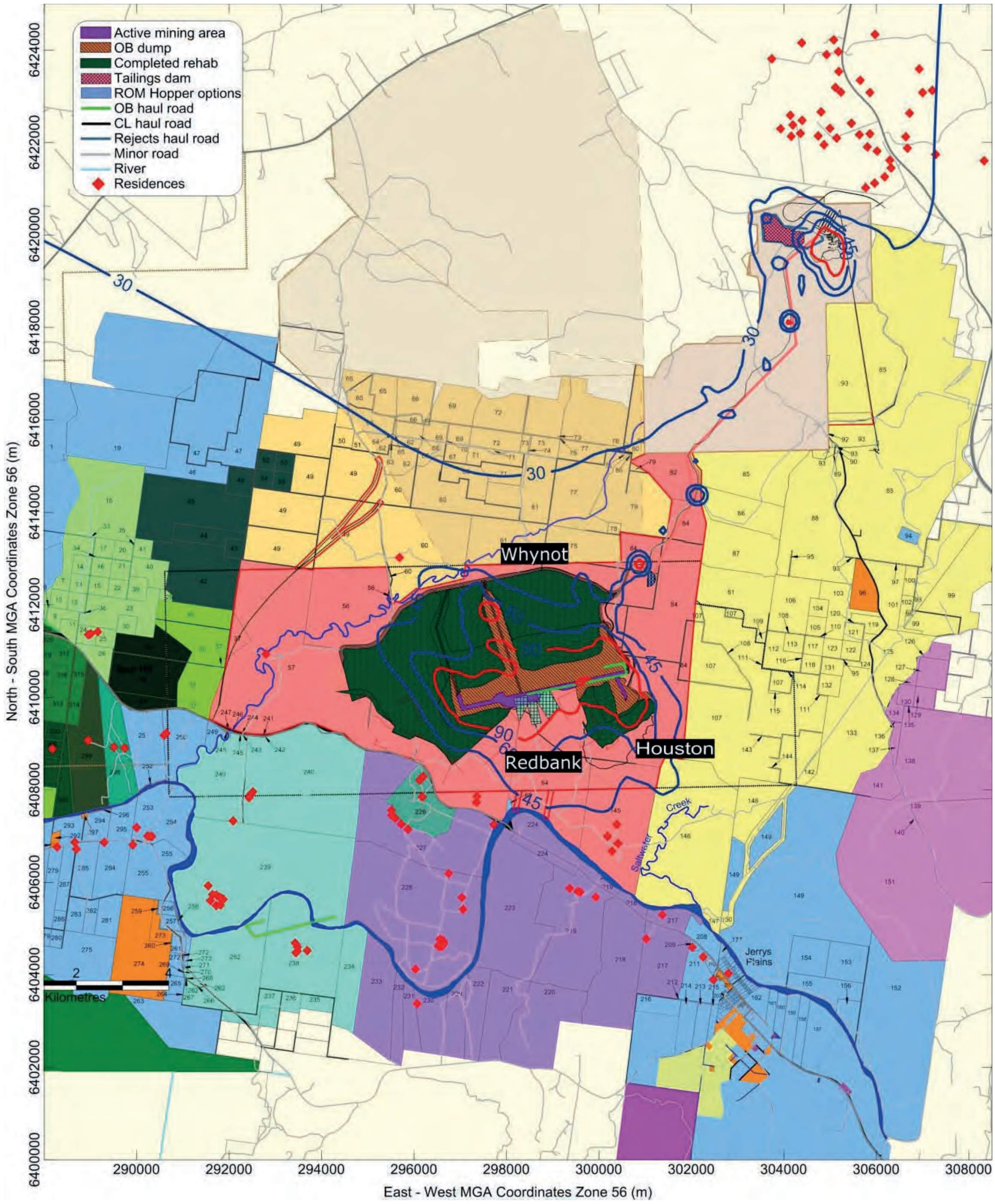
Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 15 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =90 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-37: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 15



Species: TSP	Location: Drayton South	Scenario: Year 20 (Cumulative)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	Units: µg/m³	Guideline: EPA =90 µg/m³ (shown as a bold red line)	Met Data: CALMET	Plot: K. Hill

Figure 8-38: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 27 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =90 µg/m³ (shown as a bold red line)	CALMET	K. Hill

Figure 8-39: Predicted annual average TSP concentrations due to emissions from Drayton South and other sources - Year 27

8.8 Project Only Dust Deposition Predictions

A summary of the Project-only predicted Dust Deposition concentrations at each of the individual receivers is provided in **Table 8-9**.

There are no privately owned receivers that are predicted to experience annual average Dust Deposition concentrations above the assessment criteria, due to emissions from the Project-only.

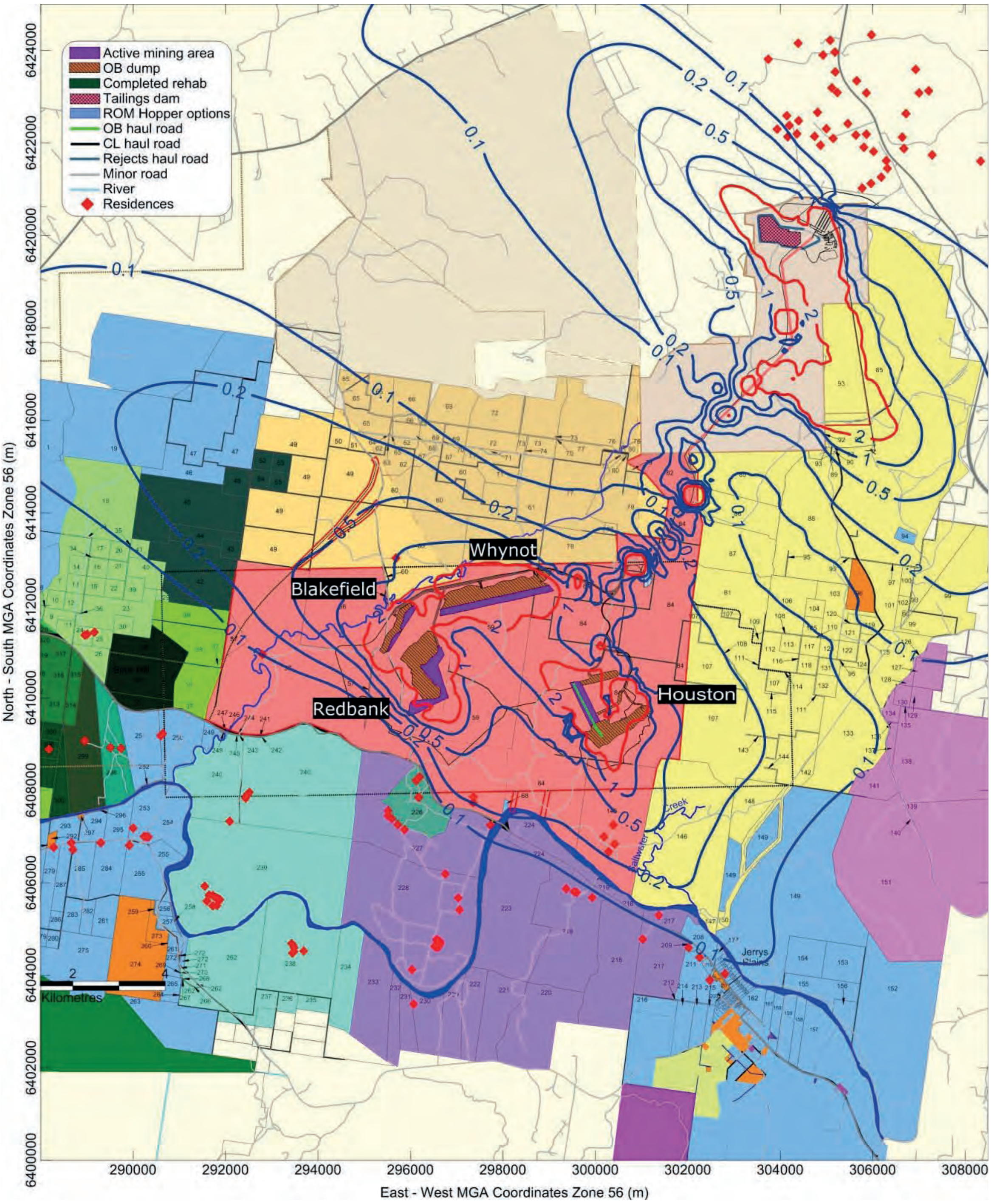
The Project-only contributions to annual average Dust Deposition concentrations are presented in **Figure 8-40** to **Figure 8-46** for each modelled year.

Table 8-9: Annual Dust Deposition concentrations ($g/m^2/month$) at nearby residences for each modelling year – Project Only

ID	Project Only						
	Annual Average Dust Deposition ($g/m^2/month$)						
	EPA Assessment criteria = 2 $g/m^2/month$						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	0.0	0.0	0.0	0.1	0.1	0.1	0.0
3	0.0	0.0	0.1	0.1	0.1	0.1	0.0
24A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.1	0.1	0.0	0.0
172	0.1	0.1	0.1	0.1	0.1	0.1	0.0
207	0.1	0.1	0.1	0.1	0.1	0.1	0.0
209	0.1	0.1	0.1	0.1	0.1	0.1	0.0
211	0.1	0.1	0.1	0.1	0.1	0.1	0.0
217A	0.1	0.1	0.1	0.2	0.2	0.2	0.1
217B	0.1	0.1	0.1	0.1	0.1	0.1	0.0
219A	0.1	0.1	0.1	0.2	0.2	0.1	0.0
219B	0.1	0.1	0.1	0.2	0.2	0.1	0.1
219C	0.1	0.1	0.1	0.2	0.2	0.1	0.0
219D	0.1	0.1	0.1	0.2	0.2	0.1	0.0
226A	0.1	0.1	0.2	0.4	0.4	0.1	0.0
226B	0.1	0.1	0.2	0.6	0.5	0.1	0.0
226C	0.1	0.1	0.2	0.5	0.5	0.1	0.0
226D	0.1	0.1	0.1	0.3	0.2	0.0	0.0
227A	0.0	0.0	0.0	0.1	0.1	0.0	0.0
227B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
227C	0.0	0.0	0.0	0.1	0.0	0.0	0.0
227D	0.0	0.0	0.0	0.1	0.1	0.0	0.0
227E	0.0	0.0	0.0	0.1	0.1	0.0	0.0
227F	0.1	0.1	0.2	0.4	0.4	0.1	0.0
228A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228D	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228G	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228H	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228I	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228J	0.0	0.0	0.0	0.0	0.0	0.0	0.0
228K	0.0	0.0	0.0	0.1	0.0	0.0	0.0
228L	0.0	0.0	0.0	0.1	0.1	0.0	0.0
228M	0.0	0.0	0.0	0.1	0.1	0.0	0.0
230	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238D	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
238F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239A	0.0	0.0	0.0	0.0	0.0	0.0	0.0

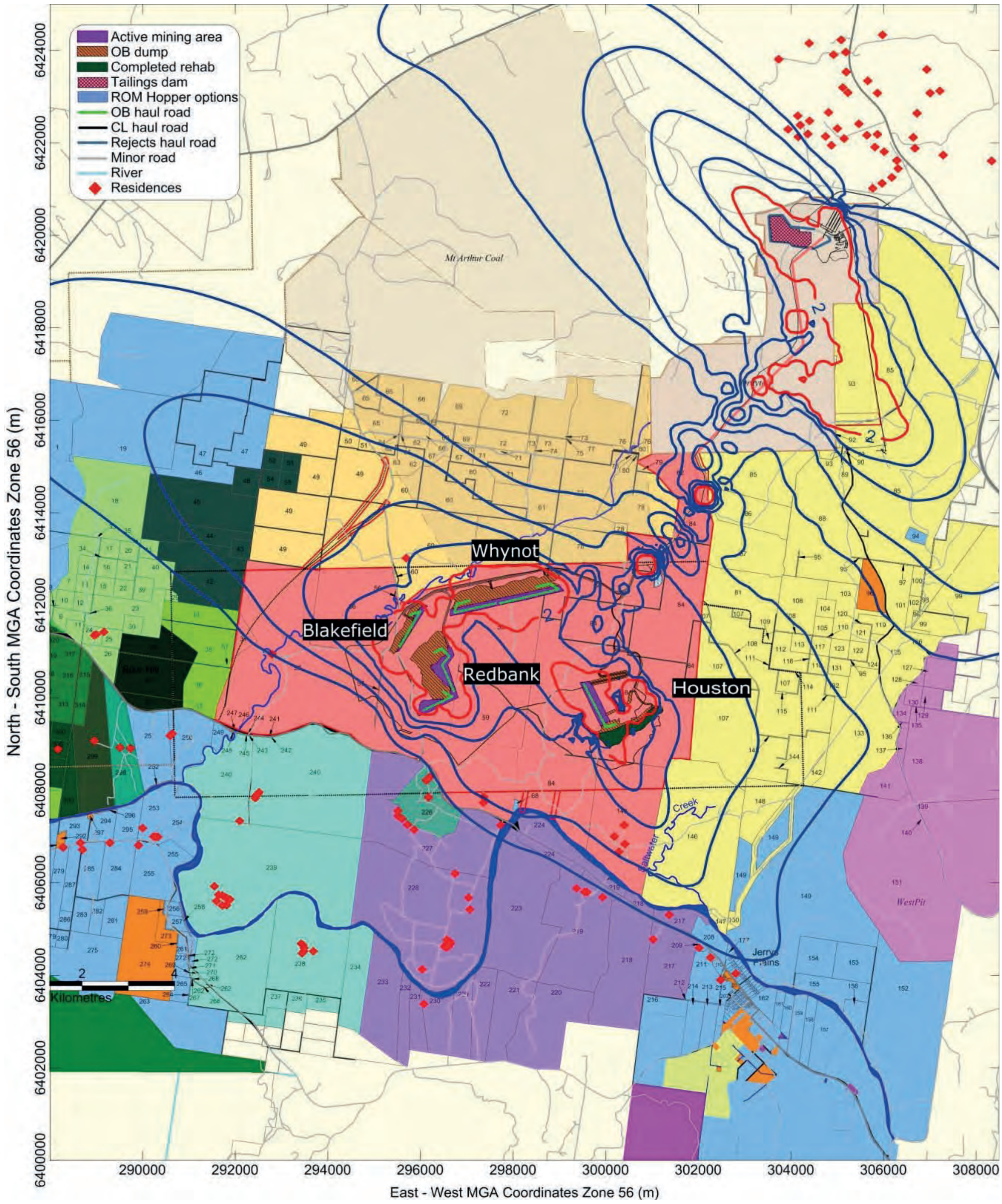
ID	Project Only						
	Annual Average Dust Deposition ($g/m^2/month$)						
	EPA Assessment criteria = 2 $g/m^2/month$						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239D	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239G	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239H	0.0	0.0	0.0	0.0	0.0	0.0	0.0
239I	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240D	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
253	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254C	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
279	0.0	0.0	0.0	0.0	0.0	0.0	0.0
284	0.0	0.0	0.0	0.0	0.0	0.0	0.0
285	0.0	0.0	0.0	0.0	0.0	0.0	0.0
287	0.0	0.0	0.0	0.0	0.0	0.0	0.0
288	0.0	0.0	0.0	0.0	0.0	0.0	0.0
298A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
298B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
299	0.0	0.0	0.0	0.0	0.0	0.0	0.0
306	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drayton Mine							
384	0.0	0.0	0.0	0.0	0.0	0.0	0.0
385	0.0	0.0	0.0	0.0	0.0	0.0	0.0
386	0.0	0.0	0.0	0.0	0.0	0.0	0.0
387	0.1	0.1	0.0	0.0	0.0	0.0	0.0
390	0.1	0.1	0.0	0.0	0.0	0.0	0.0
398	0.1	0.1	0.0	0.0	0.0	0.0	0.0
399	0.1	0.1	0.0	0.0	0.0	0.0	0.0
400	0.0	0.0	0.0	0.0	0.0	0.0	0.0
401	0.0	0.0	0.0	0.0	0.0	0.0	0.0
402	0.1	0.1	0.0	0.0	0.0	0.0	0.0
403	0.1	0.1	0.0	0.0	0.0	0.0	0.0
411	0.1	0.1	0.0	0.0	0.0	0.0	0.0
418	0.0	0.0	0.0	0.0	0.0	0.0	0.0
419	0.0	0.0	0.0	0.0	0.0	0.0	0.0
420	0.0	0.0	0.0	0.0	0.0	0.0	0.0
421	0.0	0.0	0.0	0.0	0.0	0.0	0.0
423	0.0	0.0	0.0	0.0	0.0	0.0	0.0
424	0.0	0.0	0.0	0.0	0.0	0.0	0.0
425	0.0	0.0	0.0	0.0	0.0	0.0	0.0
427	0.0	0.0	0.0	0.0	0.0	0.0	0.0
429	0.0	0.0	0.0	0.0	0.0	0.0	0.0
432	0.0	0.0	0.0	0.0	0.0	0.0	0.0
433A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
433B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
435	0.0	0.0	0.0	0.0	0.0	0.0	0.0
438	0.0	0.0	0.0	0.0	0.0	0.0	0.0
440	0.0	0.0	0.0	0.0	0.0	0.0	0.0
441	0.0	0.0	0.0	0.0	0.0	0.0	0.0
443	0.0	0.0	0.0	0.0	0.0	0.0	0.0
444	0.0	0.0	0.0	0.0	0.0	0.0	0.0
446A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
446B	0.0	0.0	0.0	0.0	0.0	0.0	0.0
451	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ID	Project Only Annual Average Dust Deposition (g/m²/month) *EPA Assessment criteria = 2 g/m²/month*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
455	0.0	0.0	0.0	0.0	0.0	0.0	0.0
456	0.0	0.0	0.0	0.0	0.0	0.0	0.0
460	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mine owned residences							
57	0.1	0.1	0.2	0.3	0.3	0.1	0.0
58A	0.2	0.2	0.3	0.9	0.8	0.1	0.0
58B	0.2	0.2	0.3	0.7	0.6	0.1	0.0
60	1.0	0.9	1.2	1.1	1.0	1.1	0.5
145A	0.3	0.3	0.3	0.4	0.4	0.4	0.2
145B	0.4	0.4	0.3	0.4	0.4	0.5	0.2
145C	0.3	0.3	0.3	0.4	0.4	0.4	0.2
145D	0.2	0.2	0.2	0.4	0.4	0.4	0.1
388	0.1	0.1	0.0	0.0	0.0	0.0	0.0
389	0.1	0.1	0.0	0.0	0.0	0.0	0.0
404	0.0	0.0	0.0	0.0	0.0	0.0	0.0
410	0.1	0.1	0.0	0.0	0.0	0.0	0.0



Species: Dust deposition	Location: Drayton South	Scenario: Year 3A (Drayton Mine + the Project only)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	Units: g/m²/month	Guideline: EPA =2 g/m²/month (shown as a bold red line)	Met Data: CALMET	Plot: K. Hill

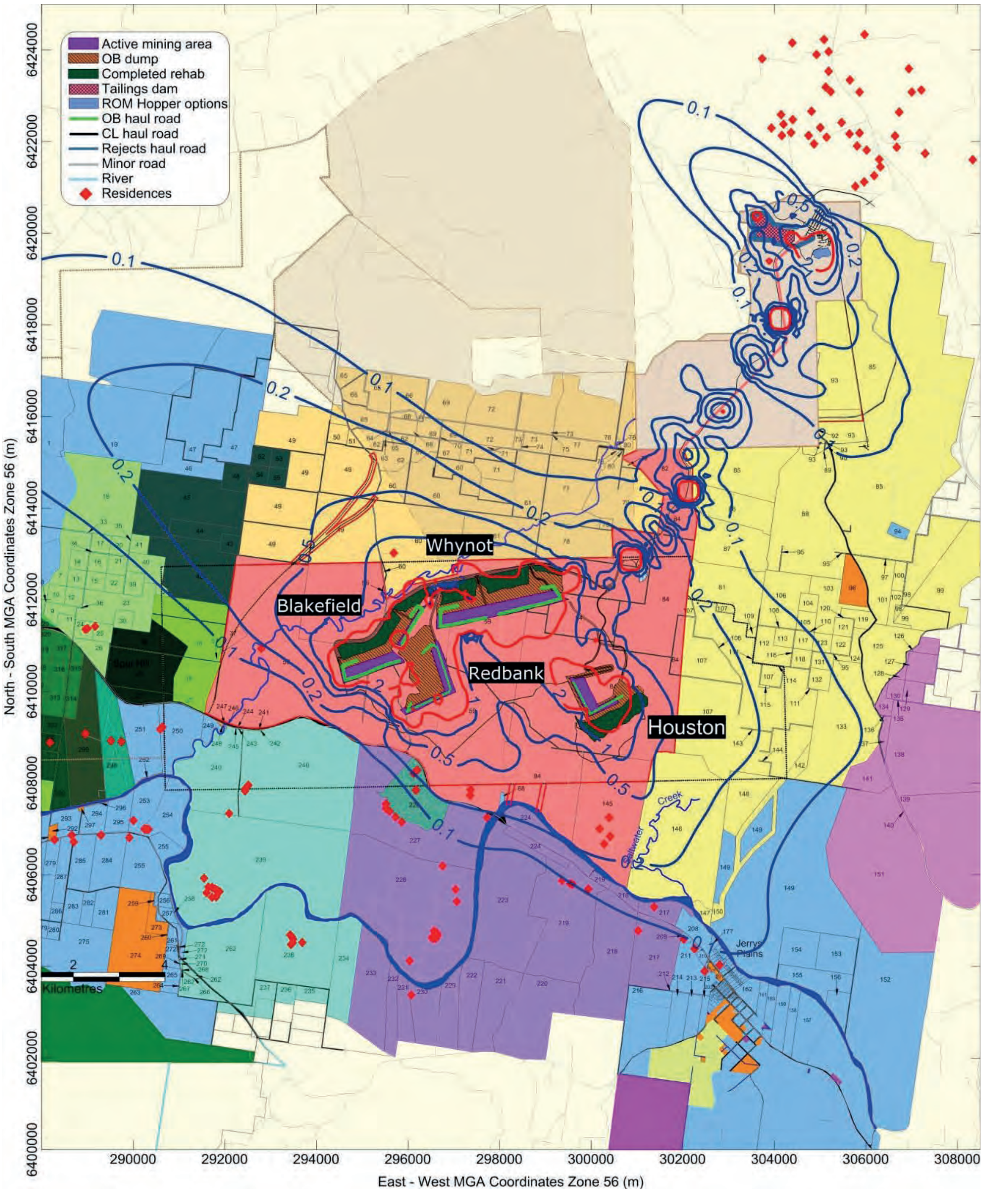
Figure 8-40: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 3A



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 3B (Drayton Mine + the Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =2 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

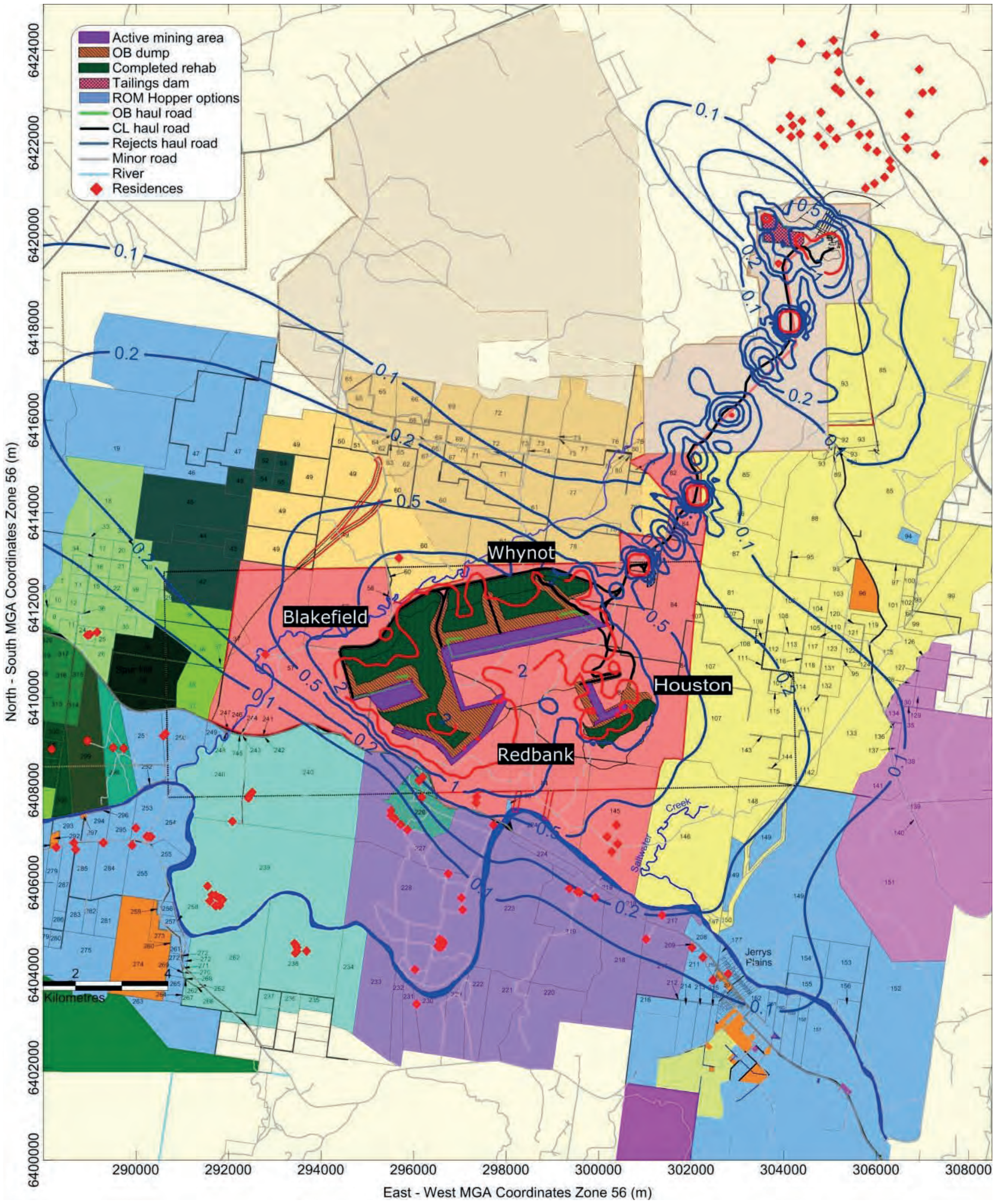
Figure 8-41: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 3B

pae holmes



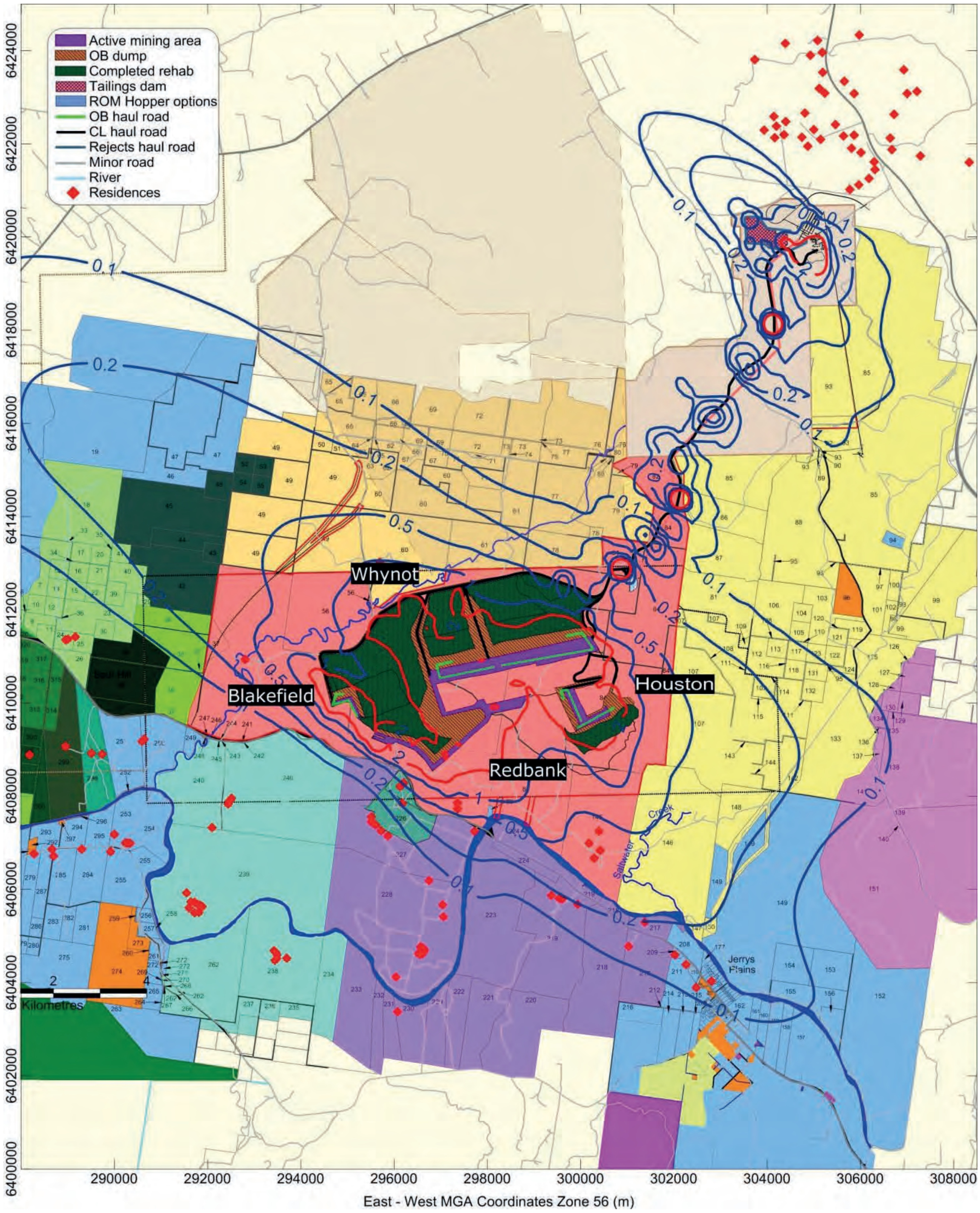
Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 5 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =2 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-42: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 5



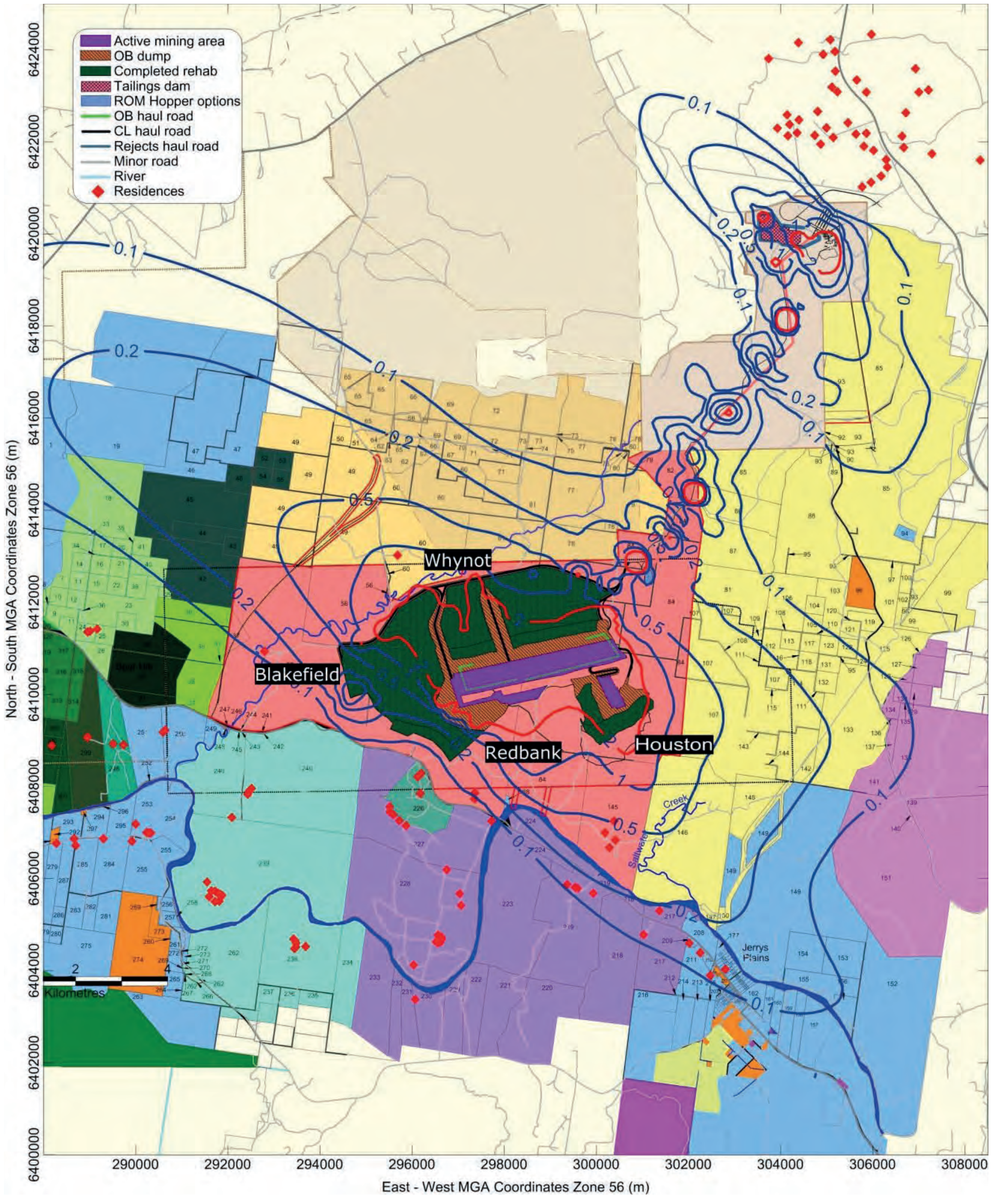
Species:	**Location:**	**Scenario:**	**Percentile:**	**Averaging Time:**
Dust deposition	Drayton South	Year 10 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =2 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-43: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 10



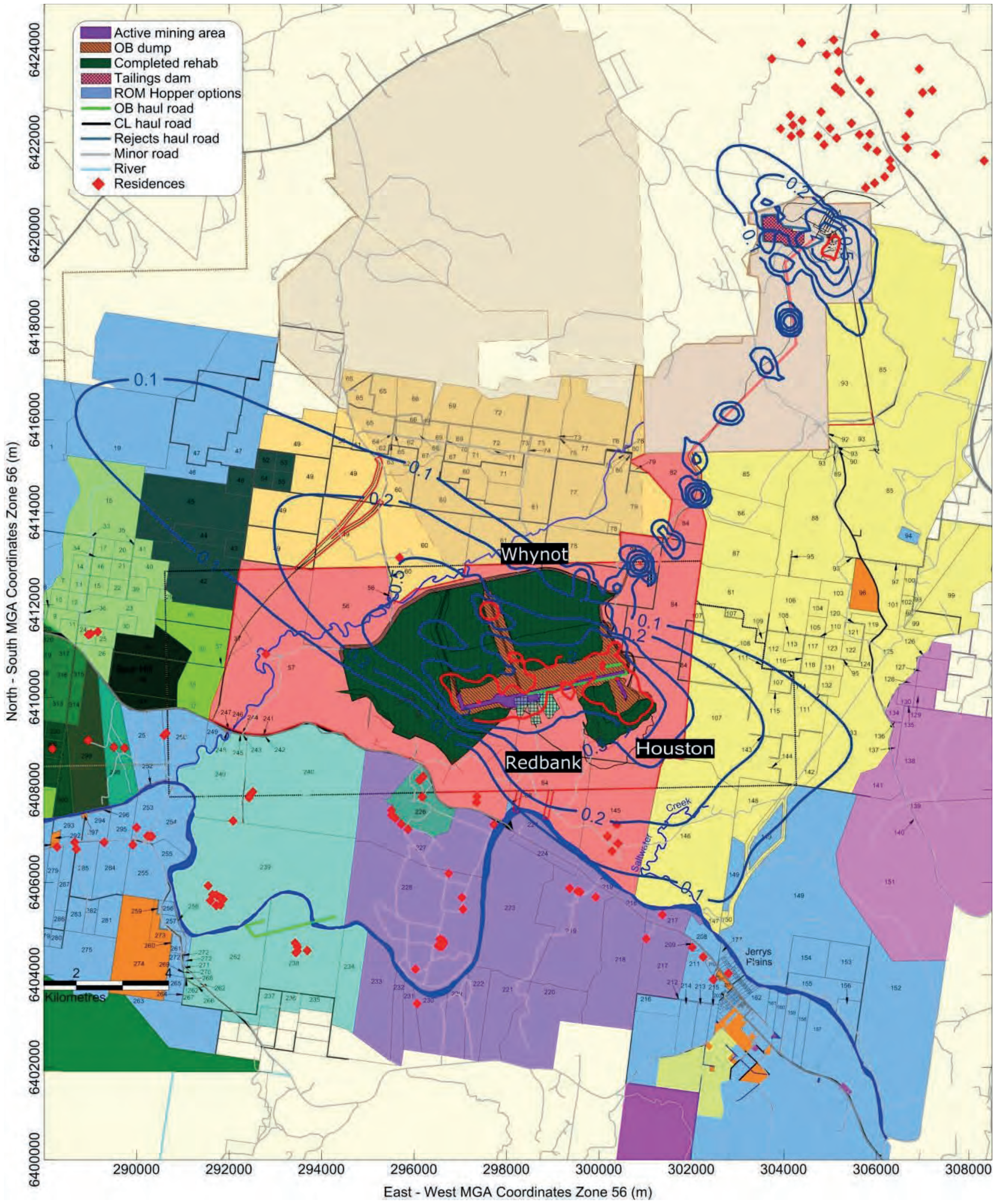
Species: Dust deposition	Location: Drayton South	Scenario: Year 15 (The Project only)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	**Units:** g/m²/month	**Guideline:** EPA =2 g/m²/month (shown as a bold red line)	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-44: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 15



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 20 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =2 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-45: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 27 (The Project only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	$g/m^2/month$	EPA =2 $g/m^2/month$ (shown as a bold red line)	CALMET	K. Hill

Figure 8-46: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 27

8.9 Cumulative Dust deposition Predictions

A summary of the Cumulative predicted Dust Deposition concentrations at each of the individual residences are provided in **Table 8-10**.

There are no residences that are predicted to experience annual average Dust Deposition concentrations above the assessment criteria, due to emissions from the Project plus background concentrations or cumulative sources.

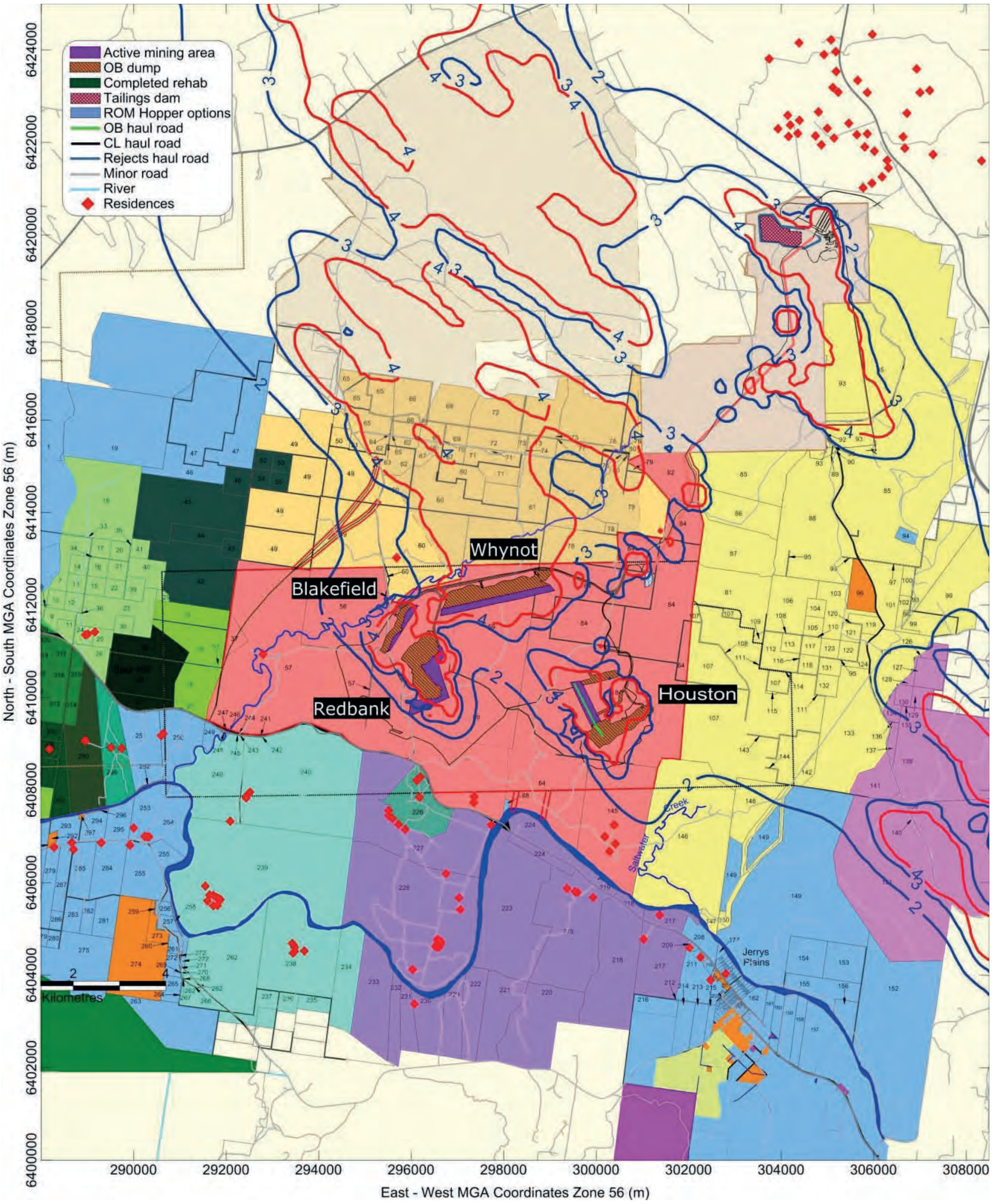
The Cumulative annual average Dust Deposition concentrations are presented in **Figure 8-47** to **Figure 8-53** for each modelled year.

Table 8-10: Annual Dust Deposition concentrations (g/m²/month) at nearby residences for each modelling year - Cumulative

ID	Cumulative Annual Average Dust Deposition (g/m²/month) *EPA Assessment criteria = 4 g/m²/month*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	1.1	1.1	1.2	1.2	1.1	1.1	1.0
3	1.2	1.2	1.2	1.2	1.1	1.1	1.0
24A	1.1	1.1	1.1	1.1	1.1	1.0	1.0
24B	1.1	1.1	1.1	1.1	1.1	1.0	1.0
25	1.1	1.1	1.1	1.1	1.1	1.0	1.0
172	1.3	1.3	1.2	1.3	1.2	1.1	1.0
207	1.2	1.2	1.2	1.3	1.2	1.1	1.0
209	1.3	1.3	1.3	1.3	1.3	1.1	1.0
211	1.3	1.3	1.2	1.3	1.3	1.1	1.0
217A	1.3	1.3	1.3	1.4	1.3	1.2	1.1
217B	1.2	1.2	1.2	1.3	1.2	1.1	1.0
219A	1.2	1.2	1.2	1.3	1.3	1.1	1.0
219B	1.2	1.2	1.3	1.4	1.3	1.2	1.1
219C	1.2	1.2	1.2	1.3	1.3	1.1	1.0
219D	1.2	1.2	1.2	1.3	1.3	1.1	1.0
226A	1.2	1.2	1.3	1.6	1.5	1.1	1.0
226B	1.2	1.2	1.4	1.7	1.6	1.1	1.0
226C	1.2	1.2	1.3	1.6	1.5	1.1	1.0
226D	1.2	1.2	1.2	1.4	1.3	1.1	1.0
227A	1.1	1.1	1.1	1.1	1.1	1.0	1.0
227B	1.1	1.1	1.1	1.1	1.1	1.0	1.0
227C	1.1	1.1	1.1	1.1	1.1	1.0	1.0
227D	1.1	1.1	1.1	1.1	1.1	1.0	1.0
227E	1.1	1.1	1.1	1.1	1.1	1.0	1.0
227F	1.3	1.3	1.3	1.6	1.5	1.1	1.0
228A	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228B	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228C	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228D	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228E	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228F	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228G	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228H	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228I	1.1	1.1	1.1	1.1	1.0	1.0	1.0
228J	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228K	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228L	1.1	1.1	1.1	1.1	1.1	1.0	1.0
228M	1.1	1.1	1.1	1.2	1.1	1.0	1.0
230	1.0	1.1	1.0	1.1	1.0	1.0	1.0
238A	1.0	1.0	1.0	1.0	1.0	1.0	1.0
238B	1.0	1.0	1.0	1.0	1.0	1.0	1.0
238C	1.0	1.0	1.0	1.0	1.0	1.0	1.0
238D	1.0	1.0	1.0	1.0	1.0	1.0	1.0
238E	1.0	1.0	1.0	1.0	1.0	1.0	1.0
238F	1.0	1.0	1.0	1.0	1.0	1.0	1.0

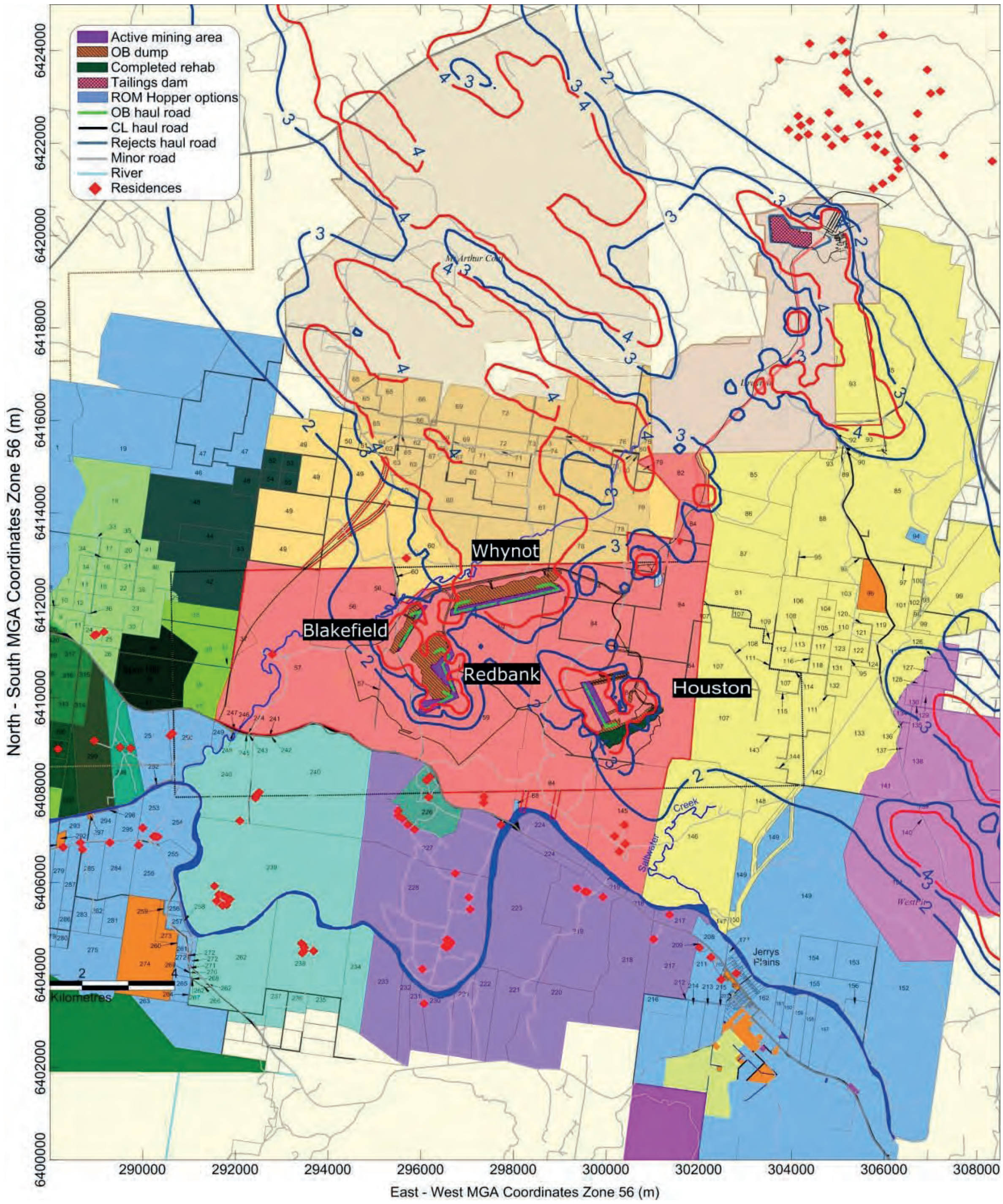
ID	Cumulative Annual Average Dust Deposition (g/m²/month) *EPA Assessment criteria = 4 g/m²/month*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239A	1.1	1.1	1.0	1.1	1.0	1.0	1.0
239B	1.1	1.1	1.1	1.1	1.0	1.0	1.0
239C	1.1	1.1	1.1	1.1	1.0	1.0	1.0
239D	1.1	1.1	1.1	1.1	1.0	1.0	1.0
239E	1.1	1.1	1.1	1.1	1.0	1.0	1.0
239F	1.1	1.1	1.0	1.1	1.0	1.0	1.0
239G	1.1	1.1	1.0	1.1	1.0	1.0	1.0
239H	1.1	1.1	1.1	1.1	1.0	1.0	1.0
239I	1.1	1.1	1.1	1.1	1.0	1.0	1.0
240A	1.1	1.1	1.1	1.1	1.1	1.0	1.0
240B	1.1	1.1	1.1	1.1	1.1	1.0	1.0
240C	1.1	1.1	1.1	1.1	1.1	1.0	1.0
240D	1.1	1.1	1.1	1.1	1.1	1.0	1.0
240E	1.1	1.1	1.1	1.1	1.1	1.0	1.0
250A	1.1	1.1	1.1	1.1	1.1	1.0	1.0
250B	1.1	1.1	1.1	1.1	1.1	1.0	1.0
253	1.1	1.1	1.1	1.1	1.0	1.0	1.0
254A	1.1	1.1	1.1	1.1	1.0	1.0	1.0
254B	1.1	1.1	1.1	1.1	1.0	1.0	1.0
254C	1.1	1.1	1.1	1.1	1.0	1.0	1.0
255	1.1	1.1	1.1	1.1	1.0	1.0	1.0
279	1.0	1.0	1.0	1.0	1.0	1.0	1.0
284	1.1	1.1	1.0	1.1	1.0	1.0	1.0
285	1.0	1.0	1.0	1.0	1.0	1.0	1.0
287	1.0	1.0	1.0	1.0	1.0	1.0	1.0
288	1.0	1.0	1.0	1.0	1.0	1.0	1.0
298A	1.1	1.1	1.1	1.1	1.1	1.0	1.0
298B	1.1	1.1	1.1	1.1	1.1	1.0	1.0
299	1.1	1.1	1.1	1.1	1.1	1.0	1.0
306	1.1	1.1	1.1	1.1	1.0	1.0	1.0
Drayton Mine							
384	1.3	1.3	1.2	1.2	1.2	1.1	1.0
385	1.3	1.3	1.2	1.2	1.2	1.1	1.0
386	1.4	1.4	1.2	1.2	1.2	1.1	1.0
387	1.5	1.5	1.3	1.3	1.3	1.1	1.0
390	1.5	1.5	1.4	1.4	1.3	1.1	1.0
398	1.5	1.5	1.3	1.3	1.3	1.1	1.0
399	1.4	1.4	1.3	1.3	1.3	1.1	1.0
400	1.4	1.4	1.2	1.3	1.2	1.1	1.0
401	1.4	1.4	1.2	1.3	1.2	1.1	1.0
402	1.4	1.4	1.3	1.3	1.3	1.1	1.0
403	1.4	1.4	1.3	1.3	1.3	1.1	1.0
411	1.4	1.4	1.3	1.3	1.3	1.1	1.0
418	1.4	1.3	1.2	1.3	1.2	1.1	1.0
419	1.3	1.3	1.2	1.3	1.2	1.1	1.0
420	1.3	1.3	1.2	1.2	1.2	1.1	1.0
421	1.3	1.3	1.2	1.2	1.2	1.1	1.0
423	1.3	1.3	1.2	1.3	1.2	1.1	1.0
424	1.3	1.3	1.2	1.2	1.2	1.1	1.0
425	1.3	1.3	1.2	1.2	1.2	1.1	1.0
427	1.3	1.3	1.2	1.2	1.2	1.1	1.0
429	1.3	1.3	1.2	1.2	1.2	1.1	1.0
432	1.3	1.3	1.2	1.2	1.2	1.1	1.0
433A	1.3	1.3	1.2	1.2	1.2	1.1	1.0
433B	1.3	1.3	1.2	1.2	1.2	1.1	1.0
435	1.3	1.3	1.1	1.2	1.2	1.1	1.0
438	1.2	1.2	1.1	1.2	1.1	1.1	1.0
440	1.3	1.3	1.2	1.2	1.2	1.1	1.0
441	1.2	1.2	1.1	1.2	1.1	1.1	1.0
443	1.2	1.2	1.2	1.2	1.2	1.1	1.0
444	1.3	1.3	1.2	1.2	1.2	1.1	1.0
446A	1.3	1.3	1.2	1.2	1.2	1.1	1.0
446B	1.3	1.3	1.2	1.2	1.2	1.1	1.0

ID	Cumulative Annual Average Dust Deposition (g/m^2/month) *EPA Assessment criteria = 4 g/m^2/month*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
451	1.2	1.2	1.2	1.2	1.2	1.0	1.0
455	1.2	1.2	1.1	1.1	1.1	1.1	1.0
456	1.2	1.2	1.1	1.1	1.1	1.1	1.0
460	1.3	1.3	1.2	1.2	1.2	1.1	1.0
Mine owned residences							
57	1.2	1.3	1.3	1.5	1.4	1.1	1.0
58A	1.4	1.4	1.5	2.0	1.9	1.1	1.0
58B	1.4	1.3	1.4	1.9	1.7	1.1	1.0
60	2.8	2.8	3.0	2.9	2.7	2.1	1.5
145A	1.5	1.5	1.5	1.6	1.6	1.4	1.2
145B	1.7	1.7	1.6	1.7	1.6	1.5	1.2
145C	1.5	1.5	1.5	1.7	1.6	1.4	1.2
145D	1.5	1.5	1.5	1.6	1.5	1.4	1.1
388	1.5	1.5	1.3	1.3	1.3	1.1	1.0
389	1.6	1.6	1.4	1.4	1.4	1.1	1.0
404	1.4	1.4	1.3	1.3	1.3	1.1	1.0
410	1.4	1.4	1.3	1.3	1.3	1.1	1.0



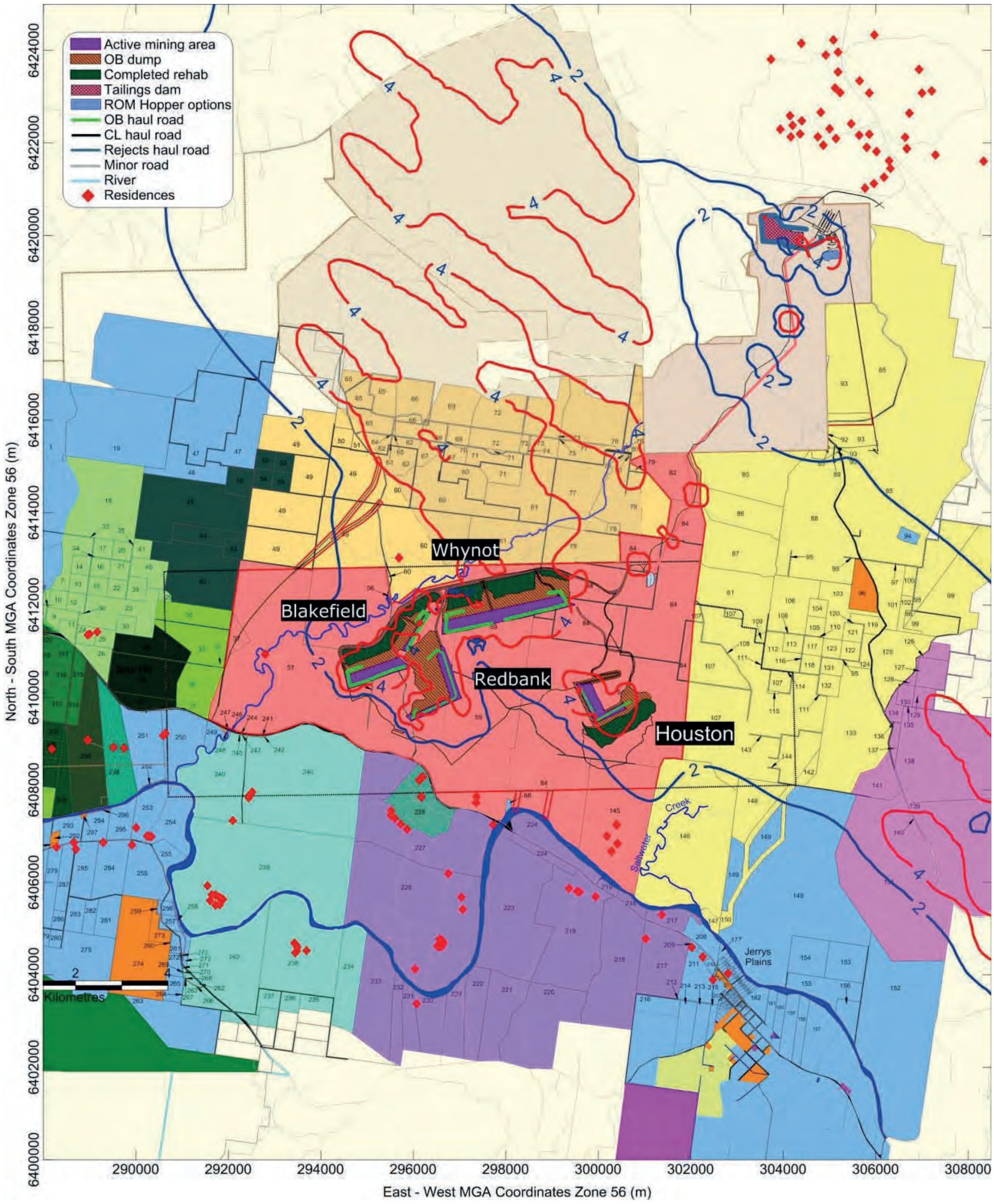
Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 3A (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =4 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-47: Predicted annual average dust deposition concentrations due to emissions from Drayton South and other sources - Year 3A



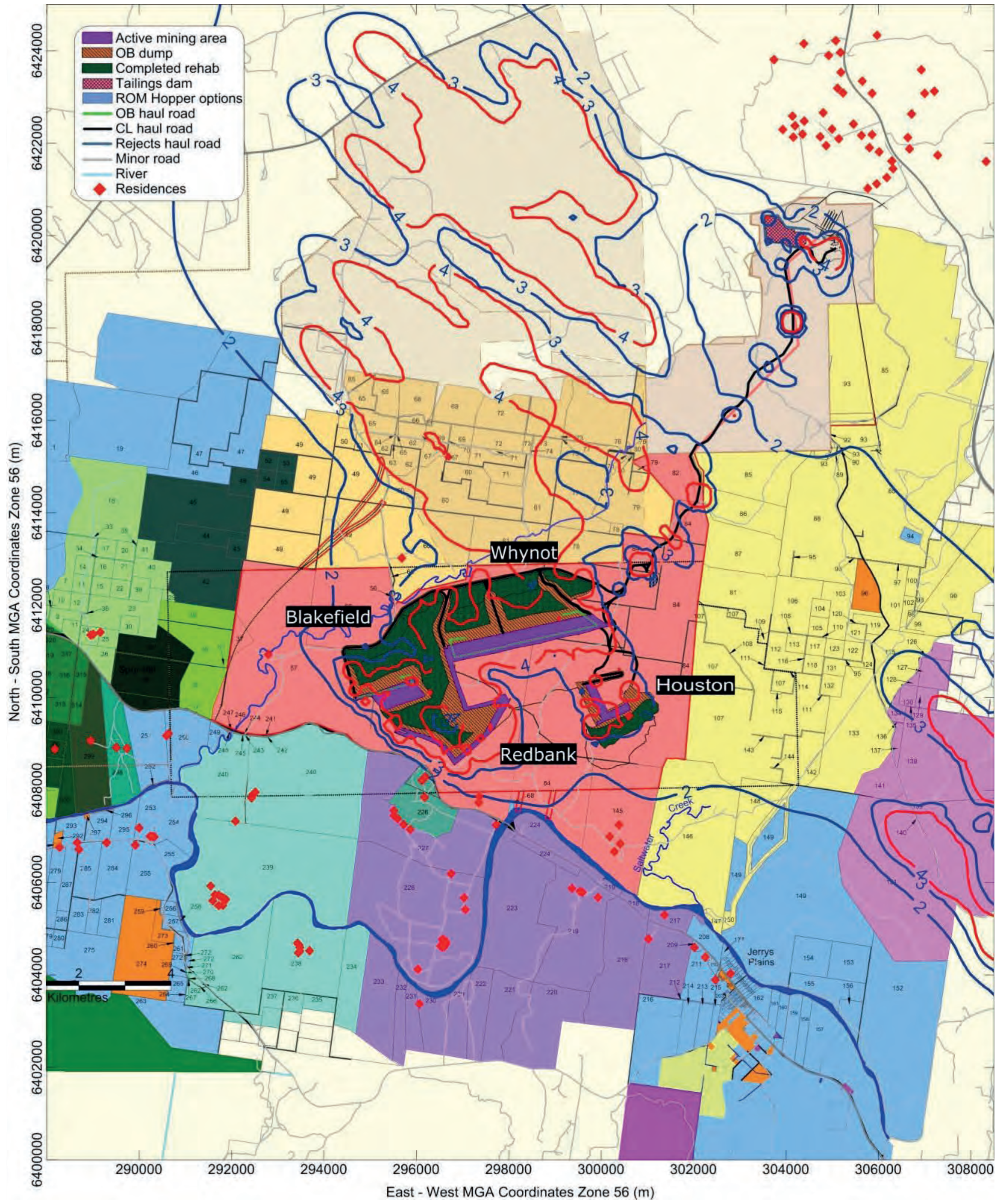
Species: Dust deposition	Location: Drayton South	Scenario: Year 3B (Cumulative)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	**Units:** $g/m^2/month$	**Guideline:** EPA =4 $g/m^2/month$ (shown as a bold red line)	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-48: Predicted annual average dust deposition concentrations due to emissions from Drayton South only - Year 3B



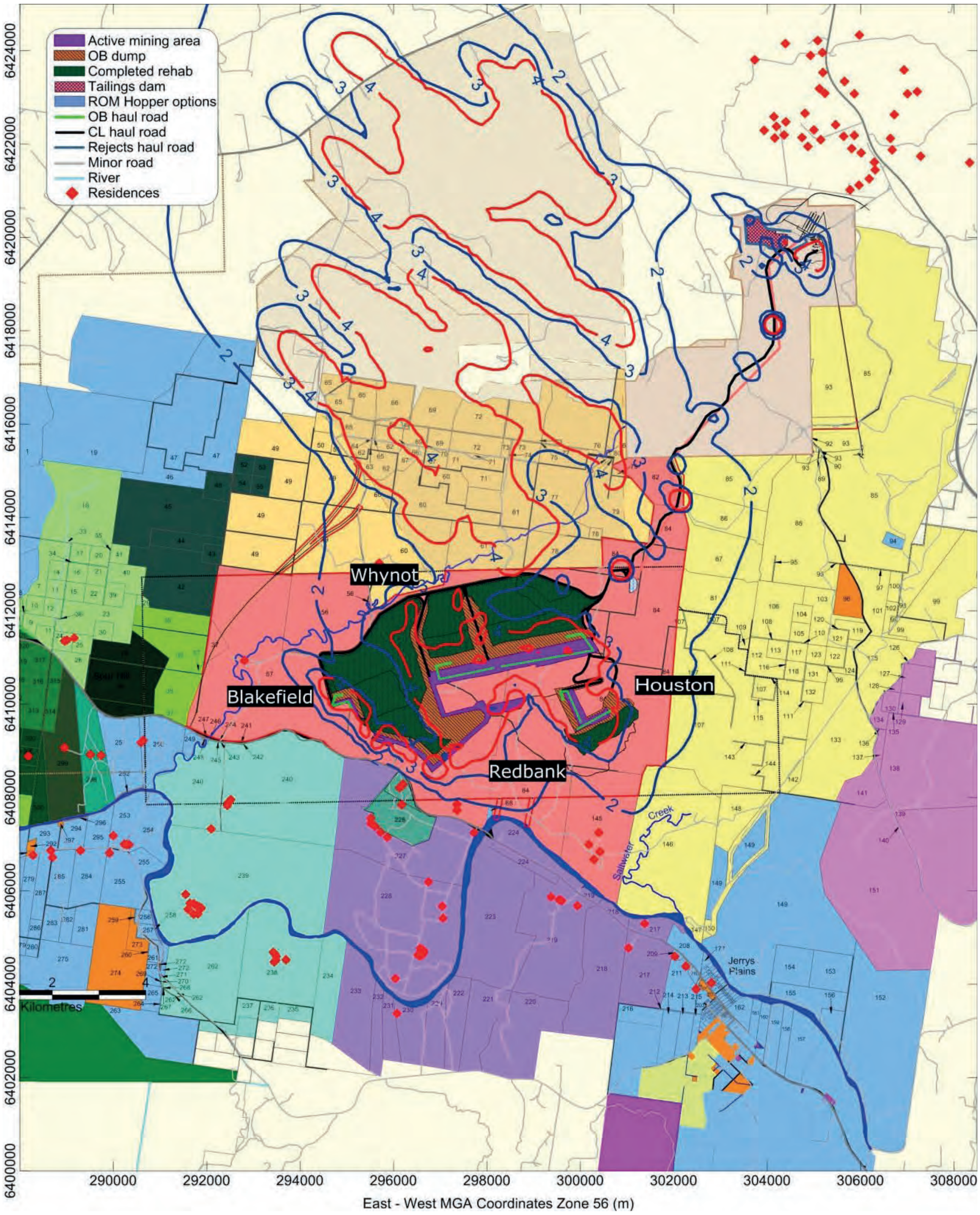
Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 5 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m²/month	EPA =4 g/m²/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-49: Predicted annual average dust deposition concentrations due to emissions from Drayton South and other sources - Year 5



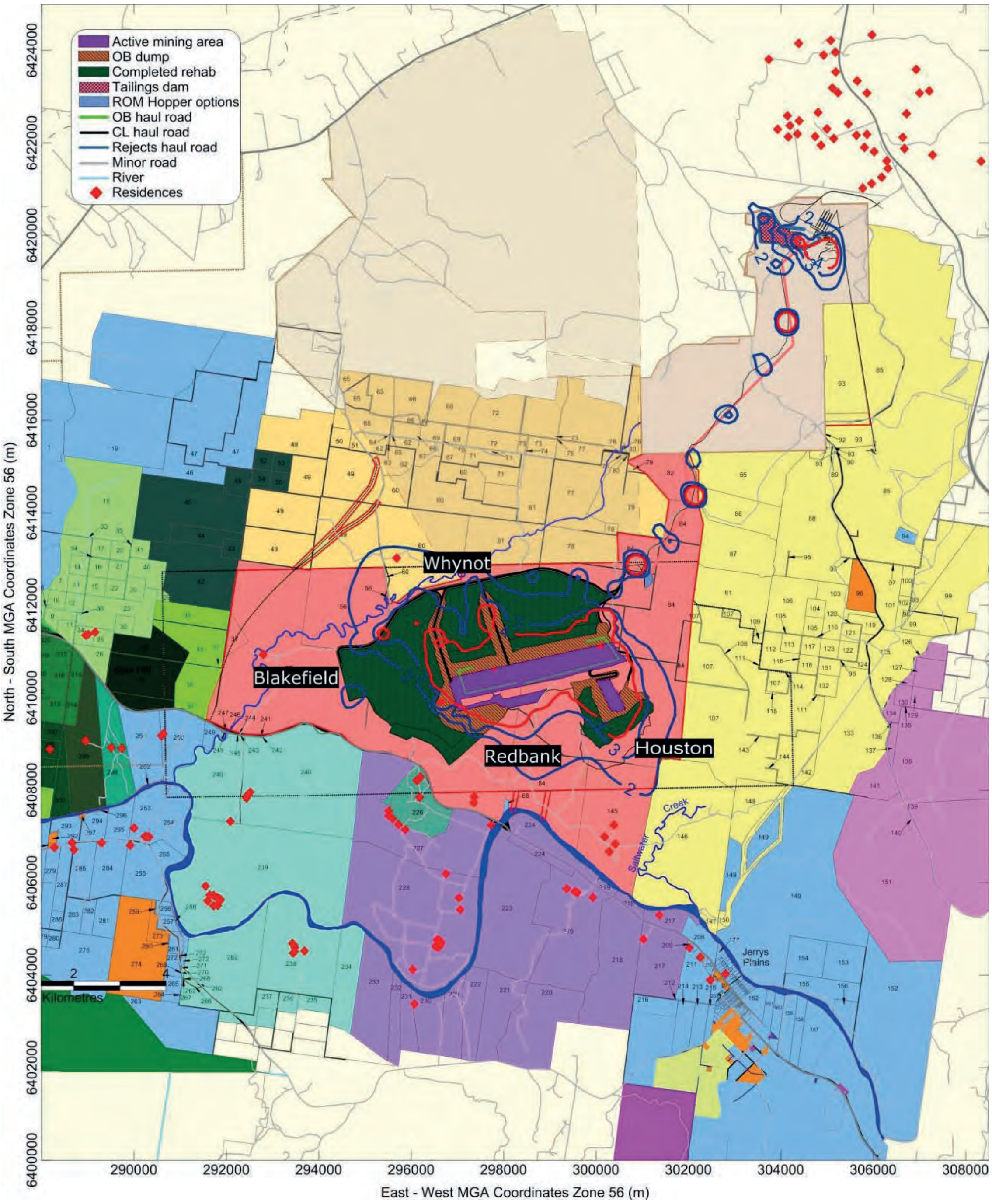
Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 10 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =4 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-50: Predicted annual average dust deposition concentrations due to emissions from Drayton South and other sources - Year 10



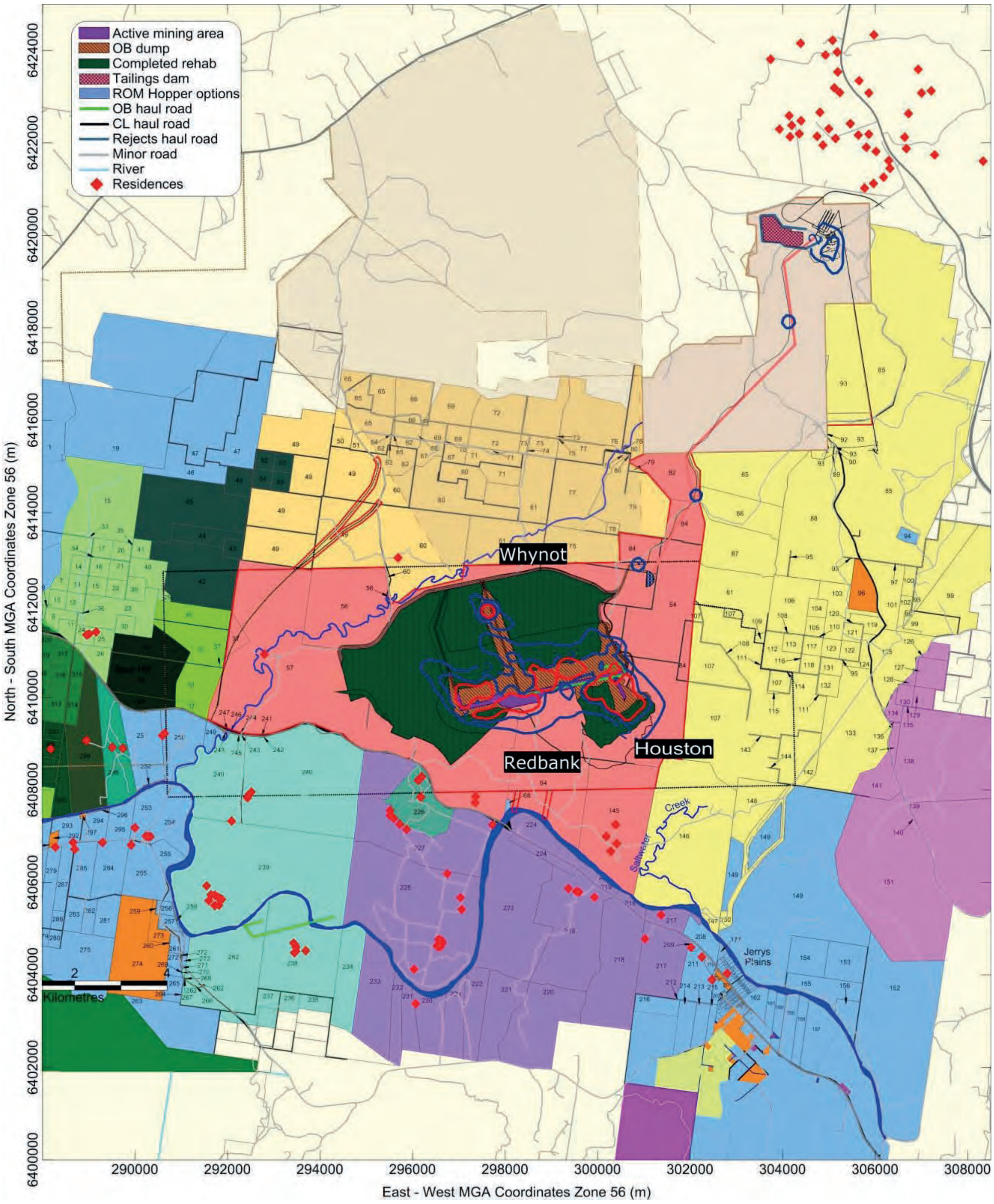
Species: Dust deposition	Location: Drayton South	Scenario: Year 15 (Cumulative)	Percentile:	Averaging Time: Annual
Model Used: CALPUFF	**Units:** $g/m^2/month$	**Guideline:** EPA =4 $g/m^2/month$ (shown as a bold red line)	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-51: Predicted annual average dust deposition concentrations due to emissions from Drayton South and other sources - Year 15



Species:	**Location:**	**Scenario:**	**Percentile:**	**Averaging Time:**
Dust deposition	Drayton South	Year 20 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m^2/month	EPA =4 g/m^2/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-52: Predicted annual average dust deposition concentrations due to emissions from Drayton South and other sources - Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 27 (Cumulative)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	g/m²/month	EPA =4 g/m²/month (shown as a bold red line)	CALMET	K. Hill

Figure 8-53: Predicted annual average dust deposition concentrations due to emissions from Drayton South and other sources - Year 27

8.10 Consideration of Vacant Land

Recent conditions of consent in relation to air quality have included a reference to vacant land in air quality criteria. Specifically, vacant land is considered to be affected if greater than 25% of a property is predicted to exceed the impact assessment criteria.

Additional assessment has been conducted to identify privately-owned land, including vacant land, where more than 25% of the land is predicted to experience dust levels above the relevant criteria and these are listed in **Table 8-11**. Blocks of land that have the same owner and are contiguous have been considered as a single area.

Both the maximum and the 98.6th percentile (6th highest) 24-hour average PM_{10} were investigated, however no privately owned or vacant land met this 98th percentile criteria. The 98th percentile was investigated as it understood that the DP&I use this as guidance for acquisition.

Table 8-11: Privately-owned land area predicted to be impacted greater than 25%

Lot ID	Land Owner	24-hour Average PM_{10} ($\mu g/m^3$) *Assessment criteria = 50 $\mu g/m^3$*						
		Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
226[(a)]	Arrowfield Estates PTY Limited	N	N	N	**Y**	**Y**	N	N

(a) As presented in **Section 8.2**, the residences on Lot 226 are predicted to exceed up to 23 days per year and it proposed that this will be managed through real time monitoring and predictive meteorological systems.

8.11 ROM Transport Options

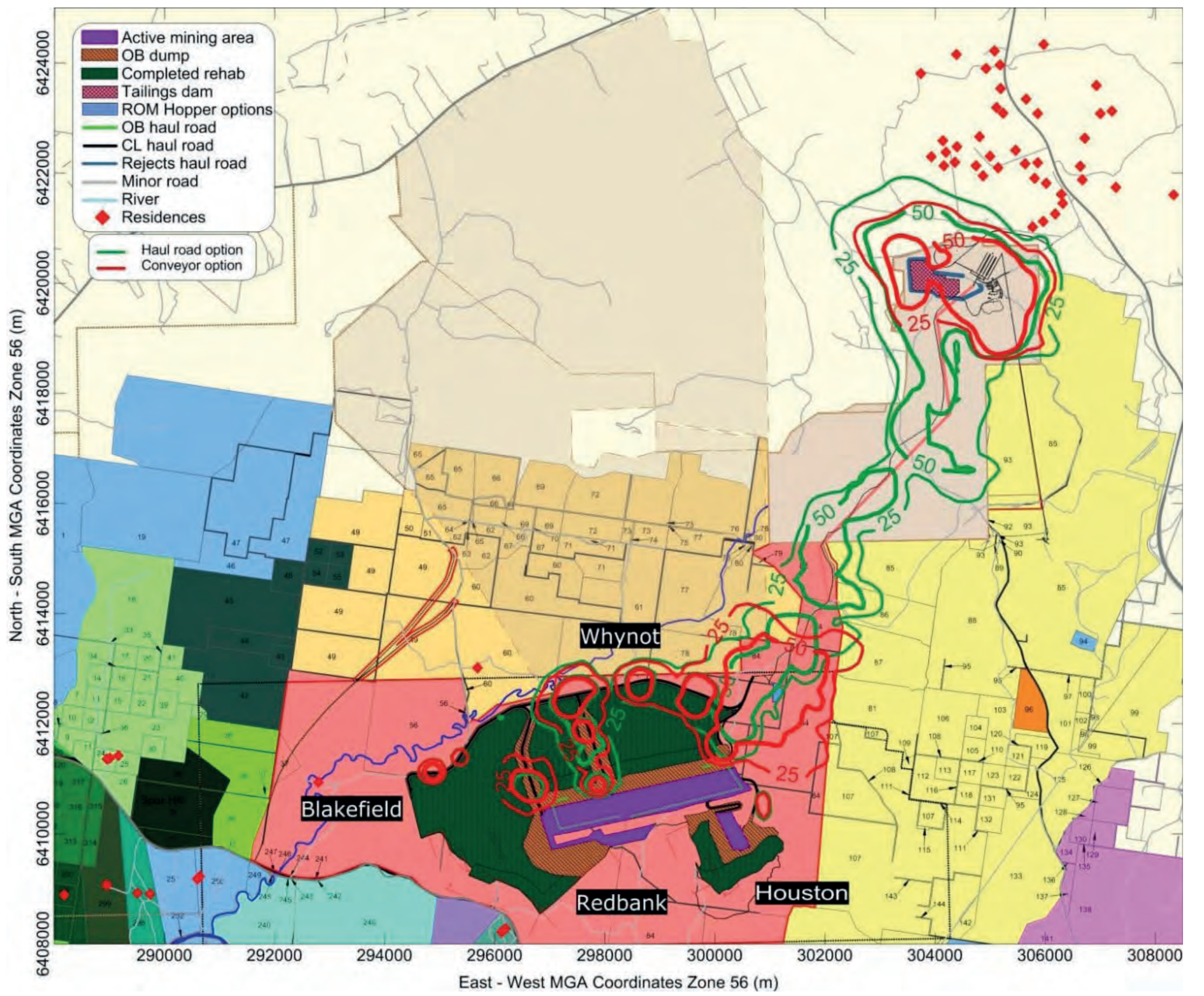
The alternative option of a conveyor to transport ROM coal from the Drayton South Mine area to the Drayton CHPP has been modelled for the year with the highest ROM coal mined (Year 20). Best practice dust controls were assumed, with walls and water sprays at all transfer points and the conveyor was assumed to be entirely enclosed.

The emission inventory for Year 20 hauling, conveying and CHPP is presented in **Table 8-12**. The Project only contributions of the conveyor option are compared with the hauling option (including CHPP) for Year 20 in **Figure 8-54**, **Figure 8-55**, **Figure 8-56** and **Figure 8-57**. The conveyor options total TSP emissions are approximately 370,000 kg/y less than the hauling option.

These contour plots show that the conveyor transport option would likely reduce impacts, in particular across the transport corridor and around the Drayton CHPP. It is noted that the land over which these impacts would be improved largely form part of the existing Drayton and Mt Arthur Coal Mine and Macquarie Generation owned buffer lands. As such there would only be marginal benefits for private land owners if the conveyor option were to be implemented.

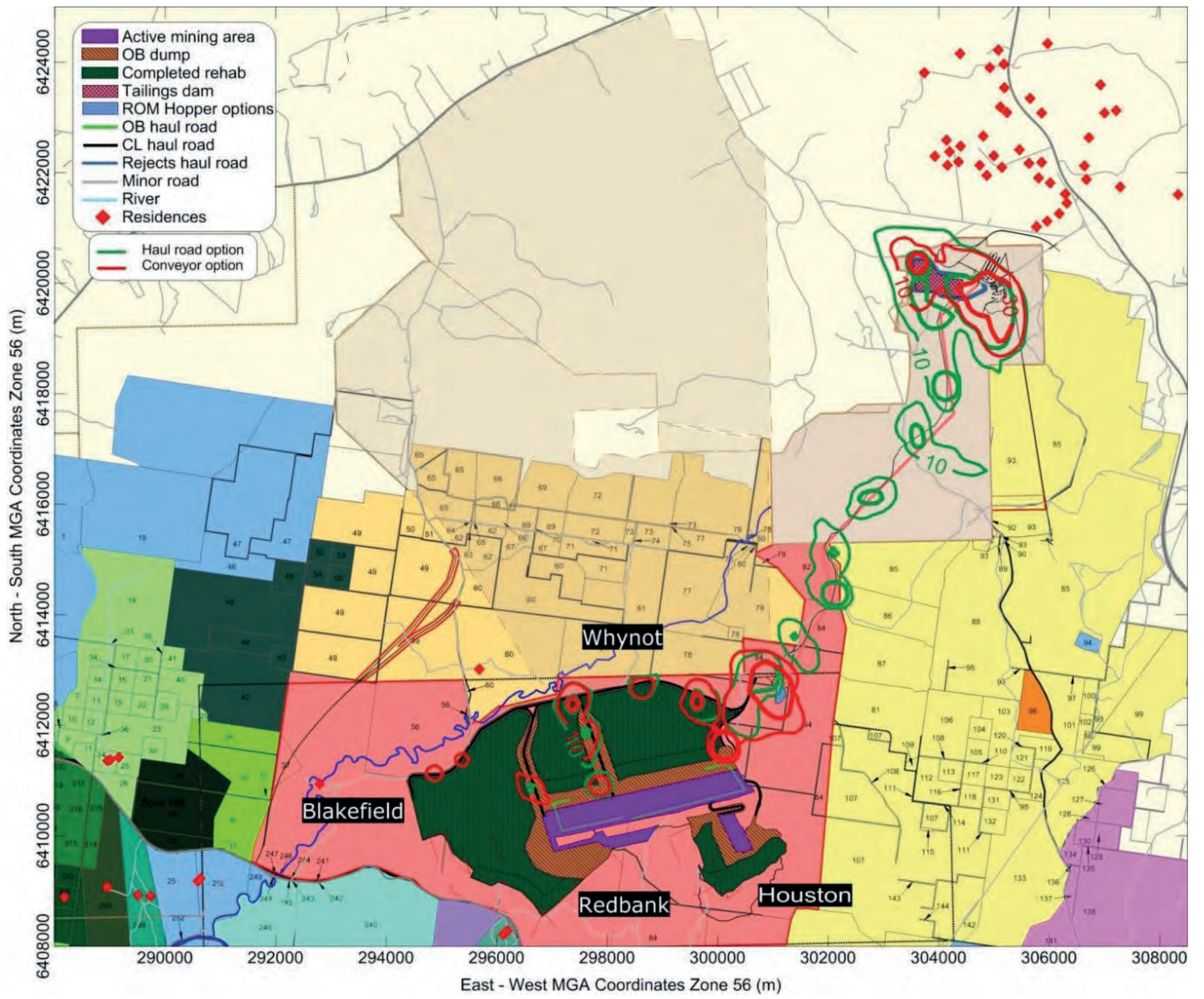
Table 8-12: Summary of estimated TSP emissions from the Conveyor option (kg/y)

ACTIVITY	TSP emissions (kg/y)
WHYNOT	
CL - Hauling ROM coal to pre-conveyor ROM pad (east) - Whynot	38,248
CL - Hauling ROM coal to pre-conveyor ROM pad (middle) - Whynot	114,984
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Whynot	11,813
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Whynot	3,938
BLAKEFIELD	
CL - Hauling ROM coal to pre-conveyor ROM pad - Blakefield	43,605
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Blakefield	1,693
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Blakefield	564
REDBANK	
CL - Hauling ROM coal to pre-conveyor ROM pad - Redbank	61,239
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Redbank	2,700
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Redbank	900
HOUSTON	
CL - Hauling ROM coal to ROM pad - Houston	34,015
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Houston	2,966
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Houston	6,391
ROM/REJECTS HANDLING	
CL - Dozers ROM Coal Handling & Rejects - CHPP ROM stockpiles	81,371
CL - Loading from pre-conveyor ROM stockpile (25% of total ROM)	15,977
CL - Unloading from pre-conveyor ROM stockpile to hopper (25% of total ROM)	15,977
CL - Hopper transfer to conveyor at pre-conveyor ROM pad	402
CL - Conveying to CHPP stockpile	0
CL - Conveyor transfer at CHPP ROM stockpile	402
CL - Loading from CHPP ROM stockpile	63,908
CL - Unloading from CHPP ROM stockpile to CHPP	63,908
CL- Handle coal at CHPP	1,341
CL - Loading rejects	-
CL - Transporting rejects	78,337
CL - Unloading rejects	-
PRODUCT COAL	
CL - Loading product stockpile	533
CL - Loading product coal to trains	711
WIND EROSION	
WE - ROM stockpiles	7,358
WE - ROM @ CHPP stockpiles	7,358
WE - Product stockpiles	52,560
TOTAL	**713,199**



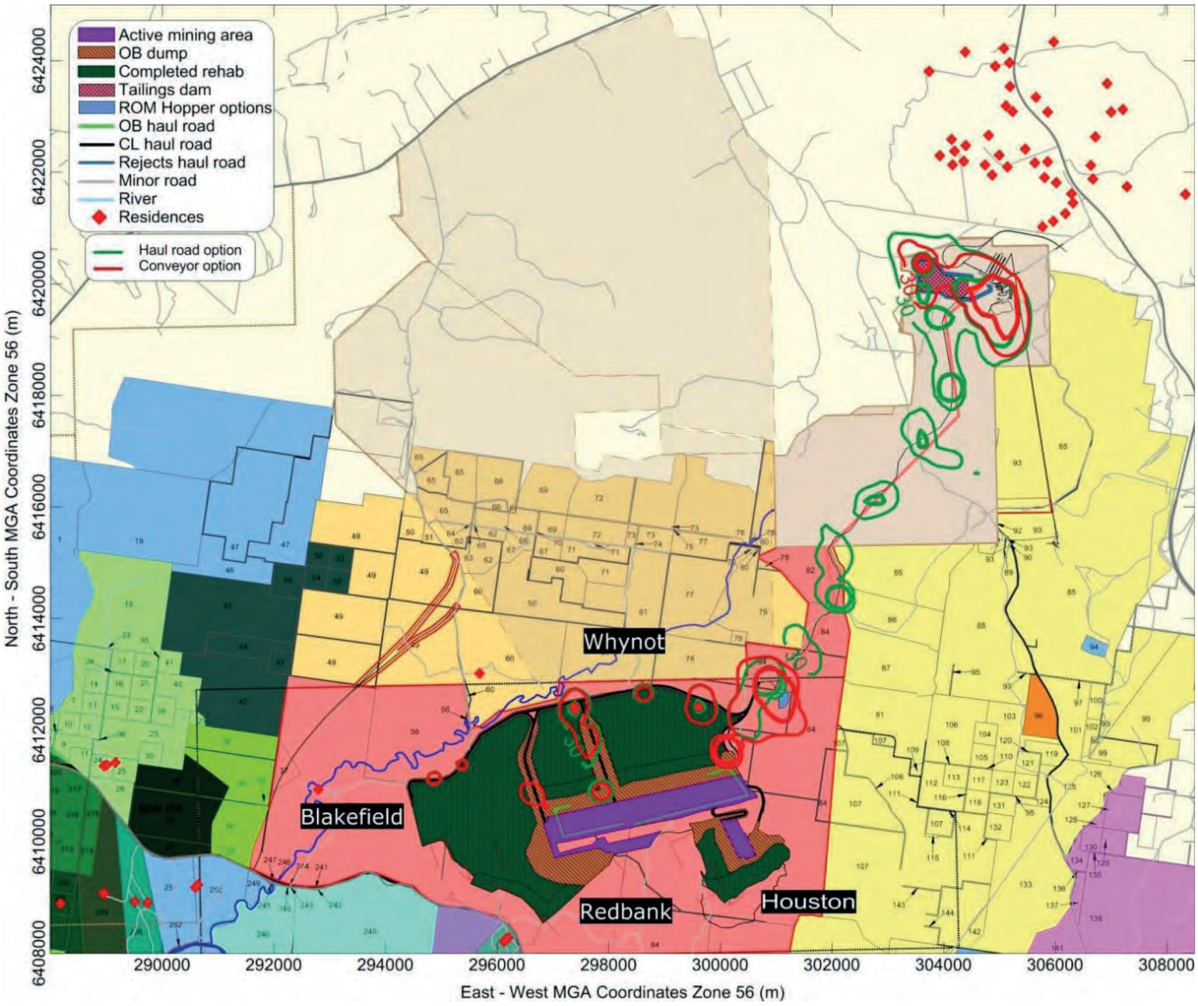
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 20 – Conveyor vs. Truck haul (Project Only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m^3	N/A	CALMET	K. Hill

Figure 8-54: Comparison of predicted maximum 24-hour average PM_{10} concentrations due to emissions from Conveyor Option and Hauling Option –Year 20



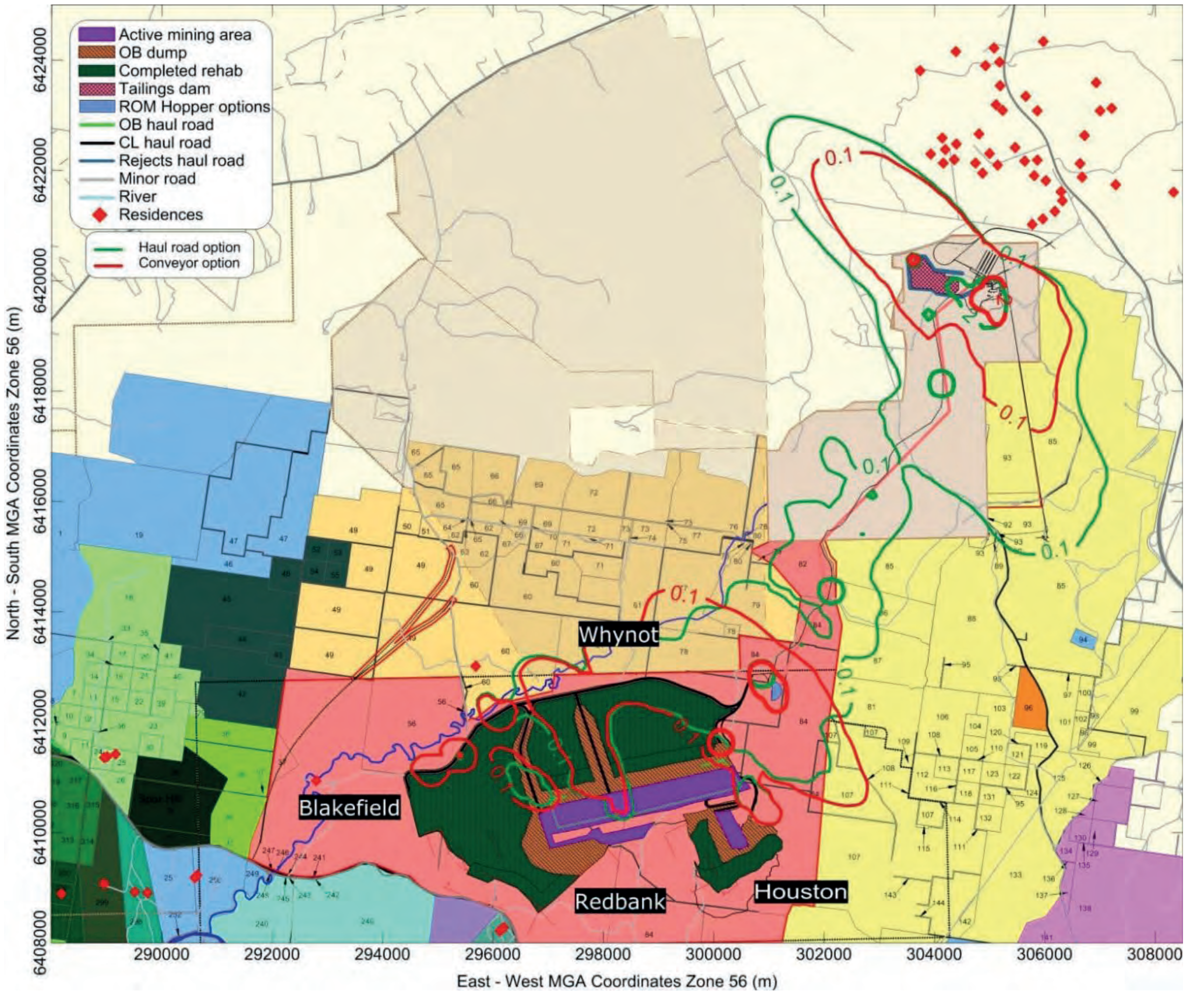
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 20 – Conveyor vs. Truck haul (Project Only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m^3	N/A	CALMET	K. Hill

Figure 8-55: Comparison of predicted annual average PM_{10} concentrations due to emissions from Conveyor Option and Hauling Option –Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
TSP	Drayton South	Year 20 – Conveyor vs. Truck haul (Project Only)		Annual
Model Used: CALPUFF	**Units:** µg/m³	**Guideline:** N/A	**Met Data:** CALMET	**Plot:** K. Hill

Figure 8-56: Comparison of predicted annual average TSP concentrations due to emissions from Conveyor Option and Hauling Option –Year 20



Species:	Location:	Scenario:	Percentile:	Averaging Time:
Dust deposition	Drayton South	Year 20 – Conveyor vs. Truck haul (Project Only)		Annual
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	$g/m^2/month$	EPA =2 $g/m^2/month$ (shown as a bold red line)	CALMET	K. Hill

Figure 8-57: Comparison of predicted annual average dust deposition concentrations due to emissions from Conveyor Option and Hauling Option–Year 20

8.12 Spontaneous Combustion

8.12.1 Introduction

Spontaneous combustion occurs when coal and other carbonaceous materials undergo natural oxidation and generate heat. Under the right conditions, the heat from the oxidation reaction can build-up to a point where the coal and contaminated overburden materials will ignite and burn. For self-heating to occur, the composition of the coal must be such that low temperature oxidation can occur. Further the material must be confined in such a way that heat from the oxidation is trapped, allowing the temperature to build-up, but not so confined as to preclude the ingress of oxygen to the combustible material at a rate sufficient to promote the combustion and release of heat energy. The ventilation of the coal must not be rapid as to remove the heat.

Once the coal reaches a high enough temperature it will liberate smoke (i.e. fine particulate matter), steam and volatile organic compounds, some of which are odorous and some of which are harmful.

As part of the Geochemistry Impact Assessment undertaken for the EA an assessment was undertaken on the propensity of the coal and reject materials from Drayton South to spontaneously combust. This assessment reports that the sulfur content of the coal and reject material at Drayton South, which is mined from the Wittingham Coal Measures is very low (generally well under 0.5%) and most of the sulfur is organic with very minor pyritic material. Within the interburden / overburden there is very little sulfur with several samples returning results below the level of detection (i.e. <0.01%). As such there is a very low probability for spontaneous combustion at Drayton South. Further details with regard to the potential for spontaneous combustion to occur at the Project can be found in the Geochemistry Impact Assessment which forms **Appendix P** of the Environmental Assessment. Based on this Geochemistry Impact Assessment, limited management measures will need to be employed to minimise spontaneous combustion and the effect on local air quality at Drayton South.

8.12.2 Potential air quality impacts

Spontaneous combustion results in the release of toxic and/or odorous gases:

- Particulates;
- Sulphur dioxide (SO_2);
- Oxides of nitrogen (NO_x);
- Hydrogen sulphide (H_2S);
- Carbon monoxide (CO);
- Polycyclic aromatic hydrocarbons (PAHs); and
- Volatile organic compounds (VOCs).

In addition, greenhouse gas (GHG) emissions will also be released:

- Carbon dioxide (CO_2); and
- Methane (CH_4).

Detailed monitoring was completed by CSIRO under the Australian Coal Association Research Program (ACARP) at the existing Drayton Mine where spontaneous combustion does occur as a result of mining in the Greta Coal measures (**Carras et al., 1999**). The CSIRO monitoring involved measuring concentrations of CH_4, CO_2, CO and Non-Methane Hydrocarbons (NMHC) (47 species) and 15 species of PAHs both inside the bulldozer cabin and in the external air.

Whilst these samples were taken primarily to ascertain occupational exposures than to test for compliance with ambient air quality criteria, further analysis of these data indicated that whilst it is unlikely that relevant air quality criteria would be exceeded, there may be a detectable odour in the residential areas on occasion (**Holmes Air Sciences, 2007a**).

As the odour emission rate cannot be accurately quantified, it is difficult to apply the EPA's standard assessment criterion. In these circumstances, the most practical approach appears to be to ensure that odour emissions are kept to the minimum practical level. This is the same as requiring that spontaneous combustion be controlled to the maximum extent that it can be practically controlled. Drayton Mine's current efforts to do this are discussed in the following section. These measures will continue to be undertaken as required at Drayton Mine whilst mining in the Greta Coal measures is undertaken. Given the very low probability for spontaneous combustion at Drayton South where mining is in the Wittingham Coal measures these management efforts will not be necessary.

8.12.3Monitoring and control of spontaneous combustion

Spontaneous combustion is controlled by avoiding disposing of combustible material in waste emplacement areas and emplacing combustible materials in locations where oxygen ingress is minimised. That is, combustible material must be disposed of in impermeable cells.

Drayton Mine currently employs these principles to minimise the occurrence of spontaneous combustion and has had significant success in reducing the area affected by spontaneous combustion. However, there are practical impediments to application of these principles. Areas that are currently being mined cannot be capped and in some cases, it is not practical to cap areas which will need to be reworked in the near or medium term. Spontaneous combustion is not expected to be an issue at the Drayton South mine, however if does occur then the management measures currently in place at existing Drayton Mine would be employed.

Drayton Mine is required to monitor and manage spontaneous combustion throughout the life of the Project. This includes:

- Managing spontaneous combustion in accordance with the approved spontaneous combustion management plan;
- Capping of all areas of spontaneous combustion with inert material;
- Monitoring and placement of coal stockpiles and their temperature; and
- Monitoring and reporting of spontaneous combustion, including:
  - Quarterly mapping of areas affected by spontaneous combustion;
  - Quarterly reporting to EPA of areas affected by spontaneous combustion and mitigation measures implemented and their effectiveness;
  - Monthly inspections of the mining operations; and
  - Compilation and enforcement of monthly action plans.

8.13 Construction Phase and Realignment of Edderton Road

As discussed in **Section 2**, the Project also includes additional infrastructure and construction/development activities, which includes the realignment of Edderton Road. The Edderton road construction works are anticipated to be completed during 2014, and last for approximately 15 months.

As shown on **Figure 8-58,** there are two options under consideration. While dust would be generated from earthworks associated with the proposed relocation, there are a number of safeguards that can be put in place during these types of operations to ensure there is no detrimental impact on the local air quality. Therefore the impacts have not been specifically modelled.

Nominal equipment to be used during the construction works will include:

- Scrapers;
- Graders;
- Excavators;
- Loaders;
- Trucks;
- Crusher
- Backhoes;
- Crane;
- Smooth drum rollers;
- Pad foot rollers;
- Flat bed trucks;
- Fuel Truck;
- Water carts; and
- Dozers.

From an air quality perspective it is important to consider the potential emissions that would occur during construction. While dust emissions from construction activities can have impacts on local air quality, impacts are typically of a short duration and relatively easy to manage through commonly applied dust control measures. Procedures for controlling dust impacts during construction would include, but not necessarily be limited to the following:

Clearing/Excavation

Emissions from vegetation stripping topsoil clearing and excavation may occur, particularly during dry and windy conditions. Emissions would be effectively controlled by increasing the moisture content of the soil/surface (i.e. through the use of water carts/trucks). Other controls that would be undertaken include:

- modifying working practices by limiting excavation during periods of high winds; and
- limiting the extent of clearing of vegetation and topsoil to the designated footprint required for construction and appropriate staging of any clearing.

Quarry Excavation

Materials for the construction of haul roads and light vehicle access roads are expected to be sourced, in part, from an existing quarry within the transport corridor located on land owned by Anglo American. Limited blasting and crushing will be required for the production of material in the quarry. Operations within the quarry will be during daylight hours only during the initial construction phase.

Controls that would be undertaken include:

- Use of water carts as required;

- Trucks entering and leaving the site being well maintained in accordance with the manufacturer's specification to comply with all relevant regulations;
- Truck movements controlled on site and restricted to designated roadways;
- Truck wheel washes or other dust removal procedures being installed to minimise transport of dust offsite; and
- Modifying activities during periods of high wind.

Road Realignments/Bulk Earthworks

The use of earth moving equipment can be a significant source of dust, and emissions would be controlled through the use of water sprays.

Haulage, Heavy Plant and Equipment

Vehicles travelling over paved or unpaved surfaces tend to produce wheel generated dust. The following measures would be implemented during construction to minimise dust emissions from these activities:

- all vehicles on-site would be confined to designated routes with speed limits enforced;
- trips and trip distances would be controlled and reduced where possible, for example by coordinating delivery and removal of materials to avoid unnecessary trips; and
- when conditions are excessively dusty and windy, a water cart/truck (for water spraying of travel routes) would be used.

Wind Erosion

Wind erosion from exposed surfaces during construction would be controlled as part of the best practice environmental management of the site. Wind erosion from exposed ground would be limited by avoiding unnecessary vegetation clearing and by progressively rehabilitating exposed areas as quickly as possible (e.g. through the use of a cover crop). Wind erosion from temporary stockpiles would be limited by minimising the number of stockpiles on-site and minimising the number of work faces on stockpiles. In addition, if stockpiles are left for a period greater than six weeks the area will be seeded with cover crop.

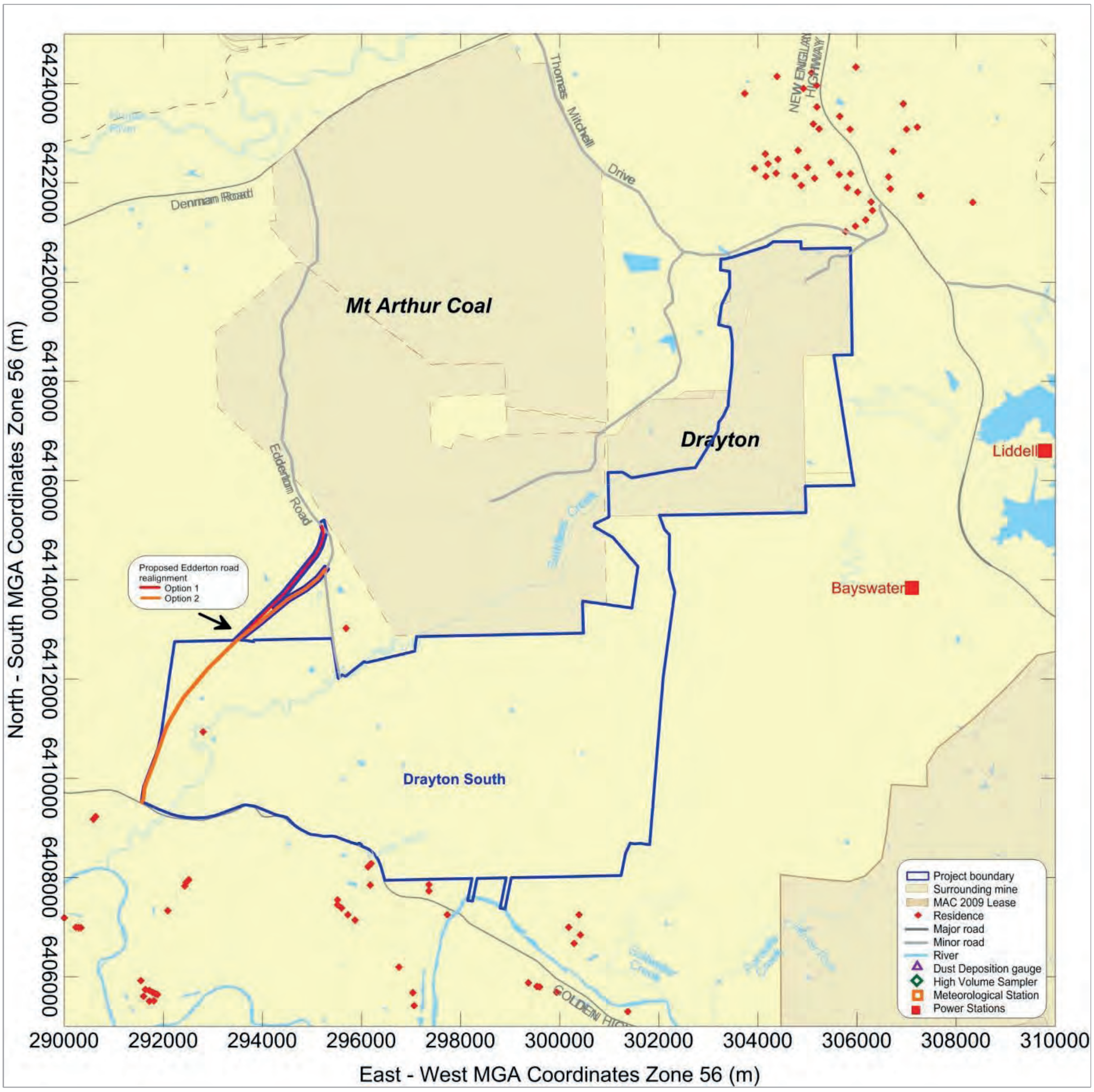


Figure 8-58: Edderton Road – proposed relocation options

9 MONITORING AND MANAGEMENT MEASURES

The Project has the potential to generate dust. It is therefore necessary to take reasonable and practicable measures to prevent or minimise dust impacts at all sensitive residences and in particular those residences predicted to experience 24-hour PM_{10} concentrations above the impact assessment criteria.

Anglo American is committed to best practice dust management and control. This includes the application of dust controls in accordance with best practice and real-time monitoring and a proactive dust management system.

The real-time monitoring and proactive dust management system approach would enable Anglo American to pro-actively manage the short-term impacts of the Project and minimise dust impacts at sensitive residences to the greatest practical extent.

9.1 Real-Time Dust Monitoring

A broad overview of the real-time monitoring and proactive dust management system is provided, however further details would be provided in the Air Quality Management Plan (AQMP) which would be updated for the Project.

- Three (3) continuous monitors for PM_{10} would be deployed in areas where worst case impacts have been predicted (i.e. south/south-west and south-east of Drayton South and north-east of existing Drayton Mine). A link could also be established with at least one of the Upper Hunter Air Quality Monitoring Network sites, for example, Jerry's Plain.
- The on-site meteorological monitoring station would be used in conjunction with the real-time dust monitors to identify the source type and location which is contributing to dust emissions. The meteorological monitoring station would also help initiate response to adverse weather conditions.

The continuous PM_{10} monitors would be connected to a modem which would allow recorded concentrations to be relayed, in (near) real time, to an IP address where the data would be stored in a customised database. The PM_{10} concentrations can also be presented graphically on a website to enable the dust emissions from the site to be visually assessed on a continuous basis.

The recorded PM_{10} concentrations at the management site would be assessed to determine if pre-defined trigger levels have been breached and when action is required. SMS notification will be sent to relevant personnel when defined trigger levels are breached.

Response levels would be defined (i.e. investigation and action levels) which would require a response from the relevant personnel. Associated with each action level is a trigger level or response level, which will determine the course of action, taken by accountable personnel. Trigger levels, action levels and responses (i.e. TARP – Trigger Action Response Plan) would be outlined in the AQMP.

The real-time monitoring and proactive dust management system allows relevant personnel to react when short term trigger levels are breached which are set at a level that allows proactive dust management for longer term impacts (24-hour) and ultimately annual averages.

9.2 Predictive Meteorological Forecasting System

A meteorological forecasting system can also be used as part of the real-time monitoring and proactive dust management system. This system would predict meteorological conditions for the coming day to determine, one day in advance, where the risk of dust emissions may occur (e.g. based on wind speed, direction, rainfall and atmospheric stability).

The predictive meteorological forecasting system would work in conjunction with the real-time monitoring and proactive dust management system, providing an alert for the appropriate personnel to review the real-time data and manage the intensity of activities for that day, increase controls or limit activity to various areas of the site.

10 GREENHOUSE GAS EMISSIONS

10.1 Introduction

GHG emissions have been estimated based on the methods outlined in the following documents:

- The World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) Greenhouse Gas Protocol *The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard Revised Edition* **(WRI/WBCSD, 2004**);
- *National Greenhouse and Energy Reporting (Measurement) Determination 2008*; and
- The Commonwealth Department of Climate Change and Energy Efficiency (DCCEE) *National Greenhouse Accounts* (NGA) *Factors 2011* (**DCCEE, 2011)**.

The GHG Protocol establishes an international standard for accounting and reporting of GHG emissions. The GHG Protocol has been adopted by the International Standard Organisation, endorsed by GHG initiatives (such as the Carbon Disclosure Project) and is compatible with existing GHG trading schemes.

Three 'scopes' of emissions (scope 1, scope 2 and scope 3) are defined for GHG accounting and reporting purposes, as described below. This terminology has been adopted in Australian GHG reporting and measurement methods and has been employed in this assessment. The 'scope' of an emission is relative to the reporting entity. Indirect scope 2 and scope 3 emissions will be reportable as direct scope 1 emissions from another facility.

1) Scope 1: Direct Greenhouse Gas Emissions

Direct GHG emissions are defined as those emissions that occur from sources that are owned or controlled by the reporting entity. Direct GHG emissions are those emissions that are principally the result of the following types of activities undertaken by an entity:

- Generation of electricity, heat or steam. These emissions result from combustion of fuels in stationary sources.
- Physical or chemical processing. Most of these emissions result from manufacture or processing of chemicals and materials (e.g. the manufacture of cement, aluminum, etc.).
- Transportation of materials, products, waste and employees. These emissions result from the combustion of fuels in entity owned/controlled mobile combustion sources (e.g. trucks, trains, ships, aeroplanes, buses and cars).
- Fugitive emissions. These emissions result from intentional or unintentional releases (e.g. equipment leaks from joints, seals, packing, and gaskets; CH_4 emissions from coal mines and venting); hydroflurocarbon emissions during the use of refrigeration and air conditioning equipment; and CH_4 leakages from gas transport.

2) Scope 2: Energy Product Use Indirect Greenhouse Gas Emissions

Scope 2 emissions are a category of indirect emissions that account for GHG emissions from the generation of purchased energy products (principally, electricity, steam/heat and reduction materials used for smelting) by the entity.

Scope 2 in relation to coal mines typically covers purchased electricity, defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity.

3) Scope 3: Other Indirect Greenhouse Gas Emissions

Scope 3 emissions are defined as those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Some examples of scope 3 activities provided in the GHG Protocol are extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

In the case of the Project, scope 3 emissions will include emissions associated with the extraction, processing and transport of diesel, and the transportation and combustion of product coal. The GHG Protocol provides that reporting scope 3 emissions is optional. If an organisation believes that scope 3 emissions are a significant component of the total emissions inventory, these can be reported along with scope 1 and scope 2. However, the GHG Protocol notes that reporting scope 3 emissions can result in double counting of emissions and can also make comparisons between organisations and/or products difficult because reporting is voluntary. Double counting needs to be avoided when compiling national (country) inventories under the Kyoto Protocol. The GHG Protocol also recognises that compliance regimes are more likely to focus on the "point of release" of emissions (i.e. direct emissions) and/or indirect emissions from the purchase of electricity.

10.2 Greenhouse Gas Emission Estimates

Emissions of CO_2 and CH_4 would be the most significant GHG emissions for the Project. These gases are formed and released during the combustion of fuels used on-site and from fugitive emissions occurring during the mining process, due to the liberation of CH_4 from coal seams.

Inventories of GHG emissions can be calculated using published emission factors. Different gases have different greenhouse warming effects (referred to as global warming potentials) and emission factors take into account the global warming potentials of the gases created during combustion. The estimated emissions are referred to in terms of carbon dioxide equivalent (CO_2-e) emissions by applying the relevant global warming potential. The GHG assessment has been conducted using the NGA Factors, published by the **DCCEE** (**2011**).

Project-related GHG sources included in the assessment are as follows:

- fuel consumption (diesel) during mining operations – scope 1;
- release of fugitive CH_4 during mining – scope 1;
- emissions associated with the loss of carbon through vegetation clearing – scope 1;
- indirect emissions associated with on-site electricity use – scope 2;
- indirect emissions associated with the production and transport of fuels – scope 3;
- emissions from coal transportation – scope 3; and
- emissions from the use of the product coal – scope 3.

A summary of the annual GHG emissions is provided in **Table 10-1**. Detailed emission calculations are provided in **Appendix G**.

Emissions from the shipping of product coal are not included in this assessment due to the uncertainties in emission estimates, including uncertainty in future export destinations and limited data on emission factors and/or fuel consumption for ocean going vessels.

Table 10-1: Summary of Estimated CO_2-e (tonnes) – All Scopes

	Scope 1 Emissions (t CO2-e)				Scope 2 Emissions (t CO2-e)	Scope 3 Emissions (t CO2-e)				
Year	Diesel	Fugitive Methane	Explosive ANFO	*Total*	Electricity	Diesel	Electricity	Coal Burning	Rail	*Total*
2014	141,928	245,430	1,474	*388,831*	43,047	10,823	8,706	10,287,399	13,779	*10,320,707*
2015	150,778	244,755	5,987	*401,520*	66,898	11,498	13,530	9,375,279	12,557	*9,412,865*
2016	144,702	315,000	7,775	*467,477*	61,853	11,035	12,510	10,837,032	14,515	*10,875,092*
2017	136,600	315,000	7,723	*459,323*	69,505	10,417	14,057	11,827,686	15,842	*11,868,002*
2018	131,416	235,159	3,474	*370,049*	69,505	10,022	14,057	12,702,275	17,014	*12,743,368*
2019	130,024	236,578	3,304	*369,906*	69,505	9,915	14,057	9,914,776	13,280	*9,952,029*
2020	77,091	252,636	3,275	*333,002*	69,505	5,879	14,057	10,132,749	13,572	*10,166,257*
2021	76,960	268,014	3,300	*348,274*	86,652	5,869	17,525	10,097,395	13,525	*10,134,314*
2022	77,122	239,383	3,231	*319,736*	86,652	5,881	17,525	10,075,569	13,495	*10,112,471*
2023	76,292	222,516	3,262	*302,070*	86,652	5,818	17,525	6,852,286	9,178	*6,884,807*
2024	76,231	211,604	3,317	*291,152*	86,652	5,813	17,525	8,065,285	10,803	*8,099,427*
2025	76,497	202,493	3,148	*282,137*	86,652	5,834	17,525	8,071,369	10,811	*8,105,539*
2026	76,141	193,832	3,101	*273,075*	86,652	5,806	17,525	8,088,272	10,834	*8,122,437*
2027	75,492	218,177	3,128	*296,797*	86,652	5,757	17,525	8,209,509	10,996	*8,243,787*
2028	75,706	207,455	3,119	*286,280*	86,652	5,773	17,525	8,208,396	10,994	*8,242,689*
2029	75,963	208,924	2,997	*287,884*	86,652	5,793	17,525	8,275,523	11,084	*8,309,925*
2030	77,674	203,707	2,988	*284,370*	86,652	5,923	17,525	8,359,995	11,198	*8,394,641*
2031	78,503	230,617	3,016	*312,135*	86,652	5,987	17,525	9,191,488	12,311	*9,227,311*
2032	82,051	238,614	3,101	*323,766*	86,652	6,257	17,525	10,244,555	13,722	*10,282,059*
2033	80,838	262,182	3,088	*346,108*	86,652	6,165	17,525	10,234,294	13,708	*10,271,691*
2034	77,201	240,799	3,084	*321,083*	86,652	5,887	17,525	10,178,198	13,633	*10,215,243*
2035	77,298	243,230	3,096	*323,624*	86,652	5,895	17,525	10,236,773	13,711	*10,273,904*
2036	78,024	197,972	3,067	*279,063*	86,652	5,950	17,525	8,186,350	10,965	*8,220,790*
2037	75,585	190,342	3,101	*269,027*	86,652	5,764	17,525	8,146,360	10,911	*8,180,560*
2038	75,499	193,087	2,940	*271,526*	86,652	5,757	17,525	8,167,049	10,939	*8,201,271*
2039	41,414	54,548	1,669	*97,631*	86,652	3,158	17,525	3,458,811	4,633	*3,484,127*
2040	23,916	48,356	679	*72,952*	86,652	1,824	17,525	2,438,824	3,267	*2,461,440*
Total	**2,366,944**	**5,920,412**	**91,442**	**8,378,798**	**2,182,863**	**180,501**	**441,478**	**239,863,496**	**321,277**	**240,806,752**

Note: Totals may differ to the sum of the columns due to rounding and significant figures.

10.3 Impact on the Environment

According to the Intergovernmental Panel of Climate Change's (IPCC) Fourth Assessment Report, global surface temperature has increased 0.74 ± 0.18ºC during the 100 years ending 2005 (**IPCC, 2007a**). The IPCC has determined *"most of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations".* "Very likely" is defined by the IPCC as greater than 90% probability of occurrence (**IPCC, 2007b**).

Climate change projections specific to Australia have been determined by the CSIRO, based on the following global emissions scenarios predicted by the IPCC (**CSIRO, 2007**):

- A1F1 (high emissions scenario) – assumes very rapid economic growth, a global population that peaks in mid-century and technological change that is fossil fuel intensive.
- A1B (mid emissions scenario) – assumes the same economic and population growth as A1F1, with a balance between fossil and non-fossil fuel intensive technological changes.
- B1 (low emissions scenario) – assumes the same economic and population growth as A1F1, with a rapid change towards clean and resource efficient technologies.

For the global emissions scenarios described above, the projected changes in annual temperature relative to 1990 levels for Australian cities for 2030 and 2070 are presented in **Table 10-2** as determined by the **CSIRO** (**2007**). The towns/cities presented in **Table 10-2** are those closest to the Project for which results are available.

Table 10-2: Projected Changes in Annual Temperature (relative to 1990)

Location	2030 - A1B (mid-range emissions scenario)	2070 - B1 (low emissions scenario)	2070 - A1F1 (high emissions scenario)
	Temperature (°C)		
Brisbane	0.7 - 1.4	1.1 - 2.3	2.1 - 4.4
Dubbo	0.7 - 1.5	1.2 - 2.5	2.2 - 4.8
St George (Queensland)	0.7 - 1.6	1.2 - 2.7	2.4 - 5.2
Sydney	0.6 - 1.3	1.1 - 2.2	2.1 - 4.3

Notes: Range of values represents the 10th and 90th percentile results.
For 2030, only A1B results are shown as there is little variation in projected results for the global emission scenarios A1B, B1 and A1F1 (**CSIRO, 2007**).

Source: **CSIRO (2007)** *Climate Change in Australia – Technical Report 2007*, Commonwealth Scientific and Industrial Research Organisation.

The CSIRO also details projected changes to other meteorological parameters (for example rainfall, potential evaporation, wind speed, relative humidity and solar radiation) and the predicted changes to the prevalence of extreme weather events (for example droughts, bush fires and cyclones).

The potential social and economic impacts of climate change to Australia are detailed in the Garnaut Climate Change Review (**Garnaut, 2008**), which draws on IPCC assessment work and the CSIRO climate projections. The Garnaut review details the negative and positive impacts associated with predicted climate change with respect to:

- agricultural productivity;
- water supply infrastructure;
- urban water supplies;
- buildings in coastal settlements;
- temperature related deaths;

- ecosystems and biodiversity; and
- geopolitical stability and the Asia-Pacific region.

The Project's contribution to projected climate change, and the associated impacts, would be in proportion with its contribution to global GHG emissions. Average annual scope 1 emissions from the Project (0.31 Mt CO_2-e) would represent approximately 0.052% of Australia's commitment under the Kyoto Protocol (591.5 Mt CO_2-e) and a very small portion of global greenhouse emissions, given that Australia contributed approximately 1.5% of global GHG emissions in 2005 (**Commonwealth of Australia, 2011**).

A comparison of predicted annual GHG emissions from the Project with global, Australian and NSW emissions inventories are presented in **Table 10-3**.

Table 10-3: Comparison of Greenhouse Gas Emissions

Geographic coverage	Source coverage	Timescale	Emission Mt CO_2-e	Reference
Project	Scope 1 only	Average annual	0.31	This report.
Global	Consumption of fossil fuels	Total since industrialisation 1750 - 1994	865,000	IPCC (2007a) Figure 7.3 converted from Carbon unit basis to CO_2 basis. Error is stated greater than ±20%.
Global	CO_2-e emissions	2005	35,000	Based on Australia representing 1.5% of global emissions (Commonwealth of Australia, 2011). Australian National Greenhouse Gas Inventory (2005) taken from http://www.ageis.greenhouse.gov.au/
Global	CO_2-e emission increase 2004 to 2005	2005	733	IPCC (2007a) From tabulated data presented in Table 7.1 on the basis of an additional 733 Mt/a. Data converted from Carbon unit basis to CO_2 basis.
Australia	1990 Base	1990	547.7	Taken from the National Greenhouse Gas Inventory (2009) http://www.ageis.greenhouse.gov.au/
Australia	Kyoto target	Average annual 2008 - 2012	591.5	Based on 1990 net emissions multiplied by 108% Australia's Kyoto emissions target.
Australia	Total	2009	564.5	Taken from the National Greenhouse Gas Inventory (2009) http://www.ageis.greenhouse.gov.au/
NSW	Total	2009	160.5	Taken from the National Greenhouse Gas Inventory (2009) http://www.ageis.greenhouse.gov.au/

The commitment from the Australian Government to reduce GHG emissions is proposed to be achieved through the introduction of the Australian Government's proposed carbon pricing mechanisms. From 1 July 2012, this will involve a fixed price on GHG emissions, with no cap on Australia's GHG emissions, or emissions from individual facilities (**Commonwealth of Australia, 2011**).

From 1 July 2015, an emissions trading scheme is proposed to be implemented. As such, Australia's GHG emissions, inclusive of emissions associated with the Project, would be capped at a level specified by the Australian Government. Under the emissions trading scheme, there will specifically be no limit on the level of GHG emissions from individual facilities, with the incentive for facilities to reduce their GHG emissions driven by the carbon pricing mechanism (**Commonwealth of Australia, 2011**).

10.4 Greenhouse Gas Emissions Intensity

The estimated GHG emissions intensity of the Project is approximately 0.083 t CO_2-e/t saleable coal (this includes all scope 1 emissions) (**Figure 10-1**).

The largest source of scope 1 GHG emissions is fugitive CH_4 emissions (approximately 70%) (refer **Table 10-1**). These emissions have likely been over-estimated by using the NGA Factors default emission factor in the absence of site specific data.

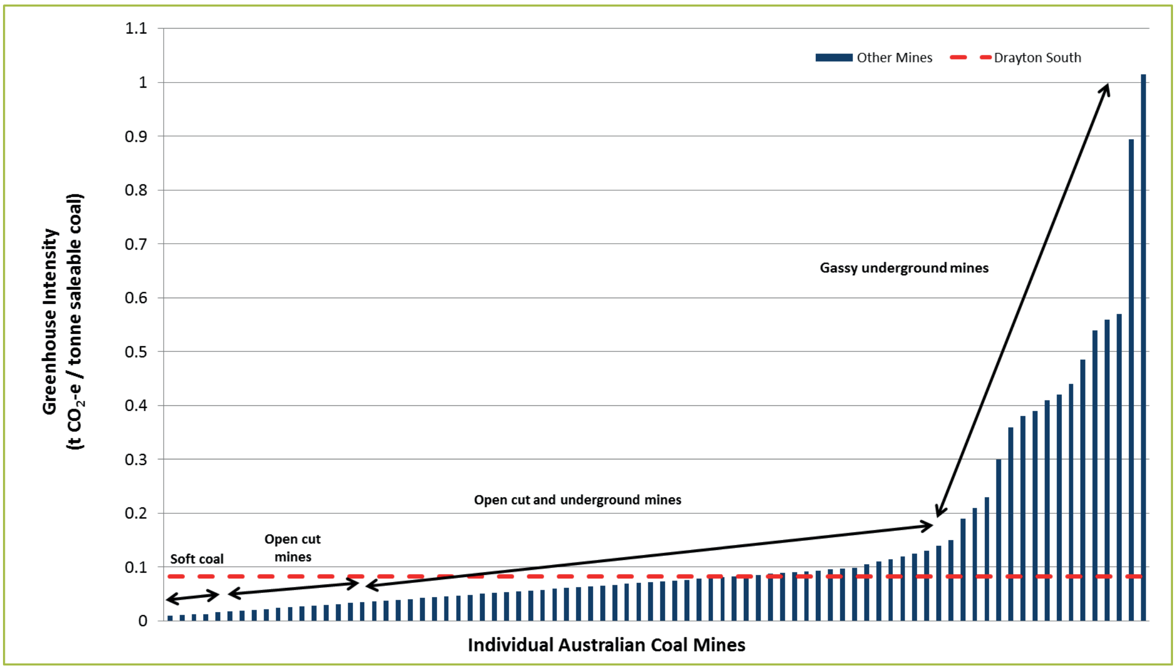


Figure 10-1: Greenhouse Gas Intensity Comparison

10.5 Greenhouse Gas Management

GHG management measures are current employed at the Drayton Mine which is described in the Drayton Greenhouse Gas Management Plan (GHGMP) (**Drayton, 2012**). Drayton has implemented a number of measures to minimise GHG emissions. These measures are described below:

- Greenhouse gas emissions and energy use are monitored and reviewed on a monthly basis and considered in the internal business planning;
- Set energy efficiency and greenhouse gas emission targets across all operations; and
- Inclusion of electricity meters for key equipment and processes.

The effectiveness of these measures to reduce GHG emissions (and energy consumption) will be monitored, as Anglo American annually estimates GHG emissions and energy consumption in accordance with National Greenhouse and Energy Reporting and Energy Efficiency Operations requirements.

11 CONCLUSIONS

This assessment has investigated the potential air quality impacts of the Drayton South Coal Project with respect to air quality and greenhouse gas emissions.

Dispersion modelling has been used to predict off-site dust concentration and dust deposition levels due to the dust generating activities that would occur as a result the Project. Emissions inventories were developed for years 3, 5, 10, 15 and 27 of the Project. The dispersion conditions for the area where characterised based on regional and local meteorological data, generated using a diagnostic meteorological modelling system known as CALMET. The annual winds predicted by CALMET correlate well with the windroses presented for the Saddlers Creek meteorological station in 2005 and nearby meteorological station at Macleans Hill. CALPUFF was used to predict the maximum 24-hour PM_{10}, annual average PM_{10}, annual average TSP and annual average dust deposition (insoluble solids).

Detailed modelling was conducted to assess whether the proposed mining operations of the Project would adversely impact any privately owned or mine-owned residences located within the vicinity of the Project Boundary. The assessment included predictions of air quality impacts from the Project in isolation as well as the potential cumulative impacts of other neighbouring mines in the region and other sources. The modelling indicates that over the 27 year operation of the Project there are a number of residences that have the potential to experience dust concentrations above the EPA's air quality assessment criteria. These residences and the potential impacts are summarised in **Table 11-1**.

Generally, the predictions presented in this report incorporate a level of conservatism due to worst case assumptions and the nature of dispersion modelling. As a result, it is expected that actual ground level concentrations would be lower during the normal operation of the Project.

Notwithstanding, it is proposed that the worst case impacts would be managed on a day to day basis using a network of real-time monitoring stations, which will enable mine personnel to respond to high dust levels prior to reaching critical levels and modify activities or increase controls as required (i.e. TARP) under the AQMP.

The potential greenhouse gas emissions that are likely to occur as a result of the operation of the Project have been estimated based on an inventory for each year of the Project's life. On average, Scope 1 emissions from the Project would increase annual emissions by 0.059% of the 1990 baseline Australian levels and therefore would have a negligible impact.

Table 11-1: Residences with potential to experience dust levels above the EPA criteria

Residence ID	Potential Impact
Privately owned residences	
226A	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 13 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 based on conservative worst case assessment.
226B	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 23 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 and annual average TSP concentrations above 90 µg/m^3 based on conservative worst case assessment.
226C	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 17 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 and annual average TSP concentrations above 90 µg/m^3 based on conservative worst case assessment.
226D	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 3 days per year from the Project alone.
227F	24-hour PM_{10} impacts above 50 µg/m^3 occur but for 1 day per year from the Project alone.
228M	24-hour PM_{10} impacts above 50 µg/m^3 occur but for 1 day per year from the Project alone.
Mine owned residences	
57	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 5 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 based on conservative worst case assessment.
58A	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 26 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 and annual average TSP concentrations above 90 µg/m^3 based on conservative worst case assessment.
58B	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 9 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 based on conservative worst case assessment.
60	24-hour PM_{10} impacts above 50 µg/m^3 occur up to 19 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 and annual average TSP concentrations above 90 µg/m^3 based on conservative worst case assessment.
145A	24-hour PM_{10} impacts above 50 µg/m^3 occur 1 day per year from the Project alone.
145B	24-hour PM_{10} impacts above 50 µg/m^3 occur but for 3 days per year from the Project alone. Cumulative annual average PM_{10} concentrations above 30 µg/m^3 based on conservative worst case assessment.
145C	24-hour PM_{10} impacts above 50 µg/m^3 occur but for 1 day per year from the Project alone.
145D	24-hour PM_{10} impacts above 50 µg/m^3 occur but for 1 day per year from the Project alone.

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APPENDIX A – WIND ROSES

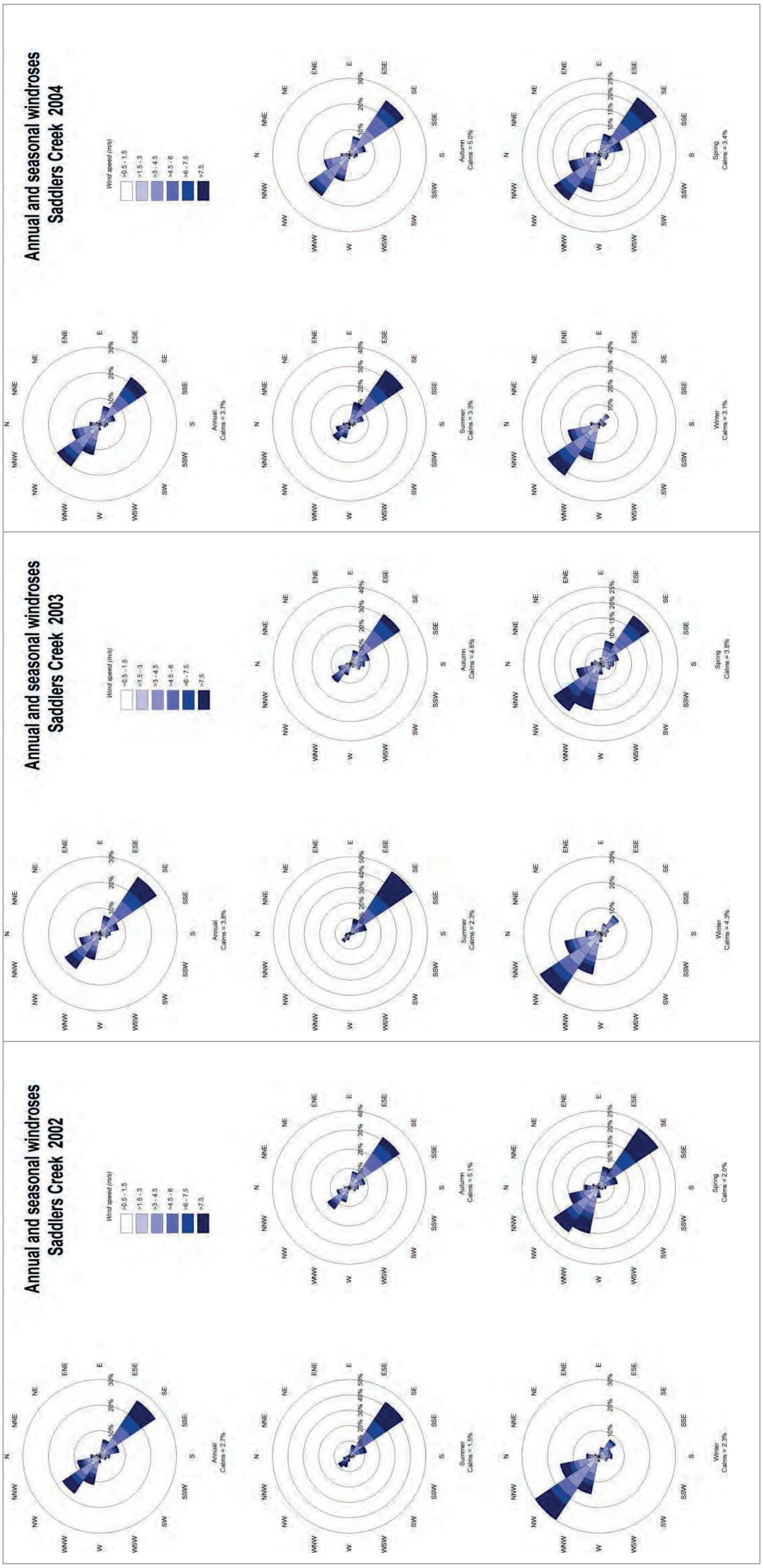

Figure A-1: Annual and seasonal windroses for Saddlers Creek, 2002, 2003 and 2004

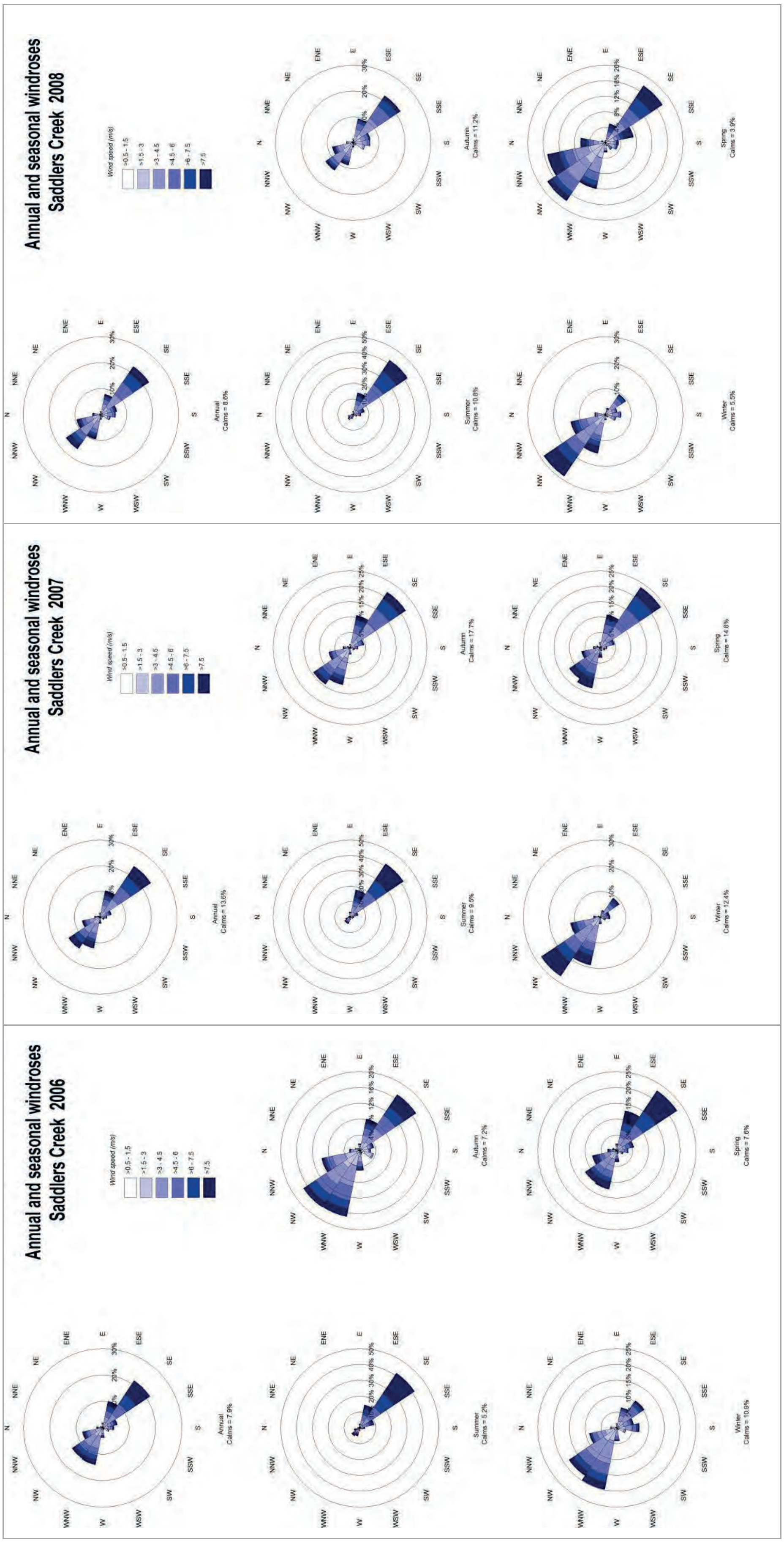

Figure A-2: Annual and seasonal windroses for Saddlers Creek, 2006, 2007 and 2008

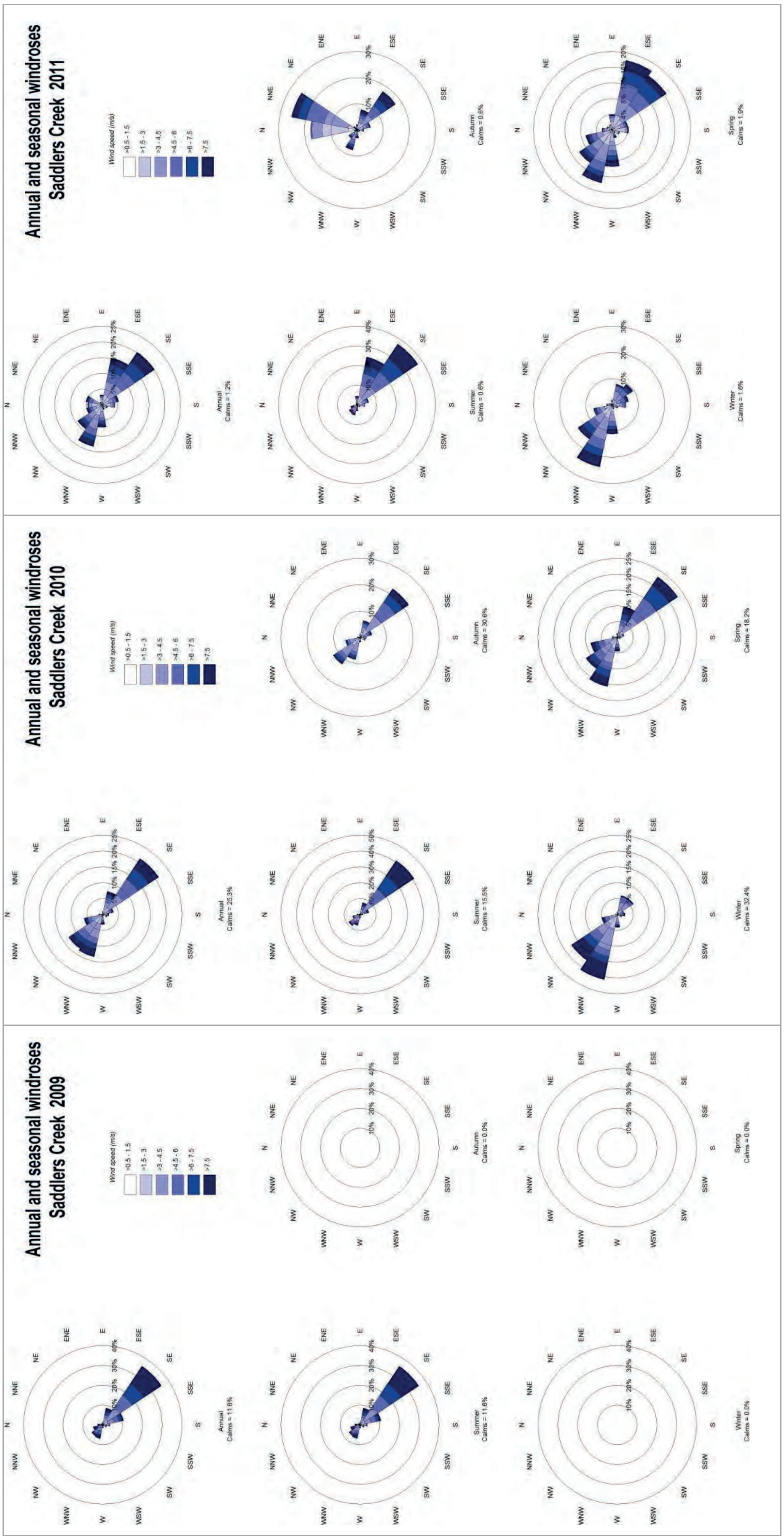

Figure A-3: Annual and seasonal windroses for Saddlers Creek, 2009, 2010 and 2011

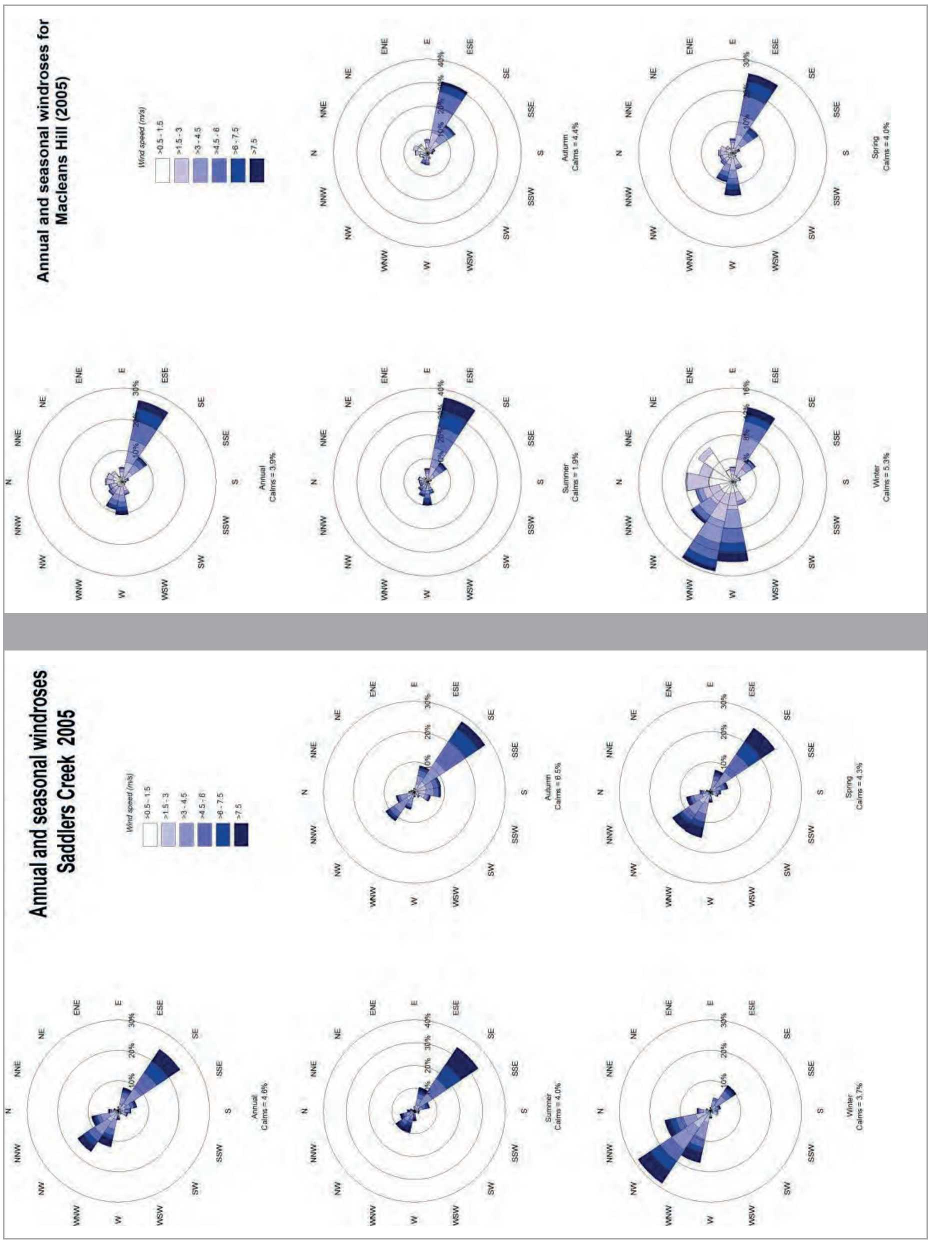

Figure A-4: Annual and seasonal windroses for Saddlers Creek and Macleans Hill for 2005

APPENDIX B – MONITORING DATA

Table B.12-1: Drayton South Monitoring data

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m^3)	TSP (µg/m^3)	PM_{10} (µg/m^3)	TSP (µg/m^3)	TSP (µg/m^3)
29/03/1998					NA
4/04/1998					NA
10/04/1998					NA
16/04/1998					52
22/04/1998					DNR
28/04/1998					DNR
4/05/1998					6
10/05/1998					34
16/02/1998					6
22/05/1998					31
28/05/1998					31
3/06/1998					
9/06/1998					
15/06/1998					37
21/06/1998					8
27/06/1998					25
3/07/1998					31
9/07/1998					6
15/07/1998					12
21/07/1998					3
27/07/1998					6
2/08/1998					10
8/08/1998					44
14/08/1998					41
20/08/1998					9
26/08/1998					22
1/09/1998					37
7/09/1998					36
13/09/1998					34
19/09/1998					33
24/09/1998					16
1/10/1998					58
7/10/1998					33
13/10/1998					45
19/10/1998					51
25/10/1998					47
31/10/1998					36
6/11/1998					53
12/11/1998					41
18/11/1998					12
24/11/1998					32
30/11/1998					40
6/12/1998					39
12/12/1998					53
18/12/1998					35
24/12/1998					26
30/12/1998					56
5/01/1999					54
11/01/1999					38
17/01/1999					35
23/01/1999					22

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
29/01/1999					na
4/02/1999					13
10/02/1999					24
16/02/1999					42
22/02/1999					na
28/02/1999					17
6/03/1999					33
12/03/1999					59
18/03/1999					41
24/03/1999					36
30/03/1999					52
5/04/1999					17
11/04/1999					26
17/04/1999					36
23/04/1999					na
29/04/1999					20
5/05/1999					32
11/05/1999					34
17/05/1999					36
23/05/1999					29
29/05/1999					25
4/06/1999					22
10/06/1999					13
16/06/1999					13
22/06/1999					33
28/06/1999					14
4/07/1999					12
10/07/1999					29
16/07/1999					14
22/07/1999					8
28/07/1999					42
3/08/1999					56
9/08/1999					15
15/08/1999					12
21/08/1999					26
27/08/1999					28
2/09/1999					50
8/09/1999					38
14/09/1999					63
20/09/1999					53
26/09/1999					36
2/10/1999					48
8/10/1999					27
14/10/1999					57
20/10/1999					50
26/10/1999					44
1/11/1999					40
7/11/1999					23
13/11/1999					24
19/11/1999					33
25/11/1999					45
1/12/1999					42

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
7/12/1999					36
13/12/1999					42
19/12/1999					37
25/12/1999					8
31/12/1999					20
6/01/2000					32
12/01/2000					30
18/01/2000					56
21/01/2000					40
30/01/2000					23
5/02/2000					51
11/02/2000					50
17/02/2000					28
23/02/2000					93
29/02/2000					39
3/03/2000					28
12/03/2000					18
18/03/2000					23
24/03/2000					24
30/03/2000					47
5/04/2000					30
11/04/2000					na
17/04/2000					24
23/04/2000					26
29/04/2000					24
5/05/2000					16
11/05/2000					16
17/05/2000					32
23/05/2000					19
29/05/2000					10.00
4/06/2000		DNR			13
10/06/2000		79			22
16/06/2000		DNR			9
22/06/2000		26			13
28/06/2000		20			14
4/07/2000	10	23			15
10/07/2000	6	14			13
16/07/2000	5	22			9
22/07/2000	9	12			18
28/07/2000	4	12			22
3/08/2000		58			35
9/08/2000		30			10
15/08/2000		24			10
21/08/2000		29			20
27/08/2000		54			11
2/09/2000	10	40			8
8/09/2000	19	25			23
14/09/2000	26	DNR			63
20/09/2000	42	61			107
26/09/2000	33	46			52
2/10/2000		87			41
8/10/2000		85			44

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM10 (µg/m³)	TSP (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
14/10/2000		34			18
20/10/2000		35			28
26/10/2000		33			51
1/11/2000	20	DNR			29
7/11/2000	25	29			16
13/11/2000	22	45			32
19/11/2000	7	25			13
25/11/2000	19	48			14
1/12/2000		25			DNR
7/12/2000		119*			65
13/12/2000		DNR			44
19/12/2000		55			52
25/12/2000		DNR			33
31/12/2000		217*			31
6/01/2001		42			58
12/01/2001		73			87
18/01/2001		53			42
24/01/2001		41			139
30/01/2001		60			30
5/02/2001		54			43
11/02/2001		3			12
17/02/2001		DNR			19
23/02/2001		DNR			49
1/03/2001		80			54
7/03/2001		46			28
13/03/2001		68			54
19/03/2001		43			67
25/03/2001		30			46
31/03/2001		33			24
6/04/2001	DNR	56			41
12/04/2001	DNR	45			38
18/04/2001	DNR	12			57
24/04/2001	DNR	34			DNR
30/04/2001	DNR	27			23
6/05/2001		DNR	DNR		7
12/05/2001		25	DNR		23
18/05/2001		31	DNR		18
24/05/2001		33	DNR		22
30/05/2001		32	DNR		17
5/06/2001		60	DNR	DNR	33
11/06/2001		44	DNR	DNR	21
17/06/2001		34	1	3	6
23/06/2001		52	DNR	9	10
29/06/2001		48	DNR	20	7
5/07/2001	10	49		12	34
11/07/2001	7	35		14	69
17/07/2001	6	15		9	10
23/07/2001	14	32		DNR	30
29/07/2001	6	15		6	9
4/08/2001	8	DNR		7	13
10/08/2001	15	29		142	58
16/08/2001	31	34		18	25
22/08/2001	18	28		13	13
28/08/2001	8	14		6	6

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
3/09/2001		18	10	8	10
9/09/2001		DNR	15	26	30
15/09/2001		DNR	3	8	25
21/09/2001		96	45	74	63
27/09/2001		52	26	47	40
3/10/2001		27	9	13	17
9/10/2001		39	22	39	38
15/10/2001		18	8	11	7
21/10/2001		57	dnr	9	39
27/10/2001		36	15	20	26
2/11/2001	48	66		86	67
8/11/2001	22	50		40	6
14/11/2001	DNR	DNR		DNR	46
20/11/2001	8	DNR		11	13
26/11/2001	14	55		105	30
2/12/2001		80	27	42	48
8/12/2001		30	10	23	16
14/12/2001		73	33	62	69
20/12/2001		75	33	54	78
26/12/2001		101	33	52	63
1/01/2002	34	64		35	55
7/01/2002	59	134		74	82
13/01/2002	43	87		101	80
19/01/2002	33	74		48	51
25/01/2002	54	105		75	74
31/01/2002	25	34		33	33
6/02/2002		13	DNR	16	18
12/02/2002		159	DNR	40	46
18/02/2002		30	16	18	27
24/02/2002		43	14	25	44
2/03/2002	57	95		46	14
8/03/2002	30	54		43	36
14/03/2002	DNR	55		39	9
20/03/2002	21	78		60	38
26/03/2002	38	76		43	DNR
1/04/2002		45	10	22	39
7/04/2002		19	17	29	26
13/04/2002		92	33	62	42
19/04/2002		22	9	14	23
25/04/2002		41	19	28	157
1/05/2002	15	41		45	44
7/05/2002	DNR	51		46	62
13/05/2002	DNR	65		DNR	58
19/05/2002	14	25		DNR	15
25/05/2002	7	31		15	7
31/05/2002	1	19		13	9
6/06/2002		21	9	15	19
12/06/2002		27	4	11	11
18/06/2002		13	4	9	8
24/06/2002		7	5	10	13
30/06/2002		21	8	11	14
6/07/2002	21	25		19	18
12/07/2002	25	27		33	14
18/07/2002	18	23		DNR	25
24/07/2002	20	27		18	49
30/07/2002	DNR	DNR		23	23
5/08/2002		23	11	28	26
11/08/2002		48	20	38	35

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
17/08/2002		DNR	27	53	42
23/08/2002		27	25	50	31
29/08/2002		36	20	42	35
4/09/2002	18	24		31	30
10/09/2002	17	27		36	26
16/09/2002	28	45		44	55
22/09/2002	11	43		44	39
28/09/2002	42	49		71	57
4/10/2002		50	43	68	63
10/10/2002		9	26	56	49
16/10/2002		52	17	79	17
22/10/2002		97	51	83	78
28/10/2002		45	34	71	46
3/11/2002	108	104		120	125
9/11/2002	114	91		107	89
15/11/2002	64	80		112	75
21/11/2002	16	34		146	31
27/11/2002	163	196		216	158
3/12/2002		DNR	37	70	58
9/12/2002		DNR	53	56	67
15/12/2002		68	22	35	39
21/12/2002		83	39	74	71
27/12/2002		37	9	20	4
2/01/2003	20	238		29	26
8/01/2003	56	84		72	72
14/01/2003	DNR	59		53	62
20/01/2003	DNR	98		87	118
26/01/2003	76	81		42	76
1/02/2003		118	88	DNR	99
7/02/2003		27	37	DNR	60
13/02/2003		88	70	DNR	71
19/02/2003		83	9	76	34
25/02/2003		DNR	10	52	4
3/03/2003	DNR	61		DNR	73
9/03/2003	16	30		163	38
15/03/2003	21	39		64	49
21/03/2003	117	123		249	156
27/03/2003	21	81		55	DNR
2/04/2003		21	4	36	20
8/04/2003		59	17	DNR	45
14/04/2003		25	8	8	3
20/04/2003		DNR	5	4	14
26/04/2003		32	4	2	4
2/05/2003	17	53		8	41
8/05/2003	16	55		28	32
14/05/2003	9	36		31	19
20/05/2003	32	46		32	30
26/05/2003	3	19		11	13
1/06/2003		35	13	22	23
7/06/2003		12	9	12	13
13/06/2003		9	12	8	17
19/06/2003		20	15	19	26
25/06/2003		41	24	28	27
1/07/2003	9.3	10		11.7	5
7/07/2003	11.9	16		14.7	12.4
13/07/2003	8.7	18		17.5	21.6
19/07/2003	24.4	42		69.3	66.5
25/07/2003	6.2	10		7	7.6

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m^3)	TSP (µg/m^3)	PM_{10} (µg/m^3)	TSP (µg/m^3)	TSP (µg/m^3)
31/07/2003	23	41		14.6	13.5
6/08/2003		41	22	28	34
12/08/2003		16	13	14	17
18/08/2003		7	5	6	6
24/08/2003		25	16	18	21
30/08/2003		DNR	20	26	44
5/09/2003	39	60		33	47
11/09/2003	44	65		19	24
17/09/2003	16	23		12	15
23/09/2003	DNR	92		14	68
29/09/2003	74	85		30	43
5/10/2003		28	DNR	19	34
11/10/2003		DNR	16	27	31
17/10/2003		91	27	50	81
23/10/2003		75	37	49	57
29/10/2003		281	192	177	199
4/11/2003	35	82		50	77
10/11/2003	44	DNR		64	96
16/11/2003	81	166		49	80
22/11/2003	8	26		15	13
28/11/2003	20	53		31	64
4/12/2003		21	14	31	34
10/12/2003		41	129	176	45
16/12/2003		49	20	34	38
22/12/2003		47	24	32	33
28/12/2003		50	28	14	68
3/01/2004	DNR	DNR		63	61
9/01/2004	83	98		83	96
15/01/2004	41	59		65	60
21/01/2004	47	84		54	79
27/01/2004	30	47		43	45
2/02/2004		97	34	57	101
8/02/2004		112	44	67	87
14/02/2004		19	39	6	79
20/02/2004		DNR	130	219	91
26/02/2004		DNR	DNR	17	19
3/03/2004	15	28		40	33
9/03/2004	65	7		41	46
15/03/2004	86	35		39	32
21/03/2004	7	36		39	53
27/03/2004	37	62		103	119
2/04/2004		DNR	38	38	73
8/04/2004		59	22	22	45
14/04/2004		11	5	5	66
20/04/2004		94	DNR	DNR	31
26/04/2004		48	26	26	73
2/05/2004	12	4		10	11
8/05/2004	24	78		66	76
14/05/2004	49	75		53	52
20/05/2004	18	34		25	32
26/05/2004	4	DNR		6	6
1/06/2004		DNR	8	DNR	23
7/06/2004		11	9	19	18
13/06/2004		15	8	10	4
19/06/2004		21	9	8	41
25/06/2004		23	7	7	10
1/07/2004	22	30		14	20
7/07/2004	40	61		9	23

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
13/07/2004	6	16		5	7
19/07/2004	9	28		4	13
25/07/2004	5	12		7	DNR
31/07/2004	14	DNR		18	DNR
6/08/2004		13	5	4	7
12/08/2004		28	10	10	18
18/08/2004		16	7	11	11
24/08/2004		35	18	DNR	5
30/08/2004		25	DNR	DNR	18
5/09/2004	17	DNR		20	11
11/09/2004	8	12		7	7
17/09/2004	43	32		DNR	13
23/09/2004	6	57		30	24
29/09/2004	70	120		73	66
5/10/2004		DNR	9	21	15
11/10/2004		56	27	39	57
17/10/2004		37	24	44	36
23/10/2004		21	DNR	26	25
29/10/2004		51	DNR	DNR	47
4/11/2004	37	49		DNR	62
10/11/2004	20	DNR		28	35
16/11/2004	42	48		72	59
22/11/2004	90	64		80	80
28/11/2004	8	74		58	79
4/12/2004		46	22	40	41
10/12/2004		22	16	26	17
16/12/2004		49	30	44	52
22/12/2004		37	50	65	31
28/12/2004		14	23	46	45
3/01/2005	91	DNR	DNR	155	118
9/01/2005	64	94	DNR	82	55
15/01/2005	131	197	DNR	208	172
21/01/2005	93	152	DNR	127	144
27/01/2005	39	69	DNR	44	51
2/02/2005	52	49	21	62	DNR
8/02/2005	41	47	14.8	24	64
14/02/2005	47	54	26.8	91	12
20/02/2005	15	20	6.4	20	42
26/02/2005	86	69	33	64	44
4/03/2005	39	43	16.1	42	64
10/03/2005	74	58	18	45	63
16/03/2005	24	88	25.2	68	89
22/03/2005	4	5	4.1	5	14
28/03/2005	80	51	10.7	44	65
3/04/2005	71	80	17.4	48	67
9/04/2005	21	62	11.3	34	38
15/04/2005	DNA	59	17.2	55	55
21/04/2005	DNA	70	12.9	16	44
27/04/2005	48	42	13.4	23	42
3/05/2005	63	43	11.3	27	47
9/05/2005	3	32	11.2	23	33
15/05/2005	9	21	7.7	11	19
21/05/2005	25	26	8.2	31	25
27/05/2005	14	15	13.5	17	28
2/06/2005	DNR	57	18.1	20	50
8/06/2005	35	58	22.3	DNR	46
14/06/2005	3	DNR	3.2	2	2
20/06/2005	6	8	2.9	1	3

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
26/06/2005	4	23	6.5	20	23
2/07/2005	4	2	3.3	6	11
8/07/2005	12	32	9.8	22	49
14/07/2005	3	7	<1	5	14
20/07/2005	14	7	12.9	28	44
26/07/2005	8	2	5.5	12	25
1/08/2005	DNA	DNR		DNA	48
4/08/2005			5.1		
7/08/2005	8	29	4.7	5	11
13/08/2005	33	19	4.6	7	17
19/08/2005	51	80	13.8	18	43
25/08/2005	3	31	16.7	38	55
31/08/2005	5	11	19.9	7	23
6/09/2005	13	21	8.3	30	46
12/09/2005	4	14	3.4	4	5
18/09/2005	7	DNA	5.2	10	12
24/09/2005	42	37	19	37	19
30/09/2005	24	23	3.9	50	13
6/10/2005	53	34	24.3	60	62
12/10/2005	41	34	16.5	56	60
18/10/2005	34	66	17.4	52	47
24/10/2005	26	57	14.9	38	40
30/10/2005	26	60	10.3	32	77
5/11/2005	30	69	12.6	43	46
11/11/2005	50	70	12.4	50	41
17/11/2005	DNR	DNR	18.9	64	38
23/11/2005	DNR	DNR	9.6	31	61
29/11/2005	22	62	7	36	27
5/12/2005	50	45	15	49	35
11/12/2005	61	30	37.7	86	70
17/12/2005	29	14	19.2	DNR	60
23/12/2005	68	21	38	87	DNR
29/12/2005	154	DNR	49.6	DNR	DNR
4/01/2006	125	149	27.1	89	110
10/01/2006	42	76	15.1	70	DNR
16/01/2006	33	66	14.7	53	40
22/01/2006	44	81	14.8	64	57
28/01/2006	81	97	22.1	82	53
3/02/2006	65	84	19.6	83	83
9/02/2006	100	111	22.6	74	181
15/02/2006	82	117	8.7	43	90
21/02/2006	56	81	16.3	72	60
27/02/2006	60	79	12.1	71	89
5/03/2006	32	81	10.2	42	47
11/03/2006	64	90	27.9	101	96
17/03/2006	84	91	21.7	92	106
23/03/2006	46	77	13.5	57	47
29/03/2006	62	107	16.3	74	59
4/04/2006	24	25	14.8	48	28
10/04/2006	76	92	21.9	73	94
16/04/2006	11	33	10.6	42	42
22/04/2006	17	37	11.6	64	72
28/04/2006	34	53	16.9	83	88
4/05/2006	64	79	11.3	57	84
10/05/2006	40	52	12.6	61	83
16/05/2006	19	29	14.6	76	103
22/05/2006	9	17	12	59	87
28/05/2006	23	32	10.6	58	118

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM10 (µg/m³)	TSP (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
3/06/2006	32	37	5.2	35	79
9/06/2006	49	56	13.3	46	47
15/06/2006	6	13	6.5	10	8
21/06/2006	15	30	10.7	42	21
27/06/2006	7	16	5.5	12	21
3/07/2006	2	9	4.6	9	2
9/07/2006	8	13	4.1	6	6
15/07/2006	13	25	5.5	13	20
21/07/2006	11	19	10.1	23	28
27/07/2006	5	14	6.8	14	20
2/08/2006	12	31	3.8	12	19
8/08/2006	24	50	15.7	16	56
14/08/2006	34	22	8.3	19	37
20/08/2006	30	56	12.7	34	52
26/08/2006	17	34	7.9	26	31
1/09/2006	13	26	4.9	18	22
7/09/2006	5	13	2.4	10	9
13/09/2006	14	25	9.6	26	24
19/09/2006	27	42	13.4	24	57
25/09/2006	49	68	17	55	79
1/10/2006	44	71	21.4	51	89
7/10/2006	49	68		115	100
13/10/2006	47	68		67	113
17/10/2006			17.8		
19/10/2006	121	102	31.4	104	95
21/10/2006			18.1		
25/10/2006	52	64	17.4	50	68
31/10/2006	49	70	16.5	53	60
6/11/2006	13	23	7.6	21	31
12/11/2006	45	42	16.7	55	56
18/11/2006	46	64	27.7	58	64
24/11/2006	112	121	39.3	94	89
30/11/2006	68	78	30	95	96
6/12/2006	52	71	21.7	60	66
12/12/2006	83	96	12.9	48	49
18/12/2006	69	94	21	69	67
24/12/2006	26	60	18.5	61	44
30/12/2006	16	44	13.1	49	40
5/01/2007	60	93	20.7	67	108
11/01/2007	48	107	33.5	92	93
17/01/2007	47	117	37.6	100	82
23/01/2007	43	121	45.0	129	121
29/01/2007	35	94	33.0	84	73
4/02/2007	39	126	32.7	123	77
10/02/2007	23	71	17.9	62	48
16/02/2007	28	72	17.6	53	48
22/02/2007	20	64	19.8	56	41
28/02/2007	15	56	13.3	39	28
6/03/2007	12	39	14.8	39	29
12/03/2007	25	82	32.6	80	63
18/03/2007	8	28	8.7	27	21
24/03/2007	24	70	17.6	45	45
30/03/2007	19	36	10.4	31	29
5/04/2007	17	52	16.5	34	5
11/04/2007	19	44	23.0	37	56
17/04/2007	24	93	32.6	66	69
23/04/2007	12	45	11.9	43	28
29/04/2007	8	18	9.5	22	18

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (μg/m³)	TSP (μg/m³)	PM_{10} (μg/m³)	TSP (μg/m³)	TSP (μg/m³)
5/05/2007	34	80	37.0	61	79
11/05/2007	14	41	18.6	57	47
17/05/2007	12	42	11.4	26	34
23/05/2007	3	15	6.2	21	11
29/05/2007	16	44	13.5	39	44
4/06/2007	9	18	7.7	22	14
10/06/2007	11	19	2.9	22	19
16/06/2007	4	5	4.6	9	5
22/06/2007	4	8	3.0	16	15
28/06/2007	5	6	1.2	6	5
4/07/2007	9	13	6.8	19	39
10/07/2007	7	12	5.2	15	5
16/07/2007	6	11	5.3	14	17
22/07/2007	16	34	12.4	31	27
28/07/2007	7	21	4.6	14	9
3/08/2007	8	18	4.1	17	11
9/08/2007	11	22	7.7	21	14
15/08/2007	16	53	16.3	57	47
21/08/2007	9	19	8.1	21	17
27/08/2007	9	19	7.9	18	24
2/09/2007	26	60	24.4	59	63
8/09/2007	nt	nt	7.9	21	nt
14/09/2007	nt	nt	22.9	73	nt
20/09/2007	nt	nt	14.2	49	nt
26/09/2007	nt	nt	26.5	78	nt
2/10/2007	nt	nt	34.8	76	nt
8/10/2007	7	47	23.6	87	29
14/10/2007	9	5	15.6	66	43
20/10/2007	75	58	43.4	96	131
26/10/2007	14	94	11.5	33	35
1/11/2007		87		95	19
2/11/2007	42		31.3		
7/11/2007		17		29	nt
8/11/2007	5		10.6		
13/11/2007		85		45	54
14/11/2007	26		18		
19/11/2007		90		89	nt
20/11/2007	40		45.5		
25/11/2007		40		45	87
26/11/2007	15		17.4		
1/12/2007	12	49	15.4	36	32
7/12/2007	24	52	17.7	48	81
13/12/2007	11	41	14.8	44	40
19/12/2007	15	46	24	50	40
25/12/2007	12	37	15.5	37	31
31/12/2007	39	138	23.9	71	51
6/01/2008	13	40	9.6	123	38
12/01/2008	35	112	25:00	106	98
18/01/2008	5	13	8	18	21
24/01/2008	22	53	22.6	53	60
30/01/2008	54	134	26.5	109	112
5/02/2008	7	27	7.8	22	20
11/02/2008	10	24	22.2	109	29
17/02/2008	13	38	13.1	82	38
23/02/2008	60	94	36.1	92	135
29/02/2008	8	19	10.1	70	6
6/03/2008	27	47	25.5	62	87
12/03/2008	15	56	13.3	44	57

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
18/03/2008	21	57	19.8	52	67
24/03/2008	16	28	12.6	34	37
30/03/2008	11	24	10.6	31	27
5/04/2008	27	76	11.3	51	55
11/04/2008	21	61	8.4	33	36
17/04/2008	12	35	4.6	28	23
23/04/2008	5	7	3.7	18	6
29/04/2008	14	16	7.9	20	24
5/05/2008	11	28	21.4	23	26
11/05/2008	14	40	7.8	54	39
17/05/2008		29		39	34
23/05/2008	9	27	13.9	45	37
29/05/2008	8	17	10.8	33	24
4/06/2008	3	6	2.4	11	8
10/06/2008	5	10	6.5	17	19
16/06/2008	3	6	3.4	12	5
22/06/2008	4	10	3.8	16	21
28/06/2008	5	17	10.5	26	34
2/10/2008	23	47	25.4	45	75.6
8/10/2008	9	30	14.4	57	24.3
14/10/2008	15	33	11.9	33	55
20/10/2008	21	55	25.9	61	99
26/10/2008	16	52	65.5	364	85.9
1/11/2008	24	96	29.8	76	119
7/11/2008	35	129	41.5	90	90.7
13/11/2008	23	68	22.2	51	72.8
19/11/2008	9	27	8.7	23	37.5
25/11/2008	15	47	20.2	52	69.2
1/12/2008	7.1	24	8.8	31.5	
3/12/2008					79.3
7/12/2008	9.0	28	12.5	33.9	27.7
13/12/2008	15.5	36	15.5	33.4	49.2
19/12/2008	10.9	37	36	159	45.9
25/12/2008	16.7	34	19.7	32.2	39.3
31/12/2008	26.1	90	41.3	83.7	94.5
5/02/2009			44.2		
6/01/2009	27.3	71		60.2	84.8
12/01/2009	32.3	101		83.1	81.5
13/02/2009			8.8		
17/02/2009			10.8		
18/01/2009	20.1(est)	65		74.6 (est)	81.6
23/02/2009			24.9		
24/01/2009	21.3	52		80.5	52.2
30/01/2009	45.0	163		92.1	87.8
1/03/2009			36.1		
5/02/2009	32.5	92		92.5	74.4
7/03/2009			23		
11/02/2009	2.7	28		32.2	41.2
13/03/2009			13.1		
17/02/2009	6.2	12		17.5	22.8
19/03/2009			12.9		
23/02/2009	17.4	51		61	31.5
25/03/2009			32.7		
1/03/2009	66.2	205		69.6	68.3
7/03/2009	45.5	138		79.8	90.6
13/03/2009	13.4	37		36.3	42.1
19/03/2009	33.0 (est)	46		37.6	52.9
25/03/2009	33.2	64		99.9	83.4

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM10 (µg/m³)	TSP (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
31/03/2009	39.1 (est)	26	10.4	32.6	25.4
6/04/2009	19.5	19	15.7	58.7	14(est)
12/04/2009	12.9	19	10.9	38.5	31.8
18/04/2009	27.3	28	17.3	53.6	41.5
24/04/2009	7.4	31	8.4	198	29.4
30/04/2009	3.6	8	11.2	32.5	15.7
6/05/2009	12.8	30	15.7	35.5	42
12/05/2009	13.0	23	10.9	39.9	42.4
18/05/2009	19.6	52	17.3	66.5	59.7
24/05/2009	15.0	33	8.4	47.6	37
30/05/2009	7.1	14	11.2	37	15.8
5/06/2009	4.8	8	2.9	17.5	9
11/06/2009	4.3	8	3.3	12.6	6.8
17/06/2009	10.3	21	8	36.1	24.6
23/06/2009	5.9	16	2.4	20.1	11.4
29/06/2009	5.4	19	8.1	22.7	12.1
5/07/2009	7.1		3.6		9.2
11/07/2009	12.4		7.9		22.8
17/07/2009	8.1		4.6		12.5
23/07/2009	nt		6.4		21.6
24/07/2009	6.6				
29/07/2009	2.6		3.9		9.1
4/08/2009	5.6	33	13.4	42.1	13.7
10/08/2009	20.4	42	20.6	57.2	61
16/08/2009	13.0	41	13.7	35.8	29.8
22/08/2009	10.7	30	25.2	61.6	20.3
28/08/2009	11.3	29	16.5	39.2	38.9
3/09/2009	26.0	61	26.5	52.3	68.7
9/09/2009	8.1	24	8.4	21.1	13
15/09/2009	47.0	83	51.2	106	101
21/09/2009	23.3	36	22.2	59.9	56.8
27/09/2009	22.7	dust storm	25.7	117	131
3/10/2009	8.4	68	9.2	23.7	28.4
9/10/2009	8.9	53	24.8	86.7	33.8
15/10/2009	11.2	24	16.6	31.3	27.3
21/10/2009	22.3	31	27.9	101	72.8
27/10/2009	9.4	19	11.8	26.6	23.7
2/11/2009	35.1	60	30.5	85.1	106
8/11/2009	8.7	21	7.1	21.5	19.9
14/11/2009	25.0	69	23.2	95.2	61.8
20/11/2009	53.7	114	39.6	94.6	109
26/11/2009	41.0	107	34.8	96.9	96.2
2/12/2009	13.2	37	13.3	46.8	40.2
8/12/2009	57.1	131	53	121	126
14/12/2009	35.9	81	30.6	104	89.1
20/12/2009	39.3	108	29.3	58	57.6
26/12/2009	7.2	15	4.6	21.4	15.2
1/01/2010	14.9	32	nt	31.6	27.5
7/01/2010	19.1	40	20	44.7	42.9
13/01/2010	33.6	69	39.9	71.8	106
19/01/2010	18.7	44	18.4	37.4	43.3
25/01/2010	50.5	103	32.1	90.8	132
31/01/2010	11.7	25	nt	192	36.3
6/02/2010	13.4	24	nt	35.4	30.7
12/02/2010	22.9	47	nt	37.2	57.7
18/02/2010	21.2	47	34	122	52.5
24/02/2010	27.7	64	25.1	55.5	77.5
2/03/2010	17.1	33	12.8	nt	47.6

Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m³)	TSP (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	TSP (µg/m³)
8/03/2010	18.3	34	10.2	48.7	37.6
14/03/2010	nt	nt	8.2	32.4	25.5
20/03/2010	29.7	57	30.1	69	75
26/03/2010	28.3	56	19.1	50.2	71.7
1/04/2010	17.2	33	10.3	55.2	47.9
7/04/2010	17.8	33	8.4	47.8	36.8
13/04/2010	nt	nt	18.7	32.7	25.2
19/04/2010	29.2	58	15.7	67.4	74
25/04/2010	27.8	55	7.2	48.3	70.5
1/05/2010	12.6	43	8.1	45	24.9
7/05/2010	8.1	17	17.7	57.1	20.8
11/05/2010			12.7		
13/05/2010	9.5	17	11.1	31.2	22.9
19/05/2010	nt	nt	21.2	nt	35.3
25/05/2010	6.4	13	6.8	nt	18.9
31/05/2010	3.3	7		13.2	5
6/06/2010	5.9	9	nt	19.5	9.3
12/06/2010	4.2	15	8.6	23.8	21.4
18/06/2010	12.7	20	4.9	20.8	20.5
24/06/2010	8.2	28	8.9	19.7	21.7
30/06/2010	2.0	6	5.4	5.1	6.4
6/07/2010	10.0	12	7.6	17.3	17.2
12/07/2010	4.2	31	7.2	10.7	10.4
18/07/2010	4.5	24	6.4	11.7	11.4
24/07/2010	7.6	28	10.2	24.3	38.5
30/07/2010	0.2	12	4.5	5.9	3.5
5/08/2010	4.9	15	4	9.4	23.2
11/08/2010	4.5	16	4.2	9.2	8.9
17/08/2010	6.5	24	8	15.4	11.6
23/08/2010	5.2	30	8.4	11.8	17.2
29/08/2010	12.3	32	14.7	39	48.5
4/09/2010	4.2	7	2.9	10.8	10.1
10/09/2010	3.1	9	10.9	6.5	6.5
16/09/2010	3.2	9	2.4	37.6	6
22/09/2010	22.1	60	23.4	73	61.9
28/09/2010	18.2	82	9.6	23.9	34.8
4/10/2010	7.0	29	6.2	20.2	23.5
10/10/2010	16.5	50	33.9	55.8	54
16/10/2010	7.8	53	4.6	27.7	35.4
22/10/2010	16.3	41	13.2	48	52.7
28/10/2010	12.4	38	23.8	43.5	38.2
3/11/2010	13.8	33	9.5	26.3	25.7
9/11/2010	16.0	37	12.7	30.3	33.5
15/11/2010	12.8	28	8.9	18.6	23.2
21/11/2010	16.5	52	27	54.4	59.4
27/11/2010	20.8	76	29.5	61	80.6
3/12/2010	15.0	30	nt	39.3	34.9
9/12/2010	13.9	41	15.1	40.9	49.4
15/12/2010	19.3	60	24.3	63.2	54.7
21/12/2010	8.1	23	40.3	139	25
27/12/2010	12.2	33	15.3	52.6	40.8
2/01/2011	31.0	97		67.4	20.4
8/01/2011	12.2	28		47.3	33.1
14/01/2011	14.5	41		56.2	50.4
20/01/2011	18.8	45		73.9	58.8
26/01/2011	38.6	99		79.8	85
1/02/2011	21.0	67.4	22.5	58.9	82.4

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Date	Llanillo (HV2a)		Jerry's Plain School (HV5)		Edderton (HV4)
	PM_{10} (µg/m^3)	TSP (µg/m^3)	PM_{10} (µg/m^3)	TSP (µg/m^3)	TSP (µg/m^3)
7/02/2011	12.0	38.3	14.8	45.2	34.2
13/02/2011	9.1	17.4	8.3	22.6	26.4
19/02/2011	21.1	45.5		49.4	49.5
25/02/2011	27.1	72.8	21.5	59.4	64.4
3/03/2011	14.5	34.5	11.7	32.3	34.5
9/03/2011	13.5	28.1	13.5	46.2	39.9
15/03/2011	20	33.7	17.4	41.1	43.0
21/03/2011	13.7	28.5	6.7	33.8	38.2
27/03/2011	9.9	33.2	10.9	40.1	38.9
2/04/2011	4	48.9	18.9	56.5	65.4
8/04/2011	7.6	24.7	7.9	28.9	26.2
14/04/2011	6.8	16.3	6.5	12.1	16.1
20/04/2011	13.8	23.4	13.8	22.3	31.6
26/04/2011	4	23.8	6	19.1	18.1
2/05/2011	9.0	22.8		192.0	43.1
8/05/2011	6.2	21.9	11	16.3	25.4
14/05/2011	3.8	12.8	2	8.7	11.5
20/05/2011	16.9	42.0	19	41.3	50.8
26/05/2011	2.7	9.6	2	8.8	15.8
1/06/2011	10.30	20.6	12	18.4	18.8
7/06/2011	5.70	10.9	5	9.0	12.6
13/06/2011	4.00	8.6	4	13.2	8.4
19/06/2011	3.60	9.4	1	8.3	9.5
25/06/2011	8.20	17.6	11	19.7	16.4
1/07/2011	5.80	16.8	10	18.2	17.9
7/07/2011	4.80	13.4	7	9.1	7.6
13/07/2011	11.00	19.8	11	14.3	16.1
19/07/2011	1.90	7.6	4	6.2	6.7
25/07/2011	2.20	7.6	9	63.7	6.0
31/07/2011	7.90	24.5	10	17.2	33.5
6/08/2011	11.10	36.7	12	25.7	56.7
12/08/2011	6.20	14.6	7	18.5	23.0
18/08/2011	4.60	9.2	4	8.8	7.8
24/08/2011	4.30	12.7	7	17.4	28.0
30/08/2011	10.30	31.4	22	45.1	36.3
5/09/2011	13.6	40.4	23	73.5	44.8
11/09/2011	3.6	8.3	4	6.8	10
17/09/2011	12	31	11	29.3	53.8
23/09/2011	21.5	51.4	23	56	69.4
29/09/2011	4.7	10.3	4	9.2	14
5/10/2011	15.6	36.2	21	43.0	42.3
11/10/2011	6.2	17.8	11	19.4	16.8
17/10/2011	16.7	50.4	28	108.0	48.1
23/10/2011	29.5	72.2	36	68.5	82.5
29/10/2011	11	32.5	10	29.6	38.7
4/11/2011	20.10	47.9	20	66.3	53.2
10/11/2011	17.70	51.6	16	43.5	59.2
16/11/2011	22.60	48.7	23	53.6	54.4
22/11/2011	13.90	28.9	15	25.8	27.1
28/11/2011	19.70	44.8	19	45.8	55.8

Table B.12-2: Drayton Mine Monitoring data

Date	Lot 22 TSP ($\mu g/m^3$)	Pringles TSP ($\mu g/m^3$)
3/01/2005	74.70	76.08
9/01/2005	40.45	37.23
15/01/2005	102.13	109.38
21/01/2005	79.39	107.58
27/01/2005	46.67	43.60
2/02/2005	44.84	50.96
8/02/2005	54.54	102.10
14/02/2005	59.63	57.73
20/02/2005	36.73	39.10
26/02/2005	75.03	81.06
4/03/2005	36.10	63.99
10/03/2005	60.77	66.10
16/03/2005	77.27	94.13
22/03/2005	44.42	18.88
28/03/2005	35.92	69.11
3/04/2005	41.17	68.79
9/04/2005	40.99	35.85
15/04/2005	47.62	67.86
21/04/2005	39.91	42.91
27/04/2005	66.90	119.68
3/05/2005	37.17	56.69
9/05/2005	20.31	
15/05/2005	48.91	61.48
21/05/2005	23.60	74.59
27/05/2005	34.90	89.30
2/06/2005	44.25	
8/06/2005	63.68	83.40
14/06/2005	9.77	
20/06/2005	7.79	55.93
26/06/2005	26.75	28.95
2/07/2005	12.88	22.05
8/07/2005	40.88	67.79
14/07/2005	17.05	33.08
20/07/2005	42.75	
26/07/2005	22.20	
1/08/2005	47.84	93.55
7/08/2005	14.48	67.11
13/08/2005	41.40	84.18
19/08/2005	40.15	241.83
25/08/2005	45.61	77.74
31/08/2005	70.65	142.14
6/09/2005	44.84	52.33
12/09/2005	23.90	61.03
18/09/2005	64.19	61.05
24/09/2005	77.18	132.96
30/09/2005	30.04	89.40
6/10/2005	74.83	127.90
12/10/2005	54.83	91.28
18/10/2005	40.17	29.01
24/10/2005	69.10	102.51
30/10/2005	48.57	27.71
5/11/2005	30.99	36.01
11/11/2005	92.30	82.64
17/11/2005	78.55	104.17
23/11/2005	51.25	53.18
29/11/2005	24.74	55.72
5/12/2005	66.15	104.62
11/12/2005	87.01	71.06

Date	Lot 9 PM_{10} ($\mu g/m^3$)
3/01/2005	27.91
9/01/2005	12.70
15/01/2005	42.77
21/01/2005	37.33
27/01/2005	19.58
2/02/2005	28.80
14/02/2005	26.39
20/02/2005	17.98
26/02/2005	42.62
4/03/2005	15.13
10/03/2005	23.82
16/03/2005	37.55
22/03/2005	11.20
28/03/2005	13.64
3/04/2005	20.01
9/04/2005	17.10
15/04/2005	19.13
21/04/2005	21.09
27/04/2005	20.55
3/05/2005	14.01
9/05/2005	9.23
15/05/2005	16.74
21/05/2005	8.16
27/05/2005	15.07
2/06/2005	24.07
8/06/2005	34.75
14/06/2005	1.55
20/06/2005	2.14
26/06/2005	8.70
2/07/2005	2.50
8/07/2005	14.72
14/07/2005	1.25
20/07/2005	17.40
26/07/2005	6.73
1/08/2005	24.41
7/08/2005	4.17
13/08/2005	13.58
19/08/2005	16.87
25/08/2005	28.12
31/08/2005	35.34
6/09/2005	16.44
12/09/2005	3.28
18/09/2005	14.72
24/09/2005	46.67
30/09/2005	8.82
6/10/2005	25.63
12/10/2005	20.50
18/10/2005	19.74
24/10/2005	25.45
30/10/2005	22.65
5/11/2005	27.31
11/11/2005	36.95
17/11/2005	24.14
23/11/2005	22.95
29/11/2005	14.31
5/12/2005	29.38
11/12/2005	40.83
17/12/2005	31.74

Date	Lot 22 TSP (µg/m³)	Pringles TSP (µg/m³)
17/12/2005	54.40	59.00
23/12/2005	87.77	105.23
29/12/2005	102.03	104.66
5/01/2007	97.42	
11/01/2007	132.90	
17/01/2007	95.12	113.2
23/01/2007	129.57	133.03
29/01/2007	116.44	
4/02/2007	125.57	
10/02/2007	90.76	
16/02/2007	83.98	
22/02/2007	75.69	81.05
28/02/2007	68.90	106.93
6/03/2007	50.14	51.03
12/03/2007	92.48	113.96
18/03/2007	38.32	43.67
24/03/2007	64.05	87.33
30/03/2007	77.18	72.68
5/04/2007	109.05	95.81
11/04/2007	69.25	95.85
17/04/2007	95.00	81.16
23/04/2007	70.03	70.18
29/04/2007	28.49	58.8
5/05/2007	72.71	125.58
11/05/2007	55.24	58.74
17/05/2007		58.79
23/05/2007		122.67
29/05/2007	41.68	190.38
4/06/2007	31.83	91.62
10/06/2007	23.72	42.18
16/06/2007	12.58	19.53
22/06/2007	9.18	115.97
28/06/2007	11.44	61.18
4/07/2007	23.49	92.12
10/07/2007	46.92	19.89
16/07/2007	35.77	37.33
22/07/2007	46.43	67.83
28/07/2007	24.68	107.89
3/08/2007	32.90	78.28
9/08/2007	34.51	117.55
15/08/2007	59.09	57.97
21/08/2007	26.82	28.94
27/08/2007	20.32	85.49
2/09/2007	47.70	100.14
8/09/2007	32.42	51.15
14/09/2007	102.03	142.74
20/09/2007	92.48	105.27
26/09/2007	95.36	82.36
2/10/2007	79.74	125.52
8/10/2007	108.40	83.76
14/10/2007	74.08	82.57
20/10/2007	133.80	
26/10/2007	27.89	163.71
1/11/2007	130.63	102.88
7/11/2007	39.51	
13/11/2007	72.95	73.75
19/11/2007	96.65	119.09
25/11/2007		50.26
1/12/2007	29.68	33.47

Date	Lot 9 PM_{10} (µg/m³)
23/12/2005	42.31
29/12/2005	51.43
4/01/2006	42.21
10/01/2006	22.05
16/01/2006	23.84
22/01/2006	23.58
28/01/2006	33.33
3/02/2006	23.91
9/02/2006	34.69
15/02/2006	32.78
21/02/2006	22.54
27/02/2006	23.18
5/03/2006	19.79
11/03/2006	38.76
17/03/2006	44.82
23/03/2006	17.64
29/03/2006	24.20
4/04/2006	18.58
10/04/2006	29.99
16/04/2006	14.24
22/04/2006	23.54
28/04/2006	22.57
4/05/2006	0.00
10/05/2006	28.67
16/05/2006	15.14
22/05/2006	11.19
28/05/2006	17.46
3/06/2006	8.76
9/06/2006	15.98
15/06/2006	9.18
21/06/2006	16.87
27/06/2006	14.31
3/07/2006	36.95
9/07/2006	10.91
15/07/2006	0.00
21/07/2006	37.19
27/07/2006	31.30
2/08/2006	11.20
8/08/2006	35.16
14/08/2006	17.22
20/08/2006	27.55
26/08/2006	19.13
1/09/2006	14.12
7/09/2006	8.17
13/09/2006	20.38
19/09/2006	53.88
25/09/2006	41.78
1/10/2006	33.57
7/10/2006	40.83
13/10/2006	36.71
19/10/2006	44.04
25/10/2006	44.06
31/10/2006	38.56
6/11/2006	24.66
12/11/2006	38.04
18/11/2006	35.40
24/11/2006	58.59
30/11/2006	44.60
6/12/2006	44.58

Date	Lot 22 TSP ($\mu g/m^3$)	Pringles TSP ($\mu g/m^3$)
7/12/2007	124.13	117.15
19/12/2007	55.37	58.27
25/12/2007	99.41	39.29
31/12/2007	99.45	122.62
6/01/2008	43.27	47.13
12/01/2008	91.82	134.35
18/01/2008	27.36	31.19
24/01/2008	57.19	40.56
30/01/2008	69.55	101.65
5/02/2008	30.63	30.95
11/02/2008	43.17	34.37
17/02/2008	45.23	49.05
23/02/2008	141.55	94.64
29/02/2008	46.73	47.89
6/03/2008		116.89
12/03/2008	55.78	89.9
18/03/2008	67.79	94.66
24/03/2008	56.70	62.25
30/03/2008	46.31	128.5
5/04/2008	59.80	111.24
11/04/2008	50.08	67.23
17/04/2008	91.60	59.45
23/04/2008		23.1
29/04/2008	22.96	86.32
5/05/2008	34.33	93.89
11/05/2008	40.35	67.94
17/05/2008	38.46	85.67
23/05/2008	50.44	87.16
29/05/2008	46.72	66.01
4/06/2008	75.27	49.33
10/06/2008		14.94
11/06/2008	11.03	
16/06/2008	47.02	
22/06/2008	28.90	75.74
28/06/2008	28.87	87.96
4/07/2008	47.62	113.62
10/07/2008	4.83	132.25
16/07/2008	9.21	87.57
22/07/2008	27.49	108.72
28/07/2008	21.69	39.84
3/08/2008	14.73	114.26
9/08/2008	6.13	123.5
15/08/2008	25.86	243.77
21/08/2008	28.49	302.69
27/08/2008	57.12	51.35
2/09/2008	49.15	92.6
8/09/2008	34.19	73.63
14/09/2008	49.11	133.27
20/09/2008	70.06	176.62
26/09/2008		121.1
2/10/2008	44.48	152.39
8/10/2008	51.74	81.91
14/10/2008	67.79	95.4
20/10/2008	75.84	158.53
26/10/2008	50.76	196.95
1/11/2008	73.20	109.27
7/11/2008	121.48	135.35
13/11/2008	113.03	110.27
19/11/2008	34.74	72.02

Date	Lot 9 PM_{10} ($\mu g/m^3$)
12/12/2006	63.89
18/12/2006	39.71
24/12/2006	26.40
30/12/2006	23.84
17/01/2007	39.04
23/01/2007	60.61
29/01/2007	43.04
4/02/2007	42.08
10/02/2007	30.60
16/02/2007	30.10
22/02/2007	45.83
28/02/2007	37.01
6/03/2007	23.55
12/03/2007	50.84
18/03/2007	23.72
24/03/2007	32.19
30/03/2007	33.43
5/04/2007	34.27
5/05/2007	42.51
11/05/2007	14.66
17/05/2007	14.66
29/05/2007	22.66
4/06/2007	17.16
10/06/2007	10.73
16/06/2007	5.13
22/06/2007	22.35
28/06/2007	1.43
4/07/2007	9.42
10/07/2007	11.14
16/07/2007	8.22
22/07/2007	18.66
28/07/2007	7.01
3/08/2007	9.06
9/08/2007	12.52
15/08/2007	28.96
21/08/2007	19.19
27/08/2007	11.56
2/09/2007	22.48
8/09/2007	41.84
14/09/2007	37.79
20/09/2007	48.12
26/09/2007	37.78
2/10/2007	43.09
8/10/2007	40.66
14/10/2007	16.81
20/10/2007	61.39
26/10/2007	13.23
1/11/2007	65.35
7/11/2007	19.67
13/11/2007	38.14
19/11/2007	45.13
25/11/2007	27.71
1/12/2007	24.21
7/12/2007	68.83
19/12/2007	54.27
25/12/2007	23.97
31/12/2007	75.57
6/01/2008	21.41
12/01/2008	45.32

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Date	Lot 22 TSP (μg/m³)	Pringles TSP (μg/m³)
25/11/2008	84.67	
1/12/2008	30.04	
7/12/2008	56.43	
9/12/2008	6.83	
13/12/2008	22.49	
19/12/2008	75.75	
25/12/2008	137.71	
31/12/2008	105.06	
12/01/2009	96.94	
18/01/2009	95.64	
24/01/2009	73.07	
31/01/2009	127.69	
6/02/2009	213.38	
12/02/2009	42.59	
18/02/2009	9.35	
28/02/2009	74.26	
7/03/2009	126.63	
13/03/2009	91.46	
19/03/2009	64.13	
25/03/2009	59.68	
31/03/2009	112.58	
6/04/2009	38.28	
12/04/2009	30.70	
18/04/2009	15.14	
24/04/2009	28.17	
30/04/2009	31.24	
6/05/2009	39.33	
12/05/2009	36.00	
19/05/2009	50.96	
30/05/2009	20.03	
5/06/2009	17.70	
11/06/2009	10.63	
17/06/2009	45.37	
23/06/2009	7.15	
29/06/2009	6.20	
5/07/2009	24.33	
11/07/2009	26.40	
17/07/2009	11.76	
23/07/2009	16.81	
29/07/2009	18.26	
4/08/2009	15.70	
10/08/2009	61.20	
16/08/2009	28.72	
22/08/2009	31.92	
28/08/2009	39.53	
3/09/2009	23.60	
9/09/2009	17.24	
15/09/2009	153.32	
21/09/2009	152.74	
27/09/2009	92.65	
3/10/2009	42.81	
9/10/2009	97.00	
15/10/2009	47.22	
21/10/2009	90.18	
27/10/2009	23.33	
2/11/2009	86.96	
8/11/2009	29.11	
14/11/2009	85.99	
20/11/2009	142.80	

Date	Lot 9 PM_{10} (μg/m³)
18/01/2008	16.70
24/01/2008	28.62
30/01/2008	30.36
5/02/2008	19.79
11/02/2008	23.54
17/02/2008	20.08
23/02/2008	60.82
29/02/2008	26.81
6/03/2008	24.20
12/03/2008	23.02
18/03/2008	39.97
24/03/2008	28.73
30/03/2008	14.66
5/04/2008	29.39
11/04/2008	20.26
17/04/2008	30.75
23/04/2008	5.48
29/04/2008	27.40
5/05/2008	21.69
11/05/2008	19.62
17/05/2008	15.61
23/05/2008	22.34
29/05/2008	31.64
4/06/2008	41.58
11/06/2008	5.90
16/06/2008	11.63
22/06/2008	5.01
28/06/2008	14.60
4/07/2008	22.54
10/07/2008	2.91
16/07/2008	13.98
22/07/2008	8.33
28/07/2008	18.03
3/08/2008	6.73
9/08/2008	2.21
15/08/2008	7.09
21/08/2008	19.80
28/08/2008	23.85
2/09/2008	21.10
8/09/2008	14.96
14/09/2008	16.11
20/09/2008	42.67
26/09/2008	9.56
2/10/2008	21.34
8/10/2008	25.28
14/10/2008	26.52
20/10/2008	28.19
26/10/2008	24.85
1/11/2008	27.37
7/11/2008	44.72
13/11/2008	38.20
19/11/2008	11.80
25/11/2008	33.78
1/12/2008	8.11
7/12/2008	23.84
13/12/2008	26.29
19/12/2008	27.59
25/12/2008	18.54
31/12/2008	44.76

Date	Lot 22 TSP ($\mu g/m^3$)	Pringles TSP ($\mu g/m^3$)
26/11/2009	109.48	
2/12/2009	76.28	
8/12/2009	160.91	
14/12/2009	149.66	
20/12/2009	115.21	
26/12/2009	30.12	
1/01/2010	34.00	
7/01/2010	115.62	
13/01/2010	96.21	
19/01/2010	78.78	
25/01/2010	140.89	
31/01/2010	45.97	
6/02/2010	21.46	
12/02/2010	89.32	
18/02/2010	106.58	
24/02/2010	104.42	
2/03/2010	59.38	
8/03/2010	40.76	
14/03/2010	15.03	
20/03/2010	60.34	
26/03/2010	78.10	
1/04/2010	158.33	
13/04/2010	64.82	
19/04/2010	37.14	
25/04/2010	14.94	
1/05/2010	27.20	
7/05/2010	27.56	
13/05/2010	34.94	
19/05/2010	41.67	
25/05/2010	35.00	
31/05/2010	5.60	
6/06/2010	24.76	
12/06/2010	30.89	
18/06/2010	19.70	
30/06/2010	14.23	
6/07/2010	32.44	
12/07/2010	9.76	
18/07/2010	12.86	
24/07/2010	32.04	
30/07/2010	10.18	
5/08/2010	19.58	
11/08/2010	1.01	
17/08/2010	53.39	
23/08/2010	31.13	
29/08/2010	73.39	
4/09/2010	15.48	
10/09/2010	23.99	
16/09/2010	25.48	
22/09/2010	66.01	
28/09/2010	63.10	
4/10/2010	31.13	
10/10/2010	54.29	
16/10/2010	46.19	
22/10/2010	62.68	
28/10/2010	85.42	
2/11/2010	47.62	
10/11/2010	42.76	
15/11/2010	77.00	
21/11/2010	52.27	

Date	Lot 9 PM_{10} ($\mu g/m^3$)
6/01/2009	23.74
12/01/2009	31.86
18/01/2009	31.17
24/01/2009	27.40
31/01/2009	45.59
6/02/2009	56.38
12/02/2009	21.93
18/02/2009	13.44
28/02/2009	38.80
7/03/2009	52.71
13/03/2009	42.37
19/03/2009	31.29
25/03/2009	32.26
31/03/2009	42.61
6/04/2009	19.91
12/04/2009	23.24
18/04/2009	10.22
24/04/2009	7.54
30/04/2009	16.81
6/05/2009	21.93
12/05/2009	28.92
19/05/2009	24.79
24/05/2009	20.20
30/05/2009	12.10
5/06/2009	5.25
11/06/2009	4.53
17/06/2009	21.45
23/06/2009	6.14
29/06/2009	2.56
5/07/2009	3.58
11/07/2009	8.59
17/07/2009	2.38
23/07/2009	6.56
29/07/2009	4.35
4/08/2009	8.94
10/08/2009	44.34
16/08/2009	10.49
22/08/2009	12.10
28/08/2009	15.79
3/09/2009	37.56
9/09/2009	8.64
15/09/2009	50.48
21/09/2009	31.65
27/09/2009	57.00
3/10/2009	14.60
9/10/2009	20.62
15/10/2009	26.82
21/10/2009	44.00
27/10/2009	18.53
2/11/2009	55.37
8/11/2009	14.61
14/11/2009	34.03
20/11/2009	108.20

Date	Lot 22 TSP ($\mu g/m^3$)	Pringles TSP ($\mu g/m^3$)
27/11/2010	93.64	
3/12/2010	52.45	
9/12/2010	28.96	
15/12/2010	73.99	
21/12/2010	36.77	
27/12/2010	56.50	
5/09/2011	20.16	
11/09/2011	17.65	
17/09/2011	31.89	
23/09/2011	76.58	
29/09/2011	31.71	
5/10/2011	50.44	
11/10/2011	37.84	
17/10/2011	50.66	
23/10/2011	71.22	
29/10/2011	52.71	
4/11/2011	51.35	
10/11/2011	53.72	
16/11/2011	39.34	
22/11/2011	7.88	
28/11/2011	56.85	
4/12/2011	34.69	
10/12/2011	35.90	
16/12/2011	47.64	
22/12/2011		
28/12/2011	60.28	

Date	Lot 9 PM_{10} ($\mu g/m^3$)

APPENDIX C – ESTIMATION OF DUST EMISSIONS

Drayton South Mine Project

For each stage of the mine shown in **Figures B1** to **B7,** a corresponding emissions inventory has been developed. The modelled scenarios are considered to be representative of worst-case operations; for example where coal and waste material amounts are highest, where extraction or wind erosion areas are largest or where operations are located closest to receivers.

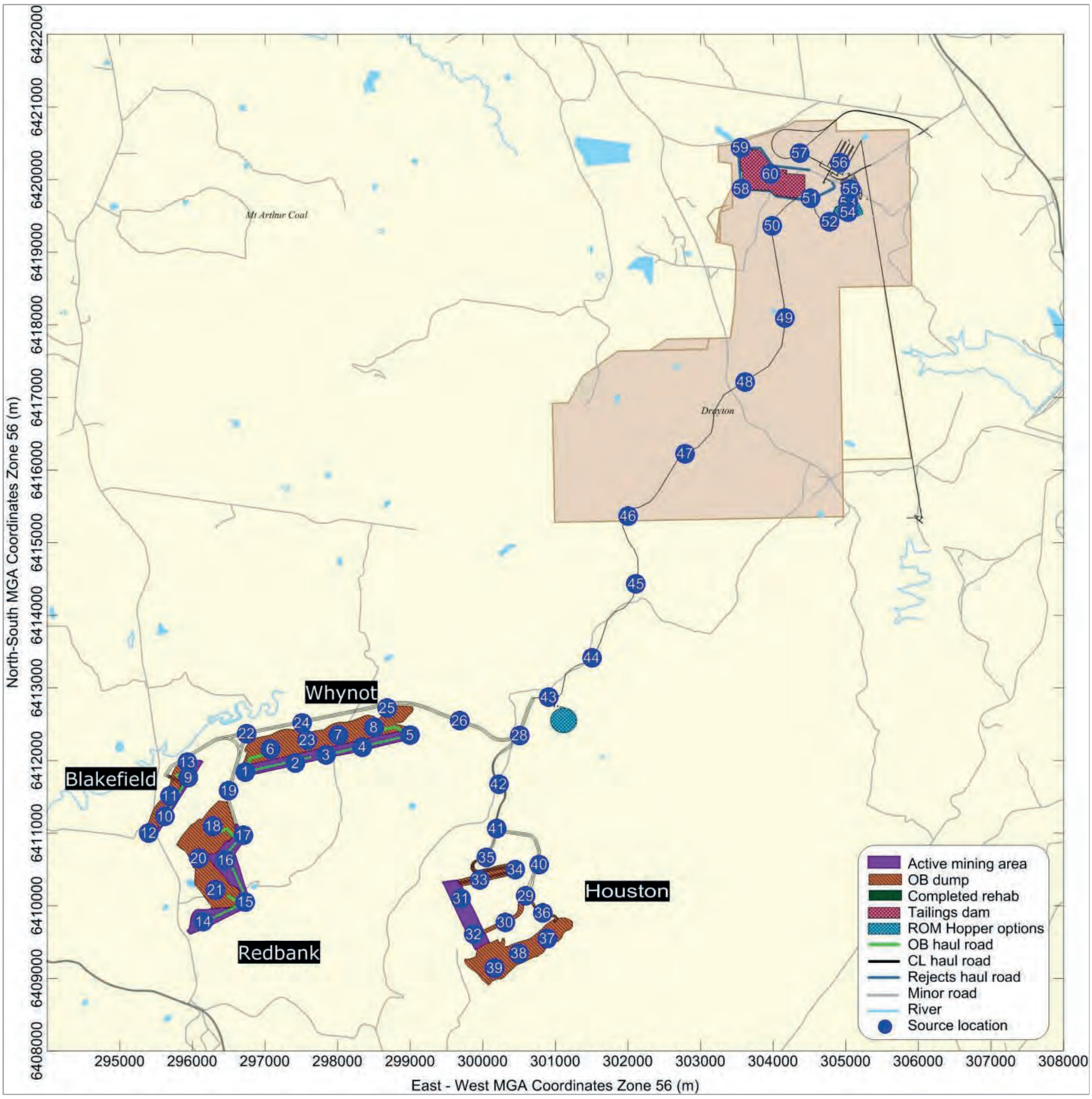


Figure C-1: Location of Sources for Year 3A

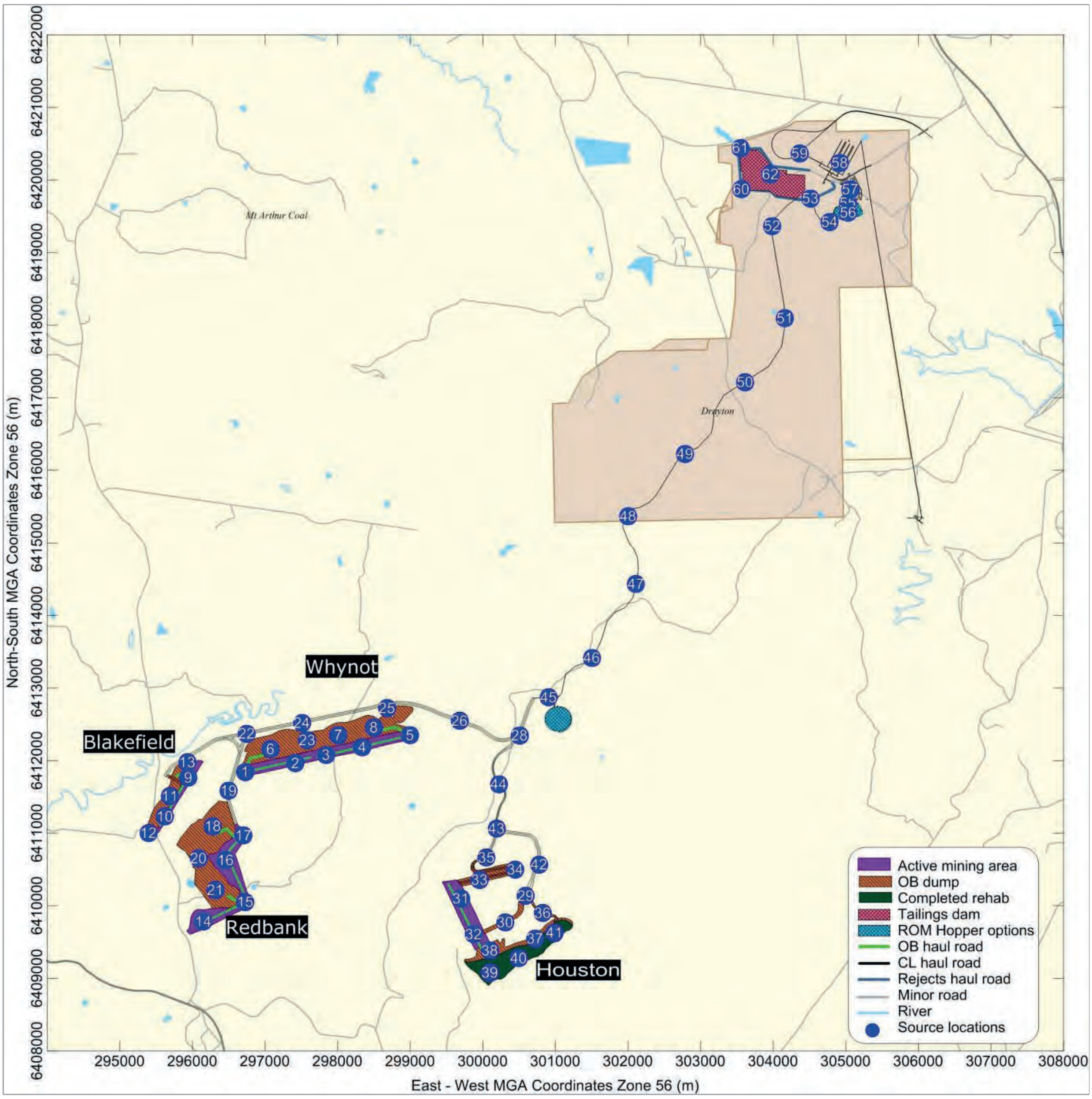


Figure C-2: Location of Sources for Year 3B

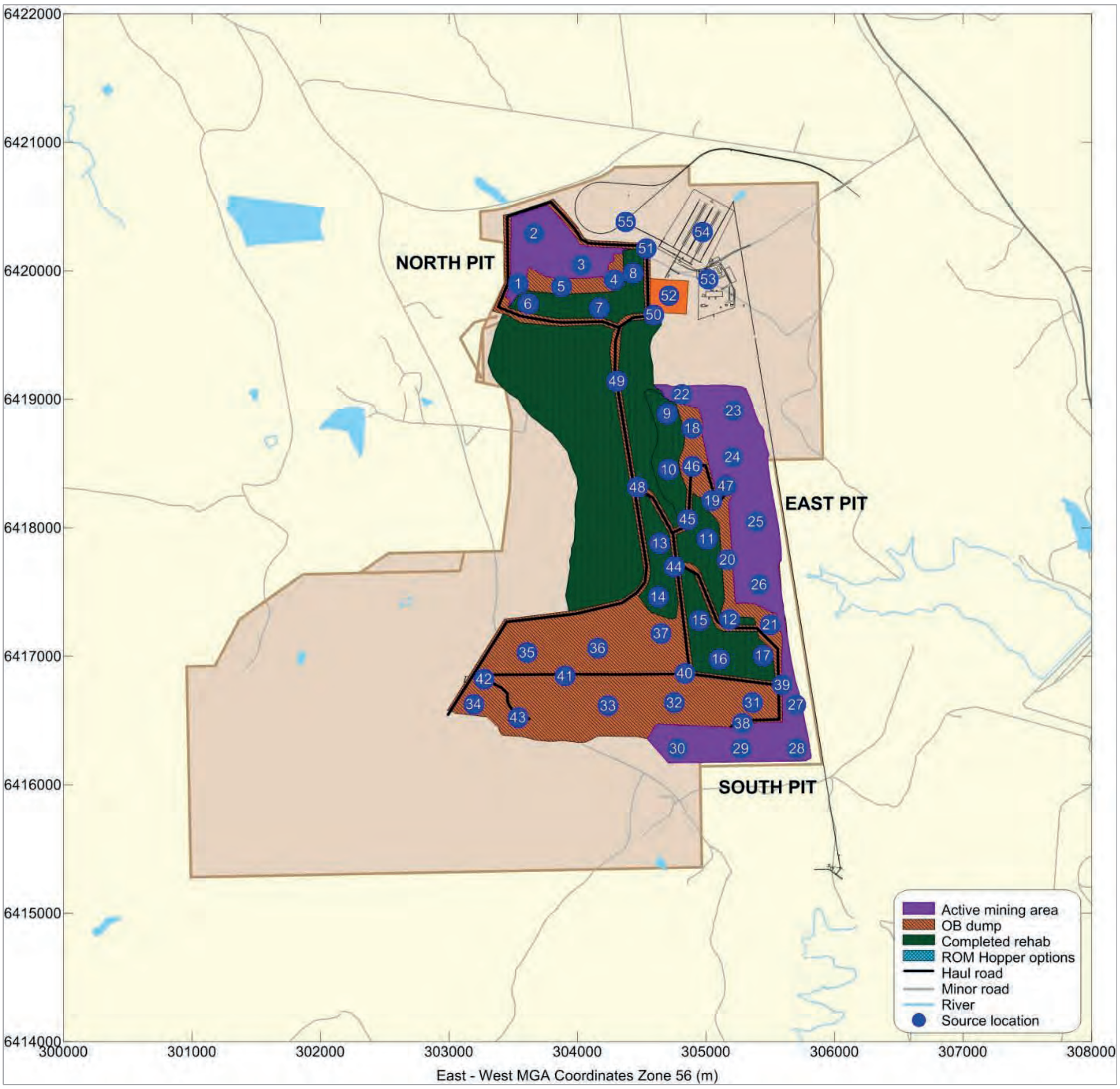


Figure C-3: Location of Sources for Drayton Coal Mine Year 3A/3B

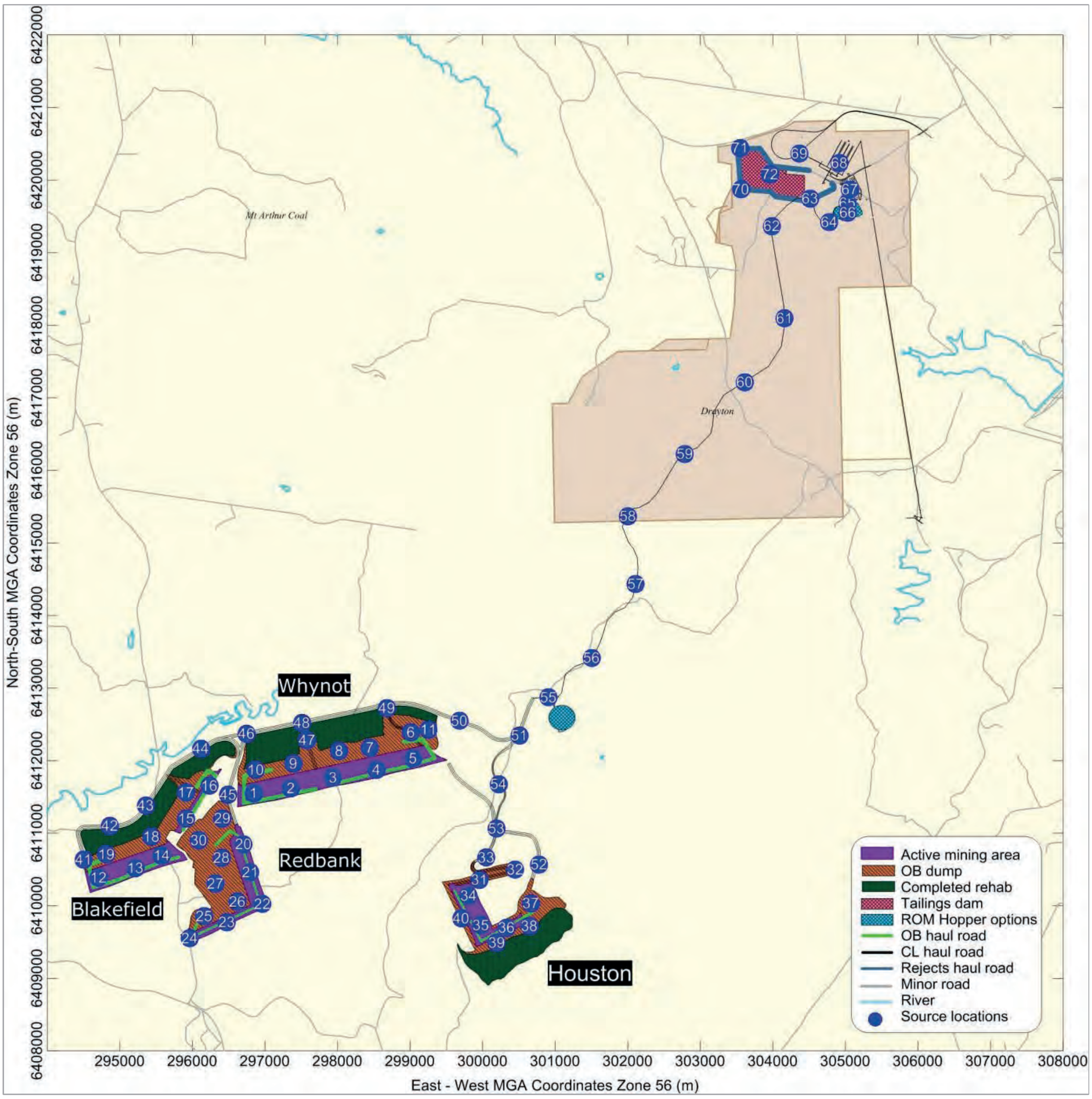


Figure C-4: Location of Sources for Year 5

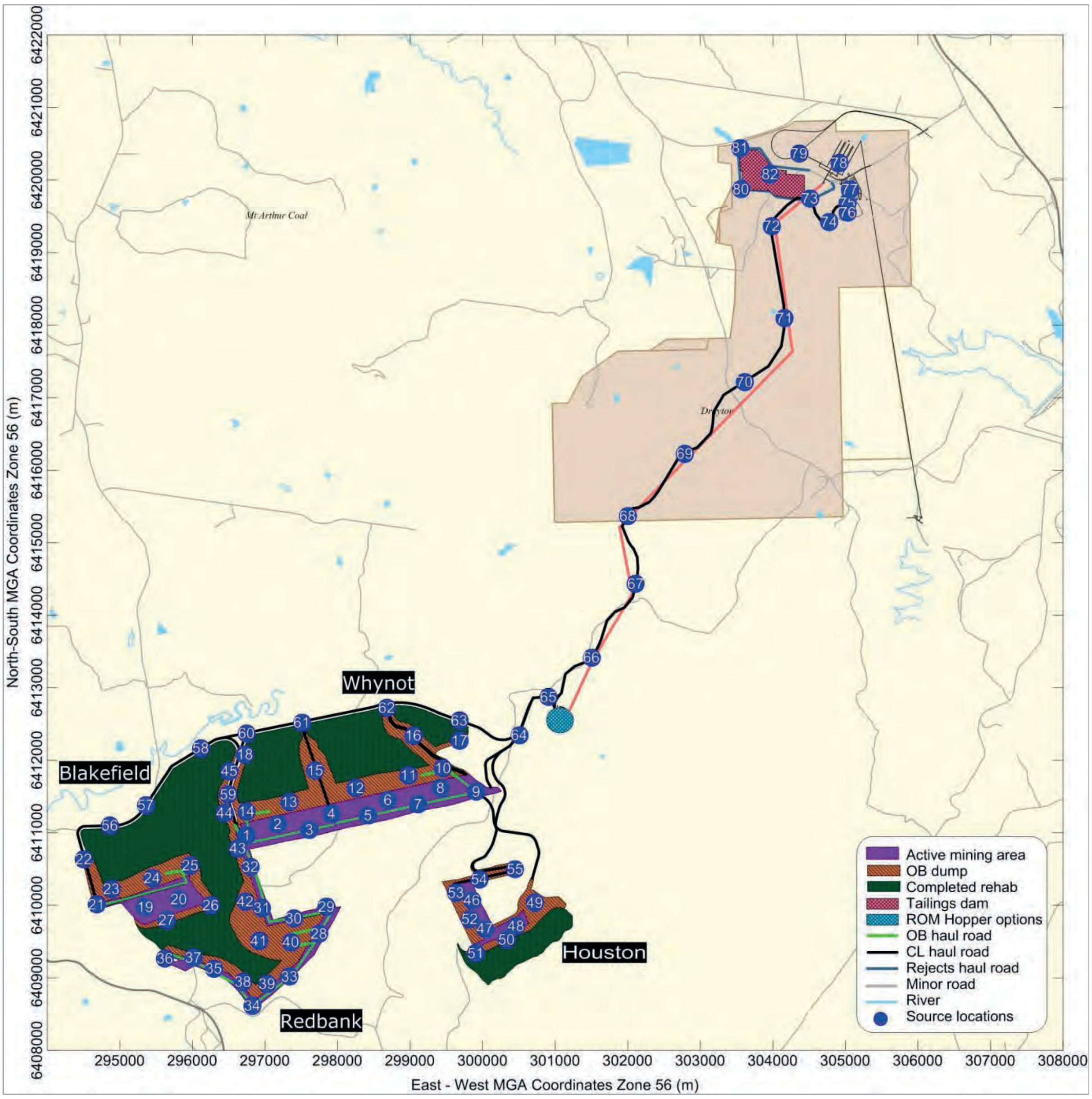


Figure C-5: Location of Sources for Year 10

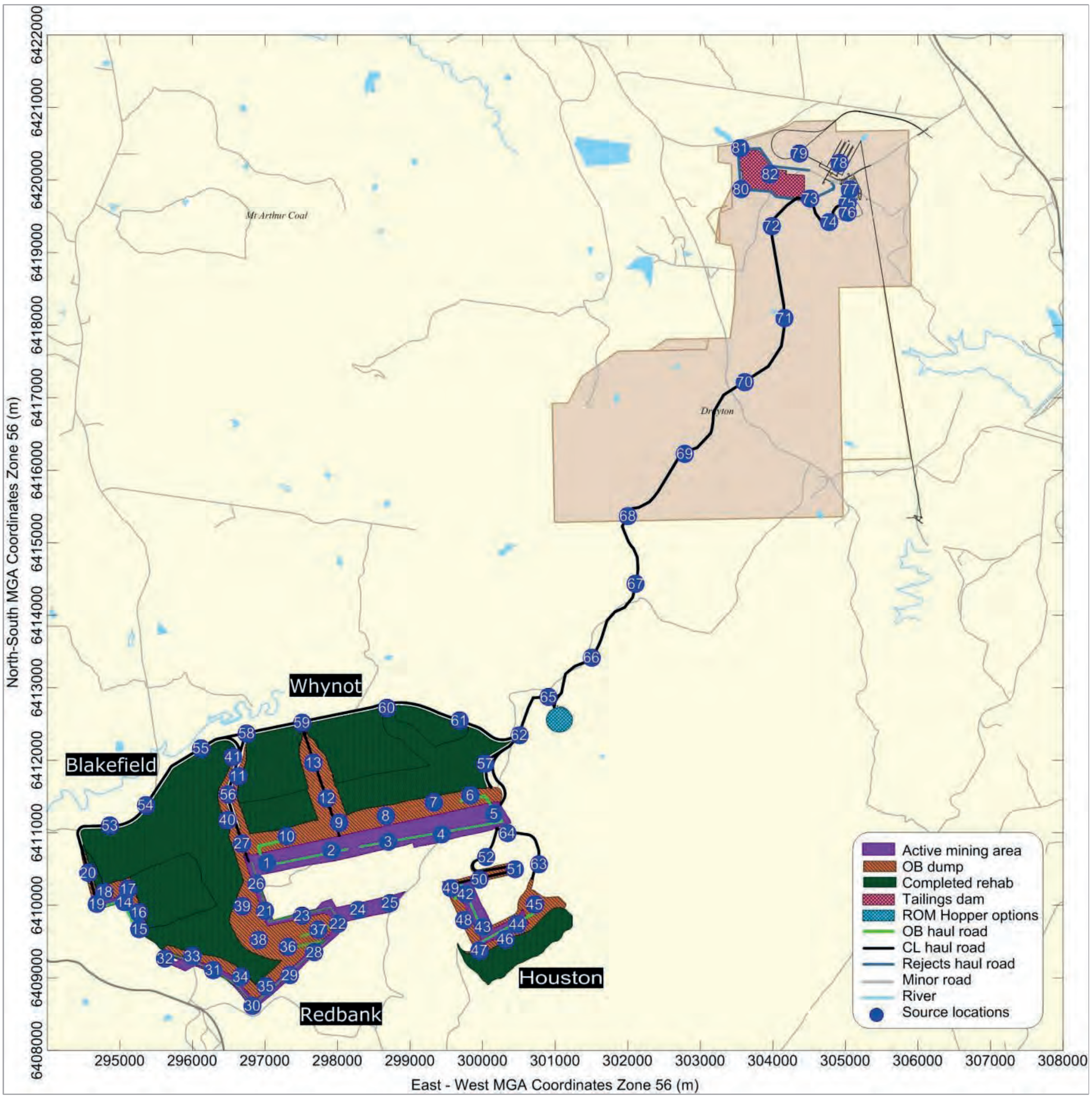


Figure C-6: Location of Sources for Year 15

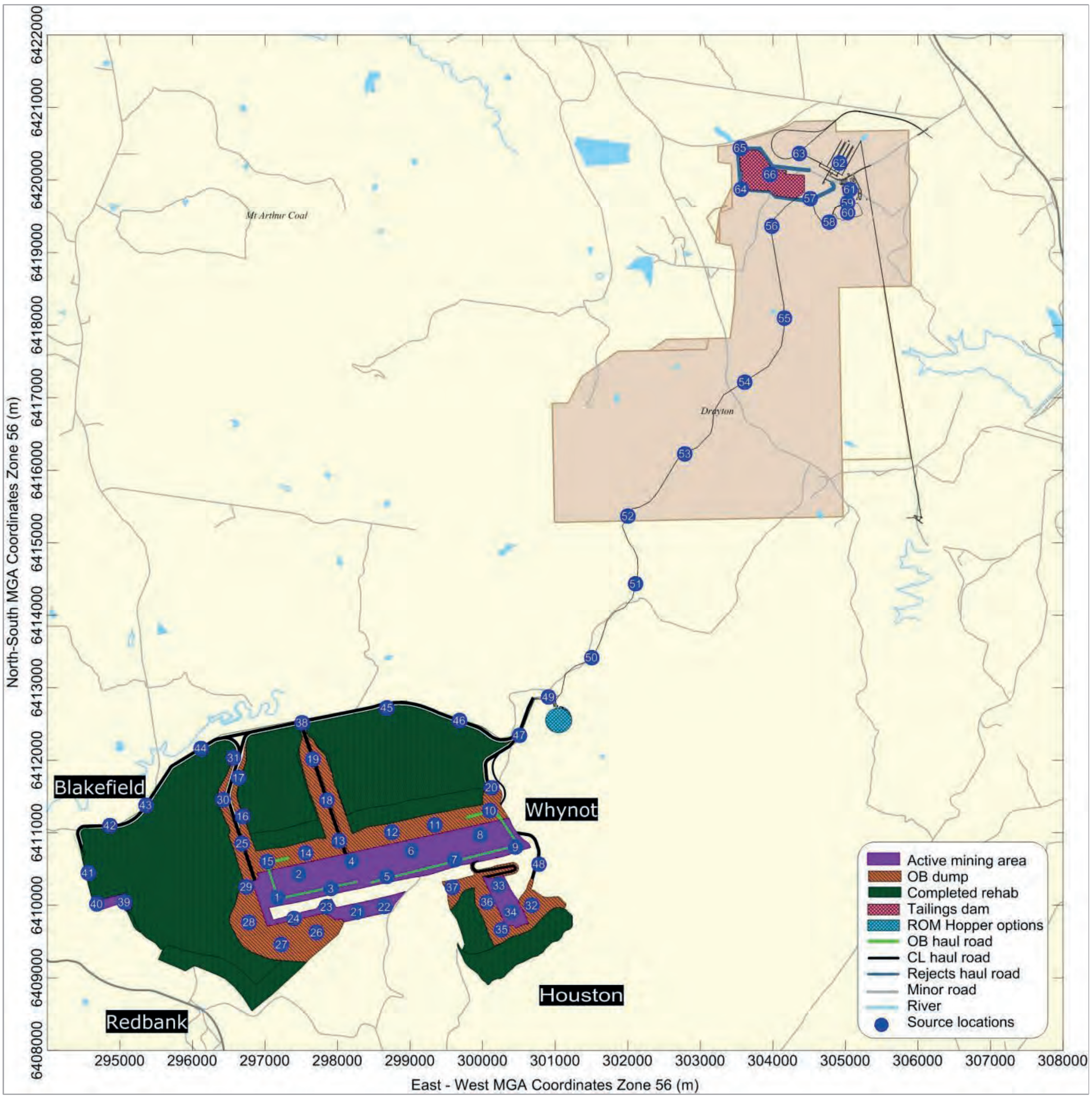


Figure C-7: Location of Sources for Year20

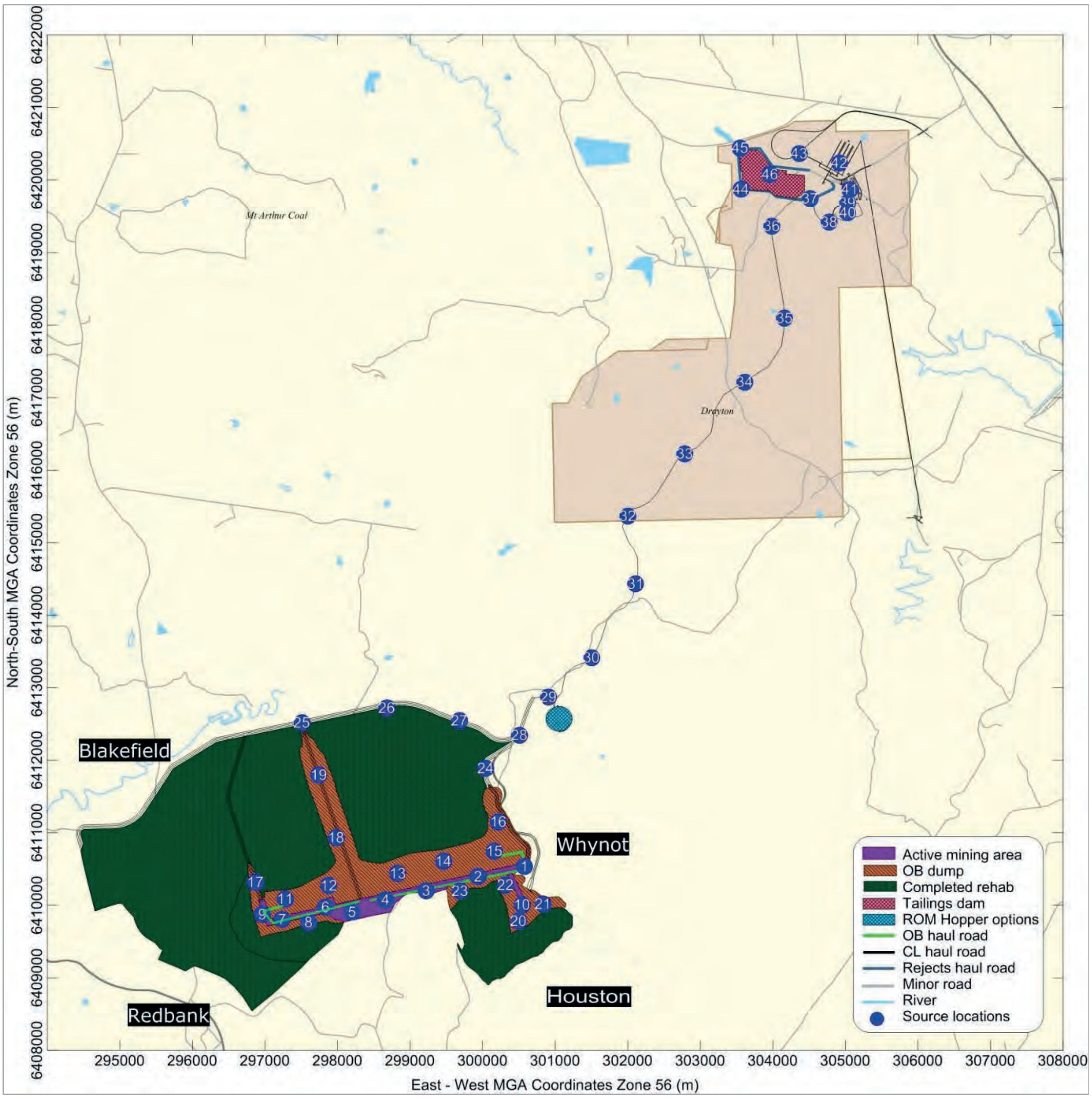


Figure C-8: Location of Sources for Year27

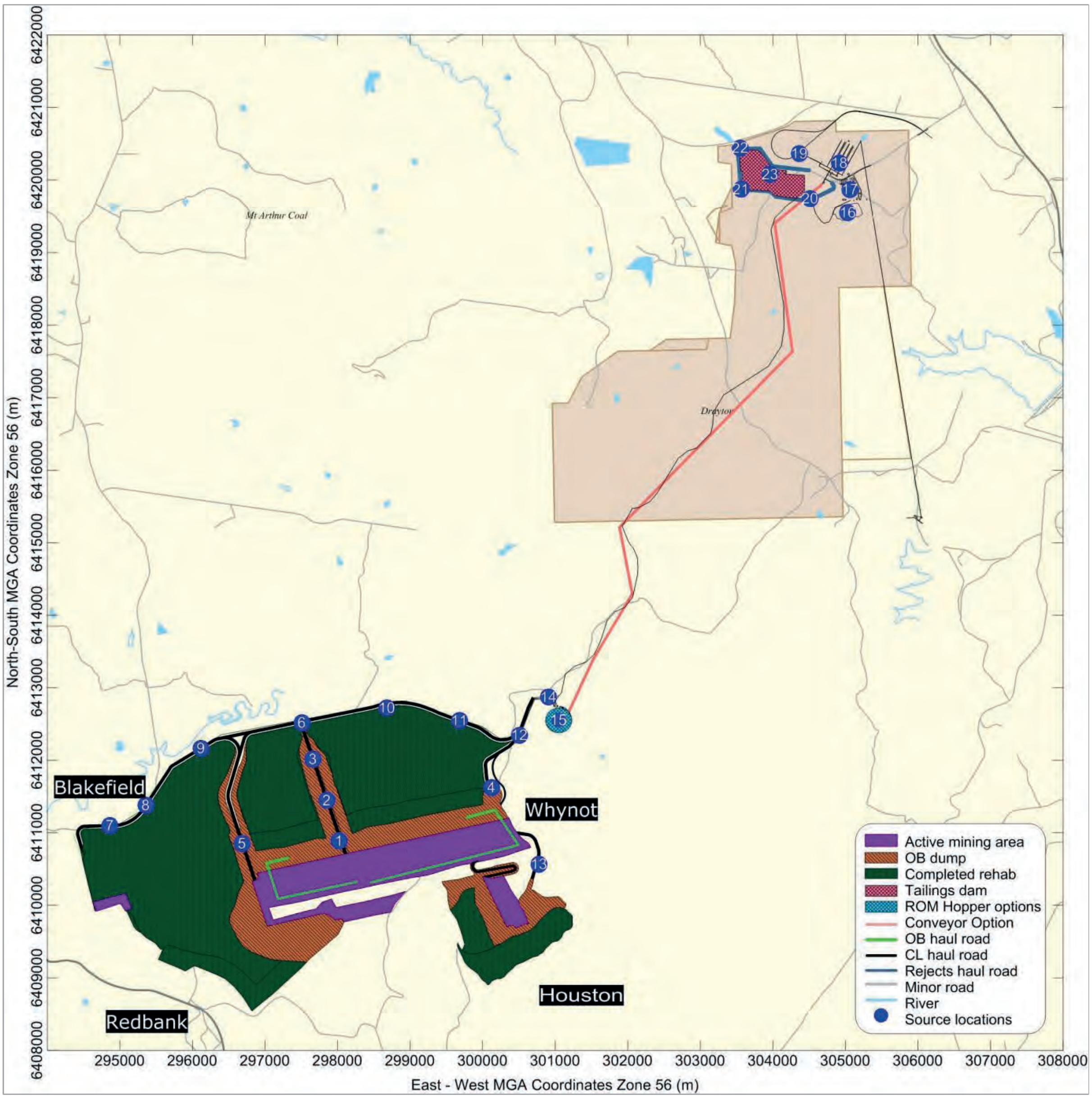


Figure C-9: Location of Sources for Year20 – Conveyor Option

Stripping topsoil

Emissions from dozers on overburden have been calculated using the United States Environment Protection Agency (US EPA) emission factor equation (**US EPA, 1985 and updates**), per **Equation 1**.

Equation 1

$$E_{TSP} = 2.6 \times \frac{s^{1.2}}{M^{1.3}} \ (kg|hour)$$

Where,
E_{TSP} =TSP emissions
s = silt content (%), and
M = moisture (%)

The silt content in the topsoil was assumed to be 10%, and the moisture content 2%. This results in an emission factor of 16.7 kg/h.

Drilling overburden and coal

The emission factor used for drilling has been taken to be 0.59 kg/hole (**US EPA, 1985 and updates**).

Blasting overburden and coal

TSP emissions from blasting were estimated using the **US EPA (1985 and updates)** emission factor equation given in **Equation 2**.

Equation 2

$$\mathrm{E_{TSP}} = 0.00022 \times \mathrm{A}^{1.5} \ (kg|blast)$$

Where,
E_{TSP}= TSP emissions
A = area to be blasted in m^2

The area blasted for each scenario is based on ha per blast provided in mine schedule each year.

Loading material /transfer material dumping overburden
Each tonne of material loaded will generate a quantity of TSP that will depend on the wind speed and the moisture content. **Equation 3** shows the relationship between these variables.

Equation 3

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right) (kg|t)$$

Where,
E_{TSP} = TSP emissions
k = 0.74,
U = wind speed (m/s)
M = moisture content % of 0.25

The mean wind speed has been taken to be 1.57-1.61 m/s for Drayton South and 1.46 m/s for Drayton and a moisture content of 2.5%.

Hauling material/product on unsealed surfaces

The emission estimate of wheel generated dust presented in the EIS is based the US EPA AP42 emission factor for unpaved surfaces at industrial sites shown below:

$$E_{TSP} = 0.2819 \times \left[4.9 \times \left(\frac{s}{12}\right)^{0.7} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}\right] (kg|VKT)$$

Where:
E_{TSP} = TSP emissions
s = silt content of road surface
W = mean vehicle weight

The adopted silt content (s) for the EA was 3%. This is higher (i.e. more conservative) than the silt content measured for the Duralie Coal Mine (1.6%) (**Heggies, 2009**) and is consistent with testing done at multiple mines sites in the Hunter Valley which measured average haul road silt contents of 2-3%, for a current ACARP project. The mean vehicle weight used in the emissions estimates is an average of the loaded and unloaded gross vehicle mass, to account for one empty trip and one loaded trip.

	Capacity	Full (GVM)	Empty	For Inventory
OB trucks (t) - CAT775	63.5	109.770	46	78
OB trucks (t) - CAT789	177	317.515	141	229
CL trucks (t)	70	100	30	65
OB trucks (t) – Komatsu 830	222	385.848	164.2	275

Dozers working on overburden

Emissions from dozers on overburden have been calculated using the US EPA emission factor **Equation 1** (**US EPA, 1985 and updates**).

The silt content of the overburden was assumed to be 10%, and the moisture content 2.5%. This results in an emission factor of 12.5 kg/h.

Dozers working on coal

The **US EPA (1985 and updates)** emission factor equation has been used. It is given below in **Equation 5**.

Equation 5

$$E_{TSP} = 35.6 \times \frac{s^{1.2}}{M^{1.4}} \quad (kg|hour)$$

Where,
E_{TSP} = TSP emissions
s = silt content (%), and
M = moisture (%)

The silt content of the coal was assumed to be 5%, and the moisture content 9%. This results in an emission factor of 14.1 kg/h.

Loading/unloading coal

The **US EPA (1985 and updates)** emission factor equation has been used. It is given below in **Equation 6**.

Equation 6

$$E_{TSP}\ \left(\frac{kg}{t}\right) = \frac{0.580}{M^{1.2}}(kg|t)$$

Where,
E_{TSP} = TSP emissions
M = moisture (%)

The moisture content of the coal was assumed to be 9%.

Wind erosion
The **SPCC (1983)** default emission factor of 0.4 has been used for wind erosion.

The following tables present the calculated emissions for Year 3, Year 5, Year 10, Year 15, Year 20 and Year 27 which corresponds to the sources allocations as represented in **Figure C1** – **Figure C7**.

The abbreviations used in the tables are as follows:

- OB - overburden related activities
- CL - coal related activities
- WE - wind erosion emissions

Table C.12-3: Year 3A – Drayton South Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT																	
Topsoil Removal & Site preparation - Dozers on Whynot	17,998	2,151	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Whynot	248	266,920	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	2,513	133,460	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	2,132	133,460	t/y	0.064	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.9	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	497	266,920	t/y	0.002	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Whynot	3,241	18,312	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	18,408	80	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	32,026	2,558	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	309,391	10,411,741	bcm/y	0.0297	kg/m3 (loose	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Whynot	19,795	1,581	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Whynot	9,188	6,745,377	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area (east) - Whynot	63,508	3,372,688	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator OB to emplacement area (west) - Whynot	53,870	3,372,688	t/y	0.064	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.9	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Whynot	4,489	359	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Whynot	4,489	359	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing excavator OB at emplacement area - Whynot	9,188	6,745,377	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	51,822	4,139	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	67,138	5,362	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	20,203	1,613	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	1,110	814,871	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	7,672	407,436	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	6,508	407,436	t/y	0.064	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.9	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	1,110	814,871	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Whynot	1,017	5,744	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Whynot	6,679	29	blasts/y	230	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	55,252	3,914	h/y	14.116	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FCLs loading open coal to trucks - Whynot	51,521	1,240,646	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	14,012	620,323	t/y	0.090	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	79,887	620,323	t/y	0.86	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	11,894	620,323	t/y	0.077	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	72,924	620,323	t/y	0.78	kg/t	70	t/load	65.0	Vehicle gross mass (t)	25	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	3,722	1,240,646	t/y	0.01	kg/t	70	% control										
CL - Handle coal at CHPP - Whynot	260	1,240,646	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	1,241	124,065	t/y	0.01	kg/t												
BLAKEFIELD																	
Topsoil removal & site preparation - Dozers on Blakefield	7,537	901	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Blakefield	65	69,522	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area - Blakefield	1,057	69,522	t/y	0.061	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Blakefield	129	69,522	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Blakefield	1,424	8,048	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Blakefield	8,090	35	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Blakefield	16,743	1,337	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Blakefield	163,950	5,517,311	bcm/y	0.030	kg/m3 (loose	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Blakefield	367	29	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Blakefield	170	125,090	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area - Blakefield	1,901	125,090	t/y	0.061	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads - Blakefield	166	13	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Blakefield	170	125,090	t/y	0.00136	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Blakefield	17,110	1,366	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Blakefield	34,527	2,757	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Blakefield	721	58	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Blakefield	229	167,953	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area - Blakefield	2,553	167,953	t/y	0.061	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Blakefield	229	167,953	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Blakefield	473	2,672	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Blakefield	3,107	13	blasts/y	230	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Blakefield	12,363	876	h/y	14.116	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FCLs loading open coal to trucks - Blakefield	23,964	577,053	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pits roads - Blakefield	6,567	577,053	t/y	0.046	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.5	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Blakefield	86,091	577,053	t/y	0.99	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31.9	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	1,731	577,053	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Blakefield	121	577,053	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	577	57,705	t/y	0.01	kg/t												
REDBANK																	
Topsoil removal - Dozers/Excavators stripping topsoil - Redbank	7,772	929	h/y	8.4	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Redbank	273	292,969	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (north) - Redbank	2,029	146,484	t/y	0.055	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.6	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (south) - Redbank	1,686	146,484	t/y	0.046	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.1	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Redbank	545	292,969	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling for excavator removal - Redbank	1,326	7,494	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Redbank	7,534	33	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit - Redbank	43,696	3,490	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Redbank	20,281	14,889,472	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (north) - Redbank	103,137	7,444,736	t/y	0.055	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.6	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (south) - Redbank	85,665	7,444,736	t/y	0.046	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.1	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (north) - Redbank	9,909	791	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (south) - Redbank	9,909	791	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Redbank	20,281	14,889,472	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area -Redbank	43,696	3,490	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Redbank	15,889	1,269	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Redbank	16,166	1,291	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Redbank	1,062	779,421	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (north) - Redbank	5,399	389,711	t/y	0.055	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.6	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (south) - Redbank	4,484	389,711	t/y	0.046	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.1	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Redbank	1,062	779,421	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Redbank	803	4,535	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Redbank	5,273	23	blasts/y	230	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Redbank	39,151	2,774	h/y	14.116	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FCLs loading open coal to trucks - Redbank	40,679	979,572	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pits roads - Redbank	29,242	979,572	t/y	0.12	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3.8	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Redbank	143,889	979,572	t/y	0.98	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31.4	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Redbank	2,939	979,572	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Redbank	206	979,572	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	980	97,957	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading rejects	-	699,318	t/y	Rejects very wet therefore no dust													
CL - Transporting rejects	34,288	699,318	t/y	0.20	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.85	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	699,318	t/y	Rejects very wet therefore no dust													
PRODUCT COAL																	
CL - Loading product stockpile	255	2,143,148	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %	25	% control						
CL - Loading product coal to trains	340	2,143,148	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Whynot - Uncontrolled	221,206	63	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Whynot - Controlled	12,289	7	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump& disturbed area - Blakefield - Uncontrolled	56,404	16	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump& disturbed area - Blakefield - Controlled	3,134	2	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump& disturbed area - Redbank - Uncontrolled	205,960	59	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump& disturbed area - Redbank - Controlled	11,442	7	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area - Whynot	122,477	35	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Blakefield	31,900	9	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Redbank	134,430	38	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-4: Year 3B – Drayton South Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT																	
Topsoil Removal & Site preparation - Dozers on Whynot	17,998	2,151	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Cx/FELs loading topsoil - Whynot	251	266,920	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	2,513	133,460	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	2,132	133,460	t/y	0.064	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.9	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	502	266,920	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Whynot	3,241	18,312	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	18,408	80	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	32,026	2,558	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	309,391	10,411,741	bcm/y	0.030	kg/m3 (loose	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavtor OB in-pit - Whynot	19,795	1,581	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Whynot	9,288	6,745,377	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area (east) - Whynot	63,508	3,372,688	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator OB to emplacement area (west) - Whynot	53,870	3,372,688	t/y	0.064	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.9	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Whynot	4,489	359	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Whynot	4,489	359	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing excavator OB at emplacement area - Whynot	9,288	6,745,377	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	51,822	4,139	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	67,138	5,362	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	20,203	1,613	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	1,122	814,871	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	7,672	407,436	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	6,508	407,436	t/y	0.064	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.9	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	1,122	814,871	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Whynot	1,017	5,744	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Whynot	6,679	29	blasts/y	230	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	55,252	3,914	h/y	14.116	kg/h	5.0	silt content in %	9	moisture content in %								
CL - Sh/Cx/FCLs loading open coal to trucks - Whynot	51,521	1,240,646	t/y	0.042	kg/t	9.0	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	14,012	620,323	t/y	0.090	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	79,887	620,323	t/y	0.859	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	11,894	620,323	t/y	0.077	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	72,924	620,323	t/y	0.78	kg/t	70	t/load	65.0	Vehicle gross mass (t)	25	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	3,722	1,240,646	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Whynot	260	1,240,646	t/y	0.000	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	1,241	124,065	t/y	0.01	kg/t												
BLAKEFIELD																	
Site preparation - Dozers on Blakefield	7,537	901	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Blakefield	65	69,522	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area - Blakefield	1,057	69,522	t/y	0.061	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Blakefield	131	69,522	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Blakefield	1,424	8,048	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Blakefield	8,090	35	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Blakefield	16,743	1,337	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Blakefield	163,950	5,517,311	bcm/y	0.030	kg/m3 (loose	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Blakefield	367	29	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Blakefield	172	125,090	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area - Blakefield	1,901	125,090	t/y	0.061	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads - Blakefield	166	13	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Blakefield	172	125,090	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area -Blakefield	17,110	1,366	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Blakefield	34,527	2,757	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Blakefield	721	58	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Blakefield	231	167,953	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area - Blakefield	2,553	167,953	t/y	0.061	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Blakefield	231	167,953	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Blakefield	473	2,672	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Blakefield	3,107	13	blasts/y	230.35	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Blakefield	12,363	876	h/y	14.116	kg/h	5.0	silt content in %	9	moisture content in %								
CL - Sh/Cx/FCLs loading open coal to trucks - Blakefield	23,964	577,053	t/y	0.042	kg/t	9.0	moisture content in %										
CL - Hauling open coal in-pits roads - Blakefield	6,567	577,053	t/y	0.046	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.5	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Blakefield	86,091	577,053	t/y	0.995	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31.9	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	1,731	577,053	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Blakefield	121	577,053	t/y	0.000	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	577	57,705	t/y	0.01	kg/t												
REDBANK																	
Topsoil removal - Dozers/Excavators stripping topsoil - Redbank	7,772	929	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Redbank	276	292,969	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (north) - Redbank	2,029	146,484	t/y	0.055	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.6	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (south) - Redbank	1,686	146,484	t/y	0.046	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.1	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Redbank	551	292,969	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling for excavator removal - Redbank	1,326	7,494	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Redbank	7,534	33	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit - Redbank	43,696	3,490	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Redbank	20,502	14,889,472	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (north) - Redbank	103,137	7,444,736	t/y	0.055	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.6	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (south) - Redbank	85,665	7,444,736	t/y	0.046	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.1	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (north) - Redbank	9,909	791	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (south) - Redbank	9,909	791	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Redbank	20,502	14,889,472	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area -Redbank	43,696	3,490	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Redbank	15,889	1,269	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Redbank	16,166	1,291	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Redbank	1,073	779,421	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to epmlacement area (north) - Redbank	5,399	389,711	t/y	0.055	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.6	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to epmlacement area (south) - Redbank	4,484	389,711	t/y	0.046	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.1	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Redbank	1,073	779,421	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Redbank	803	4,535	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Redbank	5,273	23	blasts/y	230	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Redbank	39,151	2,774	h/y	14.116	kg/h	5.0	silt content in %	9	moisture content in %								
CL - Sh/Cx/FCLs loading open coal to trucks - Redbank	40,679	979,572	t/y	0.042	kg/t	9.0	moisture content in %										
CL - Hauling open coal in-pits roads - Redbank	29,242	979,572	t/y	0.12	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3.8	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Redbank	143,889	979,572	t/y	0.98	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31.4	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Redbank	2,939	979,572	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Redbank	206	979,572	t/y	0.000	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	980	97,957	t/y	0.01	kg/t												
HOUSTON																	
Topsoil Removal - Dozers/Excavators stripping topsoil - Houston	14,930	1,784	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Houston	158	168,297	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area - Houston	2,304	168,297	t/y	0.055	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Houston	317	168,297	t/y	0.0	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling for excavator removal - Houston	2,444	13,807	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Houston	13,880	60	blasts/y	230	kg/blast	10311	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit - Houston	80,503	6,429	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Houston	37,772	27,431,844	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area - Houston	375,562	27,431,844	t/y	0.055	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads - Houston	36,511	2,916	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Houston	37,772	27,431,844	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Houston	80,503	6,429	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Houston	26,808	2,141	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Houston	11,177	893	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Houston	537	389,649	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to epmlacement area - Houston	5,335	389,649	t/y	0.055	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.5	km/return trip	3.85	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Houston	537	389,649	t/y	0.00	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Houston	1,354	7,652	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Houston	8,897	39	blasts/y	230	kg/blast	10311	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Houston	80,856	5,728	h/y	14.116	kg/h	5.0	silt content in %	9	moisture content in %								
CL - Sh/Cx/FCLs loading open coal to trucks - Houston	68,634	1,652,729	t/y	0.042	kg/t	9.0	moisture content in %										
CL - Hauling open coal in-pits roads (east) - Houston	14,466	826,365	t/y	0.070	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.2	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal in-pits roads (west) - Houston	10,846	826,365	t/y	0.053	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.7	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Houston	102,851	826,365	t/y	0.83	kg/t	70	t/load	65.0	Vehicle gross mass (t)	26.6	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal to ROM pad (west) - Houston	109,150	826,365	t/y	0.88	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28.2	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Houston	4,958	1,652,729	t/y	0.01	kg/t	70	% control										
CL - Handle coal at CHPP - Houston	347	1,652,729	t/y	0.000	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Houston	1,653	165,273	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	h/y	14.12	kg/h	5.0	silt content in %	9.0	moisture content in %								
CL - Loading rejects	-	1,112,500	t/y	Rejects very wet therefore no dust													
CL - Transporting rejects	54,547	1,112,500	t/y	0.20	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.85	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	1,112,500	t/y	Rejects very wet therefore no dust													
PRODUCT COAL																	
CL - Loading product stockpile	405	3,409,398	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11.0	moisture content in %	25	% control						
CL - Loading product coal to trains	540	3,409,398	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11.0	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Whynot - Uncontrolled	221,206	63	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Whynot - Controlled	12,289	7	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump & disturbed area - Blakefield - Uncontrolled	56,404	16	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Blakefield - Controlled	3,134	2	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump& disturbed area - Redbank - Uncontrolled	205,960	59	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump& disturbed area - Redbank - Controlled	11,442	7	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump& disturbed area - Houston - Uncontrolled	99,034	28	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump& disturbed area - Houston- Controlled	5,502	3	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area- Whynot	122,477	35	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Blakefield	31,900	9	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Redbank	134,430	38	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Houston	77,224	22	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-5: Year 5 – Drayton South Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT																	
Topsoil removal & Site preparation - Dozers on Whynot	15,412	1,842	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Whynot	225	241,302	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	2,757	120,651	t/y	0.091	kg/t	177	t/load	229.0	Vehicle gross mass (t)	4.2	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	2,462	120,651	t/y	0.082	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.8	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	449	241,302	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Whynot	2,206	12,462	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	11,406	66	blasts/y	174	kg/blast	8546	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	26,037	2,079	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	212,061	7,136,365	bcm/y	0.030	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Whynot	26,807	2,141	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Whynot	12,552	9,209,692	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area (east) - Whynot	105,223	4,604,846	t/y	0.091	kg/t	177	t/load	229.0	Vehicle gross mass (t)	4.2	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator OB to emplacement area (west) - Whynot	93,965	4,604,846	t/y	0.082	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.8	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Whynot	6,079	485	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Whynot	6,079	485	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB- Emplacing excavator OB at emplacement area - Whynot	12,552	9,209,692	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	52,844	4,220	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	48,046	3,837	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	16,388	1,309	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	875	641,966	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	7,335	320,983	t/y	0.091	kg/t	177	t/load	229.0	Vehicle gross mass (t)	4.2	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	6,550	320,983	t/y	0.082	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.8	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	875	641,966	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal and partings - Whynot	1,040	5,876	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal and partings - Whynot	1,339	22	blasts/y	59.76	kg/blast	4194	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	47,416	3,359	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Whynot	62,650	1,508,641	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	17,579	754,320	t/y	0.09	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3.0	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	93,150	754,320	t/y	0.82	kg/t	70	t/load	65.0	Vehicle gross mass (t)	26.4	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	15,545	754,320	t/y	0.08	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.6	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	100,749	754,320	t/y	0.89	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28.6	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	4,526	1,508,641	t/y	0.01	kg/t	70	% control										
CL- Handle coal at CHPP - Whynot	317	1,508,641	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	1,509	150,864	t/y	0.01	kg/t												
BLAKEFIELD																	
Topsoil removal & Site preparation - Dozers on Blakefield	12,243	1,463	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Blakefield	129	139,031	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling (25%) topsoil to emplacement area - Blakefield (east)	429	34,758	t/y	0.049	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.3	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling (75%) topsoil to emplacement area - Blakefield (west)	1,959	104,273	t/y	0.075	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Blakefield	38	139,031	t/y	0.00027	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Blakefield	1,941	10,965	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Blakefield	10,036	58	blasts/y	174	kg/blast	8546	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Blakefield	23,132	1,847	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Blakefield	276,789	9,314,606	bcm/y	0.030	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Blakefield	2,180	174	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Blakefield	1,021	749,098	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator (25%) OB to emplacement area - Blakefield (east)	2,310	187,275	t/y	0.049	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.3	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator (75%) OB to emplacement area - Blakefield (west)	10,555	561,824	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Blakefield	494	39	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Blakefield	2,675	214	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing excavator OB at emplacement area - Blakefield	1,021	749,098	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Blakefield	25,312	2,022	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Blakefield	50,113	4,002	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Blakefield	1,464	117	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - loading partings to trucks - Blakefield	265	194,396	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling (25%) partings to emplacement area - Blakefield (east)	599	48,599	t/y	0.049	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.3	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Hauling (75%) partings to emplacement area - Blakefield (west)	2,739	145,797	t/y	0.075	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.5	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings to emplacement area - Blakefield	53	194,396	t/y	0.00027	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Blakefield	697	3,936	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Blakefield	897	15	blasts/y	59.76	kg/blast	4194	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Blakefield	16,328	1,157	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Blakefield	41,973	1,010,719	t/y	0.04	kg/t	9	moisture content in %										
CL - Hauling open (25%) coal in-pit roads - Blakefield (east)	5,420	252,680	t/y	0.1	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.8	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open (25%) coal to ROM pad - Blakefield (east)	38,130	252,680	t/y	1.01	kg/t	70	t/load	65.0	Vehicle gross mass (t)	32.3	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Hauling open (75%) coal in-pit roads - Blakefield (west)	16,260	758,040	t/y	0.09	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.8	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open (75%) coal to ROM pad - Blakefield (west)	126,067	758,040	t/y	1.11	kg/t	70	t/load	65.0	Vehicle gross mass (t)	35.6	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	3,032	1,010,719	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Blakefield	212	1,010,719	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	1,011	101,072	t/y	0.01	kg/t												
REDBANK																	
Topsoil removal & Site preparation - Dozers on Redbank	15,874	1,897	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Redbank	102	109,735	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (north) - Redbank	823	54,867	t/y	0.06	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (south) - Redbank	731	54,867	t/y	0.05	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	2.5	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Redbank	204	109,735	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling for excavator removal - Redbank	2,215	12,516	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Redbank	5,685	33	blasts/y	174	kg/blast	8546	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit - Redbank	89,826	7,174	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Redbank	42,060	30,860,448	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (north) - Redbank	231,370	15,430,224	t/y	0.06	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (south) - Redbank	205,718	15,430,224	t/y	0.05	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.5	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (north) - Redbank	20,370	1,627	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (south) - Redbank	20,370	1,627	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Redbank	42,060	30,860,448	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area -Redbank	89,826	7,174	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Redbank	33,761	2,696	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Redbank	23,281	1,859	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Redbank	2,135	1,566,872	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (north) - Redbank	11,747	783,436	t/y	0.06	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.8	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (south) - Redbank	10,445	783,436	t/y	0.05	kg/t	177	t/load	229.0	Vehicle gross mass (t)	2.5	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Redbank	2,135	1,566,872	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Redbank	2,257	12,752	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Redbank	2,907	49	blasts/y	59.76	kg/blast	4194	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Redbank	89,364	6,331	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Redbank	135,967	3,274,133	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Redbank	114,888	3,274,133	t/y	0.14	kg/t	70	t/load	65.0	Vehicle gross mass (t)	4.5	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Redbank	480,387	3,274,133	t/y	0.98	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31.4	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Redbank	9,822	3,274,133	t/y	0.01	kg/t	70	% control										
CL - Handle coal at CHPP - Redbank	687	3,274,133	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	3,274	327,413	t/y	0.01	kg/t												
HOUSTON																	
Topsoil removal & Site preparation - Dozers on Houston	4,708	563	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Houston	89	95,372	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area - Houston	1,657	95,372	t/y	0.07	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	3.2	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Houston	178	95,372	t/y	0.0019	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling for excavator removal - Houston	630	3,560	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Houston	3,258	19	blasts/y	174	kg/blast	8546	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit - Houston	25,548	2,040	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Houston	11,962	8,777,141	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area - Houston	152,496	8,777,141	t/y	0.069	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.2	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads - Houston	11,587	925	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB- Emplacing at emplacement area - Houston	11,962	8,777,141	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Houston	25,548	2,040	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Houston	12,441	994	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Houston	4,009	320	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Houston	276	202,598	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Houston	3,520	202,598	t/y	0.07	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.2	km/return trip	3.84644244	kg/VKT	3	% silt content	75	% control
CL - Emplacing partings at emplacement area - Houston	276	202,598	t/y	0.0014	kg/t	1.57	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Houston	832	4,699	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Houston	1,071	18	blasts/y	59.76	kg/blast	4194	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM (in-pit) - Houston	39,638	2,808	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Houston	50,103	1,206,507	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Houston	10,419	603,253	t/y	0.069	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.2	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal in-pit roads (west) - Houston	7,514	603,253	t/y	0.05	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.6	km/return trip	2.18238556	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Houston	73,451	603,253	t/y	0.81	kg/t	70	t/load	65.0	Vehicle gross mass (t)	26.0	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal to ROM pad (west) - Houston	79,624	603,253	t/y	0.88	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28.2	km/return trip	2.18238556	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Houston	3,620	1,206,507	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Houston	253	1,206,507	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Houston	1,207	120,651	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading rejects	-	1,750,000	t/y	Rejects very wet therefore no dust													
CL - Transporting rejects	85,805	1,750,000	t/y	0.20	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.8534676	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	1,750,000	t/y	Rejects very wet therefore no dust													
PRODUCT COAL																	
CL- Loading product stockpile	632	5,318,415	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %	25	% control						
CL - Loading product coal to trains	843	5,318,415	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Whynot - Uncontrolled	284,833	81	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Whynot - Controlled	15,824	9	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump& disturbed area - Blakefield - Uncontrolled	159,847	46	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump& disturbed area - Blakefield - Controlled	8,880	5	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump& disturbed area - Redbank - Uncontrolled	304,573	87	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump& disturbed area - Redbank - Controlled	16,921	10	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - OB dump & disturbed area - Houston - Uncontrolled	158,947	45	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Houston - Controlled	8,830	5	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area- Whynot	281,582	80	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Blakefield	162,239	46	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Redbank	128,052	37	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Houston	111,292	32	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-6: Year 10 – Drayton South Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT																	
Topsoil removal & Site preparation - Dozers on Whynot	23,771	2,841	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Whynot	181	215,658	t/y	0.00168	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	3,356	107,829	t/y	0.12448	kg/t	177	t/load	229.0	Vehicle gross mass (t)	5.7	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	2,237	107,829	t/y	0.08297	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.8	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	363	215,658	t/y	0.00168	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Whynot	3,609	20,391	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	19,256	101	blasts/y	191	kg/blast	9099	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	40,707	3,251	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	327,232	11,012,155	bcm/y	0.0297	kg/m3 (loose	7	drop distance in m	2.5	moisture content in %								
OB- Emplacing Dragline OB at emplacement area - Whynot	32,525	26,429,172	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Whynot	46,613	3,723	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Whynot	26,781	21,762,027	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area (east) - Whynot	338,609	10,881,013	t/y	0.12448	kg/t	177	t/load	229.0	Vehicle gross mass (t)	5.7	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator OB to emplacement area (west) - Whynot	225,700	10,881,013	t/y	0.08297	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.8	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Whynot	10,570	844	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Whynot	10,570	844	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing excavator OB at emplacement area - Whynot	26,781	21,762,027	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	87,319	6,974	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	81,061	6,474	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	22,457	1,794	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	1,323	1,075,227	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	16,730	537,614	t/y	0.12448	kg/t	177	t/load	229.0	Vehicle gross mass (t)	5.7	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	11,151	537,614	t/y	0.08297	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.8	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	1,323	1,075,227	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal and partings - Whynot	4,999	28,241	holes/y	0.5900	kg/hole	70	% control										
CL - Blasting coal and partings - Whynot	7,374	82	blasts/y	89.8106	kg/blast	5503	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	82,677	5,857	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Whynot	94,660	2,279,456	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	39,779	1,139,728	t/y	0.13961	kg/t	70	t/load	65.0	Vehicle gross mass (t)	4	km/return trip	2.1823856	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	146,734	1,139,728	t/y	0.85830	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28	km/return trip	2.1823856	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	23,772	1,139,728	t/y	0.08343	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3	km/return trip	2.1823856	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	155,380	1,139,728	t/y	0.90887	kg/t	70	t/load	65.0	Vehicle gross mass (t)	29	km/return trip	2.1823856	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	22,795	2,279,456	t/y	0.010	kg/t	0	% control										
CL- Handle coal at CHPP - Whynot	521	2,279,456	t/y	0.0002	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	2,279	227,946	t/y	0.01	kg/t												
BLAKEFIELD																	
Topsoil removal & Site preparation - Dozers on Blakefield	4,842	579	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Blakefield	68	80,878	t/y	0.00168	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area - Blakefield	1,425	80,878	t/y	0.07050	kg/t	177	t/truck load	229.0	Vehicle gross mass (t)	3.2	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Blakefield	22	80,878	t/y	0.00027	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Blakefield	843	4,763	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Blakefield	4,498	24	blasts/y	191	kg/blast	9099	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Blakefield	8,349	667	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Blakefield	136,395	4,590,029	bcm/y	0.0297	kg/m3 (loose	7	drop distance in m	2.5	moisture content in %								
OB- Emplacing Dragline OB at emplacement area - Blakefield	13,557	11,016,071	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Blakefield	1,407	112	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Blakefield	809	657,076	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area - Blakefield	11,580	657,076	t/y	0.07050	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.2	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads - Blakefield	638	51	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB- Emplacing excavator OB at emplacement area - Blakefield	809	657,076	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Blakefield	9,757	779	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks -Blakefield	22,852	1,825	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Blakefield	488	39	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - loading partings to trucks - Blakefield	119	96,964	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area - Blakefield	1,709	96,964	t/y	0.07050	kg/t	177	t/load	229.0	Vehicle gross mass (t)	3.2	km/return trip	3.8464424	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings to emplacement area - Blakefield	119	96,964	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Blakefield	593	3,350	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Blakefield	875	10	blasts/y	89.8106	kg/blast	5503	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Blakefield	4,975	352	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Blakefield	11,229	270,394	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Blakefield	5,416	270,394	t/y	0.08012	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.6	km/return trip	2.1823856	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Blakefield	46,466	270,394	t/y	1.14563	kg/t	70	t/load	65.0	Vehicle gross mass (t)	36.7	km/return trip	2.1823856	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	811	270,394	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Blakefield	62	270,394	t/y	0.0002	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	270	27,039	t/y	0.01	kg/t												
REDBANK																	
Topsoil Removal - Dozers/Excavators stripping topsoil - Redbank	12,924	1,544	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Redbank	49	58,237	t/y	0.00168	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (north) - Redbank	724	29,119	t/y	0.09946	kg/t	222	t/truck load	275.0	Vehicle gross mass (t)	5.3	km/return trip	4.176738	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (south) - Redbank	860	29,119	t/y	0.11811	kg/t	222	t/truck load	275.0	Vehicle gross mass (t)	6.3	km/return trip	4.176738	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Redbank	98	58,237	t/y	0.00168	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling for excavator removal - Redbank	2,023	11,427	holes/y	0.59	kg/hole	70	% control										
OB - Blasting for excavator removal - Redbank	10,768	56	blasts/y	191	kg/blast	9099	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit - Redbank	72,181	5,765	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Redbank	30,639	24,896,975	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (north) - Redbank	309,528	12,448,488	t/y	0.09946	kg/t	222	t/load	275.0	Vehicle gross mass (t)	5.3	km/return trip	4.176738	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (south) - Redbank	367,586	12,448,488	t/y	0.11811	kg/t	222	t/load	275.0	Vehicle gross mass (t)	6.3	km/return trip	4.176738	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (north) - Redbank	16,368	1,307	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (south) - Redbank	16,368	1,307	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Redbank	30,639	24,896,975	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area -Redbank	72,181	5,765	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Redbank	38,111	3,044	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Redbank	9,727	777	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Redbank	922	749,032	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to epmlacement area (north) - Redbank	9,312	374,516	t/y	0.09946	kg/t	222	t/load	275.0	Vehicle gross mass (t)	5.3	km/return trip	4.176738	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to epmlacement area (south) - Redbank	11,059	374,516	t/y	0.11811	kg/t	222	t/load	275.0	Vehicle gross mass (t)	6.3	km/return trip	4.176738	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings at emplacement area - Redbank	922	749,032	t/y	0.00123	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Highwall transfer point - Redbank (Y8)	184	900,000	kg/t	0.0002	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Highwall conveyor - Redbank	17	0.0048	ha	0.4	kg/ha/h	8760	h/y										
CL - Drilling coal - Redbank	1,170	6,610	holes/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Redbank	2,496	28	blasts/y	89.8106	kg/blast	5503	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Redbank	38,625	3,409	h/y	11.3312	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Redbank	67,090	1,615,549	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Redbank	139,771	1,615,549	t/y	0.34606	kg/t	70	t/load	65.0	Vehicle gross mass (t)	11.1	km/return trip	2.1823856	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Redbank	236,311	1,615,549	t/y	0.97515	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31.3	km/return trip	2.1823856	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Redbank	4,847	1,615,549	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Redbank	369	1,615,549	t/y	0.0002	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	1,616	161,555	t/y	0.01	kg/t												
HOUSTON																	
CL - Highwall transfer point - Houston (Y9)	184	900,000	kg/t	0.0002	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Highwall conveyor - Houston	17	0.0048	ha	0.4	kg/ha/h	8760	h/y										
CL - Sh/Ex/FELs loading open coal to trucks - Houston	37,375	900,000	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Houston - east	8,958	450,000	t/y	0.07963	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.6	km/return trip	2.1823856	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal in-pit roads - Houston - west	5,331	450,000	t/y	0.04739	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.5	km/return trip	2.1823856	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Houston - east	54,749	450,000	t/y	0.81110	kg/t	70	t/load	65.0	Vehicle gross mass (t)	26.0	km/return trip	2.1823856	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal to ROM pad - Houston - west	58,748	450,000	t/y	0.87034	kg/t	70	t/load	65.0	Vehicle gross mass (t)	27.9	km/return trip	2.1823856	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Houston	2,700	900,000	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Houston	206	900,000	t/y	0.0002	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Houston	900	90,000	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading rejects	-	1,266,350	t/y	Rejects very wet therefore no dust													
CL - Transporting rejects	62,091	1,266,350	t/y	0.1961	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.8534676	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	1,266,350	t/y	Rejects very wet therefore no dust													
PRODUCT COAL																	
CL - Loading product stockpile	567	4,380,403	t/y	0.0002	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %	25	% control						
CL - Loading product coal to trains	756	4,380,403	t/y	0.0002	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Uncontrolled	1,202,360	343	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Controlled	66,798	38	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area- Whynot	420,545	120	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Blakefield	157,717	45	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Redbank	215,110	61	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Houston	86,880	25	ha	0.4	kg/ha/h	8760	h/y										
WE - active rehab areas - Uncontrolled	-	-	ha	0.4	kg/ha/h	8760	h/y										
WE - active rehab areas - Controlled	-	-	ha	0.4	kg/ha/h	8760	h/y	70	% control								
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-7: Year 15 – Drayton South Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	Units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT	NEW (All)																
Topsoil removal & Site preparation - Dozers on Whynot	26,182	3,129	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Whynot	122	129,962	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	1,628	64,981	t/y	0.10021	kg/t	222	t/load	275.0	Vehicle gross mass (t)	5.3	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	1,079	64,981	t/y	0.06644	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.5	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	245	129,962	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Whynot	3,593	20,302	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	20,406	112	blasts/y	182	kg/blast	8823	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	31,819	2,541	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	305,709	10,287,862	bcm/y	0.0297	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Whynot	60,308	4,816	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Whynot	28,513	20,694,368	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area (east) - Whynot	259,229	10,347,184	t/y	0.10021	kg/t	222	t/load	275.0	Vehicle gross mass (t)	5.3	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator OB to emplacement area (west) - Whynot	171,877	10,347,184	t/y	0.06644	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.5	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Whynot	13,676	1,092	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Whynot	13,676	1,092	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB- Emplacing excavator OB at emplacement area - Whynot	28,513	20,694,368	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	92,127	7,358	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	77,684	6,204	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	40,730	3,253	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	1,793	1,301,448	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	16,303	650,724	t/y	0.10021	kg/t	222	t/load	275.0	Vehicle gross mass (t)	5.3	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	10,809	650,724	t/y	0.06644	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.5	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	1,793	1,301,448	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal and partings - Whynot	1,949	11,014	holes/y	0.5900	kg/hole	70	% control										
CL - Blasting coal and partings - Whynot	1,798	52	blasts/y	34.2691	kg/blast	2895	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	121,150	8,583	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Whynot	98,772	2,378,473	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	43,435	1,189,236	t/y	0.14610	kg/t	70	t/load	65.0	Vehicle gross mass (t)	5	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	127,014	1,189,236	t/y	0.71202	kg/t	70	t/load	65.0	Vehicle gross mass (t)	23	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	25,657	1,189,236	t/y	0.08630	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	169,292	1,189,236	t/y	0.94903	kg/t	70	t/load	65.0	Vehicle gross mass (t)	30	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	7,135	2,378,473	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Whynot	499	2,378,473	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	2,378	237,847	t/y	0.01	kg/t												
BLAKEFIELD																	
Site preparation - Dozers on Blakefield	2,654	317	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Blakefield	11	11,236	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area - Blakefield	121	11,236	t/y	0.04293	kg/t	222	t/load	275.0	Vehicle gross mass (t)	2.3	km/return trip	4.177	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Blakefield	21	11,236	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Blakefield	418	2,359	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Blakefield	2,371.44	13	blasts/y	182	kg/blast	8823	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Blakefield	4,153	332	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Blakefield	64,652	2,175,707	bcm/y	0.0297	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Blakefield	4,153	332	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Blakefield	9,028	721	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Blakefield	546	44	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - loading partings to trucks - Blakefield	94	68,579	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area - Blakefield	736	68,579	t/y	0.04293	kg/t	222	t/load	275.0	Vehicle gross mass (t)	2.3	km/return trip	4.177	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings to emplacement area - Blakefield	94	68,579	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Blakefield	80	455	holes/y	0.5900	kg/hole	70	% control										
CL - Blasting coal - Blakefield	74	2	blasts/y	34.2691	kg/blast	2895	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Blakefield	2,417	171	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Blakefield	4,076	98,156	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Blakefield	1,320	98,156	t/y	0.05381	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.7	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Blakefield	16,700	98,156	t/y	1.13422	kg/t	70	t/load	65.0	Vehicle gross mass (t)	36.4	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	294	98,156	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Blakefield	21	98,156	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	98	9,816	t/y	0.01	kg/t												
REDBANK																	
Site preparation - Dozers on Redbank	13,219	1,580	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Redbank	78	83,191	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (north) - Redbank	958	41,596	t/y	0.09211	kg/t	222	t/load	275.0	Vehicle gross mass (t)	4.9	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (south)- Redbank	1,459	41,596	t/y	0.14035	kg/t	222	t/load	275.0	Vehicle gross mass (t)	7.4	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area -Redbank	157	83,191	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Redbank	1,825	10,312	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Redbank	10,365.04	57	blasts/y	182	kg/blast	8823	Area of blast in square metres										
OB - Dozers on Excavator OB in-pit -Redbank	72,556	5,795	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Redbank	34,303	24,896,975	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (north) - Redbank	286,656	12,448,488	t/y	0.09211	kg/t	222	t/load	275.0	Vehicle gross mass (t)	4.9	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (south) - Redbank	436,787	12,448,488	t/y	0.14035	kg/t	222	t/load	275.0	Vehicle gross mass (t)	7.4	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (north) - Redbank	16,402	1,310	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (south) - Redbank	16,402	1,310	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB- Emplacing excavator OB at emplacement area - Redbank	34,303	24,896,975	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Redbank	72,556	5,795	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Redbank	39,459	3,151	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings -Redbank	10,725	857	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - loading partings to trucks - Redbank	1,439	1,044,222	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (north) - Redbank	24,046	1,044,222	t/y	0.09211	kg/t	222	t/load	275.0	Vehicle gross mass (t)	4.9	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (south)- Redbank	36,639	1,044,222	t/y	0.14035	kg/t	222	t/load	275.0	Vehicle gross mass (t)	7.4	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Emplacing partings to emplacement area - Redbank	1,439	1,044,222	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Redbank	1,216	6,871	holes/y	0.5900	kg/hole	70	% control										
CL - Blasting coal - Redbank	1,122	33	blasts/y	34.2691	kg/blast	2895	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Redbank	49,308	3,493	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Redbank	61,621	1,483,845	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Redbank	134,830	1,483,845	t/y	0.36346	kg/t	70	t/load	65.0	Vehicle gross mass (t)	11.7	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Redbank	221,987	1,483,845	t/y	0.99735	kg/t	70	t/load	65.0	Vehicle gross mass (t)	32.0	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper -Redbank	14,838	1,483,845	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Redbank	311	1,483,845	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	1,484	148,384	t/y	0.01	kg/t												
HOUSTON																	
Topsoil removal - Dozers/Excavators stripping topsoil - Houston	6,181	739	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Houston	30	31,953	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Houston	131	15,977	t/y	0.03283	kg/t	222	t/truck load	275.0	Vehicle gross mass (t)	1.7	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Houston	159	15,977	t/y	0.03969	kg/t	222	t/truck load	275.0	Vehicle gross mass (t)	2.1	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Houston	60	31,953	t/y	0.00188	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Houston	841	4,754	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Houston	4,778	26	blasts/y	182	kg/blast	8823	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Houston	8,293	662	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Houston	82,210	2,766,556	bcm/y	0.0297	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Houston	11,497	918	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Houston	5,436	3,945,131	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (east) - Houston	16,188	1,972,565	t/y	0.03283	kg/t	222	t/load	275.0	Vehicle gross mass (t)	1.7	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (west) - Houston	19,571	1,972,565	t/y	0.03969	kg/t	222	t/load	275.0	Vehicle gross mass (t)	2.1	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Houston	2,607	208	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Houston	2,607	208	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB- Emplacing at emplacement area - Houston	5,436	3,945,131	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Houston	19,790	1,581	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Houston	18,191	1,453	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Houston	7,830	625	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Houston	242	175,692	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Houston	721	87,846	t/y	0.03283	kg/t	222	t/load	275.0	Vehicle gross mass (t)	1.7	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Houston	872	87,846	t/y	0.03969	kg/t	222	t/load	275.0	Vehicle gross mass (t)	2.1	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
CL - Emplacing partings at emplacement area - Houston	242	175,692	t/y	0.00138	kg/t	1.59	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Houston	1,665	3,491	holes/y	1.5900	kg/hole	70	% control										
CL - Blasting coal - Houston	570	17	blasts/y	34.2691	kg/blast	2895	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM (in-pit) - Houston	49,678	3,519	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Houston	31,307	753,885	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Houston	7,668	376,942	t/y	0.08137	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.6	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal in-pit roads (west) - Houston	4,454	376,942	t/y	0.04726	kg/t	70	t/load	65.0	Vehicle gross mass (t)	1.5	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Houston	45,818	376,942	t/y	0.81035	kg/t	70	t/load	65.0	Vehicle gross mass (t)	26.0	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal to ROM pad (west) - Houston	50,000	376,942	t/y	0.88430	kg/t	70	t/load	65.0	Vehicle gross mass (t)	28.4	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Houston	2,262	753,885	t/y	0.010	kg/t	70	% control										
CL - Handle coal at CHPP - Houston	158	753,885	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Houston	754	75,388	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading rejects	-	1,178,590	t/y	Rejects very wet therefore no dust													
CL - Transporting rejects	57,788	1,178,590	t/y	0.1961	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.85	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	1,178,590	t/y	Rejects very wet therefore no dust													
PRODUCT COAL																	
CL - Loading product stockpile	408	3,432,878	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %	25	% control						
CL - Loading product coal to trains	544	3,432,878	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Uncontrolled	1,306,674	373	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Controlled	72,593	41	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area - Whynot	397,444	113	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Blakefield	34,361	10	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Redbank	254,412	73	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Houston	97,717	28	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-8: Year 20 – Drayton South Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT	**NEW**																
Topsoil removal & Site preparation - Dozers on Whynot	40,720	4,866	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Whynot	200	209,439	t/y	0.00191	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Whynot	3,158	104,719	t/y	0.121	kg/t	222	t/load	275.0	Vehicle gross mass (t)	6.4	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Whynot	1,800	104,719	t/y	0.069	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.6	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Whynot	400	209,439	t/y	0.00191	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Whynot	6,331	35,768	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	33,891	176	blasts/y	193	kg/blast	9,160	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	29,219	2,334	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	341,927	11,506,666	bcm/y	0.030	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Whynot	131,675	10,516	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Whynot	63,223	45,208,878	t/y	0.00140	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling excavator OB to emplacement area (east) - Whynot	681,746	22,604,439	t/y	0.12	kg/t	222	t/load	275.0	Vehicle gross mass (t)	6.4	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling excavator OB to emplacement area (west) - Whynot	388,474	22,604,439	t/y	0.07	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.6	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads (east) - Whynot	29,859	2,385	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers on OB haul roads (west) - Whynot	29,859	2,385	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing excavator OB at emplacement area - Whynot	63,223	45,208,878	t/y	0.0014	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	160,894	12,850	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	121,956	9,740	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	68,048	5,435	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	3,036	2,171,174	t/y	0.0014	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	32,741	1,085,587	t/y	0.121	kg/t	222	t/load	275.0	Vehicle gross mass (t)	6.4	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	18,657	1,085,587	t/y	0.069	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.6	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	3,036	2,171,174	t/y	0.00140	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal and partings - Whynot	2,486	14,047	holes/y	0.5900	kg/hole	70	% control										
CL - Blasting coal and partings - Whynot	2,484	89	blasts/y	27.89	kg/blast	2524	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	199,023	14,100	h/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Whynot	171,332	4,125,733	t/y	0.04	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	96,921	2,062,867	t/y	0.19	kg/t	70	t/load	65.0	Vehicle gross mass (t)	6	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	221,150	2,062,867	t/y	0.71	kg/t	70	t/load	65.0	Vehicle gross mass (t)	23	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	56,757	2,062,867	t/y	0.11	kg/t	70	t/load	65.0	Vehicle gross mass (t)	4	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	299,156	2,062,867	t/y	0.97	kg/t	70	t/load	65.0	Vehicle gross mass (t)	31	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	12,377	4,125,733	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Whynot	866	4,125,733	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	4,126	412,573	t/y	0.01	kg/t												
BLAKEFIELD																	
CL - Highwall transfer point - Blakefield (Y18)	116	564,492	t/y	0.0002	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Highwall conveyor - Blakefield	17	0.0048	ha	0.4	kg/ha/h	8760	h/y										
CL - Sh/Ex/FELs loading open coal to trucks - Blakefield	23,442	564,492	t/y	0.04	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Blakefield	13,591	564,492	t/y	0.10	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Blakefield	93,117	564,492	t/y	1.10	kg/t	70	t/load	65.0	Vehicle gross mass (t)	35	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Blakefield	1,693	564,492	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Blakefield	118	564,492	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Blakefield	564	56,449	t/y	0.01	kg/t												
REDBANK																	
CL - Highwall transfer point - Redbank (Y20)	184	900,000	t/y	0.0002	kg/t	1.42	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Highwall conveyor - Redbank	17	0.0048	ha	0.4	kg/ha/h	8760	h/y										
CL - Sh/Ex/FELs loading open coal to trucks - Redbank	37,375	900,000	t/y	0.04	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Redbank	30,570	900,000	t/y	0.14	kg/t	70	t/load	65.0	Vehicle gross mass (t)	4	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Redbank	134,642	900,000	t/y	1.00	kg/t	70	t/load	65.0	Vehicle gross mass (t)	32	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Redbank	2,700	900,000	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Redbank	189	900,000	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Redbank	900	90,000	t/y	0.01	kg/t												
HOUSTON																	
Topsoil removal & Site preparation - Dozers on Houston	7,516	898	h/y	16.7	kg/h	10	silt content in %	2	moisture content in %	50	% control						
Topsoil removal - Sh/Ex/FELs loading topsoil - Houston	20	20,587	t/y	0.0019	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %	50	% control						
Topsoil removal - Hauling topsoil to emplacement area (east) - Houston	41	10,294	t/y	0.016	kg/t	222	t/truck load	275.0	Vehicle gross mass (t)	0.8	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Hauling topsoil to emplacement area (west) - Houston	88	10,294	t/y	0.034	kg/t	222	t/truck load	275.0	Vehicle gross mass (t)	1.8	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
Topsoil removal - Emplacing topsoil at emplacement area - Houston	39	20,587	t/y	0.0019	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
OB - Drilling - Houston	1,163	6,571	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Houston	6,226	32	blasts/y	192.87	kg/blast	9,160	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Houston	11,572	924	t/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Houston	94,616	3,184,041	bcm/y	0.030	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on Excavator OB in-pit - Houston	12,687	1,013	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Excavator loading OB to haul truck - Houston	6,091	4,355,818	t/y	0.0014	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling to emplacement area (east) - Houston	8,660	2,177,909	t/y	0.016	kg/t	222	t/load	275.0	Vehicle gross mass (t)	0.8	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling to emplacement area (west) - Houston	18,632	2,177,909	t/y	0.034	kg/t	222	t/load	275.0	Vehicle gross mass (t)	1.8	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Dozers on OB haul roads - Houston	5,754	460	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Emplacing at emplacement area - Houston	6,091	4,355,818	t/y	0.0014	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Houston	24,259	1,937	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Houston	22,406	1,789	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Houston	8,963	716	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to trucks - Houston	122	87,402	t/y	0.0014	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Houston	174	43,701	t/y	0.016	kg/t	222	t/load	275.0	Vehicle gross mass (t)	0.8	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Houston	374	43,701	t/y	0.034	kg/t	222	t/load	275.0	Vehicle gross mass (t)	1.8	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
CL - Emplacing partings at emplacement area - Houston	122	87,402	t/y	0.0014	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Drilling coal - Houston	417	2,358	t/y	0.59	kg/hole	70	% control										
CL - Blasting coal - Houston	417	15	h/y	27.89	kg/blast	2524	Area of blast in square metres										
CL - Dozers ripping/pushing/clean-up ROM (in-pit) - Houston	42,303	2,997	t/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Houston	28,762	692,611	t/y	0.042	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads - Houston	14,295	692,611	t/y	0.083	kg/t	70	t/load	65.0	Vehicle gross mass (t)	2.6	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad - Houston	84,415	692,611	t/y	0.81	kg/t	70	t/load	65.0	Vehicle gross mass (t)	26.1	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Houston	2,078	692,611	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Houston	145	692,611	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Houston	693	69,261	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	t/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading rejects	-	1,204,586	t/y														
CL - Transporting rejects	59,062	1,204,586	t/y	0.1961	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.85	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	1,204,586	t/y														
PRODUCT COAL																	
CL - Loading product stockpile	554	4,658,602	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %	25	% control						
CL - Loading product coal to trains	738	4,658,602	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Uncontrolled	1,065,361	304	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Controlled	59,187	34	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area - Whynot & Redbank	759,293	217	ha	0.4	kg/ha/h	8760	h/y										
WE - Open mining area - Blakefield (Y18)	24,613	7	ha	0.4	kg/ha/h	8761	h/y										
WE - Open mining area - Houston	74,636	21	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-9: Year 3 – Drayton Emissions Calculations

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT	**NEW**																
OB - Drilling - Whynot	3,938	22,247	holes/y	0.59	kg/hole	70	% control										
OB - Blasting - Whynot	7,356	208	blasts/y	35	kg/blast	2956	Area of blast in square metres										
OB - Dozers on Dragline OB in-pit - Whynot	24,434	1,951	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dragline removal of OB - Whynot	209,200	7,040,073	bcm/y	0.0297	kg/m3 (loose)	7	drop distance in m	2.5	moisture content in %								
OB - Dozers on OB emplacement area - Whynot	24,434	1,951	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers in-pit ancillary tasks - Whynot	144,449	11,536	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Dozers ripping/pushing/clean-up Partings - Whynot	4,056	324	h/y	12.52	kg/h	10	silt content in %	2.5	moisture content in %								
OB - Loading partings to haul trucks - Whynot	241	172,459	t/y	0.00140	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
OB - Hauling partings to emplacement area (east) - Whynot	2,435	86,229	t/y	0.11295	kg/t	222	t/load	275.0	Vehicle gross mass (t)	6.0	km/return trip	4.18	kg/VKT	3	% silt content	75	% control
OB - Hauling partings to emplacement area (west) - Whynot	717	86,229	t/y	0.03326	kg/t	222	t/load	275.0	Vehicle gross mass (t)	3.4	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
OB - Emplacing Partings at emplacement area - Whynot	241	172,459	t/y	0.00140	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	2.5	moisture content in %								
CL - Highwall transfer point - Whynot	128	550,912	t/y	0.0002	kg/t	1.61	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Highwall conveyor - Whynot	17	0.0048	ha	0.4	kg/ha/h	8760	h/y										
CL - Dozers ripping/pushing/clean-up ROM in-pit - Whynot	51,483	3,647	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Sh/Ex/FELs loading open coal to trucks - Whynot	44,625	1,074,582	t/y	0.04153	kg/t	9	moisture content in %										
CL - Hauling open coal in-pit roads (east) - Whynot	18,585	537,291	t/y	0.13836	kg/t	70	t/load	65.0	Vehicle gross mass (t)	4	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (east) - Whynot	63,736	537,291	t/y	0.79083	kg/t	70	t/load	65.0	Vehicle gross mass (t)	25	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling open coal in-pit roads (middle) - Whynot	10,897	537,291	t/y	0.08112	kg/t	70	t/load	65.0	Vehicle gross mass (t)	3	km/return trip	2.18	kg/VKT	3	% silt content	75	% control
CL - Hauling open coal to ROM pad (middle) - Whynot	81,802	537,291	t/y	1.01500	kg/t	70	t/load	65.0	Vehicle gross mass (t)	33	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to ROM stockpiles/hopper - Whynot	3,224	1,074,582	t/y	0.010	kg/t	70	% control										
CL- Handle coal at CHPP - Whynot	225	1,074,582	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Rehandle ROM coal at stockpiles/hopper - Whynot	1,075	107,458	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - ROM stockpile	81,371	5,765	h/y	14.1156	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading rejects	-	268,645	t/y	Rejects very wet therefore no dust													
CL - Transporting rejects	13,172	268,645	t/y	0.1961	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.85	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	268,645	t/y	Rejects very wet therefore no dust													
PRODUCT COAL																	
CL - Loading product stockpile	-	-	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %	25	% control						
CL - Loading product coal to trains	-	-	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - OB dump & disturbed area - Uncontrolled	1,159,429	331	ha	0.4	kg/ha/h	8760	h/y										
WE - OB dump & disturbed area - Controlled	64,413	37	ha	0.4	kg/ha/h	8760	h/y	50	% control								
WE - Open mining area - Whynot	192,750	55	ha	0.4	kg/ha/h	8760	h/y										
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y	65	% control								
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

Table C.12-10: Drayton South Emissions Calculations – Conveyor Option

ACTIVITY	TSP emissions (kg/y)	Intensity	units	Emission factor	units	Variable 1	units	Variable 2	units	Variable 3	units	Variable 4	Units	Variable 5	Units	Variable 6	Units
WHYNOT																	
CL - Hauling ROM coal to pre-conveyor ROM pad (east) - Whynot	38,248	1,968,877	t/y	0.13	kg/t	70	t/load	65.0	Vehicle gross mass (t)	4	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Hauling ROM coal to pre-conveyor ROM pad (middle) - Whynot	114,984	1,968,877	t/y	0.39	kg/t	70	t/load	65.0	Vehicle gross mass (t)	12	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Whynot	11,813	3,937,754	t/y	0.010	kg/t											70	% control
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Whynot	3,938	393,775	t/y	0.01	kg/t												
BLAKEFIELD																	
CL - Hauling ROM coal to pre-conveyor ROM pad - Blakefield	43,605	564,492	t/y	0.51	kg/t	70	t/load	65.0	Vehicle gross mass (t)	17	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Blakefield	1,693	564,492	t/y	0.010	kg/t											70	% control
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Blakefield	564	56,449	t/y	0.01	kg/t												
REDBANK																	
CL - Hauling ROM coal to pre-conveyor ROM pad - Redbank	61,239	900,000	t/y	0.45	kg/t	70	t/load	65.0	Vehicle gross mass (t)	15	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Redbank	2,700	900,000	t/y	0.010	kg/t											70	% control
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Redbank	900	90,000	t/y	0.01	kg/t												
HOUSTON																	
CL - Hauling ROM coal to ROM pad - Houston	34,015	988,521	t/y	0.23	kg/t	70	t/load	65.0	Vehicle gross mass (t)	7.4	km/return trip	2.18	kg/VKT	3	% silt content	85	% control
CL - Unloading ROM to pre-conveyor ROM stockpiles/hopper - Houston	2,966	988,521	t/y	0.010	kg/t											70	% control
CL - Rehandle ROM coal at pre-conveyor stockpiles/hopper - Houston	6,391	639,077	t/y	0.01	kg/t												
ROM/REJECTS HANDLING																	
CL - Dozers ROM Coal Handling & Rejects - CHPP ROM stockpiles	81,371	5,765	t/y	14.12	kg/h	5	silt content in %	9	moisture content in %								
CL - Loading from pre-conveyor ROM stockpile (25% of total ROM)	15,977	1,597,692	t/y	0.010	kg/t												
CL - Unloading from pre-conveyor ROM stockpile to hopper (25% of total ROM)	15,977	1,597,692	t/y	0.010	kg/t												
CL - Hopper transfer to conveyor at pre-conveyor ROM pad	402	6,390,767	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %							70	% control
CL - Conveying to CHPP stockpile	-	1.3199	ha	0.4	kg/ha/h	8760	h/y									100	% control
CL - Conveyor transfer at CHPP ROM stockpile	402	6,390,767	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %							70	% control
CL - Loading from CHPP ROM stockpile	63,908	6,390,767	t/y	0.010	kg/t												
CL - Unloading from CHPP ROM stockpile to CHPP	63,908	6,390,767	t/y	0.010	kg/t												
CL- Handle coal at CHPP	1,341	6,390,767	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	9	moisture content in %								
CL - Loading rejects	-	1,597,692	t/y														
CL - Transporting rejects	78,337	1,597,692	t/y	0.1961	kg/t	91	t/load	117.9	Vehicle gross mass (t)	6.2	km/return trip	2.85	kg/VKT	3	% silt content	75	% control
CL - Unloading rejects	-	1,597,692	t/y														
PRODUCT COAL																	
CL - Loading product stockpile	533	4,487,110	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %							25	% control
CL - Loading product coal to trains	711	4,487,110	t/y	0.0002	kg/t	1.46	average of (wind speed/2.2)^1.3 in m/s	11	moisture content in %								
WIND EROSION																	
WE - ROM stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y									65	% control
WE - ROM @ CHPP stockpiles	7,358	6	ha	0.4	kg/ha/h	8760	h/y									65	% control
WE - Product stockpiles	52,560	15	ha	0.4	kg/ha/h	8760	h/y										

APPENDIX D – $PM_{2.5}$ ASSESSMENT

D.1 PROJECT ONLY ANNUAL $PM_{2.5}$ PREDICTIONS

A summary of the Project-only predicted $PM_{2.5}$ concentrations at each of the individual residences are provided in **Table D.12-11**.

There are no privately owned residences that are predicted to experience annual average $PM_{2.5}$ concentrations due to emissions from the Project-only above the NEPM standard (8 µg/m³).

Table D.12-11: Annual PM2.5 concentrations (µg/m3) at nearby residences for each modelling year – Project Only

ID	Project Only Annual Average $PM_{2.5}$ (µg/m³) *NEPM Standard = 8 µg/m³*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	0.1	0.1	0.1	0.2	0.2	0.1	0.0
3	0.2	0.1	0.2	0.2	0.2	0.2	0.0
24A	0.1	0.1	0.2	0.2	0.2	0.2	0.0
24B	0.1	0.1	0.2	0.2	0.2	0.2	0.0
25	0.2	0.1	0.2	0.2	0.2	0.2	0.0
172	0.3	0.3	0.3	0.3	0.3	0.4	0.1
207	0.2	0.2	0.2	0.3	0.3	0.3	0.1
209	0.3	0.3	0.3	0.4	0.4	0.5	0.1
211	0.3	0.3	0.3	0.4	0.4	0.4	0.1
217A	0.4	0.4	0.4	0.6	0.6	0.6	0.2
217B	0.3	0.3	0.3	0.4	0.4	0.4	0.1
219A	0.3	0.3	0.3	0.5	0.5	0.4	0.1
219B	0.3	0.3	0.4	0.6	0.6	0.5	0.1
219C	0.3	0.3	0.3	0.6	0.5	0.4	0.1
219D	0.3	0.3	0.3	0.5	0.5	0.4	0.1
226A	0.4	0.4	0.8	1.8	1.6	0.4	0.1
226B	0.5	0.5	0.9	2.2	2.0	0.4	0.1
226C	0.4	0.5	0.9	2.0	1.8	0.4	0.1
226D	0.3	0.4	0.6	1.1	1.0	0.3	0.1
227A	0.2	0.2	0.3	0.4	0.4	0.2	0.1
227B	0.2	0.2	0.2	0.3	0.3	0.2	0.1
227C	0.2	0.2	0.2	0.3	0.3	0.2	0.1
227D	0.2	0.2	0.2	0.4	0.3	0.2	0.1
227E	0.2	0.2	0.2	0.4	0.4	0.2	0.1
227F	0.5	0.4	0.6	1.2	1.2	0.4	0.1
228A	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228B	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228C	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228D	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228E	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228F	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228G	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228H	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228I	0.1	0.1	0.1	0.1	0.1	0.1	0.0
228J	0.1	0.1	0.1	0.2	0.2	0.1	0.0
228K	0.2	0.2	0.2	0.3	0.3	0.2	0.0
228L	0.2	0.2	0.2	0.3	0.3	0.2	0.0
228M	0.2	0.2	0.2	0.4	0.4	0.2	0.1
230	0.1	0.1	0.1	0.1	0.1	0.1	0.0
238A	0.1	0.1	0.1	0.1	0.1	0.1	0.0
238B	0.1	0.1	0.1	0.1	0.1	0.1	0.0
238C	0.1	0.1	0.1	0.1	0.1	0.1	0.0
238D	0.1	0.1	0.1	0.1	0.1	0.1	0.0
238E	0.1	0.1	0.1	0.1	0.1	0.1	0.0
238F	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239A	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239B	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239C	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239D	0.1	0.1	0.1	0.1	0.1	0.1	0.0

ID	Project Only						
	Annual Average $PM_{2.5}$ (µg/m³)						
	NEPM Standard = 8 µg/m³						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239E	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239F	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239G	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239H	0.1	0.1	0.1	0.1	0.1	0.1	0.0
239I	0.1	0.1	0.1	0.1	0.1	0.1	0.0
240A	0.1	0.1	0.1	0.1	0.1	0.1	0.0
240B	0.1	0.1	0.1	0.2	0.1	0.1	0.0
240C	0.1	0.1	0.1	0.2	0.1	0.1	0.0
240D	0.1	0.1	0.1	0.2	0.2	0.1	0.0
240E	0.1	0.1	0.1	0.2	0.1	0.1	0.0
250A	0.2	0.2	0.2	0.2	0.2	0.2	0.0
250B	0.2	0.2	0.2	0.2	0.2	0.2	0.0
253	0.1	0.1	0.1	0.1	0.1	0.1	0.0
254A	0.1	0.1	0.1	0.1	0.1	0.1	0.0
254B	0.1	0.1	0.1	0.1	0.1	0.1	0.0
254C	0.1	0.1	0.1	0.1	0.1	0.1	0.0
255	0.1	0.1	0.1	0.1	0.1	0.1	0.0
279	0.1	0.1	0.1	0.1	0.1	0.1	0.0
284	0.1	0.1	0.1	0.1	0.1	0.1	0.0
285	0.1	0.1	0.1	0.1	0.1	0.1	0.0
287	0.1	0.1	0.1	0.1	0.1	0.1	0.0
288	0.1	0.1	0.1	0.1	0.1	0.1	0.0
298A	0.1	0.1	0.1	0.2	0.1	0.1	0.0
298B	0.1	0.1	0.1	0.1	0.1	0.1	0.0
299	0.1	0.1	0.1	0.1	0.1	0.1	0.0
306	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Drayton Mine							
384	0.1	0.1	0.0	0.0	0.0	0.0	0.0
385	0.1	0.1	0.0	0.0	0.0	0.1	0.0
386	0.2	0.1	0.1	0.1	0.1	0.1	0.0
387	0.2	0.2	0.1	0.1	0.1	0.1	0.0
390	0.4	0.3	0.1	0.1	0.1	0.1	0.1
398	0.3	0.3	0.1	0.1	0.1	0.1	0.0
399	0.2	0.2	0.1	0.1	0.1	0.1	0.0
400	0.2	0.2	0.1	0.1	0.1	0.1	0.0
401	0.2	0.2	0.1	0.1	0.1	0.1	0.0
402	0.2	0.2	0.1	0.1	0.1	0.1	0.0
403	0.3	0.2	0.1	0.1	0.1	0.1	0.0
411	0.3	0.3	0.1	0.1	0.1	0.1	0.0
418	0.2	0.2	0.1	0.1	0.1	0.1	0.0
419	0.2	0.2	0.1	0.1	0.1	0.1	0.0
420	0.2	0.2	0.1	0.1	0.1	0.1	0.0
421	0.2	0.2	0.1	0.1	0.1	0.1	0.0
423	0.2	0.2	0.1	0.1	0.1	0.1	0.0
424	0.2	0.2	0.1	0.1	0.1	0.1	0.0
425	0.2	0.2	0.1	0.1	0.1	0.1	0.0
427	0.2	0.2	0.1	0.1	0.0	0.1	0.0
429	0.1	0.1	0.0	0.0	0.0	0.1	0.0
432	0.1	0.1	0.0	0.0	0.0	0.0	0.0
433A	0.1	0.1	0.0	0.0	0.0	0.0	0.0
433B	0.1	0.1	0.0	0.0	0.0	0.0	0.0
435	0.1	0.1	0.0	0.0	0.0	0.0	0.0
438	0.1	0.1	0.0	0.0	0.0	0.0	0.0
440	0.1	0.1	0.0	0.0	0.0	0.0	0.0
441	0.1	0.1	0.0	0.0	0.0	0.0	0.0
443	0.1	0.1	0.0	0.0	0.0	0.0	0.0
444	0.1	0.1	0.1	0.1	0.0	0.1	0.0
446A	0.1	0.1	0.1	0.1	0.1	0.1	0.0
446B	0.1	0.1	0.0	0.0	0.0	0.0	0.0
451	0.1	0.1	0.0	0.0	0.0	0.0	0.0
455	0.1	0.1	0.0	0.0	0.0	0.0	0.0
456	0.1	0.1	0.0	0.0	0.0	0.0	0.0
460	0.1	0.1	0.0	0.0	0.0	0.0	0.0

ID	Project Only Annual Average $PM_{2.5}$ ($\mu g/m^3$) *NEPM Standard = 8 $\mu g/m^3$*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Mine owned residences							
57	0.6	0.6	0.8	0.8	0.8	0.5	0.1
58A	0.7	0.5	0.8	2.0	2.1	0.5	0.1
58B	0.6	0.5	0.7	1.6	1.6	0.4	0.1
60	2.0	2.0	2.1	1.7	1.4	1.6	0.5
145A	0.8	0.8	0.7	0.8	0.8	1.1	0.3
145B	1.2	1.1	0.8	0.8	0.9	1.3	0.4
145C	0.9	0.8	0.7	0.9	0.9	1.1	0.3
145D	0.7	0.6	0.6	0.9	0.9	1.0	0.3
388	0.3	0.3	0.1	0.1	0.1	0.1	0.0
389	0.4	0.4	0.1	0.1	0.1	0.1	0.1
404	0.0	0.2	0.1	0.1	0.1	0.1	0.0
410	0.0	0.3	0.1	0.1	0.1	0.1	0.0

D.2 CUMULATIVE ANNUAL $PM_{2.5}$ PREDICTIONS

To assess the cumulative impact of $PM_{2.5}$ the monitoring data was taken from the nearest EPA monitoring sites at Muswellbrook, Singleton and Camberwell. The annual average for 2011 for each of the site is presented in **Table D.12-12**. These values are already close to or above the current annual NEPM standard for $PM_{2.5}$.

Table D.12-12: Annual average $PM_{2.5}$ concentrations ($\mu g/m^3$) at nearby EPA monitoring sites

Monitor location	Annual average - 2011
Muswellbrook	9.11
Singleton	7.60
Camberwell	8.24

The 24-hour average values for these three sites are plotted in **Figure D-10**. This monitoring data shows a clear seasonal signal, with and increase across all three sites through winter. This increase in $PM_{2.5}$ is likely the result of domestic wood burning and would explain why the annual average is close or exceeding to the NEPM standard.

The Project alone predicted ground level concentrations are less than 1 $\mu g/m^3$ at most residences for all operational years, so they will not likely contribute too greatly to the background $PM_{2.5}$ levels.

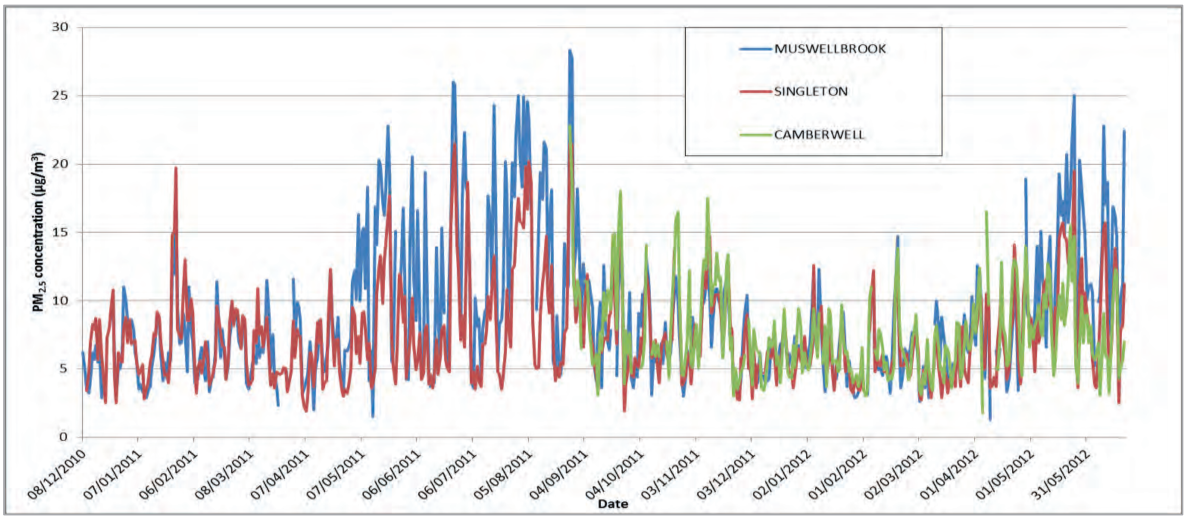


Figure D-10: Measured 24-hour average $PM_{2.5}$ at 3 EPA Upper Hunter monitoring sites

D.3 PROJECT ONLY 24 HOUR $PM_{2.5}$ PREDICTIONS

A summary of the predicted maximum 24-hour $PM_{2.5}$ concentrations at each of the individual residences are provided in **Table D.12-13**. No residences are predicted to experience 24-hour average $PM_{2.5}$ levels above the NEPM standard of 25 µg/m^3.

Note that the 24-hour $PM_{2.5}$ values do not represent a single worst case day, but rather represent the potential worst case 24-hour $PM_{2.5}$ concentration that could be reached at that particular location across the entire modelling year.

Table D.12-13: Maximum 24-hour $PM_{2.5}$ concentrations (µg/m^3) at nearby residences for each modelling year – Project Only

ID	Project Only						
	Maximum 24-hour average $PM_{2.5}$ (µg/m^3)						
	NEPM Standard = 25 µg/m^3						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
Privately owned residences							
Drayton South							
2	2	2	2	2	2	2	0
3	2	2	2	2	2	2	0
24A	3	2	3	3	2	2	0
24B	3	2	3	3	2	2	0
25	3	3	3	3	2	2	0
172	2	2	2	2	2	2	1
207	2	2	2	2	2	2	1
209	3	3	2	3	3	3	1
211	3	2	2	2	3	3	1
217A	4	3	2	3	4	4	1
217B	3	3	2	2	4	4	1
219A	4	3	3	3	4	4	1
219B	4	4	3	3	5	5	1
219C	4	3	3	3	4	4	1
219D	3	3	2	3	4	4	1
226A	5	4	7	11	4	4	2
226B	5	4	7	13	5	5	2
226C	5	4	7	12	4	4	2
226D	4	4	5	9	4	4	1
227A	3	3	4	5	3	3	1
227B	3	3	4	5	3	3	1
227C	3	3	4	5	3	3	1
227D	3	3	4	5	3	3	1
227E	3	3	4	5	3	3	1
227F	3	3	3	6	4	4	1
228A	2	2	3	4	3	3	1
228B	2	2	3	4	3	3	1
228C	2	2	3	4	3	3	1
228D	2	2	3	4	3	3	1
228E	2	2	3	4	3	3	1
228F	2	2	3	4	3	3	1
228G	2	2	3	4	3	3	1
228H	2	2	3	4	3	3	1
228I	2	2	2	3	2	2	1
228J	2	2	3	4	3	3	1
228K	2	2	3	5	4	4	1
228L	3	2	3	6	4	4	1
228M	3	2	4	6	4	4	1
230	2	2	2	3	2	2	0
238A	2	2	2	2	2	2	0
238B	2	2	2	2	2	2	0
238C	2	2	2	2	2	2	0
238D	2	2	2	2	2	2	0
238E	2	2	2	2	2	2	0
238F	2	2	2	2	2	2	0
239A	2	2	2	2	2	2	0
239B	2	2	2	2	2	2	0

ID	Project Only						
	Maximum 24-hour average $PM_{2.5}$ (µg/m^3)						
	NEPM Standard = 25 µg/m^3						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
239C	2	2	2	2	2	2	0
239D	2	2	2	2	2	2	0
239E	2	2	2	2	2	2	0
239F	2	2	2	2	2	2	0
239G	2	2	2	2	2	2	0
239H	2	2	2	2	2	2	0
239I	2	2	2	2	2	2	0
240A	3	3	3	3	3	3	0
240B	3	3	3	4	3	3	1
240C	3	3	3	4	3	3	1
240D	3	3	3	4	3	3	1
240E	3	3	3	3	3	3	1
250A	3	3	4	4	3	3	1
250B	3	3	4	4	3	3	1
253	2	2	3	3	2	2	0
254A	2	2	3	3	2	2	0
254B	2	2	3	3	2	2	0
254C	2	2	3	3	2	2	0
255	2	2	2	2	2	2	0
279	2	2	2	2	2	2	0
284	2	2	2	2	2	2	0
285	2	2	2	2	2	2	0
287	2	2	2	2	2	2	0
288	2	2	2	2	2	2	0
298A	3	3	3	3	2	2	1
298B	3	3	3	3	2	2	0
299	2	2	3	3	2	2	0
306	2	2	2	2	2	2	0
Drayton Mine							
384	2	2	1	1	1	1	0
385	3	3	1	1	1	1	0
386	3	3	1	1	1	1	0
387	4	4	1	1	2	2	1
390	5	5	2	2	2	2	1
398	5	4	2	2	2	2	1
399	4	4	1	1	2	2	0
400	4	3	1	1	1	1	0
401	4	4	1	1	1	1	0
402	4	4	1	1	2	2	1
403	5	4	1	1	2	2	1
411	4	4	3	3	2	3	1
418	4	3	3	3	2	3	1
419	3	3	2	2	2	2	1
420	3	3	2	2	2	2	1
421	3	3	2	2	1	2	1
423	3	3	1	1	1	1	0
424	3	3	1	1	1	1	0
425	3	2	1	1	1	1	0
427	3	3	1	1	1	1	0
429	3	3	1	1	1	1	0
432	2	2	1	1	1	1	0
433A	2	2	1	1	1	1	0
433B	2	2	1	1	1	1	0
435	2	2	1	1	1	1	0
438	1	1	1	1	1	1	0
440	2	2	1	1	1	1	0
441	1	1	1	1	1	1	0
443	2	2	1	1	1	1	0
444	2	2	1	2	1	1	0
446A	2	2	2	2	1	1	0
446B	2	2	1	1	1	1	0
451	1	1	1	1	1	1	0
455	1	1	1	1	1	1	0

ID	Project Only Maximum 24-hour average $PM_{2.5}$ ($\mu g/m^3$) *NEPM Standard = 25 $\mu g/m^3$*						
	Year 3A	Year 3B	Year 5	Year 10	Year 15	Year 20	Year 27
456	1	1	1	1	1	1	0
460	2	2	1	1	1	1	0
Mine owned residences							
57	6	6	8	8	8	7	1
58A	4	4	5	9	12	6	2
58B	4	3	4	8	10	5	1
60	10	9	9	7	6	8	4
145A	6	6	3	4	4	6	1
145B	8	8	4	4	4	7	2
145C	7	6	3	4	4	6	1
145D	5	5	3	4	4	6	1
388	4	4	1	1	1	2	1
389	5	5	2	2	2	2	1
404	4	4	1	1	1	1	1
410	4	4	3	3	2	3	1

D.4 CUMULATIVE 24 HOUR $PM_{2.5}$ PREDICTIONS

The Monte Carlo method was used for the cumulative analysis of the 24-hour average $PM_{2.5}$. The three nearest EPA Upper Hunter Air Quality network sites of Muswellbrook, Singleton and Camberwell $PM_{2.5}$ data were used as the background data to add to the predicted Project alone concentrations, as in the $PM_{2.5}$ cumulative analysis. The same 13 residences were assessed for the average 24-hour $PM_{2.5}$ impacts.

The results of the Monte Carlo simulations are present in **Figure D-11**, **Figure D-12** and **Figure D-13**. As in the $PM_{2}.5$ analysis the residences closer to the Project are more likely to experience days over the NEPM standard, however for all sites the predicted number of days varying between 1 to 4 days per year (see **Table D.12-14**).

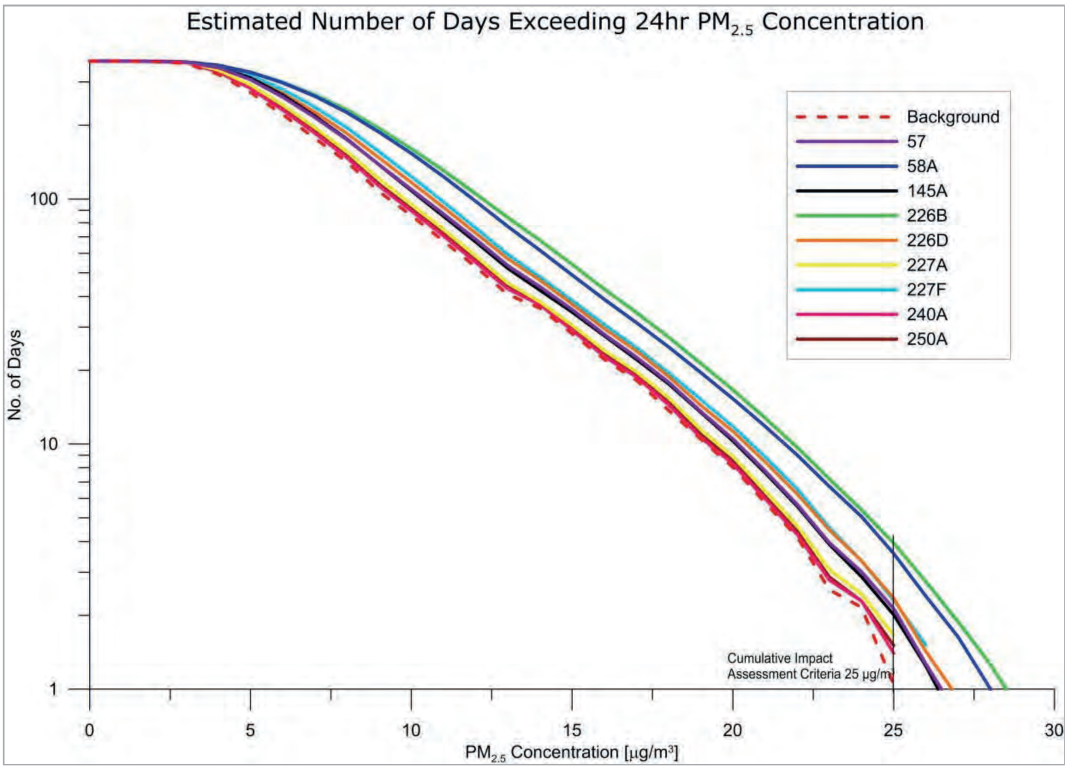


Figure D-11: Year 10 – Number of days likely to exceed cumulative maximum 24-h average $PM_{2.5}$ concentration (25 $\mu g/m^3$) for south/south-west residences

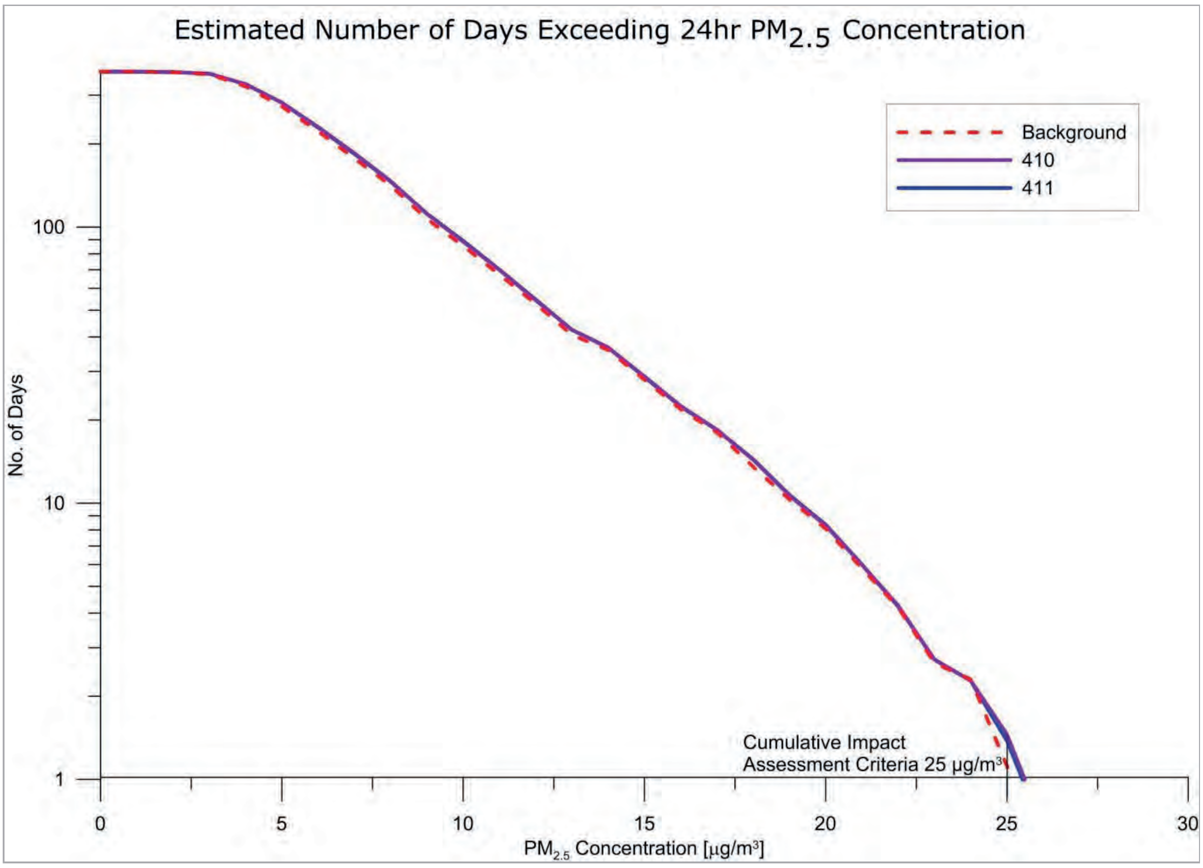


Figure D-12: Year 10 – Number of days likely to exceed cumulative maximum 24-hr average $PM_{2.5}$ concentration (25 $\mu g/m^3$) for residences north east of Drayton Mine

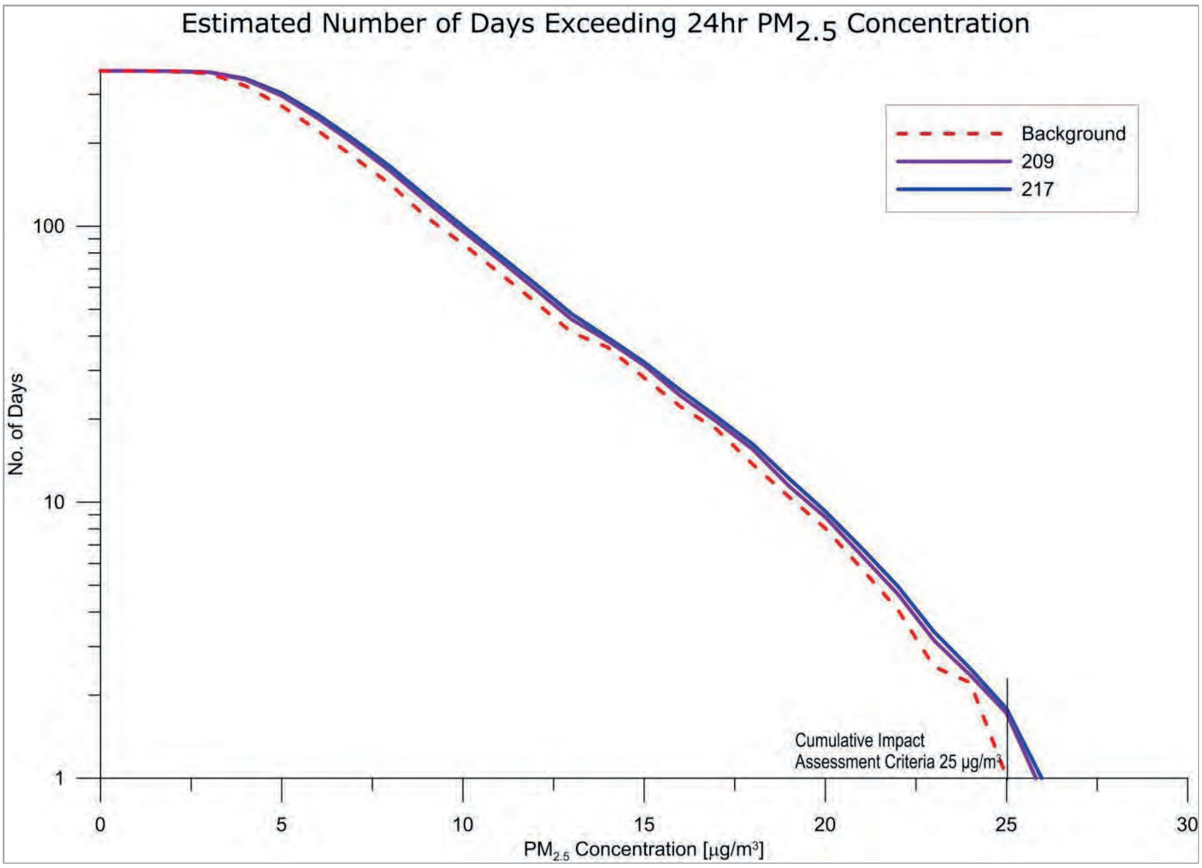
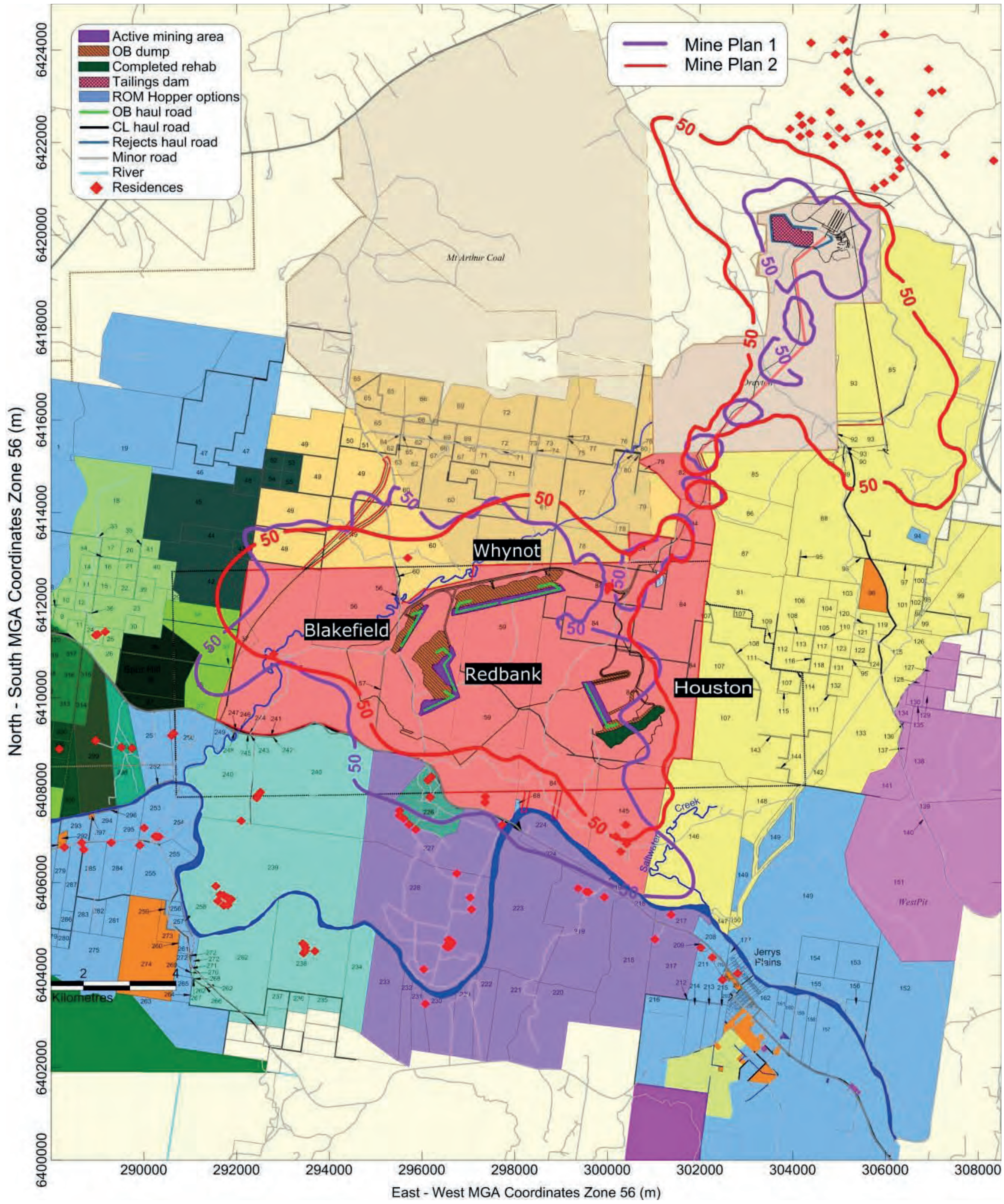


Figure D-13: Year 10 – Number of days likely to exceed cumulative maximum 24-hr average $PM_{2.5}$ concentration (25 $\mu g/m^3$) for south east residences

Table D.12-14: Summary of days exceeding 25 μg/m³ for 24 hour $PM_{2.5}$– Year10 project alone and cumulative

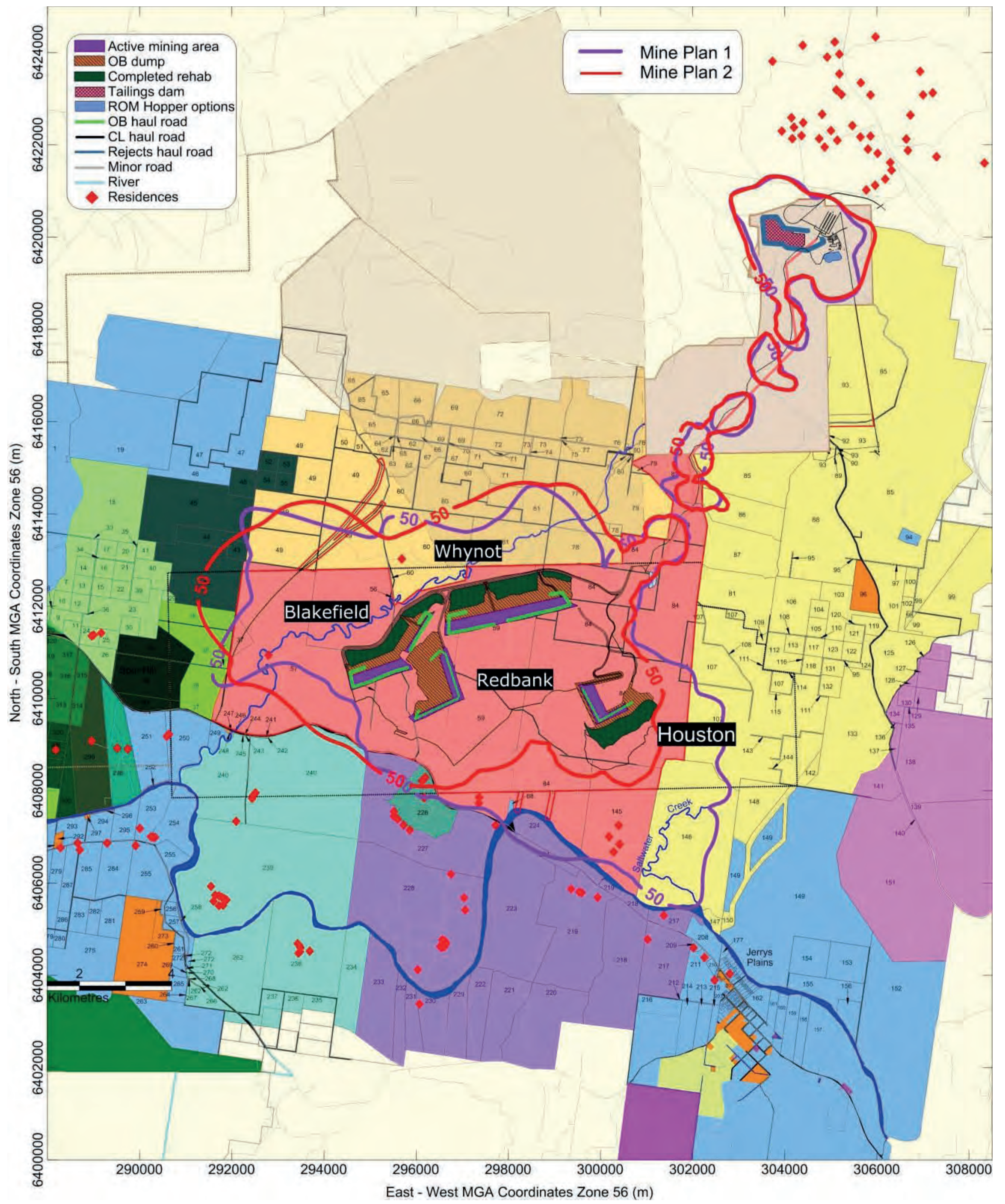
Receptor ID	Maximum predicted $PM_{2.5}$ 24-hour concentrations	Predicted number of days exceeding 25 μg/m³	
	Project Alone	Project Alone	Cumulative
57	8	0	2
58A	9	0	4
145A	4	0	2
226B	13	0	4
226D	9	0	2
227A	5	0	2
227F	6	0	2
240A	3	0	1
250A	4	0	2
209	3	0	1
217	3	0	2
410	3	0	1
411	3	0	1

APPENDIX E – COMPARISON WITH OTHER MINE PLANS



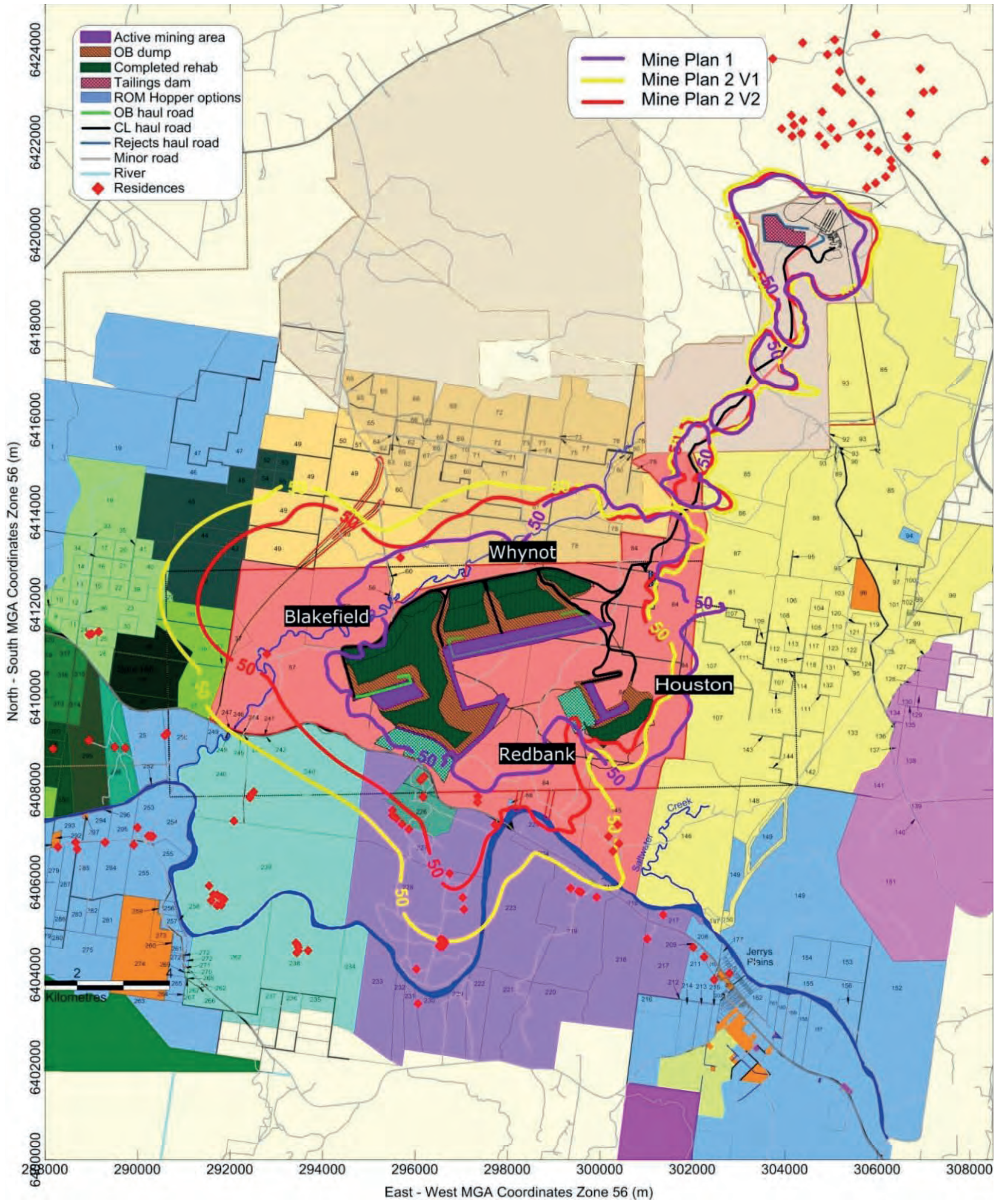
Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 3 MP1 compared to Y3B MP2 (Drayton South only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =50 µg/m³ (shown as a bold line)	CALMET	K. Hill

Figure E1: Year 3 impact comparison – Mine Plan 1 and Mine Plan 2



Species:	**Location:**	**Scenario:**	**Percentile:**	**Averaging Time:**
PM_{10}	Drayton South	Year 5B MP1 compared to Y5 MP2 (Drayton South only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =50 µg/m³ (shown as a bold line)	CALMET	K. Hill

Figure E2: Year 5 impact comparison – Mine Plan 1 and Mine Plan 2



Species:	Location:	Scenario:	Percentile:	Averaging Time:
PM_{10}	Drayton South	Year 10 MP1 compared to Y10 MP2 V1 and Y10 MP2 V2 (Drayton South only)	Maximum	24-hour
Model Used:	**Units:**	**Guideline:**	**Met Data:**	**Plot:**
CALPUFF	µg/m³	EPA =50 µg/m³ (shown as a bold line)	CALMET	K. Hill

Figure E3: Year 10 impact comparison – Mine Plan 1 and Mine Plan 2 (V1 and V2)

APPENDIX F – MODEL SET UP

Model Set Up

Table E1: Meteorological Parameters used for TAPM and CALMET

TAPM (v 4.0.4)	
Number of grids (spacing)	30 km, 10 km, 3 km, 1km
Number of grid points	42 x 42 x 35
Year of analysis	January 2005 – December 2005
Centre of domain	35°03' S, 151°34' E
CALMET (v. 6.327)	
Meteorological grid domain	120 km x 120 km (outer), 30 km x 36 km (inner)
Meteorological grid resolution	2.5 km (outer), 0.25 km (inner)
Surface meteorological stations Inner and outer grid:	Saddlers Creek Meteorological Station - Wind speed - Wind direction - Temperature Macleans Hill Meteorological Station - Wind speed - Wind direction - Temperature Drayton Meteorological Station - Wind speed - Relative humidity - Wind direction - Temperature TAPM - Wind speed - Cloud Amount - Wind direction - Relative humidity - Temperature - Sea Level Pressure - Cloud Height
Outer grid only:	Williamtown RAFF AWS (BoM, Station No. 061078) - Wind speed - Cloud Amount - Wind direction - Relative humidity - Temperature - Sea Level Pressure - Cloud Height Patterson AWS (BoM, Station No. 061250) - Wind speed - Relative humidity - Wind direction - Sea Level Pressure - Temperature Scone AWS (BoM, Station No. 061363) - Wind speed - Relative humidity - Wind direction - Sea Level Pressure - Temperature Cessnock Airport AWS (BoM, Station No. 061260) - Wind speed - Relative humidity - Wind direction - Sea Level Pressure - Temperature
3D.dat	Data extracted from 3 km TAPM

Table E2: CALMET Model Options used

IEXTRP	Extrapolate surface wind observations to upper layers	Similarity theory	Similarity theory
BIAS (NZ)	Relative weight given to vertically extrapolated surface observations versus upper air data	NZ * 0	-1, -0.5, -0.25, 0 for all other layers
TERRAD	Radius of influence of terrain	No default (typically 5- 15km)	10 km
RMAX1 and RMAX2	Maximum radius of influence over land for observations in layer 1 and aloft	No Default	6 km (outer) and 0.3 km (inner)
R1 and R2	Distance from observations in layer 1 and aloft at which observations and Step 1 wind fields are weighted equally	No Default	3 km (outer) and 0.1 km (inner)

Table E3: CALPUFF Model Options used

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

APPENDIX G – ESTIMATION OF GHG EMISSIONS

G.1 FUEL CONSUMPTION

Greenhouse gas emissions from diesel consumption were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1000}$$

Where:

E_{CO2-e}	=	Emissions of GHG from diesel combustion	(t CO_2-e)[1]
Q	=	Estimated combustion of diesel	(GJ)[2]
EF	=	Emission factor (scope 1 or scope 3) for diesel combustion	(kg CO_2-e/GJ)[3]

1 tCO_2-e = tonnes of carbon dioxide equivalent.
2 GJ = gigajoules.
3 kg CO_2-e/GJ = kilograms of carbon dioxide equivalents per gigajoule.

The quantity of diesel consumed in gigajoules (GJ) (Q) is calculated using an energy content factor for diesel of 38.6 gigajoules per kilolitre (GJ/kL).

Greenhouse gas emission factors and energy content for diesel were sourced from the NGA Factors (**DCCEE, 2011**). The estimated annual and Project total GHG emissions from diesel usage are presented in the table below.

Table G.12-15: Estimated CO_2-e (tonnes) for Diesel Consumption

Year	Diesel Consumption (kL)	Emissions (t CO_{2-e})		Total
		Scope 1	Scope 3	
2014	52,905	141,928	10,823	152,751
2015	56,204	150,778	11,498	162,276
2016	53,939	144,702	11,035	155,737
2017	50,919	136,600	10,417	147,017
2018	48,987	131,416	10,022	141,438
2019	48,468	130,024	9,915	139,939
2020	28,736	77,091	5,879	82,970
2021	28,688	76,960	5,869	82,829
2022	28,748	77,122	5,881	83,004
2023	28,439	76,292	5,818	82,110
2024	28,416	76,231	5,813	82,044
2025	28,515	76,497	5,834	82,331
2026	28,382	76,141	5,806	81,947
2027	28,140	75,492	5,757	81,249
2028	28,220	75,706	5,773	81,479
2029	28,316	75,963	5,793	81,756
2030	28,954	77,674	5,923	83,597
2031	29,263	78,503	5,987	84,489
2032	30,585	82,051	6,257	88,308
2033	30,133	80,838	6,165	87,002
2034	28,777	77,201	5,887	83,088
2035	28,813	77,298	5,895	83,192
2036	29,084	78,024	5,950	83,974
2037	28,175	75,585	5,764	81,349
2038	28,143	75,499	5,757	81,257
2039	15,437	41,414	3,158	44,572
2040	8,915	23,916	1,824	25,740
Total	**882,299**	**2,366,944**	**180,501**	**2,547,445**

G.2 ELECTRICITY

Greenhouse gas emissions from electricity usage were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1000}$$

Where:

E_{CO2-e}	=	Emissions of greenhouse gases from electricity usage	(tCO_2-e/annum)
Q	=	Estimated electricity usage	(kWh/annum)[1]
EF	=	Emission factor (Scope 2 or Scope 3) for electricity usage	($kgCO_2$-e/kWh)[2]

[1] kWh/annum = kilowatt hours per annum

[2] $kgCO_2$-e/kWh = kilograms of carbon dioxide equivalents per kilowatt hour

Greenhouse gas scope 1 emission factor (0.89 kg CO_{2-e} per kilowatt hour) and scope 2 (0.18 kg CO_{2-e} per kilowatt hour) were sourced from the NGA Factors (**DCCEE, 2011**). The estimated annual and project total GHG emissions from electricity usage are presented in the table below.

Table G.12-16: Estimated CO_2-e (tonnes) for Electricity

Year	Electricity Consumption (kWh)	Emissions (t CO_{2-e})		Total
		Scope 2	Scope 3	
2014	48,367,931	43,047	8,706	51,754
2015	75,166,485	66,898	13,530	80,428
2016	69,497,537	61,853	12,510	74,362
2017	78,095,970	69,505	14,057	83,563
2018	78,095,970	69,505	14,057	83,563
2019	78,095,970	69,505	14,057	83,563
2020	78,095,970	69,505	14,057	83,563
2021	97,361,949	86,652	17,525	104,177
2022	97,361,949	86,652	17,525	104,177
2023	97,361,949	86,652	17,525	104,177
2024	97,361,949	86,652	17,525	104,177
2025	97,361,949	86,652	17,525	104,177
2026	97,361,949	86,652	17,525	104,177
2027	97,361,949	86,652	17,525	104,177
2028	97,361,949	86,652	17,525	104,177
2029	97,361,949	86,652	17,525	104,177
2030	97,361,949	86,652	17,525	104,177
2031	97,361,949	86,652	17,525	104,177
2032	97,361,949	86,652	17,525	104,177
2033	97,361,949	86,652	17,525	104,177
2034	97,361,949	86,652	17,525	104,177
2035	97,361,949	86,652	17,525	104,177
2036	97,361,949	86,652	17,525	104,177
2037	97,361,949	86,652	17,525	104,177
2038	97,361,949	86,652	17,525	104,177
2039	97,361,949	86,652	17,525	104,177
2040	97,361,949	86,652	17,525	104,177
Total	**2,452,654,811**	**2,182,863**	**441,478**	**2,624,341**

G.3 FUGITIVE METHANE

Emissions from fugitive CH_4 were estimated using the following equation:

$$E_{co2-e} = Q \times EF$$

Where:

E_{CO2-e}	=	Emissions of greenhouse gases from fugitive CH_4	(t CO_2-e/annum)
Q	=	ROM coal extracted during the year	(t)
EF	=	Scope 1 emission factor	(t CO_2-e/tonne)

The default emission factor for fugitive emissions from open cut mines (0.045 kg CO_{2-e} per tonne of ROM) was sourced from the NGA Factors (**DCCEE, 2011**). The estimated annual and Project total GHG emissions from fugitive methane are presented in the table below.

Table G.12-17: Estimated CO_2-e (tonnes) for Fugitive Methane

Year	ROM (tpa)	Scope 1 Emissions (t CO_{2-e})
2014	5,454,000	245,430
2015	5,439,000	244,755
2016	7,000,000	315,000
2017	7,000,000	315,000
2018	5,225,755	235,159
2019	5,257,283	236,578
2020	5,614,141	252,636
2021	5,955,877	268,014
2022	5,319,613	239,383
2023	4,944,801	222,516
2024	4,702,312	211,604
2025	4,499,833	202,493
2026	4,307,385	193,832
2027	4,848,383	218,177
2028	4,610,121	207,455
2029	4,642,751	208,924
2030	4,526,831	203,707
2031	5,124,829	230,617
2032	5,302,532	238,614
2033	5,826,275	262,182
2034	5,351,083	240,799
2035	5,405,115	243,230
2036	4,399,374	197,972
2037	4,229,818	190,342
2038	4,290,827	193,087
2039	1,212,183	54,548
2040	1,074,582	48,356
Total	**131,564,705**	**5,920,412**

G.4 EXPLOSIVES

Emissions from explosive usage were estimated based on the using the following equation:

$$E_{co2-e} = Q \times EF$$

Where:

E_{CO2-e}	=	Emissions of greenhouse gases from explosives	(t CO_2-e/annum)
Q	=	Quantity of explosive used (assumed ANFO)	(t)
EF	=	Scope 1 emission factor	(t CO_2-e/tonne explosive)

Greenhouse gas emission factor (0.17 t CO2-e / tonne product) were sourced from the Australian Greenhouse Office (AGO) Factors and Methods Workbook – December 2006. It is noted that the AGO Factors and Methods were replaced by the NGA Factors (**DCCEE, 2011**), however the emission factor for explosives was omitted from the latest version.

The estimated annual and Project total GHG emissions from explosive usage are presented in the table below.

Table G.12-18: Estimated CO_2-e (tonnes) for Explosives

Year	Explosive ANFO (tonnes)	Scope 1 Emissions (t CO_{2-e})
2014	8,668	1,474
2015	35,216	5,987
2016	45,734	7,775
2017	45,430	7,723
2018	20,436	3,474
2019	19,437	3,304
2020	19,263	3,275
2021	19,411	3,300
2022	19,004	3,231
2023	19,187	3,262
2024	19,514	3,317
2025	18,515	3,148
2026	18,244	3,101
2027	18,399	3,128
2028	18,345	3,119
2029	17,631	2,997
2030	17,578	2,988
2031	17,739	3,016
2032	18,243	3,101
2033	18,163	3,088
2034	18,139	3,084
2035	18,213	3,096
2036	18,042	3,067
2037	18,241	3,101
2038	17,294	2,940
2039	9,816	1,669
2040	3,996	679
Total		**91,442**

G.5 COAL TRANSPORTATION

The scope 3 emissions associated with product coal transportation have been estimated based on all product coal being transported to Newcastle for export by rail. Emissions associated with product coal transportation have been estimated based on an emission factor for loaded trains of 12.3 grams per net tonne per kilometre (**Queensland Rail Network Access, 2002**).

Emission factors were not available for unloaded trains so the factor for loaded trains is conservatively applied for the return trip. The return rail trip from Drayton to the port of Newcastle is estimated to be 260 km.

The total estimated GHG emissions from rail transport of product coal are provided in the table below.

Table G.12-19: Estimated CO_2-e (tonnes) for Rail Transportation

Year	Product Coal (tpa)	Scope 3 Emissions (t CO_{2-e})
2014	4,308,660	13,779
2015	3,926,638	12,557
2016	4,538,862	14,515
2017	4,953,776	15,842
2018	5,320,080	17,014
2019	4,152,594	13,280
2020	4,243,888	13,572
2021	4,229,080	13,525
2022	4,219,939	13,495
2023	2,869,935	9,178
2024	3,377,974	10,803
2025	3,380,522	10,811
2026	3,387,602	10,834
2027	3,438,379	10,996
2028	3,437,913	10,994
2029	3,466,028	11,084
2030	3,501,407	11,198
2031	3,849,661	12,311
2032	4,290,715	13,722
2033	4,286,418	13,708
2034	4,262,923	13,633
2035	4,287,456	13,711
2036	3,428,680	10,965
2037	3,411,931	10,911
2038	3,420,596	10,939
2039	1,448,650	4,633
2040	1,021,450	3,267
Total	**100,461,757**	**321,277**

G.6 ENERGY PRODUCTION - USE OF PRODUCT COAL

The scope 3 emissions associated with the combustion of product coal were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EC \times EF}{1000}$$

Where:

E_{CO2-e}	=	Emissions of GHG from coal combustion	(t CO_2-e)
Q	=	Quantity of product coal burnt	(GJ)
EC	=	Energy Content Factor for black / coking coal	(GJ/t)[1]
EF	=	Emission factor for black / coking coal combustion	(kg CO_2-e/GJ)

[1] GJ/t = gigajoules per tonne

The quantity of thermal coal burnt in Mtpa is converted to GJ using an energy content factor for black coal of 27 GJ/t.

The greenhouse gas emission factor and energy content for coal were sourced from the NGA Factors (**DCCEE, 2011**). The emissions associated with the use of the product coal are presented in the table below.

Table G.12-20: Estimated CO_2-e (tonnes) for Energy Production

Year	Thermal Product Coal (tpa)	Scope 3 Emissions (t CO_{2-e})
2014	4,308,660	10,287,399
2015	3,926,638	9,375,279
2016	4,538,862	10,837,032
2017	4,953,776	11,827,686
2018	5,320,080	12,702,275
2019	4,152,594	9,914,776
2020	4,243,888	10,132,749
2021	4,229,080	10,097,395
2022	4,219,939	10,075,569
2023	2,869,935	6,852,286
2024	3,377,974	8,065,285
2025	3,380,522	8,071,369
2026	3,387,602	8,088,272
2027	3,438,379	8,209,509
2028	3,437,913	8,208,396
2029	3,466,028	8,275,523
2030	3,501,407	8,359,995
2031	3,849,661	9,191,488
2032	4,290,715	10,244,555
2033	4,286,418	10,234,294
2034	4,262,923	10,178,198
2035	4,287,456	10,236,773
2036	3,428,680	8,186,350
2037	3,411,931	8,146,360
2038	3,420,596	8,167,049
2039	1,448,650	3,458,811
2040	1,021,450	2,438,824
Total	**100,461,757**	**239,863,496**