HANCOCK PROSPECTING PTY LTD

Alpha Coal Project Environmental Impact Statement

H | Air Quality

Air Quality Assessment

Alpha Coal Project (Mine)

13 SEPTEMBER 2010

Prepared for

Hancock Prospecting Pty Ltd

Hancock House
355 Queen Street, Brisbane, QLD 4000

42626580

URS

Project Manager:

Rob Storrs
Senior Asscociate

Principal-In-Charge:

pp. Chris Pigott
Senior Principal

Author:

Bipin Bhensdadia
Environmental Engineer

Reviewer:

Dr Darlene Heuff
Senior Asscociate

URS Australia Pty Ltd

Level 16, 240 Queen Street
Brisbane, QLD 4000
GPO Box 302, QLD 4001
Australia
T: 61 7 3243 2111
F: 61 7 3243 2199

Date:	**13 September 2010**
Reference:	42626580/REP058/1
Status:	Final

© Document copyright of URS Australia Pty Limited.

This report is submitted on the basis that it remains commercial-in-confidence. The contents of this report are and remain the intellectual property of URS and are not to be provided or disclosed to third parties without the prior written consent of URS. No use of the contents, concepts, designs, drawings, specifications, plans etc. included in this report is permitted unless and until they are the subject of a written contract between URS Australia and the addressee of this report. URS Australia accepts no liability of any kind for any unauthorised use of the contents of this report and URS reserves the right to seek compensation for any such unauthorised use.

Document delivery

URS Australia provides this document in either printed format, electronic format or both. URS considers the printed version to be binding. The electronic format is provided for the client's convenience and URS requests that the client ensures the integrity of this electronic information is maintained. Storage of this electronic information should at a minimum comply with the requirements of the Commonwealth Electronic Transactions Act (ETA) 2000.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by URS and a copy will be provided if requested.

Table of Contents

URS

Tables

Figures

Appendices

Abbreviations

Abbreviation	Description
%	Percentage
±	Plus or minus
°C	Degrees Celsius
°E	Degrees East
°S	Degrees South
$\mu g/m^3$	Micrograms per cubic meter
µm	Micrometer
AS/NZS	Australian Standard/New Zealand Standard
bcm	Bank cubic meter
BMA	BHP Billiton Mitsubishi Alliance
BOM	Bureau of Meteorology
c.	Approximately
CHPP	Coal Handling and Preparation Plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DERM	Queensland Department of Environment and Resource Management
EF	Emission factors
EIS	Environmental Impact Statement
EPA	Queensland Environmental Protection Authority
EPP (Air)	Environmental Protection (Air) Policy 2008
FEL	Front End Loading
$g/m^2/month$	Grams per square meter per month
ha	Hectares
HPPL	Hancock Prospecting Pty Ltd
JORC	Joint Ore Reserves Committee
kg/h	Kilograms per hour
kg/year	Kilograms per year
km	Kilometre
LOM	Life of mine
m	Meter
m/s	Meters per second
m^2	Square meter
m^3	Cubic meter
mm	Millimetre
Mtpa	Million tonne per annum
NEPC	National Environment Protection Council
NEPM (Ambient Air Quality)	National Environment Protection Measure (Ambient Air Quality)
NPI	National Pollutant Inventory
NSW	New South Wales
PM_{10}	particulate matter less than 10 µm
$PM_{2.5}$	particulate matter less than 2.5 µm
Qld	Queensland
ROM	Run-of-mine
t	Tonne
TAPM	The Air Pollution Model

Abbreviation	Description
TEOM	Tapered Element Oscillating Microbalance
the Act	Environment Protection Act 1994
the Mine	Alpha Coal Project mining lease application area
the Project	Alpha Coal Project
TSF	Tailings Storage Facility
TSP	Total Suspended Particulates
URS	URS Australia Pty Ltd
VKT	Vehicle kilometres travelled

Executive Summary

URS has conducted an air quality assessment of the impacts of dust emissions from Alpha Coal Project (Mine) (the Project) on behalf of Hancock Prospecting Pty Ltd (HPPL).

A site-specific emissions inventory has been developed for 30 years of the life of the Project. Estimates of dust emissions associated with the construction of the box cut have also been undertaken. The emissions and impacts of dust from mine-related activities including total suspended particulates (TSP), particulate matter less than 10 microns (µm) in diameter (PM_{10}), particulate matter less than 2.5 µm in diameter ($PM_{2.5}$) and dust deposition, have been considered in this assessment.

Ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition have been presented at each of the eleven off-site receptor locations as well as for the proposed on-site accommodation village. Impacts from dust emissions associated with mining activities at these receptor locations have been estimated for six years of the mine life (years 5, 10, 15, 20, 25, 30).

In general, results of the dispersion modelling suggest that air quality at the location of Receptor 8 and Receptor 9 located to the south of the mine lease will be most affected by dust emissions from the site. As discussed in Section 3.3.3 the confirmation of (both adverse and absence of) air quality impacts predicted by the model can only be validated by observational data.

Specifically results of the dispersion modelling suggest that:

- Emissions of dust from the Project (in isolation of background dust sources) will result in elevated levels of particulate matter that exceed the EPP (Air) objective of 50 µg/m^3 for the 24-hour average ground-level concentration of PM_{10} at receptor locations to the north, east and south of the site (Receptors 1, 4, 8, 9, and 12). The frequency of exceedences is predicted to range between 5% and 30% at these locations with receptors to the south of the mine site (Receptor 8 and Receptor 9) and those to the north (Receptor 1) most affected.
- During the life of the mine, the ground-level concentration of $PM_{2.5}$ is predicted to exceed the EPP (Air) objective of 25 µg/m^3 for the 24-hour average ground-level concentration at receptors to the east and south of the mine (Receptors 4, 8, 9 and 12). The frequency of predicted exceedences has not been calculated.
- The annual average concentration of $PM_{2.5}$ is not predicted to exceed the EPP (Air) objective of 8 µg/m^3 at any sensitive receptor location with the exception of Receptor 8 located to the south of the mine lease area.
- Ground-level concentrations of TSP and dust deposition are not predicted to exceed the relevant mine goals at any of the receptor locations included in the dispersion modelling.

Mitigation measures for the Project have been proposed. Some of these measures have been incorporated into the air quality modelling, such as the engineering controls and dust suppression measures, consequently reducing the impacts from the Project. Other measures may need to be implemented during Project operation, such as operational procedures, rehabilitation strategy and the ambient air quality modelling program. These measures will ensure that the worst-case conditions do not lead to the level of impact predicted by the model.

The proposed ambient and operational monitoring programs will be used to assist in early detection of elevated levels of dust at sensitive locations that are attributable to the Project.

Introduction

URS Australia (URS) was commissioned by Hancock Prospecting Pty Ltd (HPPL) to undertake an air quality assessment of the Alpha Coal Project (Mine) (the Project) to be located approximately 50 kilometres (km) north of Alpha, 130 km south-west of the township of Clermont and approximately 360 km southwest of Mackay in Central Queensland, Australia. The location of the Project is shown on Figure 1-1.

1.1 Project Description

HPPL (the Proponent) propose to develop a 30 million tonne per annum (Mtpa) open cut thermal coal mine to target the C and D Seams in the Upper Permian coal measures of the Galilee Basin, Queensland, Australia. The Project will be supported by privately owned and operated rail and port infrastructure facilities. At the Project site the coal will be mined, washed and conveyed to a train load-out facility where it will be transported east approximately 495 km to the port facility of Abbot Point for export.

The Project is a new open cut thermal coal mine to be located within Mining Lease Application (MLA) 70426. The open cut coal mine is proposed to produce 30 million tonnes per annum (Mtpa) of ROM thermal coal for the export market. The expected life of mine (LOM) is 30 years with sufficient Joint Ore Reserves Committee (JORC) compliant resources to potentially extend the Project life beyond 30 years. The layout of the Alpha Coal Project (Mine) is presented in Figure 1-2.

The Project consists of four open cut pits (totalling approximately 25 km in total length) oriented in a north-south direction along the centre of MLA 70426.

The four pits have been named after local rural properties:

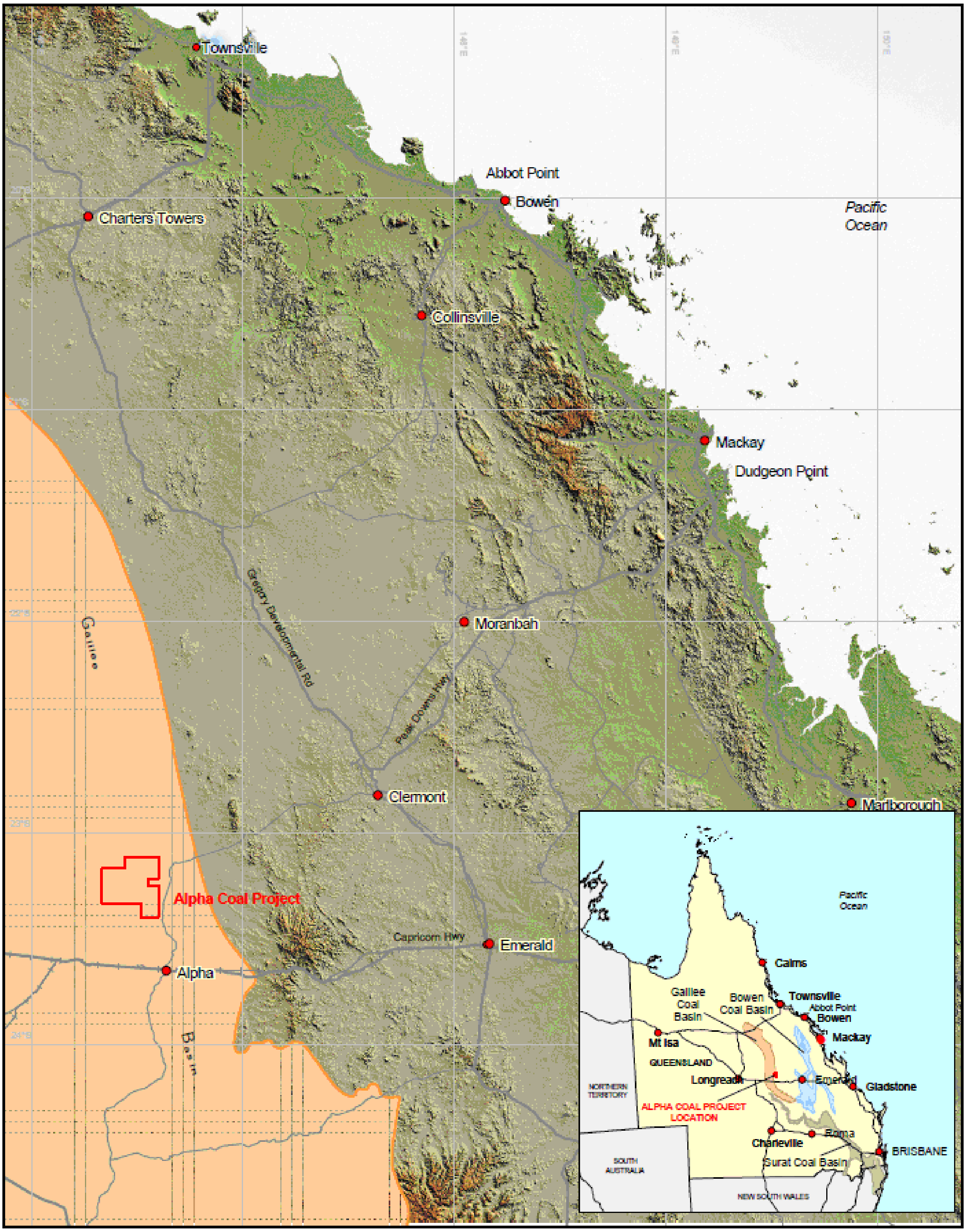
- Pit A Hobartville Pit
- Pit B Wendouree Pit
- Pit C Surbiton Pit
- Pit D Forrester Pit

The overburden will be removed by truck and shovel, excavators and dragline operations. The overburden will be initially stockpiled in out-of-pit spoil dumps and then used to backfill the open cut pits. The coal will be mined by shovel and transported by truck. Raw coal will be processed at two run-of-mine (ROM) facilities where it will be reduced in size for further processing at the Coal Handling and Preparation Plant (CHPP).

Sized raw coal will be transferred from the ROM facilities via conveyors to the multi-module CHPP, where it will be washed. 100 % of the coal resource mined and placed through the ROMs will be processed to produce an approximate 9% ash export thermal product. A Tailing Storage Facility is required for the fine rejects (also known as tailings). The coarse rejects from the CHPP will be placed in designated locations within the open cut pit spoil dumps opposite the CHPP.

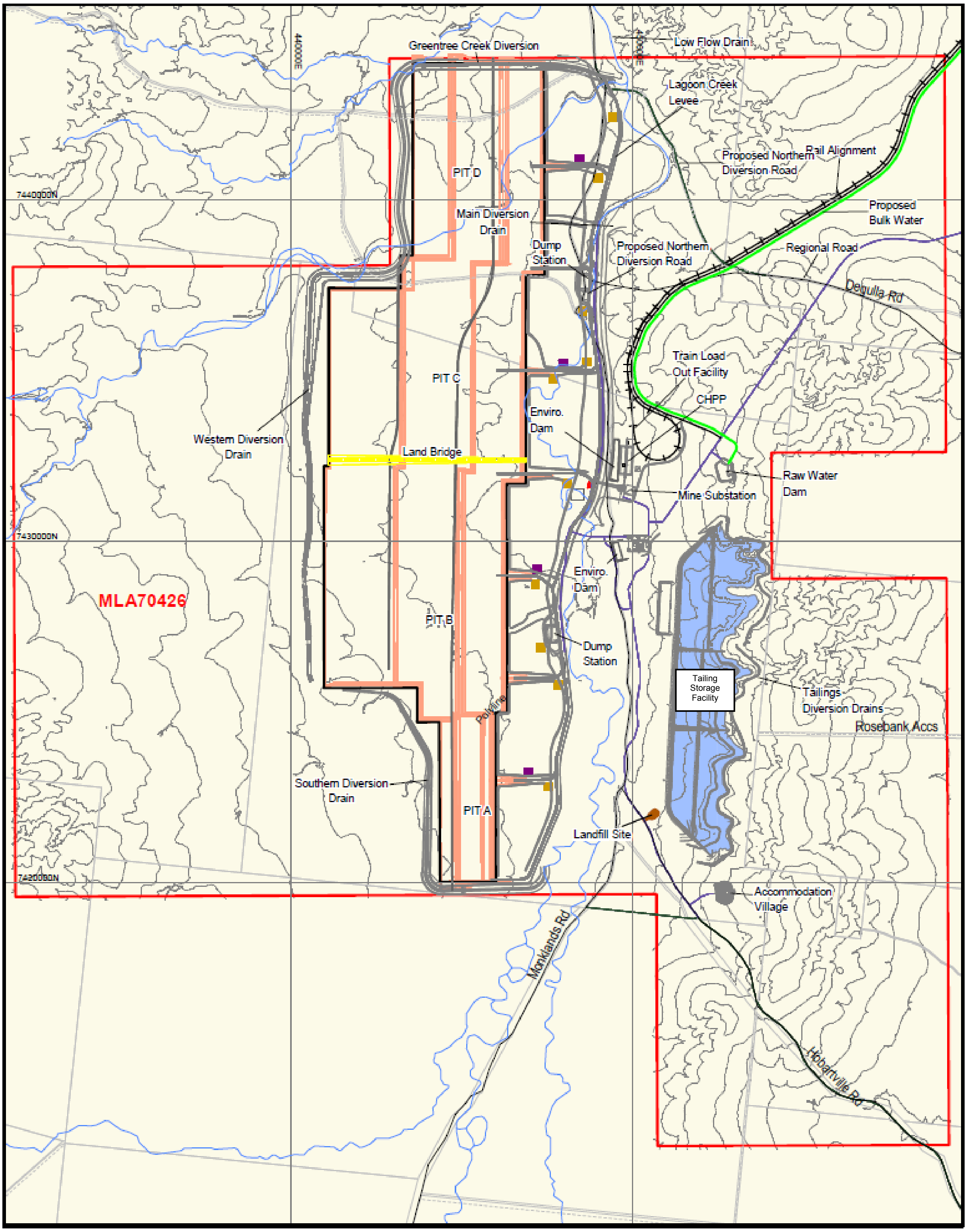
1 Introduction

Figure 1-1 Location of the Alpha Coal Project (Mine)



1 Introduction

Figure 1-2 Layout of the Alpha Coal Project (Mine)



1.2 Assessment Methodology Overview

Emissions from the Alpha Coal Project (Mine) are generated primarily from activities that move overburden and coal. The main pollutant of concern is dust and to a lesser extent emissions associated with the combustion of diesel fuel in mobile equipment.

The emissions and impacts of dust from mine-related activities including total suspended particulates (TSP), particulate matter less than 10 micrometres (µm) in diameter (PM_{10}), particulate matter less than 2.5 µm in diameter ($PM_{2.5}$), and dust deposition have been considered in this assessment.

Air pollutants that result from the combustion of diesel fuel include sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and trace quantities of volatile organic compounds (VOCs). Due to the scale of diesel fuel that is estimated to be consumed on site and the proximity of the sensitive receptors to Alpha Coal Project (Figure 3-1), these pollutants are not considered to be emitted in sufficient quantities to impact significantly on air quality at sensitive receptor locations. Air quality impacts associated with sulphur dioxide, nitrogen dioxide and VOCs have not been considered further.

Ground level concentrations of dust at sensitive receptors have been estimated for the following years of activities associated with the Alpha Coal Project:

- Life of mine Year 5
- Life of mine Year 10
- Life of mine Year 15
- Life of mine Year 20
- Life of mine Year 25
- Life of mine Year 30

Dispersion modelling has been undertaken using the CALMET/CALPUFF dispersion modelling package. Site-specific meteorology has been developed for 2009 using a combination of the CSIRO's prognostic meteorological model TAPM and the US EPA approved meteorological model CALMET.

A detailed emissions inventory for dust emissions from the Project was developed using information provided by the Proponent in conjunction with emission factors from both the Australian National Pollutant Inventory (NPI) emission estimation manual and USEPA AP-42 emission estimation manual.

A comparison of ground-level concentrations of dust associated with the Project and regulatory ambient air quality objectives at identified receptor locations will be presented in this report.

Based on the predicted dust concentration at sensitive receptors year 5 and year 30 have been identified as leading to worst-case impacts. Contour plots are presented for these two years only. However predicted ground level concentrations at sensitive receptor locations are presented in tabular form for all years modelled.

Environmental Values

Environmental values considered in the assessment are the following:

- Legislation that is applicable to ambient air quality in Queensland;
- Existing air quality in the vicinity of the mine; and
- Climate of the region surrounding the Project.

The climate of the region is presented in Volume 2, Section 3 of the Alpha Coal Project EIS which includes a discussion on:

- Ambient air temperature;
- Local winds;
- Relative humidity;
- Rainfall;
- Mixing height; and
- Stability class.

2.1 Legislative Framework

2.1.1 National Legislative Framework

National air quality guidelines are specified by the National Environment Protection Council (NEPC). The National Environment Protection Measure (NEPM) (Ambient Air Quality) was released in 1998[1] (with an amendment in 2003) and sets standards for ambient air quality in Australia.

The NEPM (Ambient Air Quality) specifies national ambient air quality standards and goals for the following common air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), particulates (as PM_{10} and $PM_{2.5}$), and lead (Pb).

In 2004 the NEPM (Air Toxics) was released which included monitoring investigation guidelines for five compounds classified as air toxics: benzene, benzo(a)pyrene, formaldehyde, toluene and xylenes. These toxic air pollutants are not released in significant quantities from the Project and have not been addressed in the air quality assessment.

Ambient concentrations of $PM_{2.5}$ are addressed only by advisory reporting standards in the NEPM, which are not applied as goals. Potential particulate emissions and impacts are addressed through consideration of the impacts of total suspended particulates and PM_{10}.

The NEPM standards are intended to be applied at monitoring locations that represent air quality for a region or sub-region of more than 25,000 people, and are not used as recommendations for locations near industrial facilities. This report has focussed on demonstrating compliance with the Environmental Protection (Air) Policy 2008 (EPP (Air)) air quality objectives.

2.1.2 Queensland Legislative Framework

In Queensland, air quality is managed under the Environment Protection Act 1994 (the Act), the Environmental Protection Regulation 2008[2] (the Regulation) and the Environmental Protection (Air) Policy 2008[3] (EPP (Air)) which came into effect on January 1, 2009.

[1] National Environmental Protection Council, *National Environment Protection Measure for Ambient Air Quality*, 1988, with amendment in 2003
[2] Queensland Government, *Environmental Protection Regulation* 2008, Office of the Queensland Parliamentary Counsel
[3] Queensland Government, *Environmental Protection (Air) Policy* 2008, Office of the Queensland Parliamentary Counsel

2 Environmental Values

The Act provides for long-term protection for the environment in Queensland in a manner that is consistent with the principles of ecologically sustainable development. The primary purpose of the EPP (Air) is to achieve the objectives of the Act in relation to Queensland's air environment. This objective is achieved by the EPP (Air) through:

- Identification of environmental values to be enhanced or protected;
- Specification of air quality indicators and goals to protect environmental values; and
- Provision of a framework for making consistent and fair decisions about managing the air environment and involving the community in achieving air quality goals that best protect Queensland's air environment.

The EPP (Air) applies "…to Queensland's air environment" but the air quality objectives specified in the EPP (Air) do not extend to workplaces covered by the Workplace Health and Safety Act (1995) (Section 8 of the EPP (Air)).

The air quality assessment presented in this report addresses off-site ambient air quality impacts only and does not cover workplace health and safety exposure.

Schedule 1 of the EPP (Air) specifies the air quality objectives that are to be (progressively) achieved though no timeframe for achievement of these objectives is specified. The Schedule includes objectives associated designed to protect the environmental values of:

- Health and well being;
- Aesthetic environment;
- Health and biodiversity of ecosystems; and
- Agriculture.

The Queensland Department of Environment and Resource Management (DERM) has also adopted a guideline for dust deposition of 4 $g/m^2/month$ (c.140 $mg/m^2/day$) to ensure adequate protection from nuisance levels of dust. This level was derived from ambient monitoring of dust conducted in the Hunter Valley, NSW in the 1980's. The former New South Wales (NSW) State Pollution Control Commission set the level to avoid a loss of amenity in residential areas, based on the levels of dust fallout that cause complaints. The current guideline level adopted in NSW[4] is that the maximum total dust deposition level should not exceed 4 $g/m^2/month$, and that the maximum increase in deposited dust is 2 $g/m^2/month$.

2.1.3 Summary of Project Ambient Air Goals

Air emissions from the Project comprise mainly particulate matter, also referred to as dust. Particulate matter for this Project is described in three size categories: particulate matter less than 2.5 μm ($PM_{2.5}$) in diameter, particulate matter less than 10 μm (PM_{10}) in diameter and total suspended particulates (TSP).

Minor pollutants that may be emitted from site operations include combustion pollutants from truck exhaust, namely SO_2, NO_2 and trace quantities of VOCs. Due to the scale of the emission of these minor pollutants, impacts of NO_2, SO_2 and VOCs have not been quantified as part of this assessment.

The EPP (Air) objectives and Queensland DERM guideline for TSP, PM_{10}, $PM_{2.5}$ and dust deposition are included in Table 2-1.

[4] NSW Department of Environment and Conservation, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, August 2005

Table 2-1 Summary of project goals for particulate matter

Pollutant	Averaging Period	Objective or Goal	Jurisdiction
Total Suspended Particulates	Annual	90 µg/m3	EPP (Air)
PM10	24-hour	50 µg/m3 (five exceedences allowed per year)	EPP (Air)
PM2.5	24-hour	25 µg/m3	EPP (Air)
	Annual	8 µg/m3	EPP (Air)
Dust Deposition	Monthly	140 mg/m2/day	Queensland DERM

2.2 Existing Air Quality

The region surrounding the Project is predominantly rural in character supporting cattle grazing and some crop farming. Dust emission sources in the surrounding region will generally consist of activities such as cultivation and harvesting.

In general, the background concentration of a particular pollutant is meant to represent the air quality environment that would exist in the absence of contributions from anthropogenic sources. Thus the background concentration includes impacts from all naturally occurring emission sources. Depending on the study area and the pollutant(s) under consideration, natural sources may include (but may not be limited to): bush fires; dust storms or biogenic emissions.

In practice however, monitoring is seldom conducted in areas absent of anthropogenic sources with roads, industry, agriculture and residential activities (as well as others) all potentially impacting on monitored pollutant levels to varying degrees. Thus depending on which emission sources are modelled explicitly and which sources (if any) are meant to be represented by the “background” concentration, there is the potential to double count the impact of emission sources when basing estimates on observational data.

The approach used to estimate background levels is further complicated in an air shed that may be influenced by existing (non Project-related) emission sources that are not explicitly represented in the dispersion modelling. In this case data used to represent background levels may be sensitive to the location of the monitoring site with levels potentially varying with (for example) wind speed, wind direction and atmospheric stability.

In practice, the interpretation of background air quality varies from assessment to assessment. Here “background” air quality is used to represent the current air quality environment as only Project-related emission sources have been explicitly modelled. The regional airshed, does not currently contain significant dust sources such as an operational mines in the surrounding region thus for this assessment the terminology “background” is synonymous with “existing” environment.

In Queensland a conservative approach to estimating background levels has typically been adopted where a single value corresponding to the 95th percentile of the data has typically been used. Approaches vary however, with the Environmental Protection Authority Victoria (EPA Victoria) recommending the use of the 70th percentile[5]. The approach in NSW is different again with the data time series utilised when available[6].

[5] Victorian Government Gazette, Special, Friday 21 December 2001.
[6] NSW Department of Environment and Conservation, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales,* August 2005.

The ‘appropriate’ percentile may depend on a number of factors including (but may not be limited to):

- Representativeness of the data set in terms of location and local influences;
- The degree of wind direction dependence of elevated levels of pollutants recorded at the site;
- The dominance of a dust emission source(s) that is not explicitly accounted for in the dispersion modelling (This may suggest a spatially varying background level is more representative than a single value applied to all sites within the study region.); and
- The degree of ‘contamination’ from emission source(s) that are explicitly accounted for in the dispersion modelling.

There is no regulatory-controlled ambient air quality monitoring stations in the vicinity of the Project site. Data from similar mining Projects have been used to represent the background levels of pollutants.

2.2.1 Particulate Matter

Particle Size Distribution

In general, dust emitted from an emission source consists of a range of particle sizes that is dependent on the source characteristics.

Dust from overburden and coal handling operations is generated using mechanical means and thus the majority of dust emitted from coal mines consists of larger-sized particles (i.e. greater than $PM_{2.5}$) when compared with particulate matter generated during combustion processes which contains a higher percentage of particles in the range of $PM_{2.5}$ to ultrafine particles. Dust from roads can be finer than that generated by material handling due to the repeated pulverising of road materials into smaller fragments and the resultant creation of fine particles which can easily become airborne.

The proportion of dust that is released from the site as either TSP or PM_{10} has been represented in the emission factors used to generate the emission data. These emission factors indicate that PM_{10} emission rates are typically less than 50% of the TSP emission rates (examples: Appendix C and/or D).

Based on data collected in the vicinity of coal mines and presented in The Australian Coal Review[7], an average of 40% of TSP was found to consist of particles in the size range of PM_{10}. Particles in the size range of $PM_{2.5}$ were found to comprise only 4% of TSP or equivalently 10% of PM_{10}. This is in sharp contrast to the urban environment which is dominated by combustion sources of particulate matter and where TSP is found to be comprised of 60% PM_{10}.

Studies conducted by the Midwest Research Institute[8] into a wide-range of dust generating activities for the purposes of developing emission factors that are utilised by the US EPA, have resulted in proposed $PM_{2.5}$ to PM_{10} ratios as outlined in Table 2-2.

.

[7] Richardson, C., *Fine Dust: Implications for the Coal Industry*, The Australian Coal Review, April 2000.
[8] C. Cowherd & D. Ono (2005) *Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*. http://www.epa.gov/ttn/chief/conference/ei15/session14/cowherd_pres.pdf

Table 2-2 Midwest Research Institute's proposed $PM_{2.5}$ to PM_{10} ratios

Source Category	PM2.5/PM10 Ratio
Paved Roads	0.15
Unpaved Roads	0.1
Construction & Demolition	0.1
Aggregate Handling & Storage Piles	0.1 (traffic), 0.15 (transfer)
Industrial Wind Erosion	0.15
Agricultural Tilling	0.2
Open Area Wind Erosion	0.15

In the absence of additional information, a conservative assumption that 20% of the dust emitted from the Project site for all dust sources consists of particles with a diameter less than 2.5 µm has been applied in this assessment.

Estimates of Background

For the purposes of this assessment, an estimate of the background dust concentration is required for the annual average concentration of TSP and $PM_{2.5}$, the 24-hour average concentration of PM_{10} and $PM_{2.5}$, as well as dust deposition.

The DERM operates dust monitoring at numerous sites across Queensland.

The nearest DERM monitoring site to the Project site is located at West Mackay in a light industrial area, approximately 400 km north-east of the Project site. The annual average PM_{10} concentration[9] at this site is 21 µg/m³. As the Project site is located in a rural area and without any light industries or operating mines in the vicinity, the existing dust levels are expected to be lower than those recorded at West Mackay.

Among DERM monitoring sites in Queensland that monitor particulate matter, the Toowoomba monitoring site located approximately 700 km southeast of the Project site has been identified as a closer representation of a rural land use. This site, however, due to its proximity to residential and light industrial land uses and distance from the Project site, it is considered that this location is not representative of the air quality expected in the vicinity of the Project site. Nonetheless, based on information contained in Queensland EPA Air Monitoring Report (2006) the Toowoomba monitoring site has recorded a 75th percentile 24-hour PM_{10} concentration of approximately 20 µg/m³ (2006). The 75th percentile 24-hour $PM_{2.5}$ concentration recorded at Toowoomba was approximately 5.2 µg/m³ (2006).

A recent report "Air Quality Impact Assessment Study of the Proposed Ensham Central Project" contains site-specific monitoring data for TSP and PM_{10} concentrations from nearby Ensham Coal Mine located approximately 40 km east of Emerald and 200 km east southeast of the Project site. The data reported in the vicinity of the Ensham Coal Mine are reported in Table 2-3 for TSP, PM_{10}, $PM_{2.5}$ and dust deposition.

[9] http://www.epa.qld.gov.au/environmental_management/air/air_quality_monitoring/air_quality_reports/monthly_bulletins/

Table 2-3 Background levels of particulate matter, Ensham Coal Mine

Pollutant	Averaging Period	Concentration	Source
TSP	Annual	28 µg/m³	Ensham Coal Mine
PM_{10}	24-hour	27 µg/m³	Ensham Coal Mine
$PM_{2.5}$	24-hour	5.4 µg/m³	Ensham Coal Mine+
	Annual	2.8 µg/m³	Ensham Coal Mine+
Dust Deposition	Monthly	54 mg/m²/day	Ensham Coal Mine

+ Based on the assumption that 20 % of PM_{10} is of the form of $PM_{2.5}$

Based on the publicly available Environment Impact Statement (EIS) for BMA-owned Daunia Coal Mine Project, BMA monitored 24-hour PM_{10} concentrations at Olive Downs and Winchester Downs from April 2007 to August 2008. Dust deposition monitoring was also conducted by BMA at these locations from May 2007 to April 2008.

The annual average TSP concentration was assumed to be double the annual average PM_{10} concentration. The background particulate levels adopted for the purposes of the Daunia assessment are presented in Table 2-4.

Table 2-4 Background levels of particulate matter, Daunia Coal Mine EIS

Pollutant	Averaging Period	Concentration	Source
TSP	Annual	20 µg/m³	Daunia Mine EIS
PM_{10}	24-hour	20 µg/m³	Daunia Mine EIS
$PM_{2.5}$	24-hour	NA	Daunia Mine EIS
	Annual	NA	Daunia Mine EIS
Dust Deposition	Monthly	145 mg/m²/day	Daunia Mine EIS

2.2.2 Dust Deposition

Site-specific dust deposition monitoring (data provided by the Proponent) was conducted at four locations during 2009. Data for approximately 12 months has been made available for this assessment. Location HKD3 and HKD4 are within the mining lease application MLA 70426, HKD1 located just outside the eastern boundary of MLA 70426 and HKD2 located north of MLA 70426. Dust deposition monitoring locations are shown in Figure 2-1.

URS understands that potentially as many as three of the dust deposition gauges have been sited adjacent to dirt roads. Thus the dust fall out levels are expected to be a conservative representation of regional fall out levels away from the dirt roads. See Table 2-5 for summary of site-specific dust deposition data.

2 Environmental Values

Figure 2-1 Location of dust deposition monitoring sites

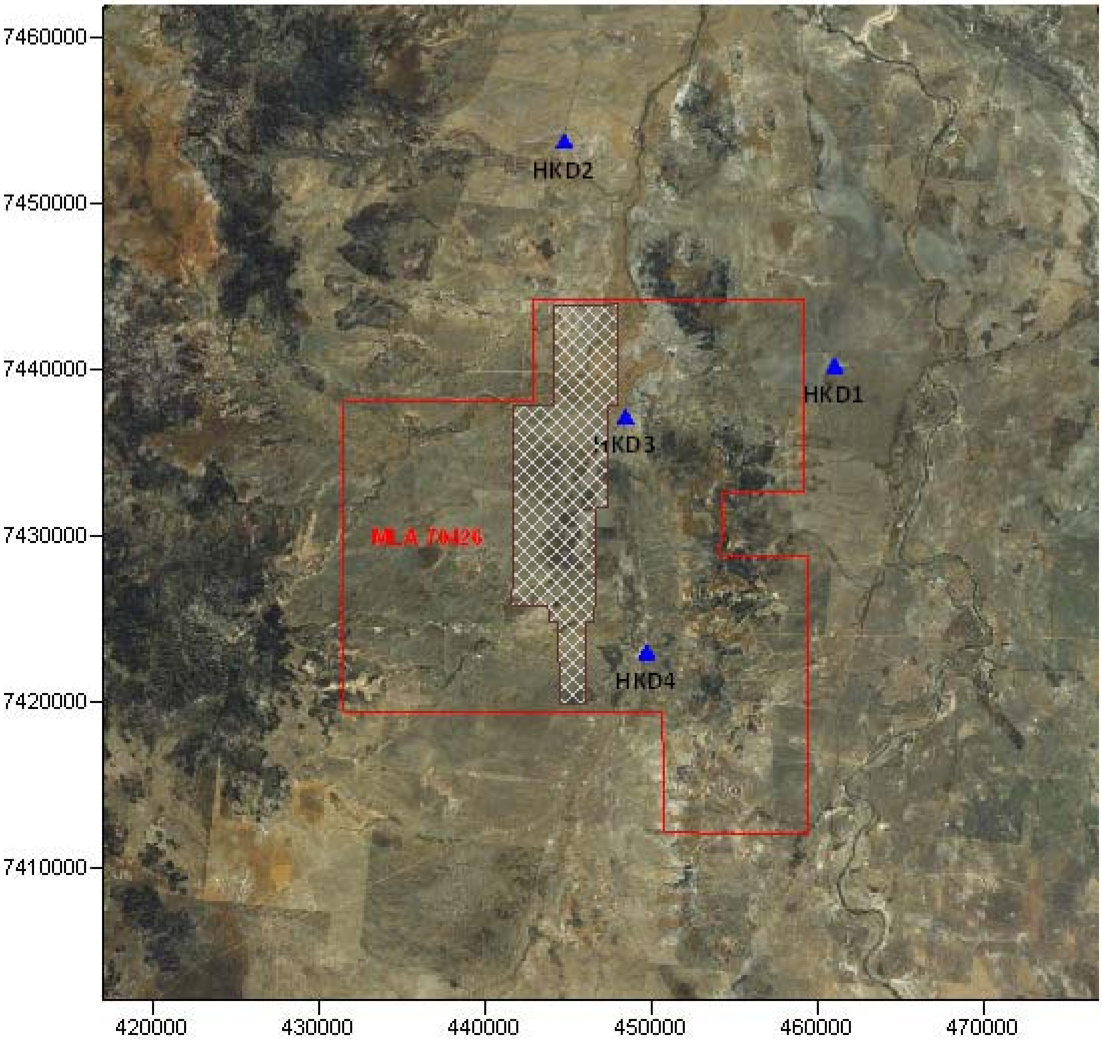


Table 2-5 Summary of site-specific dust deposition data

Start Date	End Date	Sample Period (days)	Total Insoluble Matter (mg/m²/day)			
			HKD1	HKD2	HKD3	HKD4
23/12/2008	20/01/2009	28	207.0	26.0	37.0	19.0
20/01/2009	17/02/2009	28	75.0	46.4	50.0	
17/02/2009	19/03/2009	30	26.7	50.0	73.3	46.7
19/03/2009	14/04/2009	n/a[1]	n/a[1]	n/a[1]	n/a[1]	n/a[1]
14/04/2009	12/05/2009	28	35.7	17.9	21.4	200.0
12/05/2009	13/06/2009	32	56.3	40.6	118.8	128.1
13/06/2009	8/07/2009	25	16.0	24.0	28.0	32.0
8/07/2009	28/07/2009	20	20.0	20.0	20.0	20.0

URS

Start Date	End Date	Sample Period (days)	Total Insoluble Matter (mg/m²/day)			
			HKD1	HKD2	HKD3	HKD4
28/07/2009	28/08/2009	31	74.2	19.4	45.2	87.1
28/08/2009	26/09/2009	29	48.3	69.0	55.2	58.6
26/09/2009	30/10/2009	34	85.3	102.9	61.8	267.6
30/10/2009	10/12/2009	41	34.1	61.0	56.1	100.0
10/12/2009	8/01/2010	29	79.3	89.7	110.3	189.7
Average over entire monitoring program			**63.2**	**47.2**	**56.4**	**104.4**
Average for all four sites over entire monitoring program			**67.8**			

Note 1: No dust deposition data available for the monitoring period

2.2.3 Summary of Estimates of Background Levels

In the absence of site-specific data, estimates of background levels of dust used in the assessment of the Ensham Mine have been adopted, which is a conservative position. Due to the uncertainty in the representativeness of the estimated background levels, both the Project-only (i.e. incremental) and total (Project and background) ground-level concentrations of dust will be reported, see Table 2-6 following.

Table 2-6 Summary of estimates of background levels for particulate matter

Pollutant	Averaging Period	Background Level	Source
TSP	Annual	28 µg/m³	Ensham
PM_{10}	24-hour	27 µg/m³	Ensham
$PM_{2.5}$	24-hour	5.4 µg/m³	Ensham
	Annual	2.8 µg/m³	Ensham
Dust Deposition	Monthly	68 mg/m²/day	Hancock

Air Quality Assessment Methodology

Dispersion modelling has been used to assess the likelihood of adverse air quality impacts at sensitive receptor locations surrounding the Alpha Coal Project (Mine). Air quality impacts resulting from emissions of dust from mine-related activities under typical and worst case conditions have been considered. The details of the assessment methodology are presented below. Results of the dispersion modelling are presented in Section 4.

3.1 Sensitive Receptor Location

Presented in Table 3-1 are the locations of the sensitive receptors for which results of the dispersion modelling will be presented. These are illustrated in Table 3-1.

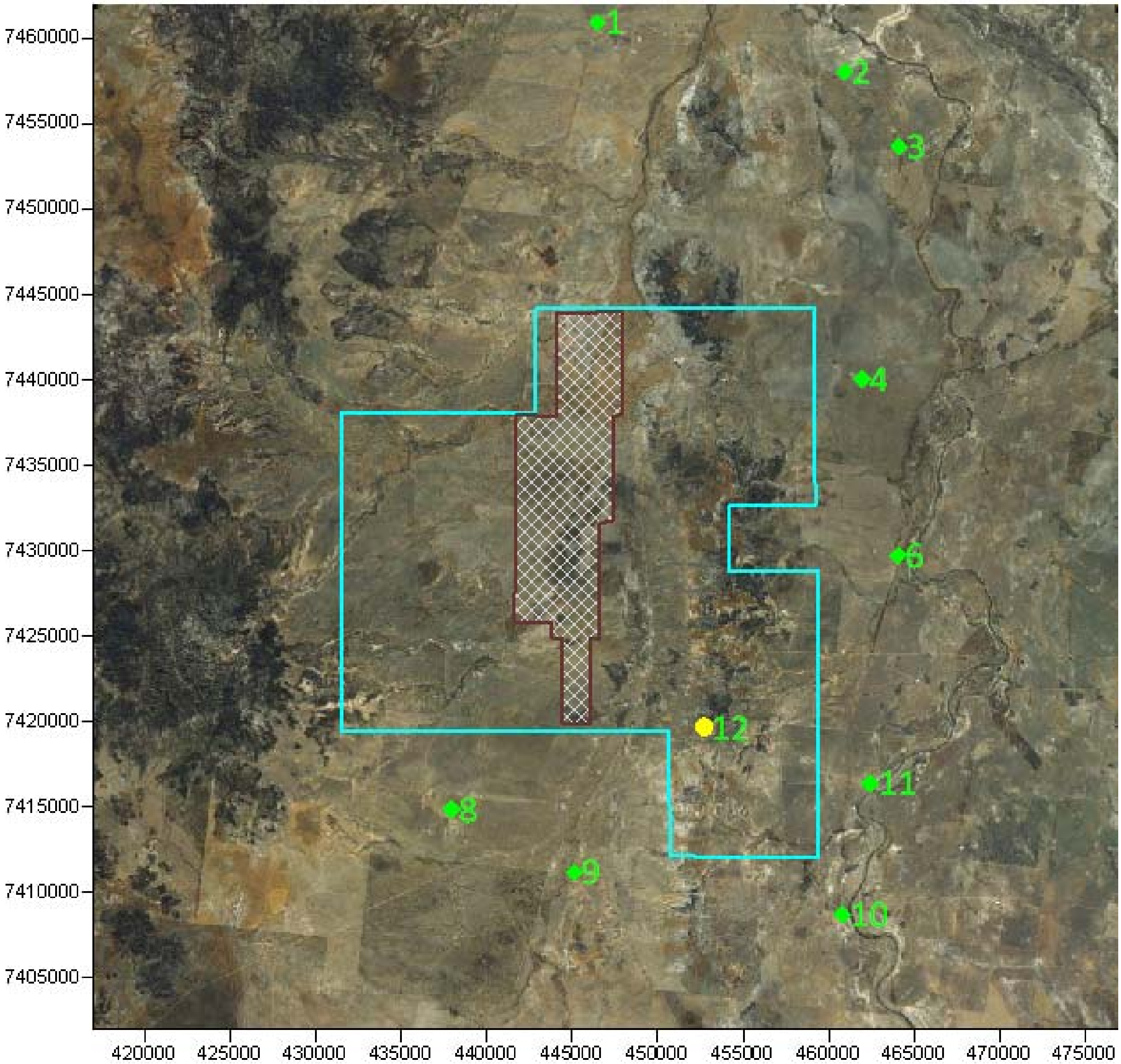
Table 3-1 Sensitive receptor locations in the vicinity of the Alpha Coal Project (Mine)

Receptor ID	Receptor Description	UTM Easting (m)	UTM Northing (m)
1	Forrester Homestead	446462	7460888
2	Surbiton Station	460936	7458001
3	Eullmbie Homestead	464135	7453631
4	Surbiton Homestead (Surbiton South Station)	461950	7440055
6	Burtle Homestead	464057	7429716
8	Kia Ora Homestead	437918	7414891
9	Monklands Homestead	445097	7411185
10	Mentmore Homestead	460780	7408727
11	Tressillian Homestead	462419	7416374
12	Alpha Coal Project Accommodation Village	452720	7419695

There are currently two other residences within the study area (Hobartville and Wendouree homesteads). However these two residences are within the boundary of MLA 70426 and will be acquired by the proponent.

3 Air Quality Assessment Methodology

Figure 3-1 Sensitive receptor locations



3.2 Air Emissions from the Alpha Coal Project (Mine)

3.2.1 Emission Sources

Dust emission sources associated with the Alpha Coal Project (Mine) include (but may not be limited to):

Construction Phase:

- Clearing of vegetation;
- Infrastructure construction (processing area, haul roads etc);
- Construction of the box cut;
- Transport of materials to site; and
- Onsite quarrying activities.

Operational Phase:

- Graders;
- Scrapers;
- Dozers operating on overburden, interburden and coal;
- Blasting;
- Front end loading of material to trucks;
- Truck dumping of material;
- Loading and unloading of stockpiles;
- Draglines;
- Transport of material (overburden, coal, rejects);
- Conveying of coal to:
  - ROM,
  - CHPP;
- The product stockpiling area;
- The train load-out;
- Rehabilitation; and
- Transfer points.

3.2.2 Emission Factors for TSP and PM_{10}

Presented in Table 3-2 is a summary of the uncontrolled emission factors for TSP and PM_{10} developed for this assessment. Details are given in Appendix C.

Table 3-2 Summary of uncontrolled TSP and PM_{10} emission factors

Source Description	Working Material	Final Emission Factors		
		TSP	PM_{10}	Unit
Dragline	Overburden	0.056	0.009	kg/bcm
Exc/Shov/FEL	Overburden	0.0004	0.0002	kg/t
Exc/Shov/FEL	Coal	0.016	0.008	kg/t
Bulldozers	Coal	16.4	4.7	kg/h
Bulldozers	Overburden	7.6	1.9	kg/h

Source Description	Working Material	Final Emission Factors		
		TSP	PM_{10}	Unit
Trucks (dumping overburden)	Overburden	0.012	0.004	kg/t
Trucks (dumping coal)	Coal	0.010	0.004	kg/t
Drilling	-	0.590	0.310	kg/hole
Blasting	interburden	220.0	114.4	(kg/blast)(ha^1.5)
Wheel generated dust (full)	Overburden	7.067	1.738	kg/VKT
Wheel generated dust (empty)	Overburden	4.918	1.209	kg/VKT
Wheel generated dust (full)	Interburden	4.679	1.151	kg/VKT
Wheel generated dust (empty)	Interburden	3.283	0.807	kg/VKT
Wheel generated dust (full)	Coal	6.882	1.692	kg/VKT
Wheel generated dust (empty)	Coal	5.145	1.265	kg/VKT
Wheel generated dust (full)	Rejects	5.680	1.397	kg/VKT
Wheel generated dust (empty)	Rejects	3.893	0.957	kg/VKT
Scrapers	Overburden	2.807	0.939	kg/VKT
Graders	Roads	0.190	0.085	kg/VKT
Loading Stockpiles	-	0.004	0.002	kg/t
Unloading from Stockpiles	-	0.030	0.013	kg/t
Loading to Trains	-	0.0004	0.0002	kg/t
Miscellaneous Transfer Points	-	0.0003	0.0001	kg/t
Erosion from exposed areas and stockpiles	-	Wind speed dependent	Wind speed dependant	kg/ha/h

3.2.3 Dust Reduction Measures

Dust control measures that will be implemented on site have been identified by the Proponent. These consist of a mixture of engineering controls (such as partial enclosure of conveyors) and control measures (such as watering of haul roads and stockpiles). The descriptions of control measures to be used for the Project have been matched to estimates of the control efficiency, as described in the NPI manual, for inclusion in modelling.

3.2.4 Emissions During Construction

As noted in Section 3.2.1, emissions of dust during the construction phase of the Project will primarily be associated with:

- Construction of infrastructure;
- Construction of the box cut; and
- Quarrying activities.

Construction of Infrastructure and Box Cut

Presented in Table 3-3 is a summary of emissions during construction associated with disturbance and the construction of the box cut. Emissions of dust associated with the construction of infrastructure such as the processing area and haul roads will be of a short duration and have not been estimated.

3 Air Quality Assessment Methodology

Table 3-3 Site specific emissions during construction (kg/year)

Parameter	Construction Year 1	Construction Year 2
Topsoil		
Disturbance	48,935	13,617
Overburden & In Pit		
Drilling & Blasting	-	15,682
FEL of Overburden into Trucks	-	7,911
Wheel generated Dust - Transport of Overburden to dumps	-	214,584
Truck Dumping at Overburden Dumps	-	172,847
Dozers	-	17,810
Graders	-	623
TOTAL (kg/year)	**48,935**	**443,075**

Quarrying

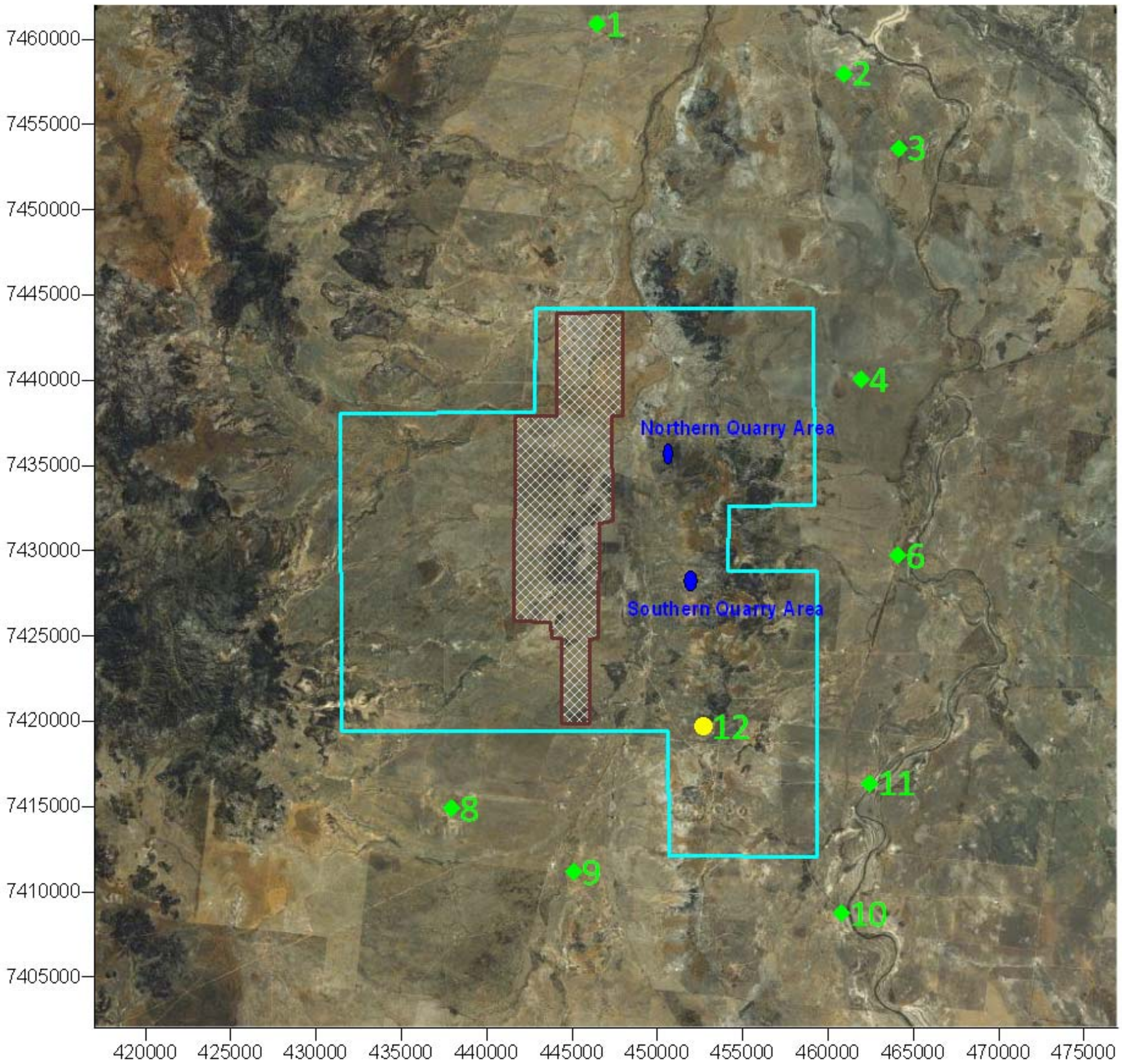
The site will provide approximately 2.3 million m^3 of on-site gravel materials from three areas over the life of the Project (Figure 3-2). The amount of material to be sourced on-site in the initial construction period is c.170,000 m^3 with the remainder sourced from off-site supplies.

Of this c.170,000 m^3 to be sourced on site during the initial construction period, 5,000 m^3 will be sourced from the footprint of the tailing storage facility (southern area in Figure 3-2), and the remainder (c.165,000 m^3) is proposed to come from the nominated borrow pit adjacent to the rail loop (northern area in Figure 3-2). The size of these borrow pits are just indicative of the area that suitable material may be found not the area that will be necessarily disturbed.

It is anticipated that the rail line will need a 17 m deep cut for the alignment and assuming an average of 10 m depth, the area required from which the 164,511 m^3 would be sourced is c.16,451 m^2 or 1.6 ha. This work would be expected to take no longer than a month to complete and would not include blasting.

Due to the scale of the quarrying activities during the construction phase of the Project, emission of dust associated with quarrying is considered immaterial compared with dust generation during the operational phase of the Project and therefore dust emissions estimation has not been undertaken.

Figure 3-2 Indicative location of proposed quarrying activities



3.2.5 Emissions During Operation

Presented in Table 3-4 is a summary of the site emissions inventory for PM_{10} based on level 2 watering of haul road (i.e. greater than 2 litres/m^2 per hour as required). The key sources of dust emissions are estimated to be associated with the transport of overburden and overburden dumping as well as wind erosion from the tailing storage facility.

Refinement of the site-specific emissions inventory may be warranted as conservative assumptions have been applied (for example) with respect to the size of the tailing storage facility that may contribute to wind erosion. As wind speed dependent wind erosion (from exposed areas, the tailing storage facility and stockpiles) are not predicted to contribute significantly to the maximum 24-hour average ground-level concentrations of PM_{10} (Section 4.3), the results presented here are not sensitive to the conservatism associated with the estimates of the area subject to wind erosion.

Table 3-4 Site-specific PM_{10} emissions during operation (kg/year)

Activity	Y1	Y5	Y10	Y15	Y20	Y25	Y30
Topsoil							
Disturbance & Rehabilitation	45,759	129,493	89,765	88,528	88,967	84,837	90,058
Overburden & In Pit							
Drilling & Blasting	85,886	433,308	391,404	447,837	374,669	383,614	439,609
Dragline	-	126,771	701,551	1,325,310	1,933,320	2,093,051	2,171,533
FEL of Overburden into Trucks	33,825	119,497	92,794	81,338	83,032	89,460	110,379
Transport of Overburden to dumps	932,346	3,403,907	2,629,672	2,291,753	2,310,160	2,480,075	3,030,093
Truck Dumping at Overburden Dumps	739,061	2,610,994	2,027,534	1,777,225	1,814,224	1,954,674	2,411,761
FEL of coal trucks	37,831	338,704	352,241	358,688	360,175	361,483	364,728
Dozers	101,493	539,422	486,871	476,120	487,638	527,206	610,657
Graders	2,894	14,043	13,933	13,819	14,303	15,432	18,632
ROM Activities							
Processing	6,507	58,255	60,583	61,692	61,948	62,173	62,731
Truck Dumping at ROM	20,219	181,020	188,255	191,700	192,495	193,194	194,928
FEL at ROM	7,566	67,741	70,448	71,738	72,035	72,297	72,946
Dozer hours - Coal at ROM (total)	1,839	18,307	19,111	19,457	19,535	19,610	19,788
Wind Erosion from Stockpiles	959	959	959	959	959	959	959
ROM to CHPP Conveyor							
Conveyors	1,034	1,034	1,034	1,034	1,034	1,034	1,034
Miscellaneous Transfer Points	7,135	63,883	66,436	67,652	67,932	68,179	68,791
CHPP Activities							
Processing	13,014	116,509	121,166	123,384	123,895	124,345	125,461
FEL at CHPP	7,566	67,741	70,448	71,738	72,035	72,297	72,946
Dozer Hours - Coal at CHPP	1,839	18,307	19,111	19,457	19,535	19,610	19,788
Loading Stockpiles	3,825	30,590	30,610	30,621	30,659	30,550	30,613
Unloading from Stockpiles	29,250	233,920	234,076	234,158	234,453	233,615	234,101
CHPP Conveyors	148	148	148	148	148	148	148
Miscellaneous Transfer Points	926	7,408	7,413	7,416	7,425	7,399	7,414
Wind Erosion from Stockpiles	29,144	29,144	29,144	29,144	29,144	29,144	29,144
Main Haul Roads							
Transport of Coal To ROM	51,465	542,108	676,220	794,600	897,061	1,001,950	1,125,676
Transport of Rejects to Dumps	7,106	90,722	131,202	166,774	195,303	230,675	243,224
Tailing storage facility							
Wind Erosion from Tailing storage facility	556,276	556,276	556,276	556,276	556,276	556,276	556,276
TOTAL (kg/year)	**2,724,914**	**9,800,210**	**9,068,404**	**9,308,564**	**10,048,359**	**10,713,285**	**12,113,416**

3.3 Modelling Methodology

A brief overview of the methodology for meteorological modelling using TAPM and CALMET and dispersion using CALPUFF is described below. Additional details are included in Appendix E.

3.3.1 Meteorological Modelling Methodology

No meteorological monitoring station recording hourly data of wind speed and direction, temperature, mixing height and stability class have been identified in the vicinity of the Project; as such there is insufficient data with which to undertake detailed dispersion modelling. To overcome these limitations, the three-dimensional prognostic meteorological model TAPM (The Air Pollution Model), developed by the CSIRO (Hurley, 2005) was used to generate wind data for the site location.

TAPM was set up for the region around the Project to simulate wind flows around the location to a 1 km resolution. Output data files were used as direct inputs to the CALMET meteorological model. The resultant three-dimensional wind fields from CALMET were used as inputs to the dispersion model CALPUFF.

3.3.2 Dispersion Modelling Methodology

Pollutants Modelled

The pollutants modelled from the operation of the Project were TSP, PM_{10} and included dust deposition. Emission rates for each dust source on site were derived using the methodology described in the previous sections. The emission sources that were identified from the data provided by the Proponent were modelled for average and peak 24-hour emissions for the year, as detailed in Section 3.2.

Model results for PM_{10} will be used to predict the impact of emissions of $PM_{2.5}$ from mine-related dust generating activities based on a conservative estimate of 20% of PM_{10} as $PM_{2.5}$ (Table 2-2).

Receptor Locations Modelled

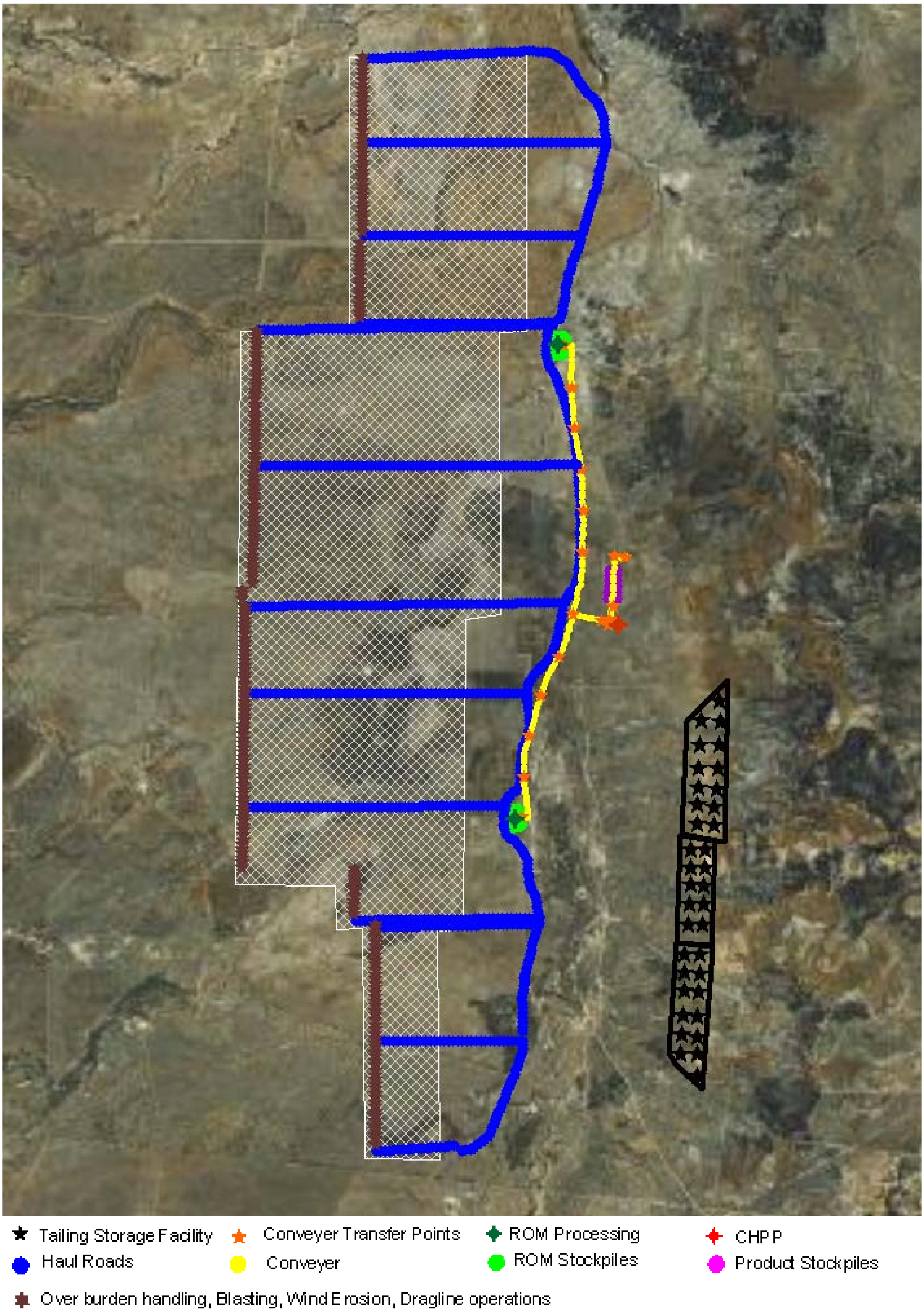
Sensitive receptor locations were included in the CALPUFF modelling for the prediction of air quality impacts as described in Section 3.1.

Emission Source Locations

The location of emission sources that were modelled for operational year 30 is presented in Figure 3-3. Additional figures indicating the location of modelled dust emission sources for years 5, 10, 15, 20, and 25 are presented in Appendix F.

3 Air Quality Assessment Methodology

Figure 3-3 Location of dust emission sources for Year 30



3 Air Quality Assessment Methodology

Averaging Time and Percentiles for Compliance

The modelling results have been analysed for the same averaging periods as the relevant air quality goals presented in Section 2.1.3.

Schedule 1 of the EPP (Air) 2008 indicates an allowance of five exceedences of the air quality objective of 50 µg/m^3 for the 24-hour average concentration of PM_{10}. Thus for this assessment, the 5th highest 24-hour average ground level concentration of PM_{10} at each receptor location will be presented.

The maximum 24-hour average ground-level concentration of $PM_{2.5}$ will be presented.

3.3.3 Limitations of Dispersion Modelling

General Limitations

Modelling of complex physical systems is based on the use of numerical techniques to solve a set of governing equations. In general, the more complicated the system that is modelled, the more parameterisations (or approximations) that are required in order to solve these equations; particularly in relation to the representation of sub-grid scale processes. Thus, there are inherently a number of 'tuneable' parameters that are required as input into the models. Model developers often suggest default values for these parameters which may be based on observational data, laboratory experiments or professional experience. Depending on the scale of the mine, assessing the sensitivity of model results to input data and/or the value of tuneable parameters can be prohibitive, either in terms of computational requirements, timeframes for completion of the assessment, and/or budget constraints.

Model validation is a critical component to both model development and application. Rarely however does a suitable data set exist with which to conduct a detailed, statistically meaningful model validation study. The CALPUFF dispersion model has been developed to estimate the impact of emissions from a range of source types including: point sources (tall and short stacks), buoyant line sources (aluminium smelters), buoyant area sources (i.e. forest fires), area sources, and volume sources. Model validation exercises have tended to focus on the impacts of emissions from point sources (i.e. stacks). Non-buoyant line sources such as haul roads are not explicitly included as a source type in CALPUFF. Instead these types of sources are typically represented as a series of volume sources whose separation distance is taken as a function of the minimum distance to the nearest receptor following the simulated line source methodology used in regulatory approved dispersion model AUSPLUME developed by the EPA Victoria. Model validation of low level emissions of pollutants (such as dust generated by large-scale mining activities) is additionally complicated by the near-surface release of emissions, the non-stationality of emission sources, and the variability in the locale of activities (such as blasting events).

In general, models have difficulty in accurately dealing with light wind speeds (i.e. less than 1 m/s) due to the dominance of physical processes other than advection and or turbulent diffusion under such conditions. The inability to accurately predict the minimum mixing height is another limiting factor of dispersion modelling and is particularly important when dealing with low level, non-buoyant (or low-buoyancy) emission sources such as those present on a coal mine.

Another challenge facing the dispersion modeller is the uncertainty in relation to the preciseness and representativeness of input data combined with limited observational data which are key factors contributing to the lack of comprehensive model validation studies for the majority of air quality assessments.

Project Specific Limitations

This assessment relies on the completeness, accuracy and/or representativeness of a number of input data sets including:

- Alpha Coal Project information;
- Regulatory supplied ambient air and meteorological monitoring data;
- Client and supplied monitoring data;
- NPI emission factors; and
- Non site-specific default parameters used in the development of the emission factors.

Other limitations of the assessment include (but may not be limited to):

- The accuracy of the characterisation of the background environment; and
- The sensitivity of the dispersion modelling results to tuneable model input parameters.

3.3.4 Refinements to the Assessment Methodology

The assessment methodology includes a number of conservative assumptions that may lead to unnecessarily conservative dispersion modelling results.

As such, there are a number of opportunities for refinement of the assessment methodology including (but not limited to):

- Refine input parameters such as the estimates of tailing storage facility areas that are dry;
- Obtain additional and/or most recent parameters values for Project-specific information in order to refine emissions estimation including:
  - Blasting hole depth
  - Moisture content of in situ coal, ROM coal and product coal
  - Moisture content of overburden and interburden
  - Silt content of materials (of tailings, coal, overburden, haul roads);
- Development of site-specific emission factors (for example):
  - Truck dumping
  - Dozers operations on overburden and interburden;
- Develop an estimate of background levels based on site-specific monitoring data (if available);
- Investigate opportunities for revised Project definition with improved air quality outcomes for example:
  - Reduction in vehicle kilometers travelled (VKT)
    - Optimise material handling to reduce the number of VKT travelled by empty vehicles
    - Transport via conveyors as opposed to truck and shovel
  - Reduce equipment fleet such as the number of dozers; and
- Incorporate pit retention factor for activities below 50 m.

4

Dispersion Modelling Results

Results from the dispersion modelling have been analysed at discrete receptor locations in the vicinity of the Alpha Coal Project (Mine). Additionally, contour plots showing the predicted impacts in the vicinity of the proposed mine are presented.

4.1 Interpretation of Results

When reviewing output from dispersion models it is important to interpret the results presented in the context of the limitations outlined in Section 3.3.3. In particular, those associated with validating the relevance and applicability of both the model input data sets and model output which may have a significant impact on the accuracy of the results presented.

Dispersion modelling is undoubtedly a very useful tool for the identification of potential air quality issues within the study region. However, the confirmation of a model-predicted impact (either adverse or beneficial) can only be definitively assessed by the detailed analysis of observational data.

Based on these comments it is plausible that the representativeness of reported model results may vary depending on both the averaging period and/or the source type and will undoubtedly be guided by comparison of model results with observational data.

Other minor comments noted include:

- Software graphics packages such as SURFER which has been used in this assessment to develop the regional contour plots involve the interpolation of results onto the contour grid and will therefore be associated with some degree of spatial uncertainty. Results presented in tabular form are extracted directly from model output and are thus a better representation of predicted impacts at receptor locations.
- It is noted that the presentation of results within the tables are reported to the nearest whole number. However, this suggests a level of accuracy of model predictions which is not realisable, nor verifiable. Reporting (for example) a concentration of 24 $\mu g/m^3$ implies an accuracy of ±1 $\mu g/m^3$. Quantifying the uncertainty in the results presented is in general, not undertaken for the reasons discussed in Section 3.3.3.

Results presented in the following sections include both the Project-related incremental contribution to ground level concentrations of dust at receptor locations as well as combined impacts that incorporate the estimates of background levels of dust.

4.2 Construction Phase

Based on information provided by the Proponent, impacts during construction are anticipated to be significantly less than that during operation of the mine (Section 3.2.4) and impacts at receptor locations have not been explicitly modelled. Mitigation measures during construction (and operation) of the mine are discussed in Section 5.

4.3 Operational Phase

A summary of results of the dispersion modelling are presented for Year 5 and Year 30 (representing worst-case impacts at receptor locations) in the following. Results for Years 10, 15, 20, and 25 are included as Appendix G.

4 Dispersion Modelling Results

As noted in Section 2.2.3, due to the lack of site-specific data, the representativeness of the estimates of background levels is considered to be uncertain. As it is likely that there will be development of other mines within the area (such as Waratah Coal Mine and Kevins Corner Coal Mine), an assessment of cumulative impacts would be required in order to more accurately estimate the likely air quality future environment. As sufficient information regarding other proposed Projects in the area is currently unavailable, when presenting results of the dispersion modelling, both Project-only (i.e. incremental) and total (Project plus estimates of background levels Section 2.2.3) are presented. The total estimate for the ground-level concentration of pollutants is then compared against ambient air criteria.

Refinement of the estimate of 'background' levels may be warranted should sufficient additional information such as site-specific monitoring data become available.

4.3.1 Particulate Matter as PM_{10}

Presented in Table 4-1 is summary of results for the fifth highest 24-hour average predicted ground-level concentration of PM_{10}. Results suggest an exceedence of the Project goals at six receptor locations during Year 5 and Year 30 with receptors to the south of the site predicted to be the most affected by dust emissions from the mine.

Contour plots for year 5 and year 30 are presented as Figure 4-1 and Figure 4-2 respectively and highlight the areal extent of the region predicted to exceed the EPP (Air) objective of 50 µg/m^3.

Table 4-1 Results for the 5th highest 24-hour average ground level concentration of PM_{10}. The EPP (Air) Objective is 50 µg/m^3. Background concentration estimated at 27 µg/m^3.

Receptor	Y05			Y30		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	51	**78**	156%	49	**76**	153%
2	24	**51**	102%	23	50	100%
3	22	49	99%	22	49	98%
4	55	**82**	164%	55	**82**	164%
6	21	48	95%	21	48	96%
8	96	**123**	246%	172	**199**	399%
9	139	**166**	332%	104	**131**	262%
10	10	37	75%	11	38	76%
11	11	38	77%	11	38	76%
12	56	**83**	166%	42	**69**	138%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

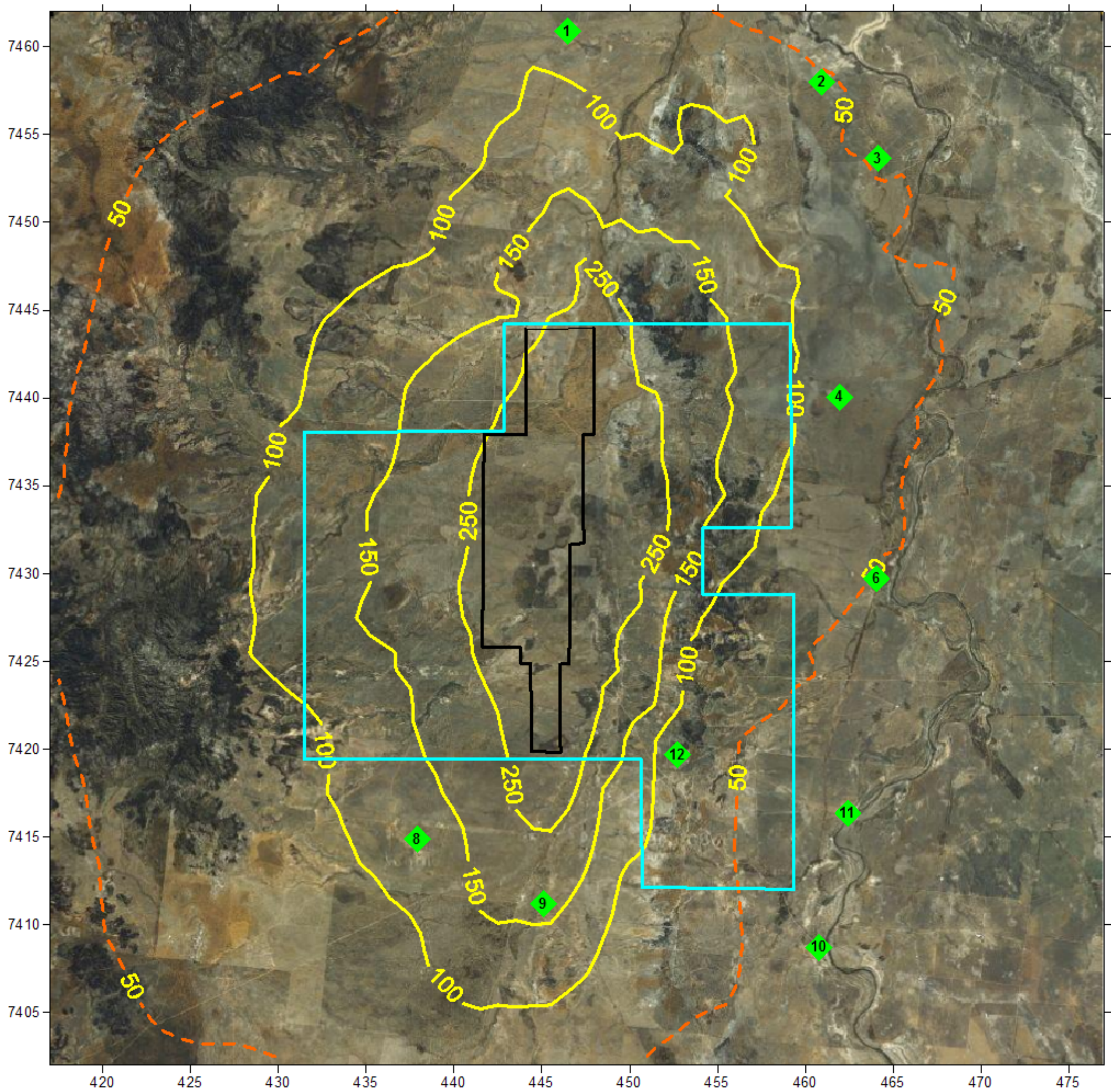
Presented in Table 4-2 is a summary of the estimated frequency of exceedences of the ambient air objective of 50 µg/m^3 for the 24-hour average ground-level concentration of PM_{10}. Receptor 8 and Receptor 9 located to the south of the mine and Receptor 1 located to the north of the mine are predicted to be the most affected with elevated levels of dust above the EPP (Air) objective predicted to occur c. 30%, 20% and 10% of the time respectively. Note that Receptor 12 is the accommodation village located within the mine lease area. The predicted number of exceedences is not reported for this receptor.

Table 4-2 Predicted frequency of exceedences of the PM_{10} 24-hour average criteria per year. The EPP (Air) Objective is 50 µg/m^3. Background concentration estimated at 27 µg/m^3 has been included.

Receptor	1	2	3	4	6	8	9	10	11
Year 5	12%	2%	1%	5%	1%	28%	20%	1%	1%
Year 10	10%	1%	1%	5%	1%	27%	18%	1%	0%
Year 15	10%	1%	1%	5%	1%	29%	18%	1%	0%
Year 20	10%	1%	1%	5%	1%	31%	18%	1%	0%
Year 25	10%	1%	1%	5%	1%	32%	18%	1%	0%
Year 30	11%	1%	1%	5%	1%	34%	18%	1%	0%

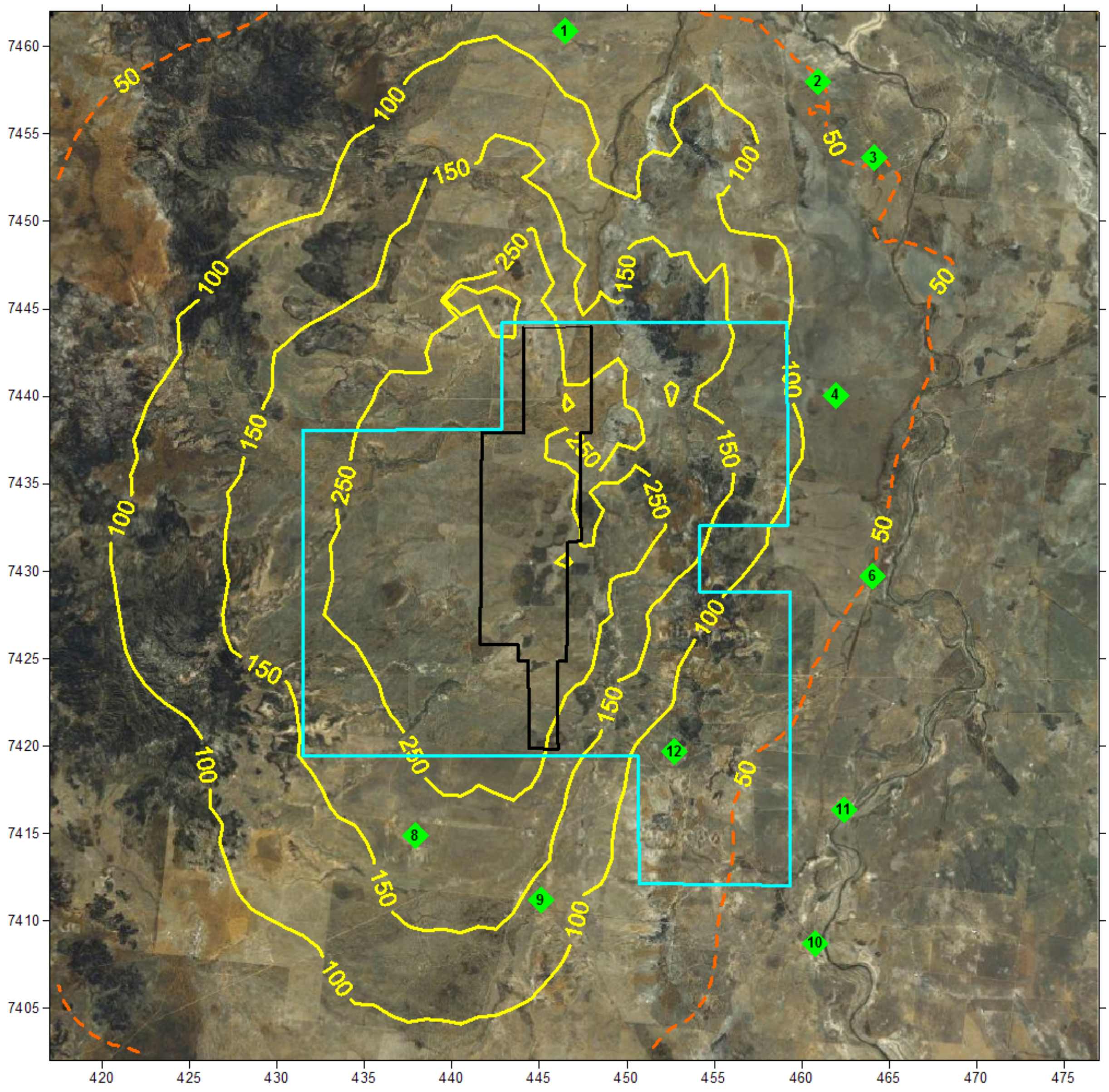
4 Dispersion Modelling Results

Figure 4-1 Year 5: The fifth highest 24-hour average ground-level concentration of PM_{10}. The EPP (Air) Objective is 50 µg/m^3. Background concentration estimated at 27 µg/m^3 has been Included.



4 Dispersion Modelling Results

Figure 4-2 Year 30: The fifth highest 24-hour average ground-level concentration of PM_{10}. The EPP (Air) Objective is 50 µg/m^3. Background concentration estimated at 27 µg/m^3 has been Included.



4.3.2 Particulate Matter as $PM_{2.5}$

Presented in Table 4-3 is a summary of the predicted maximum 24-hour average ground-level concentration of $PM_{2.5}$ at receptor locations. Both the Project only and total ground-level concentrations are presented. Results of the dispersion modelling suggest that elevated levels of dust above the EPP (Air) objective of 25 µg/m^3 may occur at receptors 4, and 12 (to the east of the mine) and receptors 8 and 9 located to the south.

4 Dispersion Modelling Results

The results for the annual average ground-level concentration of $PM_{2.5}$ are presented in Table 4-4. An exceedence of the EPP (Air) objective of 8 µg/m^3 is predicted to occur only at receptor 8 for year 30. No other exceedences are predicted at sensitive receptor locations during these two years.

Contour plots for year 30 are presented in Figure 4-3and Figure 4-4.

Additional results are presented in Appendix G.

Table 4-3 Results for the maximum 24-hour average ground level concentration of $PM_{2.5}$. The EPP (Air) Objective is 25 µg/m^3. Background concentration estimated at 5.4 µg/m^3.

Receptor	Y05			Y30		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	14	20	79%	14	19	77%
2	9	14	56%	8	13	53%
3	8	13	54%	8	14	54%
4	20	**25**	101%	22	**28**	110%
6	6	12	46%	6	11	45%
8	21	**27**	107%	40	**45**	180%
9	32	**38**	151%	25	**30**	122%
10	6	11	45%	6	11	45%
11	5	11	43%	5	10	41%
12	24	**30**	119%	23	**29**	115%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

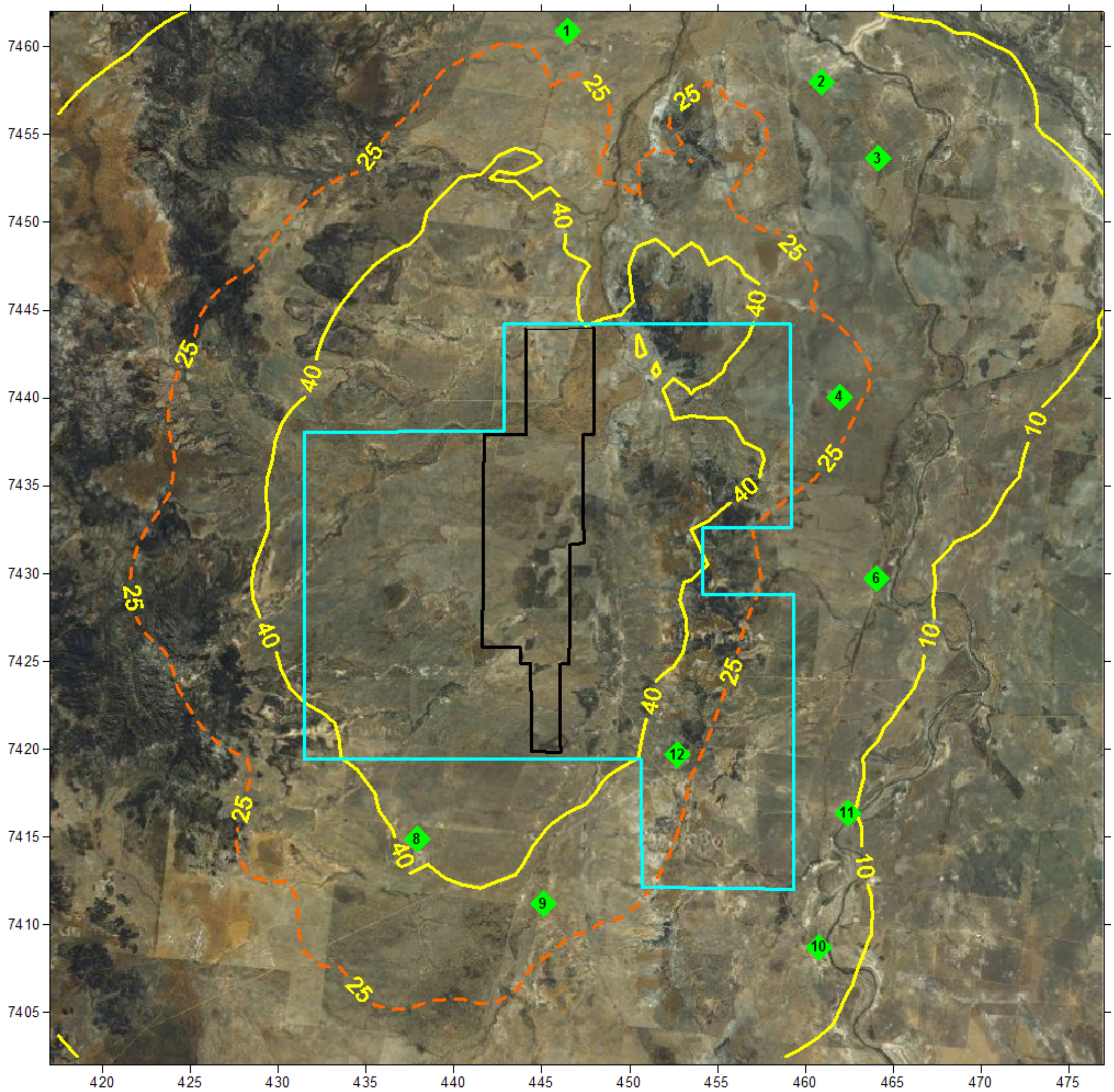
Table 4-4 Results for the annual average ground level concentration of $PM_{2.5}$. The EPP (Air) Objective is 8 µg/m^3. Background concentration estimated at 2.8 µg/m^3.

Receptor	Y05			Y30		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	2	4	54%	1	4	54%
2	0	3	40%	0	3	40%
3	0	3	39%	0	3	39%
4	1	4	44%	1	4	44%
6	0	3	38%	0	3	38%
8	5	7	92%	8	**11**	131%
9	4	7	86%	3	6	74%
10	0	3	37%	0	3	37%
11	0	3	37%	0	3	37%
12	1	4	46%	1	4	46%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

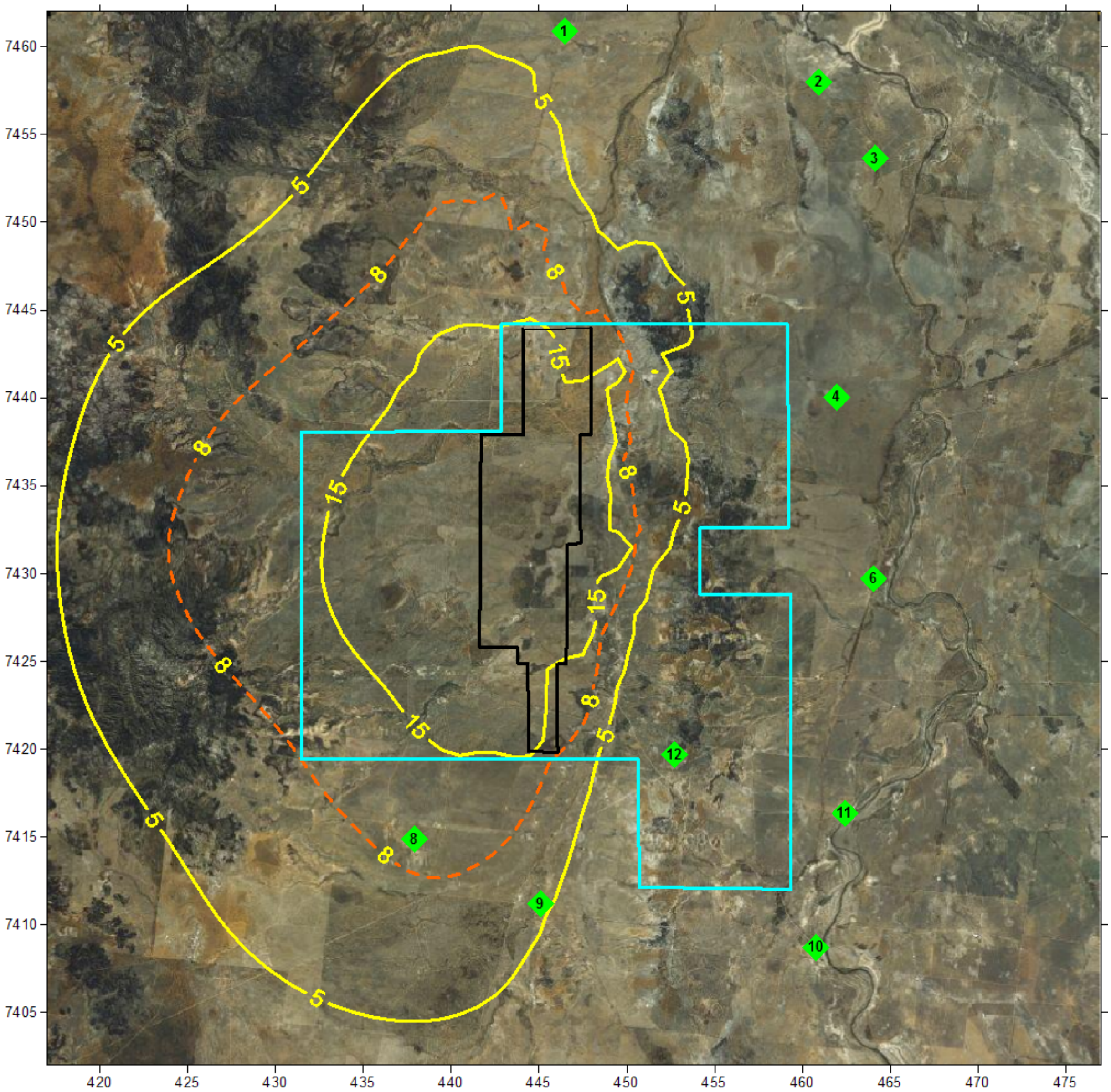
4 Dispersion Modelling Results

Figure 4-3 Year 30: The maximum 24-hour average ground-level concentration of $PM_{2.5}$. The EPP (Air) Objective is 25 µg/m^3. Background concentration estimated at 5.4 µg/m^3 has been Included.



4 Dispersion Modelling Results

Figure 4-4 Year 30: The annual average ground-level concentration of $PM_{2.5}$. The EPP (Air) Objective is 8 μg/m^3. Background concentration estimated at 2.8 μg/m^3 has been Included.



4.3.3 Particulate matter as TSP

Presented in Table 4-5 are the results for the annual average ground level concentration of TSP. Results do not highlight any issues with respect to meeting the EPP (Air) objective of 90 μg/m^3.

Results for the other modelled years are given in Appendix G.

Table 4-5 Results for the annual average ground level concentration of TSP. The EPP (Air) Objective is 90 µg/m^3. Background concentration estimated at 28 µg/m^3.

Receptor	Y05			Y30		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	8	36	40%	8	36	41%
2	3	31	34%	3	31	34%
3	3	31	34%	2	30	34%
4	4	32	36%	4	32	36%
6	1	29	33%	1	29	32%
8	28	56	62%	47	75	83%
9	25	53	59%	19	47	52%
10	1	29	32%	1	29	32%
11	1	29	32%	1	29	32%
12	6	34	38%	5	33	36%

Note (1): Numbers highlighted in bold exceed the relevant EPP (Air) Objective

4.3.4 Dust Deposition

Presented in Table 4-6 is a summary of the results for dust deposition. No issues relating to the deposition of dust at sensitive receptor locations are highlighted.

Results for the other modelled years are given in Appendix G.

Table 4-6 Results for dust deposition. The project goal is 140 mg/m^2/day. Background concentration estimated at 68 mg/m^2/day.

Receptor	Y05			Y30		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	3	71	60%	4	72	60%
2	3	71	59%	3	71	59%
3	3	71	59%	2	70	59%
4	3	71	59%	2	70	59%
6	1	69	57%	1	69	57%
8	20	88	73%	33	101	84%
9	20	88	73%	14	82	69%
10	1	69	58%	1	69	57%
11	1	69	57%	1	69	57%
12	5	73	61%	3	71	59%

Note (1): Numbers highlighted in bold exceed the relevant Project Goal.

4.3.5 Cumulative Impacts

The role of dispersion modelling is to highlight the potential for adverse air quality impacts within the study region and to guide decisions relating to the design and implementation of ambient air monitoring programs. Assurances that air quality is maintained at levels that are acceptable to the local communities can be verified through a well designed and implemented ambient air monitoring program.

Note that there are inherent limitations associated with modelling low level, non-buoyant dust sources, and combined with the large degree of uncertainty in relation to the location of the dust sources associated with the existing and proposed mines in any given 24-hour period, it is unlikely that modelling will provide the necessary certainties.

Based on the geographic location of the sensitive receptors and proposed mining operations including Alpha Coal Project, Waratah Coal Project and Kevin's Corner Coal Project, possible impacts on the 24-hour average concentration of PM_{10} at current sensitive receptor locations may include (but may not be limited to) the following:

- Impacts from dust generating activities located within a similar band of wind directions will be additive. Thus when the wind is from the west (for example), dust sources to the west of a receptor will be additive.
- Impacts from activities located within different bands of wind directions will not be additive. Thus when the wind is from the west (for example), dust sources to the south of a receptor are not likely to have a significant impact on dust levels at that location.
- Even if worst-case impacts from two or more dust emissions sources are not additive at a particular sensitive receptor location, as mining increases within the airshed, the frequency of elevated levels of PM_{10} is likely to increase.

Thus, worst-case 24-hour average concentrations of PM_{10} due to dust-generating activities from emission sources in the region are not additive during any given 24-hour period as worst-case meteorological conditions for each significant emission source (such as wind speed and wind direction) differ depending on the geographic location of the significant dust emission source(s) to the receptor.

With respect to the annual average of $PM_{2.5}$, TSP, and monthly dust deposition, impacts will be cumulative.

5

Mitigation Measures

Dust mitigation for the operation of Alpha Coal Project (Mine) involves several elements to ensure adequate management of air quality in the vicinity of the mine, namely:

- Engineering control measures;
- Dust suppression measures;
- Rehabilitation of exposed surfaces;
- Operational procedures; and
- Measurement of ambient air quality.

5.1 Engineering Control Measures

Possible control measures at the CHPP include the following:

- Enclosure of transfer points and sizing stations;
- Roof on overland conveyors;
- Belt washing and belt scrapers to minimise dust from the return conveyors;
- Reduced drop height from stackers to stockpiles; and
- Enclosure of raw coal surge bins.

5.2 Dust Suppression Measures

Dust suppression measures primarily include the application of water to control dust emissions such as:

- Watering of haul roads to best-practice level of more than 2 litres/m^2/hour of water applied;
- Watering of ROM stockpiles using water sprays as required;
- Water sprays on stacker/reclaimer units; and
- High moisture content of product coal and reject material as they leave the CHPP which avoids the need for supplementary watering.

In the event that adverse conditions are encountered during operation of Alpha Coal Project, additional dust suppression measures may have to be implemented. The circumstances where this might be required include pre-strip and overburden dumping operations in the northern and southern pits and during construction of the CHPP and associated infrastructure.

5.3 Rehabilitation of Exposed Surfaces

Rehabilitation of exposed surfaces will be undertaken progressively as mining and stockpiling activities are completed. A detailed rehabilitation plan will be developed for the Project, which will include the use of fast-growing temporary cover material to accelerate the effectiveness of dust controls. Improving the effectiveness and time for rehabilitation measures would result in reduced dust emissions from exposed areas.

5.4 Operational Procedures

Operational procedures set out how the Project is to be operated in order to meet targets for air quality performance. In relation to air quality, the following procedures may be incorporated into the site operational procedures:

- Use of water trucks to achieve sufficient watering of haul roads and other high-risk areas. The schedule for truck use will be developed for the Project and will incorporate consideration of recent rainfall and weather conditions;
- Use of water sprays as required with additional use as determined by ambient conditions;
- Maintenance of water spray equipment and engineering controls to minimise dust emissions; and
- Sufficient number of watering trucks to allow for continuation of dust suppression when one or more truck is out of service;

These procedures will be incorporated into the site Environmental Management Plan (EMP). The EMP will be regularly audited to ensure that these key elements for air quality management are satisfied.

Prevention and Mitigation of Worst Case Impacts

Due to the varying depths of pit activities, particular consideration needs to be paid to operations that are close to the natural surface level, such as truck and shovel operations and overburden dumping. To prevent worst-case conditions from occurring, it is recommended that the EMP and mine planning give consideration to:

- Implementing additional dust control measures for operations that are close to the natural surface level. These could include watering of truck and shovel operations that are close to the ends of the northern and southern most pits ;
- Implementation of dust monitoring to gauge the level of off-site impacts; and
- Implementation of management strategies that restrict operations in the northern and southern most pts during adverse meteorological conditions.

5.5 Measurement of Ambient Air Quality

It is widely recognised that although elevated levels of TSP may lead to dust nuisance, it is elevated levels of PM_{10} that is associated with an increased risk of adverse impacts on human health. Even more recent studies suggests that particulate matter in the range associated with $PM_{2.5}$ may pose an even greater risk to human health as the smaller sized particles have an increased potential to penetrate deep into the lungs.

The results of the dispersion modelling presented in Section 4 have highlighted the potential for adverse air quality impacts at some of the nearby receptor locations. As discussed in Section 3.3.3 the confirmation of (both adverse and absence of) air quality impacts predicted by the model can only be validated by observational data.

As noted in Section 2.2.1, in general, the mechanical generation of dust (as opposed to particulate matter associated with combustion processes) is associated with only a small fraction (i.e. 10% - 20%) of particulate matter in the range of $PM_{2.5}$. Thus the proposed site-based ambient air quality monitoring program focuses on dust deposition and PM_{10}.

The outcomes of the ambient monitoring program outlined in Section 5.5.3 will be used by the Proponent to determine whether the mine's operations are contributing to excessive dust levels at nearby residential locations. The Proponent will take action to avoid adverse impacts on air quality at nearby receptor locations. The monitoring data will be used to provide an indication of excessive off-site dust levels that may be attributable to the mine's operations in order that appropriate and effective corrective actions can be identified and implemented.

An operational monitoring program outlined in Section 5.6 is proposed for the purpose of monitoring air quality within the region predicted to be directly impacted upon by dust generating activities at the proposed Project site and will be incorporated into the site-based EMP. This monitoring program will allow the Proponent to monitor local air quality with the level of review and implementation of additional mitigation measures dependent on the level of impacts as measured at the operational monitoring sites.

5.5.1 Monitoring Standards

Ambient air monitoring will be conducted in accordance with and/or in consideration of:

- AS/NZS 3580.1.1:2007, Methods for sampling and analysis of ambient air – Guide to siting air monitoring equipment;
- AS/NZS 3580.9.10:2006, Methods for sampling and analysis of ambient air Method 9.10: Determination of suspended particulate matter—$PM_{2.5}$ low volume sampler— Gravimetric method;
- AS/NZS 3580.9.9:2006, Determination of suspended particulate matter – PM_{10} Low volume sampler – Gravimetric method;
- AS/NZS 3580.9.3.2003 Determination of suspended particulate matter-Total suspended particulate matter (TSP) - High volume sampler gravimetric method;
- AS/NZS 3580.9.6:2003, Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM_{10} High Volume sampler with size selective inlet - Gravimetric method;
- AS/NZS 3580.10.1:2003, Methods for sampling and analysis of ambient air – Determination of ambient air - Determination of suspended particulate matter – Deposited matter – Gravimetric method;
- Queensland Government, Air Quality Sampling Manual; and
- A method determined in consultation with the QLD EPA

5.5.2 Monitoring Locations

The precise location of monitoring equipment will be dependent on siting requirements (Section 5.5.1) of the instrumentation to be implemented at each site.

Presented in Figure 5-1 and Table 5-1 are the proposed monitoring locations for the Project. Proposed monitoring locations correspond to receptor locations, the processing area (or offices area), the accommodation village, and additional sites not represented by receptor locations. Revision of the site monitoring program may be warranted based on future development within the regional airshed.

5 Mitigation Measures

Figure 5-1 Proposed monitoring locations (Indicative only)

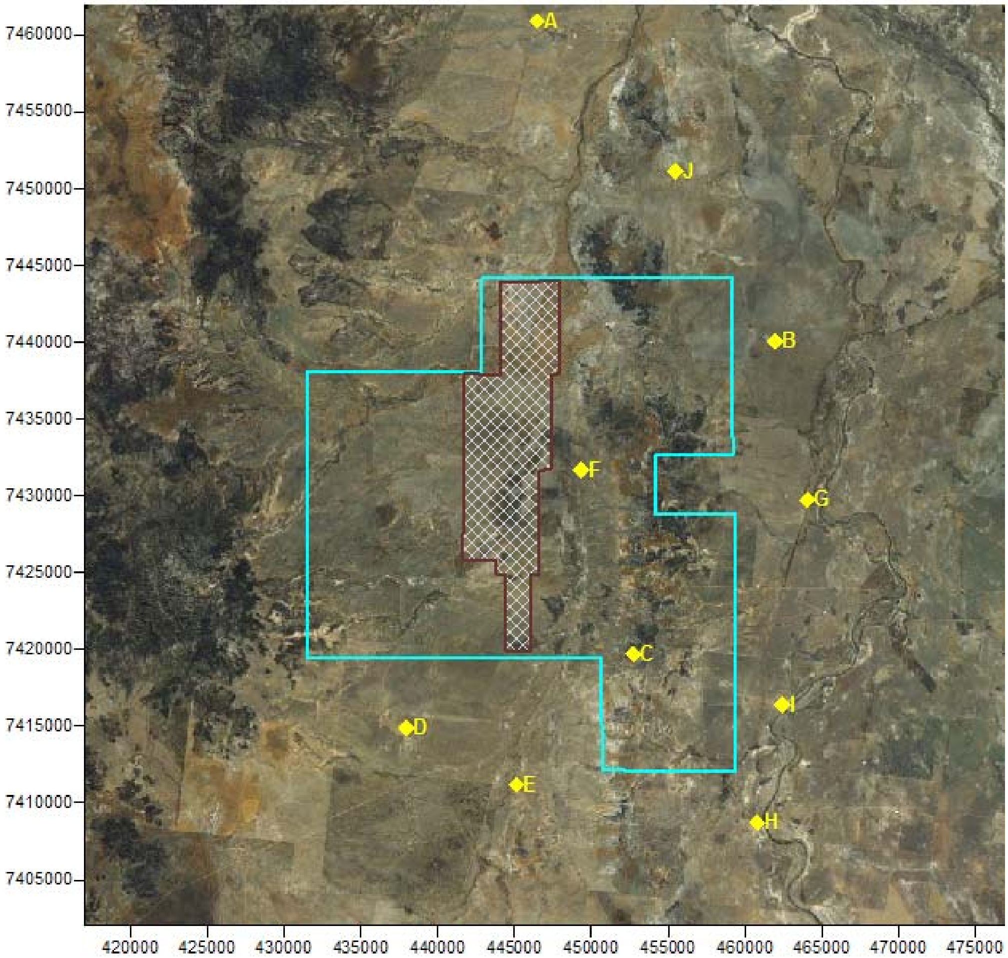


Table 5-1 Proposed monitoring locations (Indicative only)

Location*	Description
A	Receptor 1
B	Receptor 4
C	Receptor 12 (Alpha Coal Project Accommodation Village)
D	Receptor 8
E	Receptor 9
F	CHPP
G	Receptor 6
H	Receptor 10
I	Receptor 11
J	To the northeast of mine lease area

* Monitoring locations are indicative only. Actual siting of the monitoring stations will depend on the availability of suitable locations.

5.5.3 Ambient Air Monitoring Program

Presented in Table 5-3 is a summary of the proposed frequency of monitoring for PM_{10}, dust deposition and meteorology.

Meteorological monitoring is proposed to include (as a minimum) wind speed, wind direction, relative humidity, and air temperature. Additional meteorological parameters may include (but may not be limited to): solar radiation, rainfall, differential temperature, and differential wind speed.

Monitoring of PM_{10} is proposed to be undertaken using the TEOM sampling methodology at the specified locations.

Table 5-2 Pollutant and frequency of monitoring at specified locations (Indicative only)

Location	PM_{10}	Dust Deposition	Meteorology
A	Continuous	monthly	Continuous
B	-	monthly	-
D	Continuous	monthly	Continuous
E	Continuous	monthly	Continuous
G	-	monthly	-
H	-	monthly	-
I	-	monthly	-
J	-	monthly	-

5.6 Operational and On-Site Monitoring Program

Presented in Table 5-3 is a summary of the proposed frequency of monitoring of on-site meteorology for the purposes of minimising off-site impacts during the operational phase. Dust monitoring at the location of the accommodation village will assist in the assessment of the effectiveness of implement dust mitigation measures.

It is noted that due to the prevailing wind direction and the relative location of receptors and mining activities, the accommodation village (Receptor 12) is not predicted to be the most affective sensitive receptor. Thus air quality within the accommodation village will not be representative of worst-case impacts which is predicted to occur to the south of the mine and monitoring location D and E (Figure 5-1).

Meteorological monitoring is proposed to include (as a minimum) wind speed, wind direction, relative humidity, and air temperature. Additional meteorological parameters may include (but may not be limited to): solar radiation, rainfall, differential temperature, and differential wind speed.

Table 5-3 Operational monitoring program

Location	PM_{10}	Dust Deposition	Meteorology
C	Continuous	monthly	Continuous
D	Continuous	monthly	Continuous
E	Continuous	monthly	Continuous
F	-	-	Continuous

Due to the level of impacts predicted at the location of Receptor 8 and Receptor 9, meteorological data (from their corresponding monitoring locations D and E) (Figure 5-1) will be incorporated into the site based EMP in order to ensure that dust impacts at these locations are minimised as far as practicable. Monitoring of dust levels at locations D and E should commence as soon as possible in order to establish a representative baseline prior to the commencement of construction to establish a representative baseline. Dust levels recorded at sites D and E during construction (particularly of the box cut) will provide some insight into the relative level of conservatism that is inherent in the modelling methodology. Based on the results of the dispersion modelling, the effective management of mine-related dust as determined by measurements of dust at site D will lead to improved air quality outcomes at other receptor locations.

5.7 Consultation

As part of the Proponent's community consultation program, discussions are continuing with landowners and occupiers in the vicinity of the Project site, including those noted in Section 3.1 of this report. The discussions will include the provision of information from this air quality assessment and the provision of additional relevant information as the implementation plans for the Project are further developed. The discussions will include appropriate compensation arrangements to ensure the landholders specific requirements are properly satisfied.

Discussion

URS has conducted an air quality assessment of the impacts of dust emissions from the Alpha Coal Project (Mine) on behalf of the proponent.

A site-specific emissions inventory has been developed for all 30 years of the life of the mine. Estimates of dust emissions associated with the construction of the box cut have also been undertaken.

Ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition have been presented at each of the eleven off-site receptor locations as well as for the proposed on-site accommodation village. Impacts from dust emissions associated with mining activities at these receptor locations have been estimated for six years of the mine life (years 5, 10, 15, 20, 25, 30).

In general, results of the dispersion modelling suggest that air quality at location of Receptor 8 and Receptor 9 located to the south of the mine lease will be most affected by dust emissions from the site. As discussed in Section 3.3.3 the confirmation of (both adverse and absence of) air quality impacts predicted by the model can only be validated by observational data.

Specifically results of the dispersion modelling suggest that:

- Emissions of dust from the Alpha Coal Project (Mine) (in isolation of background dust sources) will result in elevated levels of particulate matter that exceed the EPP (Air) objective of 50 µg/m^3 for the 24-hour average ground-level concentration of PM_{10} at receptor locations 1, 4, 8, 9, and 12. The frequency of exceedences is predicted to range between 5% and 30% at these locations with receptors to the south of the mine site (Receptor 8 and Receptor 9) and those to the north (Receptor 1) most affected.
- During the life of the mine, the ground-level concentration of $PM_{2.5}$ is predicted to exceed the EPP (Air) objective of 25 µg/m^3 for the 24-hour average ground-level concentration at receptors 4, 8, 9 and 12. The frequency of predicted exceedences has not been calculated. The annual average concentration of $PM_{2.5}$ is not predicted to exceed the EPP (Air) objective of 8 µg/m^3 at any sensitive receptor location with the exception of Receptor 8.
- Ground-level concentrations of TSP and dust deposition are not predicted to exceed the relevant mine goals at any of the receptor locations included in the dispersion modelling.

Mitigation measures for the Alpha Coal Project (Mine) have been proposed. Some of these measures have been incorporated into the air quality modelling, such as the engineering controls and dust suppression measures, consequently reducing the impacts from the site. Other measures may need to be implemented during Project operation, such as the operational procedures, rehabilitation strategy and the ambient air quality modelling program. These measures will ensure that the worst-case conditions do not lead to the level of impact predicted by the model.

The proposed ambient and operational monitoring programs will be used to assist in early detection of elevated levels of dust at sensitive locations that are attributable to the site.

7

References

Bureau of Metorology, Long term climate averages for Clermont Sirius St, Barcaldine and Emerald meteorological station, Available at www.bom.gov.au

C. Cowherd & D. Ono (2005) Proposed Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. http://www.epa.gov/ttn/chief/conference/ei15/session14/cowherd_pres.pdf

Daunia Coal Mine Project, Nov 2008, Environment Impact Statement Section 10 http://www.bhpbilliton.com/bb/ourBusinesses/metallurgicalCoal/bma/growthProjects/dauniaProject.jsp

Ensham Central Project EIS, "*Air Quality Impact Assessment Study of the Proposed Ensham Central Project"*

Hancock Coal Pty Ltd, March 2009, *Alpha Coal Project Pre-Feasibility Study*, *Section 6 Mining*

Hancock Coal Pty Ltd, March 2009, *Alpha Coal Project Pre-Feasibility Study, Section 7 Mining Infrastructure and Engineering Development*

Hancock Coal Pty Ltd, March 2009, *Alpha Coal Project Pre-Feasibility Study, Section 8 CHPP*

Hancock Coal Pty Ltd, Dust deposition data provided by Hancock Coal Pty Ltd, *Dust Fallout Results.Xlsx*

Hurley, P. J. (2005), The Air Pollution Model (TAPM) Version 3, Part 1: Technical Description, CSIRO Atmospheric Research Technical Paper 71

National Pollutant Inventory (NPI), 2001, *Emission Estimation Technique Manual for Mining, Version 2.3,* Available at: <http://www.npi.gov.au/handbooks/approved_handbooks/mining.html>

National Environmental Protection Council, *National Environment Protection Measure for Ambient Air Quality*, 1988, with amendment in 2003

NSW Department of Environment and Conservation, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, August 2005

Queensland Government, DERM, *Queensland 2006 Air monitoring report*, available online at < http://www.derm.qld.gov.au/environmental_management/air/air_quality_monitoring/air_quality_reports/index.html>

Queensland Government, *Environmental Protection (Air) Policy 2009*, Office of the Queensland Parliamentary Counsel

Richardson C., *Fine Dust: Implications for the Coal Industry*, The Australian Coal Review, April 2000

Sinclair Knight Merz (2005), *Improvement of NPI Fugitive Particulate Matter Emission Estimation Techniques*, May 2005

TAPM, Hurley, P. J. (2005), *The Air Pollution Model (TAPM) Version 3, Part 1: Technical Description*, CSIRO Atmospheric Research Technical Paper 71

TRC Environmental Corporation, CALPUFF Version 6 Users' Instructions (Draft), Lowell, Massachusetts, USA, May 2006

USEPA *AP-42 - Compilation of Air Pollutant Emission Factors,* Fifth Edition, Volume 1

Victorian State Environment Protection Policy (Air Quality Management), 2001

URS

8 Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Hancock Prospecting Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 18th May 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 7 June 2010 and 13 September 2010 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A Seasonal and Hour of Day Wind Roses, CALMET 2009

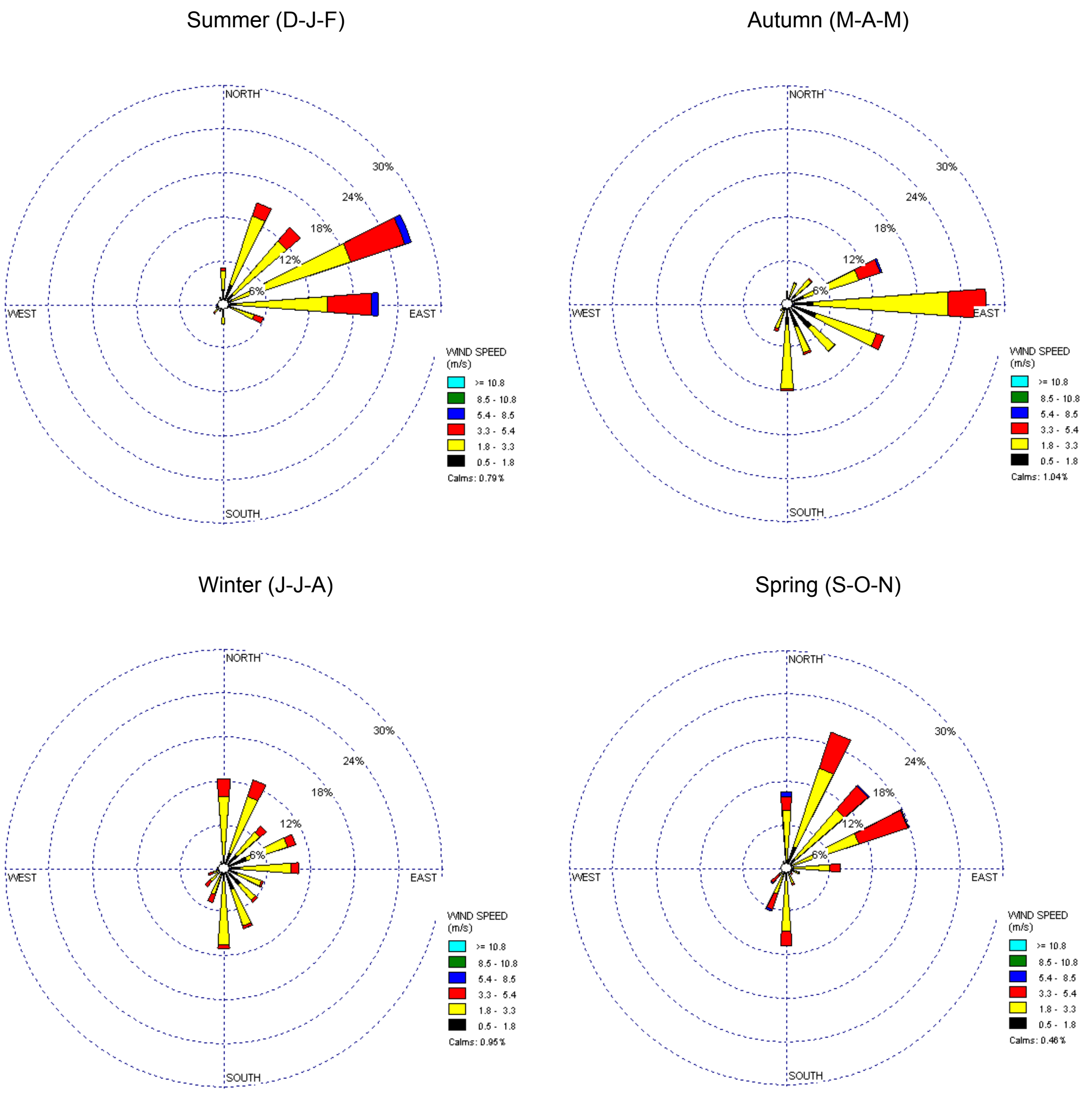


Figure A-1 Seasonal Wind Rose, CALMET 2009

Appendix A

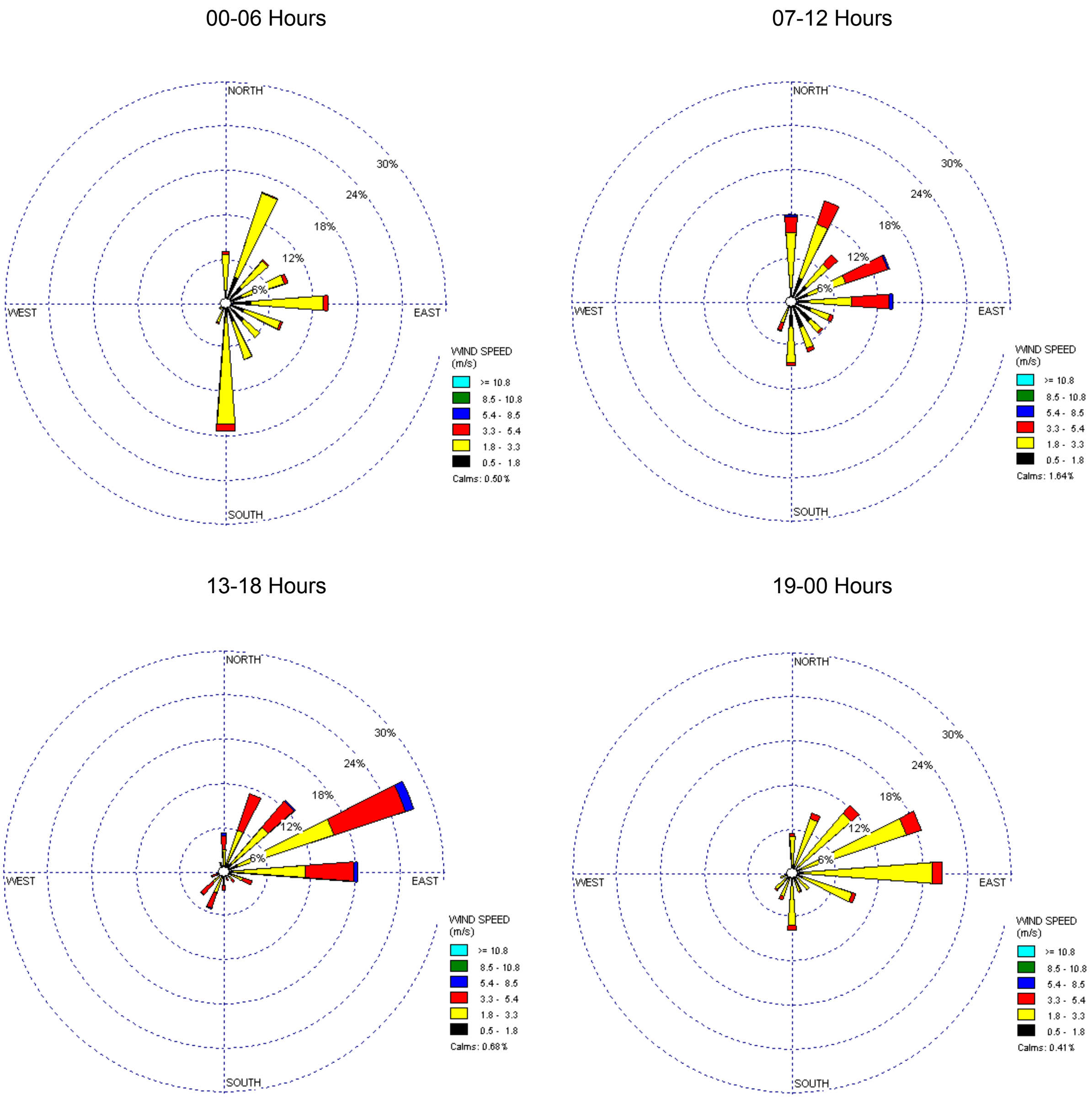


Figure A-2 Wind Roses by Hour of Day, CALMET 2009

Appendix B Wind Speed Dependant Wind Erosion

B.1 Introduction

In a recent evaluation of fugitive particulate matter emission estimation techniques, SKM (2005) recommended not using the current default emission factors in the NPI Mining Manual (2001), which are a constant value of 0.4 kg/ha/h for TSP and 0.2 kg/ha/hr for PM_{10}, as crucial environmental factors such as wind and surface wetness are not considered. SKM (2005) suggested retaining the current NPI equation, presented here as Equation 1, to account for the climate variations across Australia while recognising the uncertainty and indicative nature of the NPI equation.

$$E = 1.9(\frac{s}{1.5})365(\frac{365-p}{2356})(\frac{f}{15})$$ **Equation 1**

Where:

- s is the silt content (%)
- f is the percentage of time that wind speed is greater than 5.4 m/s at the mean height of the stock pile
- p is the number of days when rainfall is greater than 0.25 mm

Equation 1 is used in the revised modelling of the impacts of dust emissions from the Alpha Coal Project to provide an estimate for the annual total emissions of dust associated with wind erosion. The local meteorological data was then used to distribute the total annual emissions equally to those hours for which the wind speed is greater than a critical wind speed using the methodology outlined in the following sections.

B.2 Wind Erosion for Stockpiles

NPI Mining Manual (2001) suggested the use of Equation 1 to calculate annual dust emission from active coal stockpiles. Equation 1 is for estimating emissions for total suspended particles (TSP). Emissions of PM_{10} are estimated from TSP using a PM_{10} to TSP ratio of 1/2. Equation 1 represents the annual total emissions.

Equation 2 (SKM, 2005, Eq 5.14) was then used to distribute the total annual emissions into hourly emissions

$$F = ku^3(1-\frac{u^2}{u_0^2}) \text{ when } u > u_0 \text{, otherwise F = 0}$$ **Equation 2**

Where:

- k is a constant
- u is hourly average wind speed at root mean square height of the stockpile (m)
- u0 is a wind speed threshold velocity.

The critical wind speed u_0 is calculated based on a critical wind speed of 5.4 m/s at the root mean square height of the stockpile, corrected to 10 m based on logarithmic wind speed profile as shown in Equation 3.

$$u_0 = 5.4\ln(\frac{10-z_0}{z-z_0})$$ **Equation 3**

Where:

- z is the root mean square height of a stockpile (m)
- z_0 is the surface roughness (0.05 m)

The constant k in Equation 2 is obtained based on the relationship that the cumulative hourly emissions calculated from Equation 2 are equal to the total annual emissions calculated from Equation 1.

B.3 Wind Erosion for Exposed Areas

The methodology for the development of wind speed dependent dust emissions for exposed areas is identical to that for stockpiles with a critical wind speed of 5.4 m/s at 10 m height used in Equation 2.

B.4 Wind Speed Dependent Emission Factors

Presented in Figure B-3 is an example of the wind speed dependent wind erosion emission factors used in the Alpha Coal Project air quality assessment. A summary of the annual wind speed dependent erosion for stockpiles and exposed areas is presented in Table B-1.

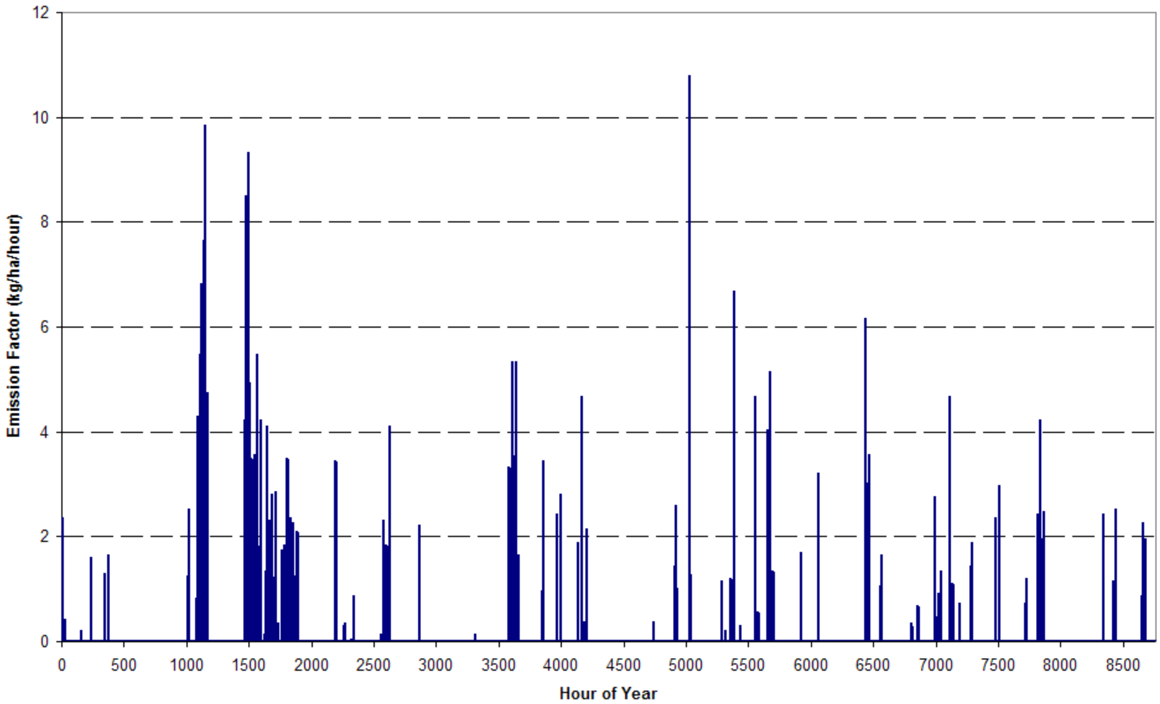


Figure B-3 (Example) Wind Speed Dependent Emission Factor for Stockpiles

Appendix B

Table B-1 Summary of Parameters used to Calculate Wind Erosion Emission Factors

Parameter	Units	Product Stockpiles	ROM Stockpiles	Tailing Dams	Exposed Areas
Source height	m	20	4	-	-
Source root mean square height	m	14.14	2.83	10	10
Wind speed at source height	m/s	5.40	4.11	5.4	5.40
Critical wind speed @ 10 m (m/s)	m/s	5.07	5.40	5.40*	5.40*
Hours over critical wind speed	%	4.4%	2.2	2.5	2.2%
Silt content	%	5	5	60	14
F (kg/ha/year)	kg/ha/year	830	410	4865	1,135
k		0.0798	0.0843	1.01	0.236

* A conservative approach has been adopted which will overestimate the frequency of emissions from exposed areas.

Appendix C Emissions Estimation Methodology

C.1 Emissions Estimation

Data on the emissions of dust from the proposed mine cannot be obtained from direct measurement, as the mine is not yet operational. The National Pollutant Inventory (NPI) has a series of Emission Estimation Technique Manuals that are intended to provide data on emissions of air pollutants during typical operations, and which are based on measurements of dust emissions from other operational coal mines in Australia. The NPI Emission Estimation Technique Manual for Mining (NPI, 2001) has been used to provide data to estimate the amount of TSP and PM_{10} emitted from the various activities on a mine site, based on the amount of coal and overburden material mined as provided by the Proponent. The emission factor for truck movements on haul roads has been derived from the US EPA's AP42 emission estimation manual for unpaved roads.

C.1.1 Input Parameters

Site-specific parameters were used to derive emission factors for trucks on unpaved roads, draglines, excavators, shovels, graders, dozers and blasting. The input parameters used for the assessment are listed in Table C-2. Silt content data were obtained from publicly available information for Queensland coal mine in the Bowen Basin (BMA's Caval Ridge Mine Project). For estimation of dust emissions from unpaved roads, the average loaded and unloaded vehicle masses for the various hauling operations on site are listed in Table C-3

Table C-2 Emission Factor Input Parameters

Parameter	Material					Units
	Overburden	Coal			Road Material	
		In Situ	ROM	Product		
Moisture Content	5	6.9	6.9	6.9	-	%
Silt Content	14	5			4	%
Blasting Area	Variable					m2
Dragline Drop Distance	15					m
Mean Wind Speed	2.6					m/s
Density	2.4	1.4			-	t/bcm

Table C-3 Vehicle Masses for Hauling Fleet

Vehicle Mass	Overburden Hauling CAT797B	Interburden Hauling CAT785C	Coal Hauling K200 C II	Reject Hauling CAT793 D	Units
Empty	279	113	308	166	Tonnes
Payload	345	136	280	218	Tonnes
Full	624	249	588	384	Tonnes

Table C-4 Source Area

Source	Area	Units
Tailing storage facility - North	290	ha (dry)
Tailing storage facility - Centre	182	ha (dry)
Tailing storage facility – South	215	ha (dry)
Stockpiles – ROM South	10	ha
Stockpiles – ROM South	10	ha
Stockpiles – product	172	ha

C.1.2 Emission Factors

Dragline operation

For TSP, the following NPI equation is used:

$$EF = 0.0046 \times \frac{d^{1.1}}{M^{0.3}}, \qquad kg/bcm$$

where

- d = drop distance in meters
- M = moisture content of overburden in %
- bcm = bank cubic metre

For PM_{10}, the following NPI equation is used:

$$EF = 0.0022 \times \frac{d^{0.7}}{M^{0.3}}, \qquad kg/bcm$$

For the Alpha Coal Project, a 15 m dragline drop height and 5% overburden moisture content was used.

Loading truck with overburden using excavators/shovel/front-end loaders

The following NPI equation is used to estimate dust emission:

$$EF = k \times 0.0016 \times \left(\frac{U}{2.2}\right)^{1.3} \left(\frac{M}{2}\right)^{1.4} \qquad kg/t$$

where

- k = 0.74 for TSP and 0.35 for PM_{10}
- U = mean wind speed (m/s)
- M = moisture content of overburden (%)

For the Alpha Coal Project, a mean wind speed of 2.6 m/s and moisture content of 5% was used.

Appendix C

Loading truck with coal using excavators/shovel/front-end loaders

The following NPI equation is used to estimate dust emission:

$$EF = k \times 0.0596 \times M^{0.9} \qquad kg/t$$

where

- k = 1.56 for TSP and 0.75 for PM_{10}
- M = moisture content of coal (%)

For the Alpha Coal Project, a moisture content of 6.9% was used.

Bulldozer on coal

For TSP, use the following NPI equation

$$EF = 35.6\frac{s^{0.9}}{M^{1.4}} \qquad kg/h$$

where

- s = silt content (%)
- M = moisture content of overburden (%)

For PM_{10}, use the following NPI equation

$$EF = 6.33\frac{s^{1.5}}{M^{1.4}} \qquad kg/h$$

Using values of 5% for silt content and 6.9% for moisture content gives an emission rate of 16.4 kg/h for TSP and 4.7 kg/h for PM_{10}.

Bulldozer on overburden

For TSP, use the following NPI equation

$$EF = 2.6\frac{s^{1.2}}{M^{1.3}} \qquad kg/h$$

For PM_{10}, use the following NPI equation

$$EF = 0.34\frac{s^{1.5}}{M^{1.4}} \qquad kg/h$$

Using values of 14% for silt content and 5% for moisture content gives an emission rate of 7.6 kg/h for TSP and 1.9 kg/h for PM_{10}.

Trucks dumping (unloading) overburden or coal

For trucks dumping overburden, use a default NPI value of 0.012 kg/t for TSP and of 0.0043 for PM_{10}. For trucks dumping coal, the default values are 0.010 kg/t for TSP and of 0.0042 for PM_{10}. No equations are recommended by NPI.

Drilling

Emissions from drilling are a relatively minor component from an open cut mine. Default NPI emission factors have been used for drilling, which are 0.59 kg/hole for TSP and 0.31 kg/hole for PM_{10}.

Clearly other variables such as the depth and diameter of the hole and moisture and silt content of the material are also relevant. However, no equations were available for NPI to recommend.

Blasting

Due to the limited information available, estimates of dust emissions associated with blasting were developed using the following formula from the current USEPA-AP42 - Vol.1, 5th edition Section 13.2.2

$$EF = 0.00022 * A^{1.5} \qquad kg/blast$$

where

- A = area of blasting (m²)

For PM_{10}, multiply the value calculated for TSP by 0.52.

For the Alpha Coal Project, information associated with the average blast area plus the number of blasts per year was provided by the Proponent.

Wheel-generated dust from unpaved roads

USEPA-AP42 formula has been used to estimate dust emission from wheel generated dust over unpaved roads:

$$EF = 1.381(\frac{s}{12})^A(\frac{W}{3})^B \qquad kg/VKT$$

where

- s = silt content in % of road material = 4%
- W = vehicle gross mass in tonnes as per truck below

Truck	W (Vehicle Gross Mass)
Overburden truck (full)	624 tonnes
Overburden truck (empty)	279 tonnes
Interburden truck (full)	250 tonnes
Interburden truck (empty)	114 tonnes
Coal truck (full)	588 tonnes
Coal truck (empty)	308 tonnes
Reject truck (full)	384 tonnes
Reject truck (empty)	166 tonnes

Exponentials are

- A = 0.7 (TSP) and 0.9 (PM_{10})

- B = 0.45 (TSP) and 0.45 (PM_{10})

Use of grader

The following NPI formulas have been used to estimate grader dust emission:

$$EF = 0.0034S^{2.5} \qquad kg/VKT \qquad \text{for TSP}$$

$$EF = 0.0034S^{2.0} \qquad kg/VKT \qquad \text{for } PM_{10}$$

where

- S = mean vehicle speed in km/h (5 km/h)

Miscellaneous transfer and conveying

For conveyor belt transfer points, the following NPI formula has been used:

$$EF = k0.0016(\frac{U}{2.2})^{1.3}(\frac{M}{2})^{-1.4} \qquad kg/t$$

where

- U = mean wind speed (m/s)
- M = material moisture content (%)
- k = 0.74 for TSP and 0.35 for PM_{10}

For this assessment, a mean wind speed of 2.61 m/s and moisture content of 6.9% results in emission factors of 0.00026 kg/t for TSP and 0.00012 kg/t for PM_{10}.

Wind Erosion

See Appendix B Wind dependent emission factors

Coal crushing and screening

The NPI does not provide methods to estimate emissions from crushing and screening of coal. US EPA's AP42 emission estimation manual for Mineral Products Industry (Chapter 11.19.2) provides emission factors for crushing stone – tertiary crushing, which are 0.0027 kg/t for TSP and 0.0012 kg/ton for PM_{10}. Note that in AP42, the emission factors for primary and secondary crushing stone are not determined. Hence the tertiary crushing is a conservative value for primary and secondary crushing activities.

In the absence of more representative information, emission factors of 0.0034 kg/t (TSP) and 0.00135 kg/t (PM_{10}) have been adopted for this assessment based on those used in the assessment of the Metropolitan Coal Project NSW (Holmes Air, 2008). It is noted that the contribution to the site emission inventory is c.0.25% and is considered immaterial.

C.1.3 Production Data

Production data were provided by the Proponent from the pre-feasibility study (Section 6 Mining, Section 7 Mining Infrastructure and Engineering Development, and Section 8 CHPP). This provided detailed data for Alpha Coal Project on the following items for each year of operation:

- Tonnes of ROM and Product coal moved;
- Volume of overburden removed by dragline, dozer and truck and shovel;
- Area of disturbed land;
- Volume of coal and overburden material blasted;
- Total metres of coal and overburden material drilled; and
- Tonnes of reject material from the CHPP.

C.2 Dust Reduction Measures

C.2.1 Dust Control Measures

Dust control measures that will be implemented on site have been identified by the Proponent. These consist of a mixture of engineering controls (such as enclosure of conveyors) and control measures (such as watering of haul roads and stockpiles). The descriptions of control measures to be used for the Mine have been matched to estimates of the control efficiency, as described in the NPI manual, for inclusion in modelling.

The water requirements for the mine have been addressed in the water balance for the mine. This has included an allocation of water to be used for the proposed dust suppression measures.

C.2.2 Pit Retention Factor

Mining activities that take place in an open cut pit do not have the same magnitude of air emissions as the equivalent activity would if conducted at surface level. This is due to the natural retention of dust within the pit, particularly the larger particles which tend to be deposited in the pit close to the dust source due to their larger size and mass. The pit retention factor is used in modelling the dust emissions from mines to represent this natural tendency of larger dust particles to remain within the pit, and thus not become a nuisance to health at residential locations.

The pit retention factor that is recommended for use in the NPI Emission Estimation Technique Manual for Mining is a factor of 50% for TSP and 5% for PM_{10}. This factor is the percentage of particles that are initially emitted by dust-generating activities within the open cut pit but remain in the pit and therefore do not contribute to off-site dust impacts.

As a conservative approach, the pit retention factor has not been applied. Typically, pit retention factors are applied only to sources that are at least 50 m below the natural surface level of the pit, such as coal excavation, draglines and dozers in the pit (with the coal or dragline operations). As the majority of the dust emissions are associated with the transport and dumping of overburden, the exclusion of the pit retention factor is not predicted to have a significant impact on results presented here. Sources that are close to or above the natural surface level would not have the pit retention factor applied to their emission rates, such as the CHPP, haul roads, truck and shovel operations, dozers associated with the truck and shovel or overburden stockpiles and activities on the box cut disposal area.

Appendix D Site Emissions Inventory

Presented in this appendix is the site-specific emissions inventory for PM_{10} developed for all years of the mine including construction years 1 and 2.

The inventory is presented as the percentage contribution of dust from each of the activities to the site total given in kg/year.

The results presented highlight the transport and dumping of overburden as the largest contributors to the site dust emissions inventory.

Table D-5 Ratio of PM_{10} to TSP

Activity	Ratio of PM_{10}/TSP
Topsoil	
Disturbance & Rehabilitation	0.50
Overburden & In Pit	
Drilling & Blasting	0.52
Dragline	0.16
FEL of Overburden into Trucks	0.47
Wheel generated Dust - Transport of Overburden to dumps	0.25
Truck Dumping at Overburden Dumps	0.36
FEL of coal trucks	0.48
Dozers	0.26
Graders	0.45
ROM Activities	
Processing	0.39
Truck Dumping at ROM	0.42
FEL at ROM	0.48
Dozer hours - Coal at ROM (total)	0.29
Wind Erosion from Stockpiles	0.50
ROM to CHPP Conveyor	
Conveyors	0.50
Miscellaneous Transfer Points	0.47
CHPP Activities	
Processing	0.39
FEL at CHPP (based on same # of hours as FEL at ROM)	0.48
Dozer Hours - Coal at CHPP (total)	0.29
Loading Stockpiles	0.43
Unloading from Stockpiles	0.43
CHPP Conveyors	0.50
Miscellaneous Transfer Points	0.47
Wind Erosion from Stockpiles	0.50
Main Haul Roads	
Transport of Coal To ROM	0.25
Transport of Rejects to Dumps	0.25
Tailing Storage Facility	
Wind Erosion from Tailing Storage Facility	0.50
Site Average	**0.26**

Appendix D

Table D-6 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10}

Summary - PM_{10}	CY1	CY2	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Topsoil									
Disturbance & Rehabilitation	100%	3%	2%	2%	1%	1%	1%	1%	1%
Overburden & In Pit									
Drilling & Blasting	0%	4%	3%	3%	4%	5%	4%	4%	4%
Dragline	0%	0%	0%	0%	0%	1%	1%	2%	2%
FEL of Overburden into Trucks	0%	2%	1%	1%	1%	1%	1%	1%	1%
Wheel generated Dust - Transport of Overburden to dumps	0%	48%	34%	36%	36%	35%	35%	33%	32%
Truck Dumping at Overburden Dumps	0%	39%	27%	28%	28%	27%	27%	25%	25%
FEL of coal trucks	0%	0%	1%	2%	3%	3%	3%	4%	4%
Dozers	0%	4%	4%	5%	5%	5%	6%	5%	5%
Graders	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM Activities									
Processing	0%	0%	0%	0%	0%	1%	1%	1%	1%
Truck Dumping at ROM	0%	0%	1%	1%	2%	2%	2%	2%	2%
FEL at ROM	0%	0%	0%	0%	1%	1%	1%	1%	1%
Dozer hours - Coal at ROM (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM to CHPP Conveyor									
Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	0%	0%	0%	0%	1%	1%	1%	1%	1%
CHPP Activities									
Processing	0%	0%	0%	1%	1%	1%	1%	1%	1%

Appendix D

Summary - PM_{10}	CY1	CY2	Y1	Y2	Y3	Y4	Y5	Y6	Y7
FEL at CHPP (based on same # of hours as FEL at ROM)	0%	0%	0%	0%	1%	1%	1%	1%	1%
Dozer Hours - Coal at CHPP (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unloading from Stockpiles	0%	0%	1%	2%	2%	2%	2%	3%	3%
CHPP Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	1%	1%	0%	0%	0%	0%	0%
Main Haul Roads									
Transport of Coal To ROM	0%	0%	2%	4%	5%	5%	6%	7%	7%
Transport of Rejects to Dumps	0%	0%	0%	1%	1%	1%	1%	1%	1%
Tailing Storage Facility									
Wind Erosion from Tailing Storage Facility	0%	0%	20%	10%	8%	6%	6%	6%	6%
TOTAL (kg)	**48,935**	**443,075**	**2,724,914**	**5,366,086**	**7,034,958**	**8,797,490**	**9,800,210**	**9,357,616**	**9,292,784**

Appendix D

Table D-7 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10} (Continued)

Summary - PM_{10}	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16
Topsoil									
Disturbance & Rehabilitation	1%	1%	1%	1%	1%	1%	1%	1%	1%
Overburden & In Pit									
Drilling & Blasting	4%	5%	4%	4%	4%	4%	5%	5%	4%
Dragline	4%	6%	8%	8%	10%	13%	13%	14%	16%
FEL of Overburden into Trucks	1%	1%	1%	1%	1%	1%	1%	1%	1%
Wheel generated Dust - Transport of Overburden to dumps	32%	30%	29%	28%	27%	25%	25%	25%	24%
Truck Dumping at Overburden Dumps	24%	23%	22%	22%	21%	19%	19%	19%	18%
FEL of coal trucks	4%	4%	4%	4%	4%	4%	4%	4%	4%
Dozers	5%	5%	5%	5%	5%	5%	5%	5%	5%
Graders	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM Activities									
Processing	1%	1%	1%	1%	1%	1%	1%	1%	1%
Truck Dumping at ROM	2%	2%	2%	2%	2%	2%	2%	2%	2%
FEL at ROM	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours - Coal at ROM (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM to CHPP Conveyor									
Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	1%	1%	1%	1%	1%	1%	1%	1%	1%
CHPP Activities									

Appendix D

Summary - PM_{10}	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16
Processing	1%	1%	1%	1%	1%	1%	1%	1%	1%
FEL at CHPP (based on same # of hours as FEL at ROM)	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer Hours - Coal at CHPP (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unloading from Stockpiles	2%	2%	3%	3%	2%	3%	3%	3%	2%
CHPP Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Main Haul Roads									
Transport of Coal To ROM	7%	7%	7%	9%	8%	9%	9%	9%	9%
Transport of Rejects to Dumps	1%	1%	1%	2%	2%	2%	2%	2%	2%
Tailing Storage Facility									
Wind Erosion from Tailing Storage Facility	6%	6%	6%	6%	6%	6%	6%	6%	6%
TOTAL (kg)	**9,691,097**	**9,392,766**	**9,068,404**	**9,086,812**	**9,475,985**	**8,913,597**	**9,038,057**	**9,308,564**	**9,494,531**

Appendix D

Table D-8 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10} (Continued)

Summary - PM_{10}	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Topsoil									
Disturbance & Rehabilitation	1%	1%	1%	1%	1%	1%	1%	1%	1%
Overburden & In Pit									
Drilling & Blasting	4%	4%	4%	4%	4%	4%	3%	4%	4%
Dragline	17%	18%	19%	19%	19%	20%	20%	19%	20%
FEL of Overburden into Trucks	1%	1%	1%	1%	1%	1%	1%	1%	1%
Wheel generated Dust - Transport of Overburden to dumps	23%	24%	23%	23%	23%	23%	22%	23%	23%
Truck Dumping at Overburden Dumps	18%	18%	18%	18%	18%	18%	18%	18%	18%
FEL of coal trucks	4%	4%	4%	4%	3%	3%	4%	3%	3%
Dozers	5%	5%	5%	5%	5%	5%	5%	5%	5%
Graders	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM Activities									
Processing	1%	1%	1%	1%	1%	1%	1%	1%	1%
Truck Dumping at ROM	2%	2%	2%	2%	2%	2%	2%	2%	2%
FEL at ROM	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer hours - Coal at ROM (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROM to CHPP Conveyor									
Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	1%	1%	1%	1%	1%	1%	1%	1%	1%
CHPP Activities									

Appendix D

Summary - PM_{10}	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Processing	1%	1%	1%	1%	1%	1%	1%	1%	1%
FEL at CHPP (based on same # of hours as FEL at ROM)	1%	1%	1%	1%	1%	1%	1%	1%	1%
Dozer Hours - Coal at CHPP (total)	0%	0%	0%	0%	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unloading from Stockpiles	2%	2%	2%	2%	2%	2%	2%	2%	2%
CHPP Conveyors	0%	0%	0%	0%	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%	0%	0%	0%	0%
Main Haul Roads									
Transport of Coal To ROM	9%	9%	9%	9%	10%	10%	10%	10%	9%
Transport of Rejects to Dumps	2%	2%	2%	2%	2%	2%	2%	2%	2%
Tailing Storage Facility									
Wind Erosion from Tailing Storage Facility	6%	6%	6%	6%	5%	5%	5%	5%	5%
TOTAL (kg)	**9,571,594**	**9,807,852**	**9,808,416**	**10,048,359**	**10,407,932**	**10,539,356**	**10,384,588**	**10,495,166**	**10,713,285**

Appendix D

Table D-9 Relative Contribution of Dust Generating Activities to the Overall Site Emissions Inventory for PM_{10} (Continued)

Summary - PM_{10}	Y26	Y27	Y28	Y29	Y30
Topsoil					
Disturbance & Rehabilitation	1%	1%	1%	1%	1%
Overburden & In Pit					
Drilling & Blasting	4%	4%	4%	4%	4%
Dragline	19%	19%	18%	18%	18%
FEL of Overburden into Trucks	1%	1%	1%	1%	1%
Wheel generated Dust - Transport of Overburden to dumps	24%	24%	24%	25%	25%
Truck Dumping at Overburden Dumps	19%	19%	19%	20%	20%
FEL of coal trucks	3%	3%	3%	3%	3%
Dozers	5%	5%	5%	5%	5%
Graders	0%	0%	0%	0%	0%
ROM Activities					
Processing	1%	1%	1%	1%	1%
Truck Dumping at ROM	2%	2%	2%	2%	2%
FEL at ROM	1%	1%	1%	1%	1%
Dozer hours - Coal at ROM (total)	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%
ROM to CHPP Conveyor					
Conveyors	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	1%	1%	1%	1%	1%
CHPP Activities					
Processing	1%	1%	1%	1%	1%

Appendix D

Summary - PM_{10}	Y26	Y27	Y28	Y29	Y30
FEL at CHPP (based on same # of hours as FEL at ROM)	1%	1%	1%	1%	1%
Dozer Hours - Coal at CHPP (total)	0%	0%	0%	0%	0%
Loading Stockpiles	0%	0%	0%	0%	0%
Unloading from Stockpiles	2%	2%	2%	2%	2%
CHPP Conveyors	0%	0%	0%	0%	0%
Miscellaneous Transfer Points	0%	0%	0%	0%	0%
Wind Erosion from Stockpiles	0%	0%	0%	0%	0%
Main Haul Roads					
Transport of Coal To ROM	10%	10%	10%	9%	9%
Transport of Rejects to Dumps	2%	2%	2%	2%	2%
Tailing Storage Facility					
Wind Erosion from Tailing Storage Facility	5%	5%	5%	5%	5%
TOTAL (kg)	**11,248,573**	**11,671,519**	**11,765,103**	**12,184,554**	**12,113,416**

Appendix E Modelling Methodology - Additional Details

E.1 Meteorological Modelling

TAPM uses detailed synoptic analysis of all surface and upper air data collected in Australia to determine the wind flows over a chosen model domain and time period. It contains databases on the vegetation types, land use, soil moisture content and terrain elevation (from 9-second DEM data) that are used to specify the surface parameters for the selected model domain.

TAPM was set up for the region around the Alpha Coal Project to simulate wind flows around the location to a 1 km resolution. The model parameters specified for the run were as follows:

- Grid centred on latitude -23°13', longitude 146°29', with local coordinates 447,000 m E, 7432,000 m N (UTM Zone 55);
- Nested grids of 61 by 61 grid points, with grid intervals of 25 km, 10 km, 3 km and 1 km; and
- The period modelled was 1 January 2009 to 31 December 2009

The data files were used as direct inputs to the CALMET meteorological model[10] by extracting the modelled data at the location of the CHPP for the surface and upper air data files. In addition, a data file (CSUMM format) containing all the three-dimensional upper air wind speed and direction data from each level of the TAPM results was used as an "initial guess" field in CALMET, to fully capture the influence of regional topographical features, such as hills and valleys, which are outside the detailed modelling domain.

The CALMET model domain was 61 km by 61 km. This is of sufficient size to capture the mining activities as well as the individual homesteads that may be affected by the proposed mining operations. Since no appropriate surface meteorological observation data were available within the model domain, synthetic data generated by TAPM was used to initialise the model. The CALMET model features enhanced treatment of terrain effects around the site and allows the wind fields to be influenced by the differential heating of the land surface depending on the angle of the sun. Its non steady-state formulation also allows the wind fields to travel around or over obstacles such hills, depending on the strength of the wind, and to recirculate pollutants within the model domain as the prevailing wind directions change through the day. CALMET calculates parameters such as mixing height and stability class that are used in the model to determine the dispersion conditions for every hour of the year.

E.2 Dispersion Modelling

E.2.1 Model Setup

The model domain was 61 km by 61 km, with the dispersion results calculated at a resolution of 1,000 m. The dispersion parameters specified in the model include the use of dispersion coefficients based on turbulence data computed from the modelled micrometeorology and partial plume path adjustment for terrain correction of plume impacts.

E.2.2 Source Types and Locations

The selection of source type to represent an air emission source is matched by the nature of the dust generating activities and how the dust is released. Possible source types in CALPUFF are point, area, volume and line sources. Volume sources have been used for dispersion modelling of all sources of

[10] TRC Environmental Corporation, CALPUFF Version 6 Users' Instructions (Draft), Lowell, Massachusetts, USA, May 2006

Appendix E

dust from the site to represent the nature of activities conducted on open-cut mines. The equipment that is used for open-cut mining operations is some of the largest equipment available. Activities such as excavating of coal or dropping of overburden from a dragline bucket result in the instantaneous creation of a cloud of dust, which is clearly visible from the edge of an operating open-cut pit. Likewise, the plume of dust that is generated by a truck moving on unpaved roads is mixed in the wake of the vehicle to form a visible dust cloud that rises above the vehicle height. The volume source is the most representative of the nature of these activities, as it accounts for the dispersion of an amount of dust that is well mixed in the air immediately at the source. For this reason, volume sources have been used throughout the assessment.

The sensitive receptor locations are at some distance from the mining activities (a minimum of c. 2,500 m from the mine boundary). This separation of the sources and receptors lessens the influence of the initial source structure (i.e. whether modelled as volume, area or point source) and results over 1 km from the source should be relatively independent of source selection for near-surface sources such as those in coal mines.

Source emission parameters, such as the height of release and the initial spread of the plume from each release point, were estimated from data provided by HPCL on the height of sources and the source types. These data have been used to derive the source height and initial spread of the plume, used in the dispersion modelling setup, as noted in Table E-10.

Table E-10 Source Height and Initial Horizontal and Vertical Spread of Plumes as used in Dispersion Modelling

Source Type	Source Height Above Ground Level (m)	Initial Horizontal Spread (m)	Initial Vertical Spread (m)
Overburden handling	10	15	5
Coaling	10	15	5
Blasting	15	100	7.5
Wind erosion	3	50	1.5
CHPP	10	20	5
ROM stockpiles	4	50	2
ROM processing	5	10	2.5
Conveyer from ROM to CHPP	3	3	1.5
Conveyer from CHPP to product stockpiles	10	3	5
Product stockpiles	10	50	5
Haul Roads	10	50	5
Tailing dams	3	50	1.5

The locations of each source were derived from the mine plan that was developed for the site. Haul road locations do not change throughout operation of the mine, however the progression of the mine westward results into increase in length of haul roads within the Pits.

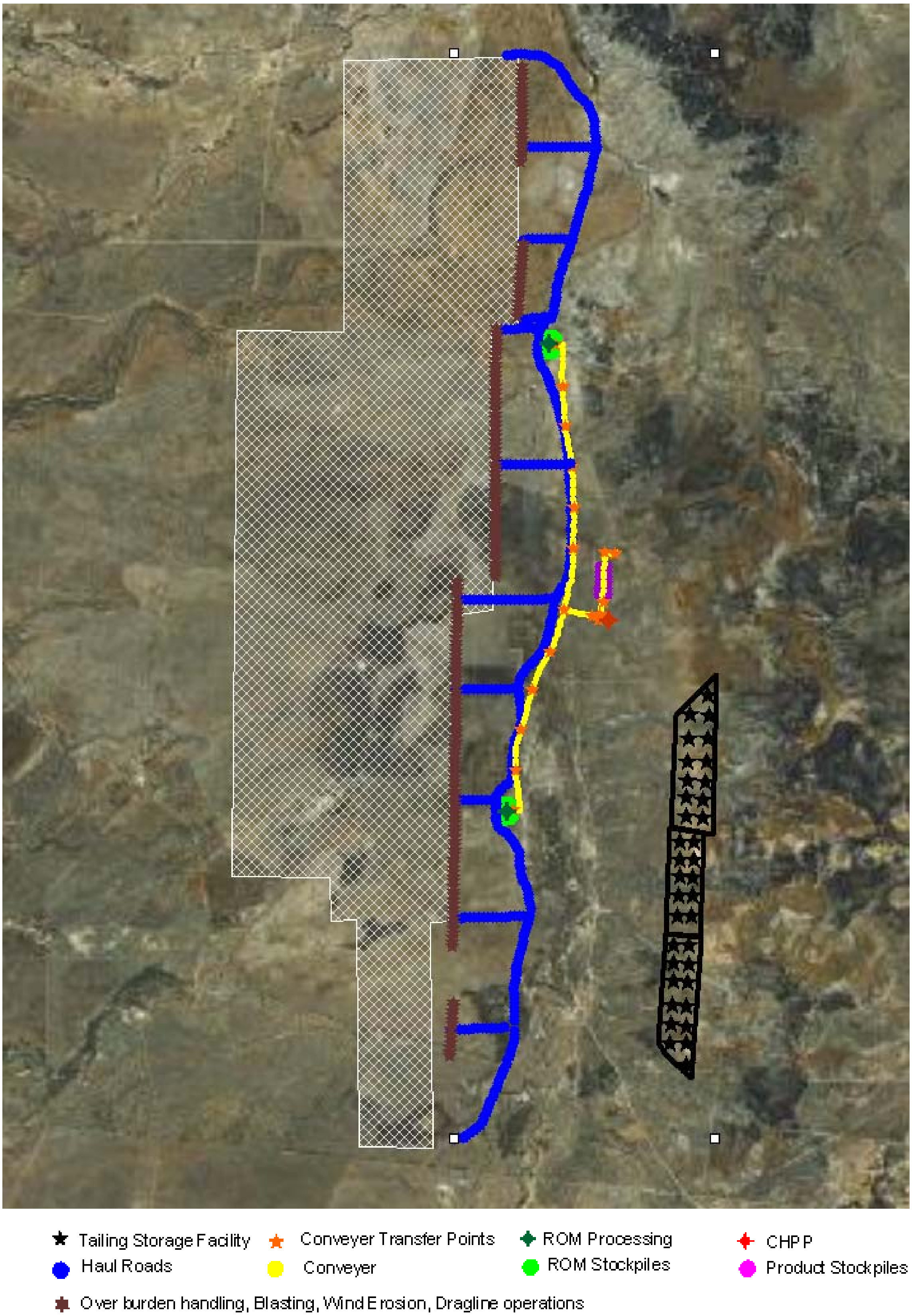
Haul roads were modelled as volume sources that were spread out along the haul routes at approximately 100 m intervals. The emissions for each road section were determined from the number of vehicle movements on the section and the distance travelled for the return journey.

Sources that are located in the pit, including draglines, truck and shovel, coaling equipment and blasting, were modelled as volume sources. For modelling of typical operations from the Mine, the source locations were spread out along the pit length at 100 m intervals, with emission rates corresponding to the appropriate pit activities.

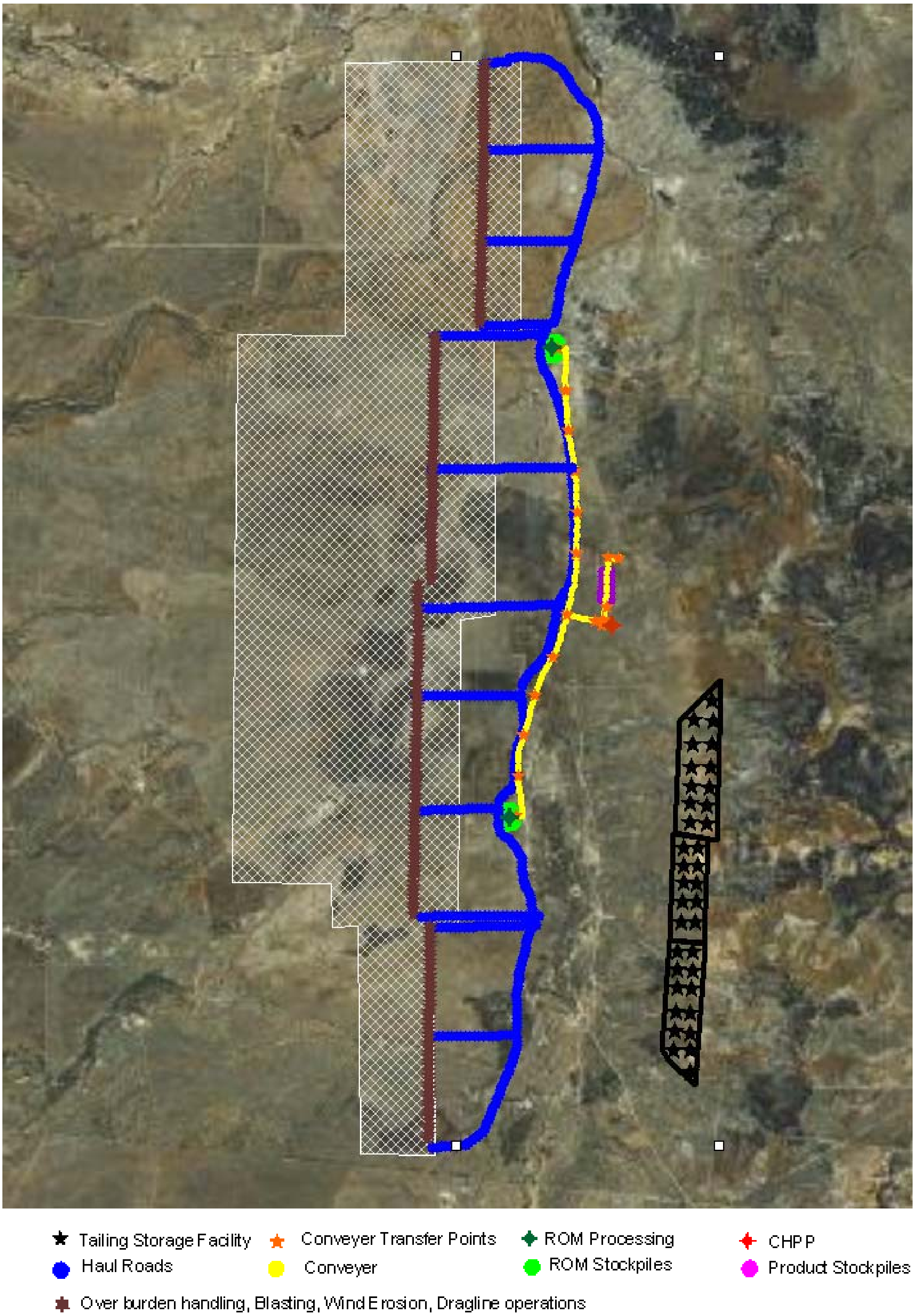
Activities at the CHPP, such as ROM coal dumping and stockpile movements were modelled as volume sources located at the centre of each dust-generating activity.

Appendix F Location of Modelled Sources

F.1 Year 5

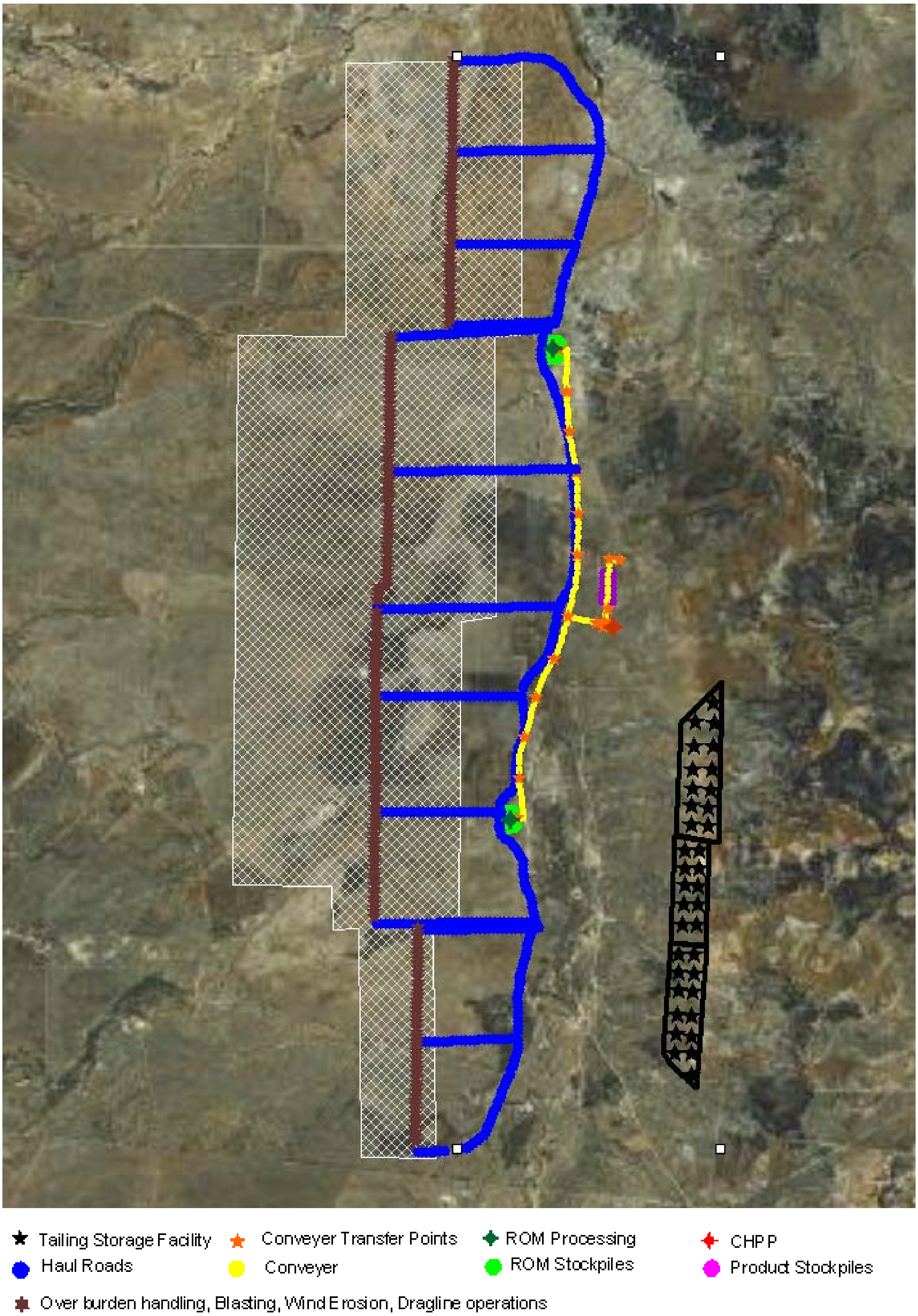


F.2 Year 10

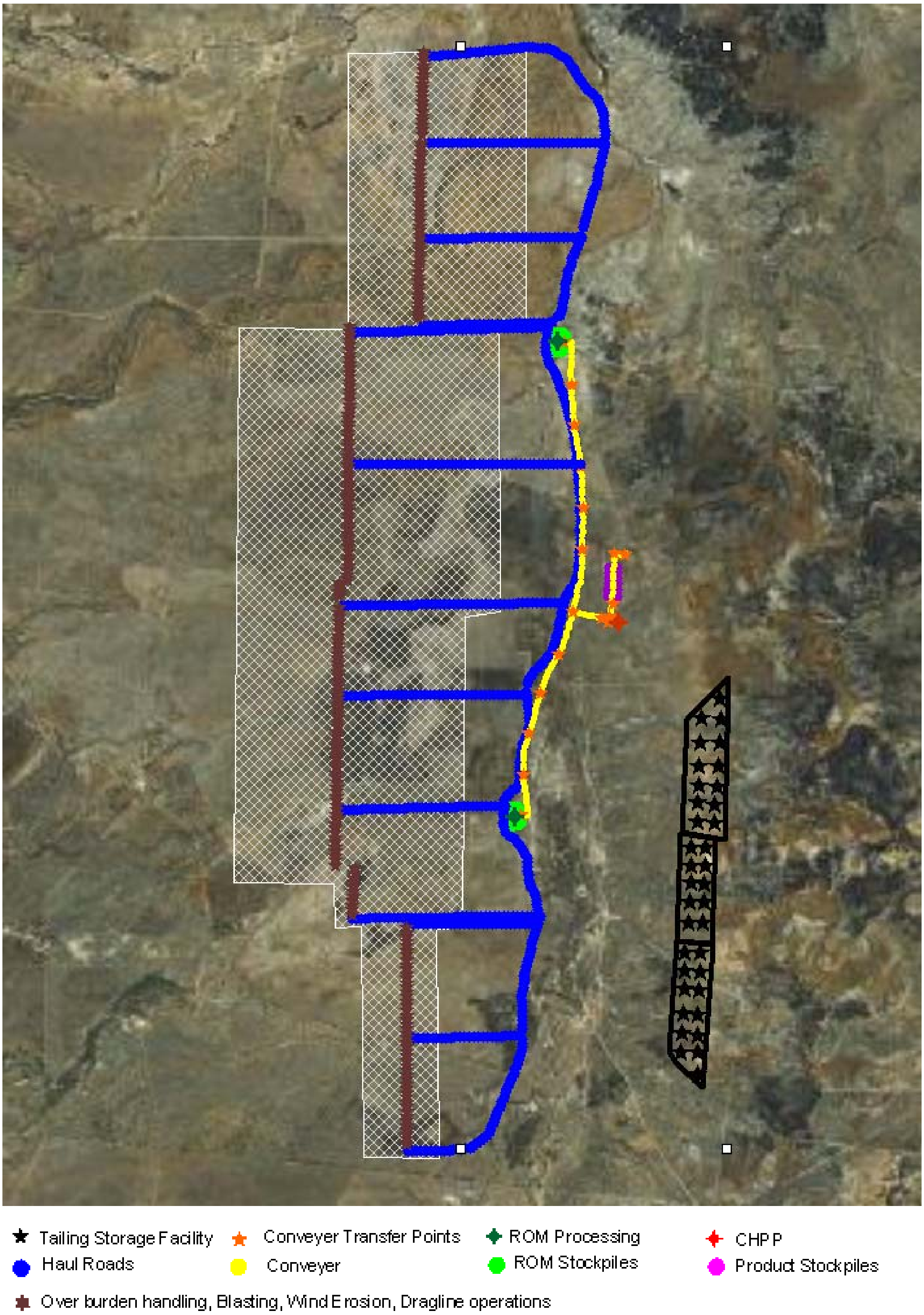

Tailing Storage Facility
Conveyer Transfer Points
ROM Processing
CHPP
Haul Roads
Conveyer
ROM Stockpiles
Product Stockpiles
Over burden handling, Blasting, Wind Erosion, Dragline operations

Appendix F

F.3 Year 15

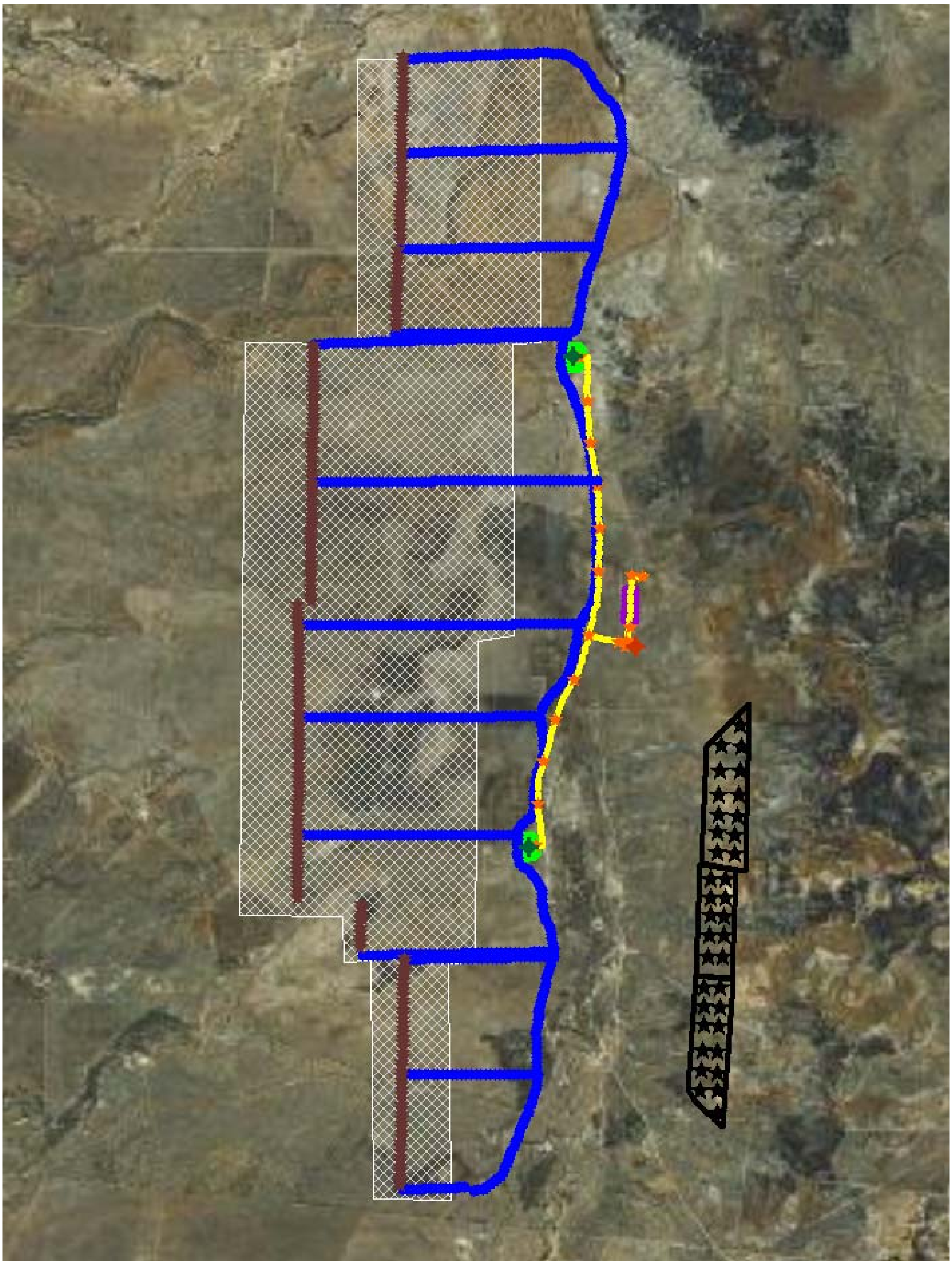


F.4 Year 20


Tailing Storage Facility
Conveyer Transfer Points
ROM Processing
CHPP
Haul Roads
Conveyer
ROM Stockpiles
Product Stockpiles
Over burden handling, Blasting, Wind Erosion, Dragline operations

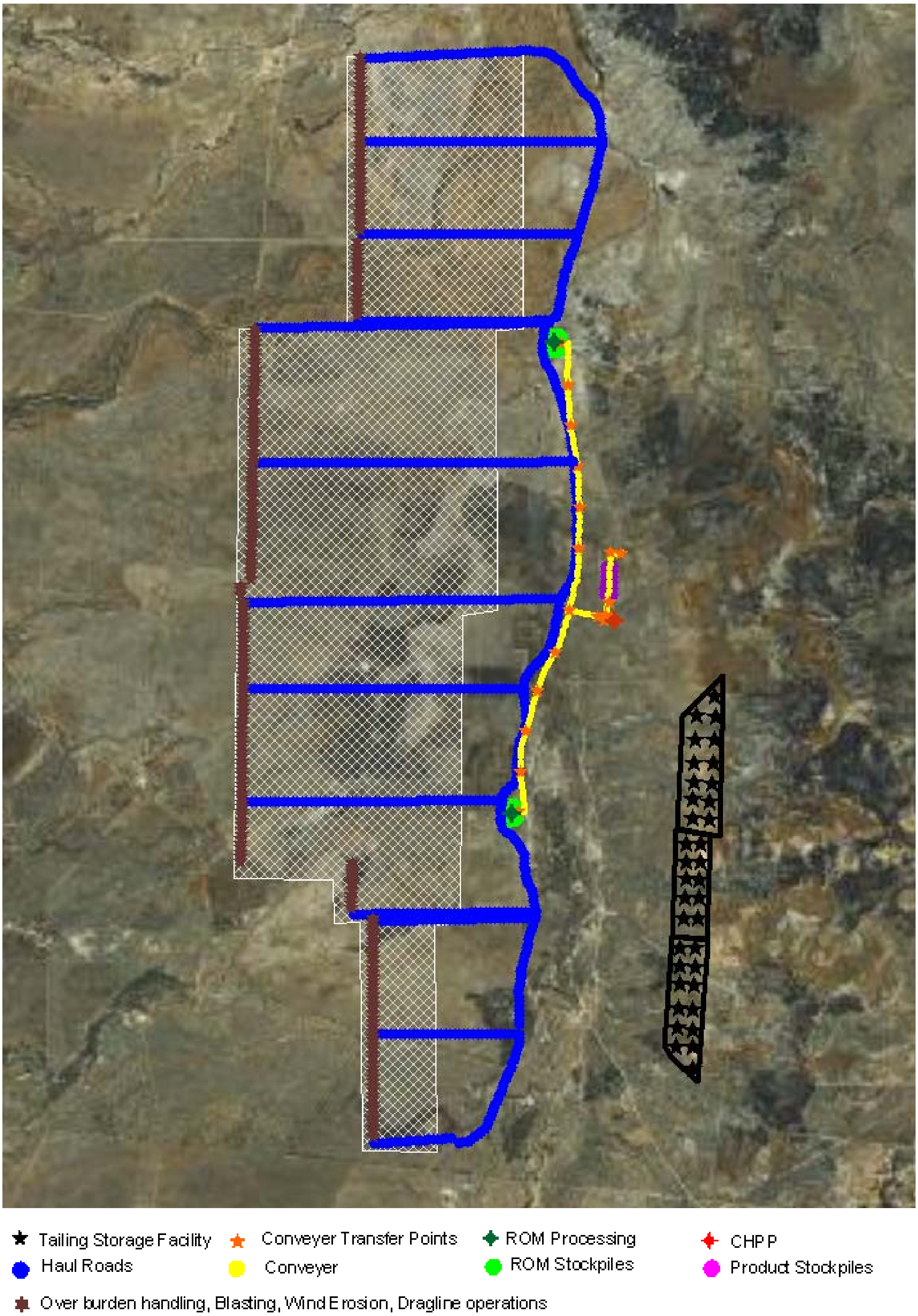
Appendix F

F.5 Year 25



★ Tailing Storage Facility · Conveyer Transfer Points · ROM Processing · CHPP
Haul Roads · Conveyer · ROM Stockpiles · Product Stockpiles
Over burden handling, Blasting, Wind Erosion, Dragline operations

F.6 Year 30


Tailing Storage Facility
Conveyer Transfer Points
ROM Processing
CHPP
Haul Roads
Conveyer
ROM Stockpiles
Product Stockpiles
Over burden handling, Blasting, Wind Erosion, Dragline operations

Appendix G Results of the Dispersion Modelling

Presented in this appendix are the results of the dispersion modelling for:

- The 5th highest 24-hour average ground-level concentration of PM_{10}
- The maximum 24-hour average ground-level concentration of $PM_{2.5}$
- The annual average ground-level concentration of $PM_{2.5}$
- The annual average ground-level concentration of TSP
- Dust deposition

for:

- Year 10
- Year 15
- Year 20
- Year 25

at each of the receptor locations.

Appendix G

Table G-11 The 5th Highest 24-Hour Average Ground-Level Concentration of PM_{10} ($\mu g/m^3$)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	45	**72**	145%	46	**73**	145%	47	**74**	149%	48	**75**	149%
2	23	50	100%	24	**51**	101%	23	**50**	100%	22	49	98%
3	20	47	94%	19	46	92%	20	47	94%	19	46	93%
4	51	**78**	155%	50	**77**	154%	52	**79**	158%	53	**80**	159%
6	20	47	94%	19	46	93%	20	47	94%	20	47	94%
8	95	**122**	244%	102	**129**	258%	117	**144**	288%	139	**166**	333%
9	121	**148**	296%	110	**137**	273%	111	**138**	275%	102	**129**	258%
10	10	37	73%	10	37	74%	10	37	75%	10	37	75%
11	11	38	75%	10	37	75%	11	38	75%	10	37	75%
12	48	**75**	149%	44	**71**	143%	45	**72**	143%	43	**70**	139%

Appendix G

Table G-12 The Maximum 24-Hour Average Ground-Level Concentration of $PM_{2.5}$ ($\mu g/m^3$)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	14	19	76%	14	19	76%	14	19	76%	12	18	71%
2	8	13	53%	8	13	52%	8	13	53%	8	13	52%
3	7	13	51%	7	13	51%	8	13	52%	8	13	53%
4	19	25	99%	19	25	100%	20	**26**	103%	21	**26**	105%
6	6	11	45%	6	11	44%	6	11	45%	6	11	44%
8	23	**28**	113%	26	**31**	125%	28	**34**	134%	32	**37**	150%
9	27	**32**	130%	25	**31**	123%	25	**30**	121%	24	**29**	118%
10	5	11	43%	5	11	43%	6	11	44%	6	11	44%
11	5	10	41%	5	10	40%	5	10	41%	5	10	40%
12	22	**27**	110%	21	**27**	107%	22	**28**	110%	22	**28**	110%

Appendix G

Table G-13 The Annual Average Ground-Level Concentration of $PM_{2.5}$ (µg/m³)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	1	4	53%	1	4	53%	1	4	53%	1	4	53%
2	0	3	39%	0	3	39%	0	3	39%	0	3	39%
3	0	3	39%	0	3	39%	0	3	39%	0	3	39%
4	1	3	44%	1	3	43%	1	4	44%	1	3	44%
6	0	3	37%	0	3	37%	0	3	37%	0	3	37%
8	5	7	93%	5	8	98%	6	**9**	107%	6	**9**	115%
9	3	6	78%	3	6	76%	3	6	76%	3	6	73%
10	0	3	37%	0	3	37%	0	3	37%	0	3	37%
11	0	3	37%	0	3	37%	0	3	37%	0	3	37%
12	1	4	45%	1	4	45%	1	4	45%	1	4	45%

Appendix G

Table G-14 The Annual Average Ground-Level Concentration of TSP (µg/m³)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	8	36	39%	8	36	40%	8	36	40%	8	36	40%
2	2	30	34%	3	31	34%	2	30	34%	3	31	34%
3	2	30	34%	2	30	34%	2	30	34%	2	30	34%
4	4	32	36%	4	32	36%	4	32	36%	4	32	36%
6	1	29	32%	1	29	32%	1	29	32%	1	29	32%
8	28	56	62%	31	59	66%	35	63	70%	38	66	74%
9	21	49	54%	20	48	54%	20	48	53%	18	46	52%
10	1	29	32%	1	29	32%	1	29	32%	1	29	32%
11	1	29	32%	1	29	32%	1	29	32%	1	29	32%
12	5	33	37%	5	33	36%	5	33	36%	5	33	36%

Appendix G

Table G-15 Dust Deposition (mg/m²/day)

Receptor	Y10			Y15			Y20			Y25		
	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)	Project	Total	% of EPP (Air)
1	3	**71**	59%	4	**72**	60%	4	**72**	60%	4	**72**	60%
2	3	**71**	59%	3	**71**	59%	2	**70**	59%	3	**71**	59%
3	2	**70**	59%	2	**70**	59%	2	**70**	58%	2	**70**	58%
4	2	**70**	59%	2	**70**	59%	2	**70**	59%	2	**70**	59%
6	1	**69**	57%	1	**69**	57%	1	**69**	57%	1	**69**	57%
8	20	**88**	73%	24	**92**	76%	24	**92**	77%	27	**95**	79%
9	16	**84**	70%	16	**84**	70%	14	**82**	69%	13	**81**	68%
10	1	**69**	58%	1	**69**	58%	1	**69**	57%	1	**69**	57%
11	1	**69**	57%	1	**69**	57%	1	**69**	57%	1	**69**	57%
12	4	**72**	60%	4	**72**	60%	3	**71**	59%	3	**71**	59%

URS Australia Pty Ltd
Level 16, 240 Queen Street
Brisbane, QLD 4000
GPO Box 302, QLD 4001
Australia
T: 61 7 3243 2111
F: 61 7 3243 2199

www.ap.urscorp.com