TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

10.1 INTRODUCTION

A detailed Air Quality and Greenhouse Gas Assessment for the project was undertaken, (see Volume 5, Appendix 18 and Appendix 19, respectively). This Chapter discusses the outcomes of both assessments and is divided into two parts. The first part of the Chapter provides an assessment of the potential impacts of the construction and operation of the mine on the ambient air quality of the site, and discusses suitable mitigation and management measures to address potential impacts.

The air quality assessment evaluates the local climate of the region and the existing environments in relation to particulate matter (PM, i.e. dust). Local meteorology is a key factor in assessing and identifying potential transport and dispersion of particulate matter across the mine site. Atmospheric dispersion modelling has been performed to quantify air quality impacts of particulate matter in conjunction with estimates of PM emissions during the mine's operational life. The assessment is based upon an annual ROM coal production of 56 Mtpa and 40 Mtpa saleable coal at the mine site.

The second section of this Chapter provides an assessment of the greenhouse gases that will potentially be generated during the construction and operation of the mine. The potential impacts and abatement measures are also discussed.

10.2 AIR QUALITY

10.2.1 LEGISLATIVE FRAMEWORK

The objective of the EP Act is the protection of the environment within the context of ecologically sustainable development. To achieve this outcome the EP Act provides a range of tools, these including Environmental Protection Policies (EPPs). The EPP (Air) achieves one of the objectives of the EP Act: to protect Queensland air quality while allowing for ecologically sustainable development.

Ambient air quality objectives are provided in Schedule 1 of the EPP (Air) for various ranges of averaging periods. These objectives are consistent with the air quality guidelines specified in the National Environment Protection Measure (NEPM) (Ambient Air Quality) and the NEPM (Air Toxics). These objectives are set to protect human health and wellbeing, to protect the health and biodiversity of ecosystems, to protect the aesthetics of the environment, including the appearance of urban and rural environments, and to protect agricultural use of the environment.

The EPP (Air) air quality objectives relevant to this air quality assessment are shown in Table 1.

Table 1. Air quality guidelines for particulate matter in Queensland

POLLUTANT	OBJECTIVE ($\mu G/M^3$)	PROTECTION CATEGORY	AVERAGING PERIOD	ALLOWABLE EXCEEDANCES
Total Suspended Particulate (TSP)	90	Annual	EPP (Air)	Nil
Particulate Matter <10 µm (PM_{10})	50	24 hour	EPP (Air) and NEPM	5 days each year [a]
Particulate Matter <2.5 µm ($PM_{2.5}$)	25	24 hour	EPP (Air)	Nil
	8	Annual	EPP (Air)	Nil
Dust Deposition	2 g/m^2/month (incremental)	Monthly	QLD and NSW	Nil

[a] 5 days of each year allowable exceedances are considered to exclude days with regional dust storms. These events are not impacted by local sources.

10.2.2 ASSESSMENT METHOD

The impacts to air quality from the activities at the mine have been assessed against EPP (Air) ground-level dust concentration guidelines for total suspended particles (TSP), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}) and particulate matter with an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$). Dust deposition rates have also been assessed against relevant guidelines.

Air dispersion modelling has been used to predict ground-level concentrations of pollutants and rates of dust deposition, based on 2008 meteorological data for the mine region and estimated emission rates for the mine's activities. The USEPA regulatory dispersion models CALMET/CALPUFF were selected, driven by The Air Pollution Model (TAPM) - generated meteorological data.

Emission rates were estimated using methodologies sourced from the National Pollutant Inventory (NPI) and USEPA AP-42. To assess the worst case conditions, emissions were estimated for year 19 of the mine's life, as this represents peak emissions. The major sources of emissions were waste handling by the draglines, the transport of waste to the out of pit waste dumps, hauling of coal and wind erosion of exposed areas.

Background concentrations were estimated based on air quality monitoring conducted at West Mackay by DERM. They are likely higher than the actual background dust level at the Mine.

A detailed description of the methods used for the air quality assessment are at Volume 5, Appendix 18.

10.2.3 DESCRIPTION OF ENVIRONMENTAL VALUES

Environmental values in the form of ambient air quality for the mine site were considered for this project with respect to relevant Queensland legislation. Associated air quality for this assessment was comprised of PM, which is primarily referred to as dust. Pollutants of interest related to particulate matter are descriptively categorised for this project as below:

- particulate matter with an aerodynamic diameter less than ten microns (PM_{10});
- particulate matter with an aerodynamic diameter less than two and half microns ($PM_{2.5}$); and
- Total Suspended Particles (TSP).

10.2.3.1 Meteorology

The climate of the mine site has a sub-tropical continental climate. Generally in winter, days are warm and sunny, and nights are cold. Summer days tend to be hot and nights warm. Summer weather is influenced by a semi-permanent trough that lies roughly north-south through the interior of the state. The trough is normally the boundary between relatively moist air to the east and dry air to the west. It is best developed and generates most weather during spring and summer months. The position of the trough fluctuates diurnally due to vertical mixing and from day to day due to interaction with broad-scale synoptic influences. The trough often triggers convection with showers and thunderstorms on its eastern side.

Based on meteorological data collected twice a day at 9 am and 3 pm at multiple BOM stations near the mine site, the climate for the project area can be summarised as below. These stations are Barcaldine, Emerald, Claremont and Blackall stations, as these are the closest to the location of the mine site.

- long term wind roses from two representative locations in the study area (one from the east at Emerald Airport and one from the west of the study area at Barcaldine Airport) show very different wind strengths although similar wind directions across the study area. Emerald has winds that are frequently from the east with more moderate winds. Barcaldine has a higher frequency of winds from the east but also has a higher frequency of low wind speeds than Emerald;
- the rainfall is the highest during summer and lowest during winter, with a total annual rainfall approximately 500 to 600 mm. Rainfall data shows a consistent pattern across the study region of 80-120 mm of rain per month on average during the summer months, dropping to average lows of 15-20 mm during winter;
- the long term monthly average temperatures within the study area display typical ranges for subtropical regions. Longreach, being further inland, is generally hotter than the other monitoring stations in the region although it can be cooler during mid-winter. Mean monthly minimum temperatures can be as high as 19°C to 22°C in the summer and drop as low as 7°C in the winter. The mean maximum temperatures can range between 33 to 36°C in the hottest months and drop to between 22 and 25°C during the coldest part of the year; and

- relative humidity in the study area is typically higher during the summer and autumn months and lower during the spring months. During the summer months the higher temperatures allow greater saturated vapour pressures resulting in lower relative humidity. Finally the relative humidity is also affected by the distance from the sea with stations further from the ocean having less water vapour available and hence lower relative humidity levels.

The temperature inversion strength and frequency have been estimated based on TAPM meteorological modelling output (for the year 2008) for a central location within the project area. Analysis of the inversions shows that strong inversions occur in 13% of occasions.

10.2.3.2 Existing Air Quality

DERM monitor ambient air levels across major populated districts across the state. These levels are assessed to comply against the NEPM (Ambient Air Quality) and the EPP (Air). Due to the remoteness of the Mine site there are no regulatory ambient air quality monitoring stations within the vicinity. The closest DERM air quality monitoring station is located at West Mackay. West Mackay is located in a light industrial area, which often observes high levels of dust attributed from local industries. Table 2 summaries recent dust monitoring data at West Mackay over a five year period.

Existing emission sources on air quality across the mine site are expected to be relatively low, due to agricultural land use practices, and occasional impacts from biogenic emissions, regional dust storms and fires. No current mines or major populous settlements are within the mine site.

Estimating existing background dust level for the project from the West Mackay Station data are a conservative approach as air quality emissions are substantially higher across the region of Mackay due to light industry and are not representative to estimates of air quality across the mine site.

Table 2. Recent dust monitoring data at West Mackay

YEAR	PM_{10} CONCENTRATIONS (μG/M3) 24 HOUR PERIOD			
	MAX	95TH PERCENTILE	70TH PERCENTILE	ANNUAL AVERAGE
2006	106	31	22	19.6
2007	58	37	25	21.5
2008	94	43	27	23.3
2009	515	48	28	24.4*
EPP (Air) Guideline		50		No Guideline

* All data from 23 – 30 September 2009, extremely high values due to regional dust storms, are not included in the calculation of annual average.

For the purposes of this EIS assessment and considering the predominantly rural environment within the study area, the estimated background levels for dust are:

- 26 μg/m³ for 24-hour average PM_{10} levels (70th percentile of 24-hour concentrations, averaged during 2006-2009);
- 22 μg/m³ for annual average PM_{10} levels (annual average concentrations, averaged during 2006-2009);
- 5.2 μg/m³ for 24-hour average $PM_{2.5}$ levels (20% of PM_{10} values, based on Midwest Research Institute, 2006);
- 4.4 μg/m³ for annual average $PM_{2.5}$ levels (20% of PM_{10} values, based on Midwest Research Institute, 2006); and
- 44 μg/m³ for annual average TSP levels (twice PM_{10} values, based on Midwest Research Institute, 2006).

The use of 20% of PM_{10} to estimate $PM_{2.5}$ background concentrations is based on Midwest Research Institute (2006), in which the recommended ratio of $PM_{2.5}$ to PM_{10} is 0.2 for agriculture activities, which is applicable to the mine where terrestrial wind erosion is presumably the major source of background dust emissions.

10.2.3.3 Sensitive Receptors

Figure 1 illustrates the established atmospheric modelling domain for the mine study area. Seven sensitive receptor locations are shown, labelled as 1-7. Receptors 1-5 are single residences within close proximity to the mine. Receptors 6 and 7 represent the township of Jericho and Alpha respectively.

10.2.4 POTENTIAL IMPACTS

10.2.4.1 Construction Emission Sources

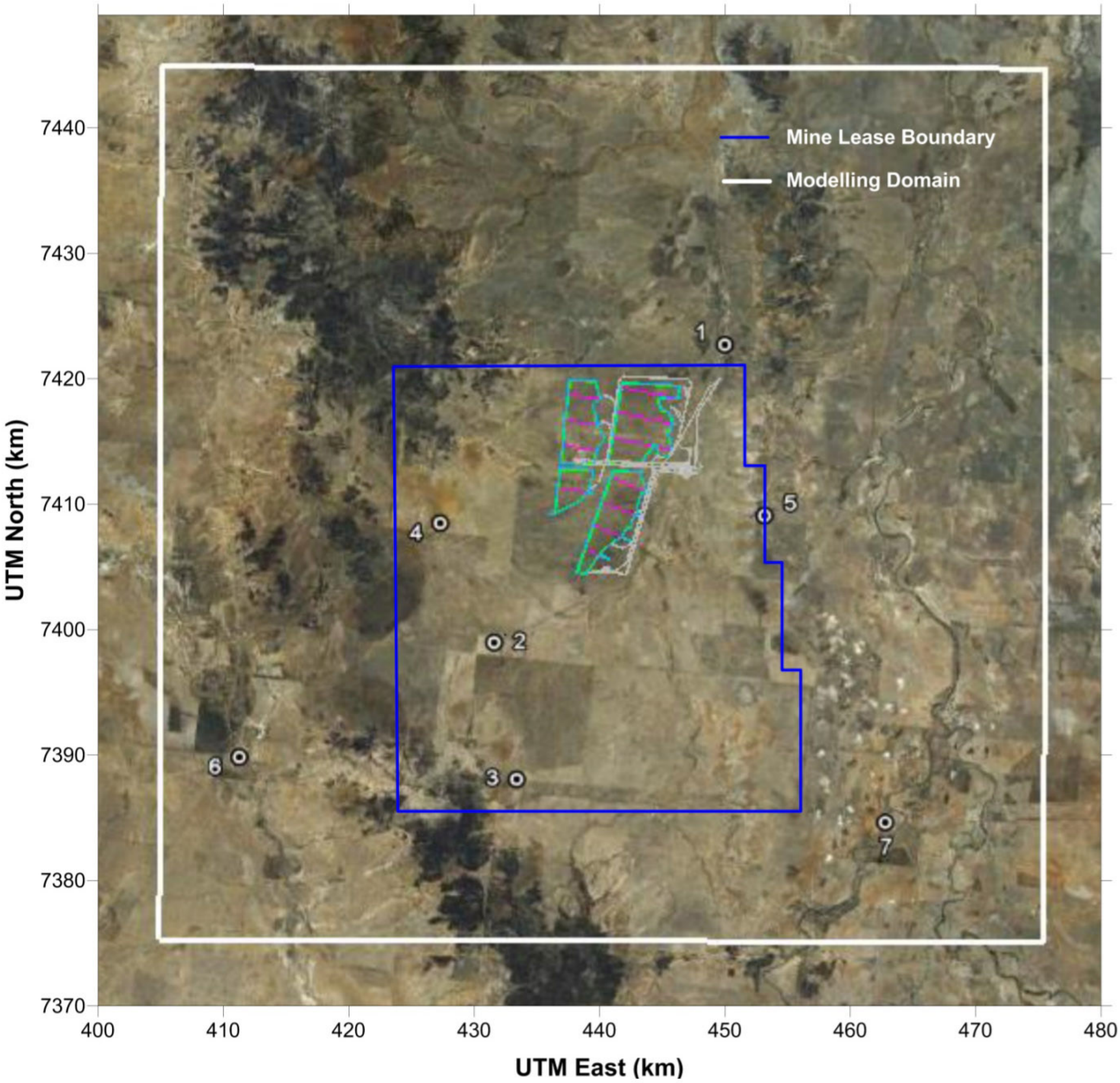
Dust impacts during the initial construction phase of the coal mine, primarily from pre-stripping of the tertiary materials and the construction of the access portals to underground mines, are likely to exist. These impacts are expected to be of a transient nature, and dust volumes are likely to be much less than those from the combined open cut and underground mining activities during normal operations. For these reasons, air quality impacts during construction of the coal mine have not been predicted through air dispersion modeling; rather, they will be managed through the mine's EMP.

10.2.4.2 Operation Emission Sources

Air quality impacts have been assessed via dispersion modeling for the operational phase of the mine. The following pollutants will likely emit from the mining activities:

- sulphur dioxide (SO_2);
- NOx as nitrogen dioxide;

Figure 1. Modelling Domain for the Mine Air Quality Assessment



- carbon monoxide (CO);
- volatile organic compounds (VOCs);
- particulate matter with an aerodynamic diameter less than ten microns (PM_{10});
- particulate matter with an aerodynamic diameter less than two and half microns ($PM_{2.5}$); and
- Total Suspended Particles (TSP).

Of the pollutants listed above, detailed air quality impact study was only undertaken for the three dust-related pollutants.

Australian diesel fuel has low sulphur content; therefore, it is unlikely that the impacts from mining equipment using diesel will lead to exceedances of the EPP (Air) objectives for SO_2. Similarly emissions of NOx, CO and VOCs associated with fuel combustion activities from a mine are generally very small and not of concerns for air quality. Therefore detailed air quality impact study was not undertaken for SO_2, NOx, CO and VOCs.

Greenhouse gases, carbon dioxide (CO_2) and methane (CH_4), emitted from this project will not impact air quality as they have no adverse impacts on human health and environment, except that they may lead to climate change. Even though methane is an organic component, it is very stable in the air and therefore has little impact on ozone formation or depletion. Therefore, the air quality impacts of greenhouse gases are not considered in this chapter.

No hazardous or toxic pollutants are expected to release from this mining project at sufficient quantity. Odour may rise from fuel burning of vehicles or equipment or explosive usage, but it is not expected to reach significant levels in the ambient air. Hence their potential impacts are not quantitatively evaluated in this assessment.

10.2.4.3 Estimated Dust Emissions

Dust emissions from the mine have been estimated based on the projected activities occurring for year 19 of the mine life, using emission factors obtained from appropriate reference sources, and proposed dust controls measures.

Emission factors used to estimate emissions of TSP and PM_{10} have been sourced from the following:

- National Pollutant Inventory (NPI) Emissions Estimation Manual (EET) for Mining v2.3 (2001); and
- USEPA AP-42 - Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume 1 (Chapter 11 for Western Surface Coal Mining).

A summary of the estimated dust emissions from the mine is presented in Table 3.

The dust control measures considered in the assessment, shown as control factors (i.e. percentage reduction) in Table 3, are the level 2 watering (greater than 2 litres / m^2 / hour) for haul roads, and the reduction of wind erosion from the not-recently-disturbed exposed areas. Other dust control measures proposed for the mine led to the emissions from the following sources too small to been considered:

- the CHPP, as all activities are enclosed (including loading) and the CHPP uses a wet process;
- conveying, and conveyor transfer points (excluding loading/unloading), as all conveyors are fully enclosed;
- loading coal to trains, as train loading is fully enclosed; and
- tailings dams, as the tailings will be maintained as a wet paste.

As can be seen the majority of emission are associated with the waste (overburden soil and rocks) handling by the draglines, the transport of waste to the out-of-pit waste dumps, wheel-generated dust during hauling of coal and wind erosion of exposed areas. Emission from the cut and cover operations for the development of the underground mines have not been modelled as they do not occur during peak emissions. The emissions from cut and cover operations are significant (approximately 451,000 kg for TSP and 123,333 kg for PM_{10} for all UGMs), however they are outweighed by emissions from wind erosion of exposed areas for the OCM pits and out of pit waste dumps. Emissions from wind erosion cannot be assumed to occur at the same time as the cut and cover operations, as the OCM mines will not have progressed to create the exposed areas. The emissions presented in Table 3 represent peak emissions at year 19 of the life of the mine.

Table 3. Summary of dust emission from the operation of the mine (at year 19 of the mine life)

	SOURCE OF EMISSIONS		ACTIVITY DATA	UNITS	EMISSION FACTOR			CONTROL FACTOR	EMISSIONS			% OF TOTAL TSP	% OF TOTAL PM_{10}
					TSP	PM_{10}	UNITS		TSP	PM_{10}	UNITS		
Open Cut Mines	Scrapers	OCM pits	280,320	VKT/a	1.64	0.53	kg/VKT	–	459,725	148,570	kg/a	3%	2%
	Truck shovels/truck excavators[a]	DL1	28,600,000	tonnes/a	0.002	0.001	kg/t	–	45,879	21,699	kg/a	3.1%	3.9%
	Shovel trucks	DL2	72,800,000	tonnes/a	0.002	0.001	kg/t	–	116,782	55,235	kg/a		
	Shovel trucks	DL3	109,200,000	tonnes/a	0.002	0.001	kg/t	–	175,173	82,852	kg/a		
	Shovel trucks	DL4	104,000,000	tonnes/a	0.002	0.001	kg/t	–	166,832	78,907	kg/a		
	Blasting	OCMs	313,335	holes/year	0.15	0.08	kg/blast	–	46,577	24,220	kg/a	0.3%	0.4%
	Drilling	OCMs	313,335	holes/year	0.59	0.31	kg/hole	–	184,868	97,134	kg/a	1.1%	1.6%
	Draglines	All dragline systems	112,000,000	bcm/a	0.05	0.02	kg/bcm	–	5,380,505	2,313,617	kg/a	33%	38%
	Bulldozers	OCM pits	70,080	hrs/year	17	4	kg/h	–	1,191,360	280,320	kg/a	7%	5%
	Hauling – overburden	DL1	228,800	VKT/a	3.88	0.96	kg/VKT	76%	221,936	54,912	kg/a	15%	10%
	Hauling – overburden	DL2	582,400	VKT/a	3.88	0.96	kg/VKT	76%	564,928	139,776	kg/a		
	Hauling – overburden	DL3	873,600	VKT/a	3.88	0.96	kg/VKT	76%	847,392	209,664	kg/a		
	Hauling – overburden	DL4	832,000	VKT/a	3.88	0.96	kg/VKT	76%	807,040	199,680	kg/a		
	Waste dumping	DL1	28,600,000	tonnes/a	0.002	0.001	kg/t	–	45,879	21,699	kg/a	3.1%	3.9%
	Waste dumping	DL2	72,800,000	tonnes/a	0.002	0.001	kg/t	–	116,782	55,235	kg/a		
	Waste dumping	DL3	109,200,000	tonnes/a	0.002	0.001	kg/t	–	175,173	82,852	kg/a		
	Waste dumping	DL4	104,000,000	tonnes/a	0.002	0.001	kg/t	–	166,832	78,907	kg/a		
	Coal excavating/ loading	OCMs	20,000,000	tonnes/a	0.03	0.00	kg/tonne	–	612,503	98,475	kg/a	4%	2%
	Hauling – coal	DL1	340,000	km/annum	3.88	0.96	kg/VKT	76%	329,800	81,600	kg/a	8%	5%
	Hauling – coal	DL2	240,000	km/annum	3.88	0.96	kg/VKT	76%	232,800	57,600	kg/a		
	Hauling – coal	DL3	420,000	km/annum	3.88	0.96	kg/VKT	76%	407,400	100,800	kg/a		
	Hauling – coal	DL4	300,000	km/annum	3.88	0.96	kg/VKT	76%	291,000	72,000	kg/a		
	Coal handling/sizing[b]	OCM sizing stations	20,000,000	tonnes/a	0.01	0.00	kg/t	–	227,383	96,951	kg/a	1%	2%
	Bulldozers	OCM sizing stations	17,520	hrs/year	11.89	3.79	kg/h	–	208,382	66,427	kg/a	1.3%	1.1%
	Reject coal dumping	OCM pits	16,000,000	tonnes/a	0.01	0.00	kg/t	–	160,000	67,200	kg/a	1.0%	1.1%

SOURCE OF EMISSIONS			ACTIVITY DATA	UNITS	EMISSION FACTOR			CONTROL FACTOR	EMISSIONS			% OF TOTAL TSP	% OF TOTAL PM_{10}
					TSP	PM_{10}	UNITS		TSP	PM_{10}	UNITS		
Underground mines	Coal handling/sizing[c]	UGM sizing stations	36,000,000	tonnes/a	0.0007	0.0003	kg/t		24,644	11,656	kg/a	0.2%	0.2%
	Bulldozers	UGM sizing stations	9,984	hrs/year	11.89	3.79	kg/h		118,749	37,854	kg/a	0.7%	0.6%
	Wind erosion – coal stockpiles	UGM drift stockpiles	8	ha	0.40	0.20	kg/ha/hour		27,471	13,736	kg/a	0.2%	0.2%
	Vents	UGMs	56,764,800,000	m3/annum	0.0016	0.0011	g/nn3		90,824	62,441	kg/a	0.6%	1.0%
CHPP and stockpiles	Coal loading/ reclaiming[d]	Raw coal stockpiles	56,000,000	tonnes/a	0.0003	0.0001	kg/t		15,334	7,253	kg/a	0.1%	0.1%
	Wind erosion – coal stockpiles	Raw coal stockpiles	11	ha	0.40	0.20	kg/ha/hour		38,894	19,447	kg/a	0.2%	0.3%
	Coal loading/ reclaiming[e]	Product coal stockpiles	40,000,000	tonnes/a	0.0003	0.0001	kg/t		10,953	5,181	kg/a	0.07%	0.08%
	Wind erosion – coal stockpiles	Product coal stockpiles	8	ha	0.40	0.20	kg/ha/hour		29,434	14,717	kg/a	0.2%	0.2%
	Coal loading/ reclaiming[f]	Reject coal stockpiles	16,000,000	tonnes/a	0.0004	0.0002	kg/t		6,572	3,108	kg/a	0.0%	0.1%
	Wind erosion – coal stockpiles	Reject coal stockpiles	5	ha	0.40	0.20	kg/ha/hour		18,922	9,461	kg/a	0.1%	0.2%
	Bulldozers	CHPP	17,520	hrs/year	11.89	3.79	kg/h		208,382	66,427	kg/a	1.3%	1.1%
Wind erosion of exposed areas	Wind erosion – recently disturbed exposed areas	OCMs	600	ha	850	425	kg/ha/y		510,000	255,000	kg/a	3%	4%
	Wind erosion – not recently disturbed exposed areas	OCMs	2,900	ha	850	425	kg/ha/y	50%	1,232,500	616,250	kg/a	8%	10%
	Wind erosion	Out of pit waste dumps	993	ha	850	425	kg/ha/y		844,066	422,033	kg/a	5%	7%
TOTAL EMISSIONS									**16,359,675**	**6,130,895**	**kg/a**	**100%**	**100%**

a DL1-4 refers to dragline systems 1-4

b Emission factors presented are the sum of emission factors for 'trucks dumping coal' and 10 x 'miscellaneous transfer' to account for all steps of material handling at OCM sizing stations.

c Emission factors presented are the sum of 5 x 'miscellaneous transfer' emission factors to account for all steps of material handling at UGM sizing stations.

d, e Emission factors presented are the sum of 2 x 'miscellaneous transfer' emission factors to account for coal loading and reclaiming.

f Emission factors presented are the sum of 3 x 'miscellaneous transfer' emission factors to account for coal loading, reclaiming and loading to haul trucks.

10.2.4.4 Predicted Impacts at Sensitive Receptors

The predicted ground-level dust concentrations and deposition at the sensitive receptors are summarised in Table 4. The assessment indicates that:

- the predicted ground-level concentrations, including background, are well below the EPP (Air) objectives for TSP and $PM_{2.5}$;
- for PM_{10}, the 24-hour EPP (Air) objective of 50 µg/m³ is exceeded at Receptors 1-5 when background PM_{10} concentration is included - impacts from the mine, excluding background, exceed the guidelines at Receptors 2 and 4; and
- the dust deposition is well below the recommended guideline of 2 g/m²/month.

It should be noted that Receptors 2 and 4 are within the mining boundary, and Receptor 1 is likely to be within the boundary of proposed Hancock Coal mine.

10.2.4.5 Predicted Impacts over Modelling Grids

The predicted impacts over the modelling grids are shown as contour plots in Figure 2 to Figure 10. Impacts predicted from only the mine site are presented, as well as the impacts predicted from the mine site plus background concentrations of pollutants. The concentration contours are shown as yellow lines, except for the contour level corresponding to the EPP (Air) guideline value shown as red lines.

10.2.4.5.1 PM_{10}

The predicted maximum ground-level 24-hour PM_{10} concentrations for the mine site and mine site plus background respectively are presented in Figure 2 and Figure 3. It can be seen that impacts from the mine only are predicted to exceed the guideline of 50 µg/m³ beyond the mine boundary, including at Receptors 2 and 4. When background concentrations are included there is a larger area of exceedance, including Receptors 1, 2, 3, 4 and 5.

Figure 2. Predicted maximum 24-hour ground-level concentrations of PM_{10} (in µg/m³) – mine only

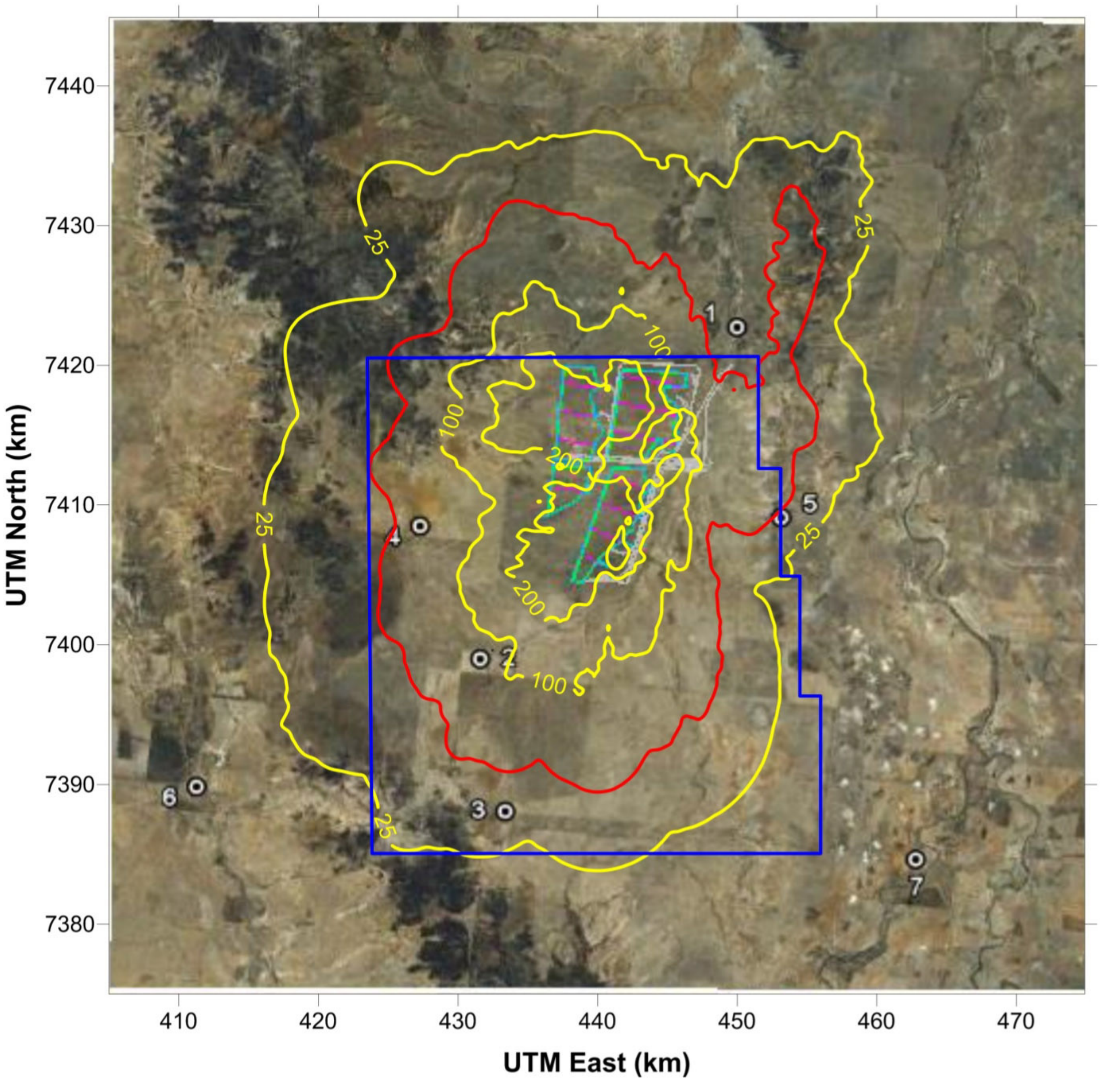


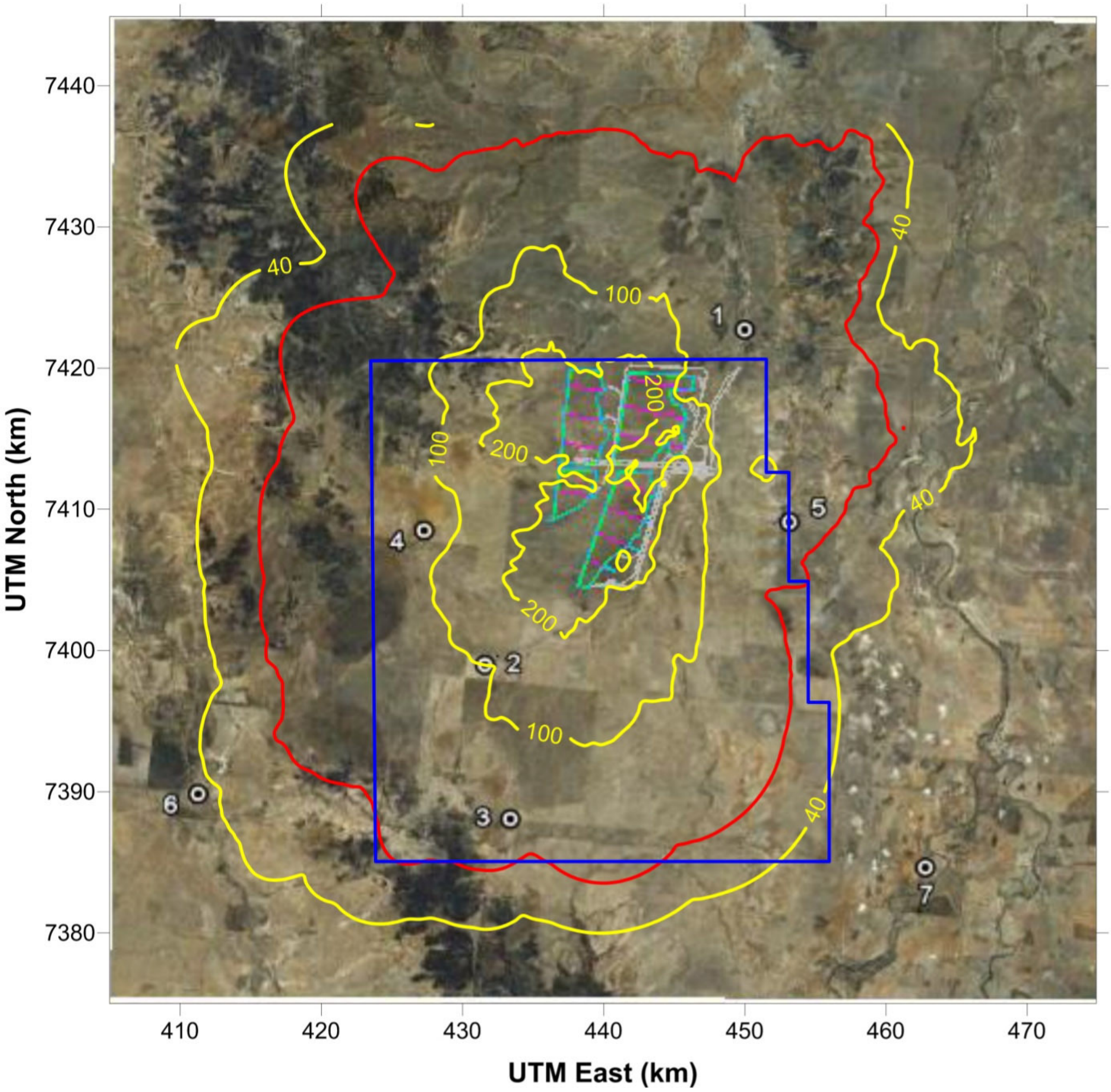
Table 4. Predicted air quality impacts at sensitive receptor near the mine during operation

DUST GROUP	SOURCES	RECEPTOR #1*	RECEPTOR #2**	RECEPTOR #3	RECEPTOR #4	RECEPTOR #5	RECEPTOR #6	RECEPTOR #7	OBJECTIVES
PM_{10} 24-hour Max (μg/m³)	Project	39.6	73.6	35.5	57.9	48.3	12.0	4.2	50, EPP (Air)
	Project + background	65.6	99.6	61.5	83.9	74.3	38.0	30.2	
$PM_{2.5}$ 24-hour Max (μg/m³)	Project	5.0	9.2	4.4	7.2	6.0	1.5	0.5	25, EPP (Air)
	Project + background	10.2	14.4	9.6	12.4	11.2	6.7	5.7	
$PM_{2.5}$ Annual (μg/m³)	Project	0.4	1.4	0.4	2.3	0.1	0.2	0.01	8, EPP (Air)
	Project + background	4.8	5.1	4.8	6.7	4.5	4.6	4.4	
TSP Annual (μg/m³)	Project	3.8	13.6	3.9	20.1	1.1	1.6	0.1	90, EPP (Air)
	Project + background	47.8	57.6	47.9	64.7	45.1	45.6	44.1	
Dust Deposition Monthly Max (g/m²/month)	Project	0.15	0.43	0.16	0.40	0.07	0.04	0.01	2 (recommended guideline)

* Receptor 1 is likely to be relocated or demolished as part of the Hancock Coal mine development

** Receptors 2 and 4 are located within the proposed mine for Waratah Coal and will need to be demolished or relocated

Figure 3. Predicted maximum 24-hour ground-level concentrations of PM_{10} (in µg/m³) – mine + background



10.2.4.5.2 $PM_{2.5}$

The predicted maximum ground-level 24-hour $PM_{2.5}$ concentrations for the mine site and mine site plus background respectively are presented in Figure 4 and Figure 5. The impacts from the mine only are not predicted to exceed the guideline of 25 µg/m³ outside the mine boundary. The impacts, including background concentrations, exceed the guidelines in an area just beyond the northern mine boundary. $PM_{2.5}$ concentrations are not predicted to exceed guideline levels at any of the Receptors.

The ground-level annual average $PM_{2.5}$ concentrations for the mine site and mine site plus background are presented in Figure 6 and Figure 7 respectively. As with the 24-hour $PM_{2.5}$ concentrations, the impacts of the mine plus background concentrations exceed the guidelines of 8 µg/m³ in an area just beyond the northern mine boundary; however, $PM_{2.5}$ concentrations are not expected to exceed the guideline levels at any of the sensitive Receptors.

Figure 4. Predicted maximum 24-hour ground-level concentrations of $PM_{2.5}$ (in µg/m3) – mine only

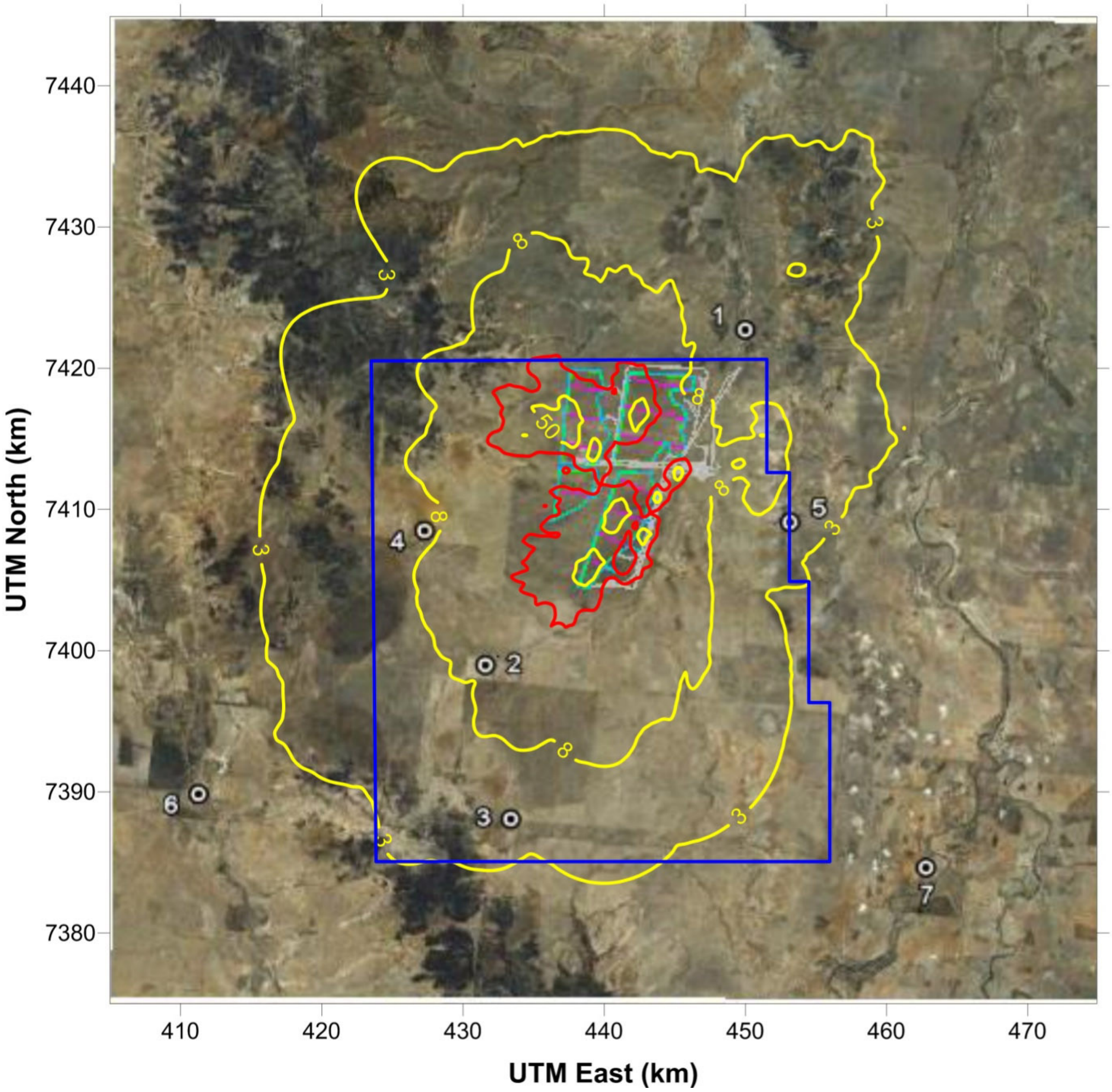


Figure 5. Predicted maximum 24-hour ground-level concentrations of $PM_{2.5}$ (in µg/m³) – mine + background

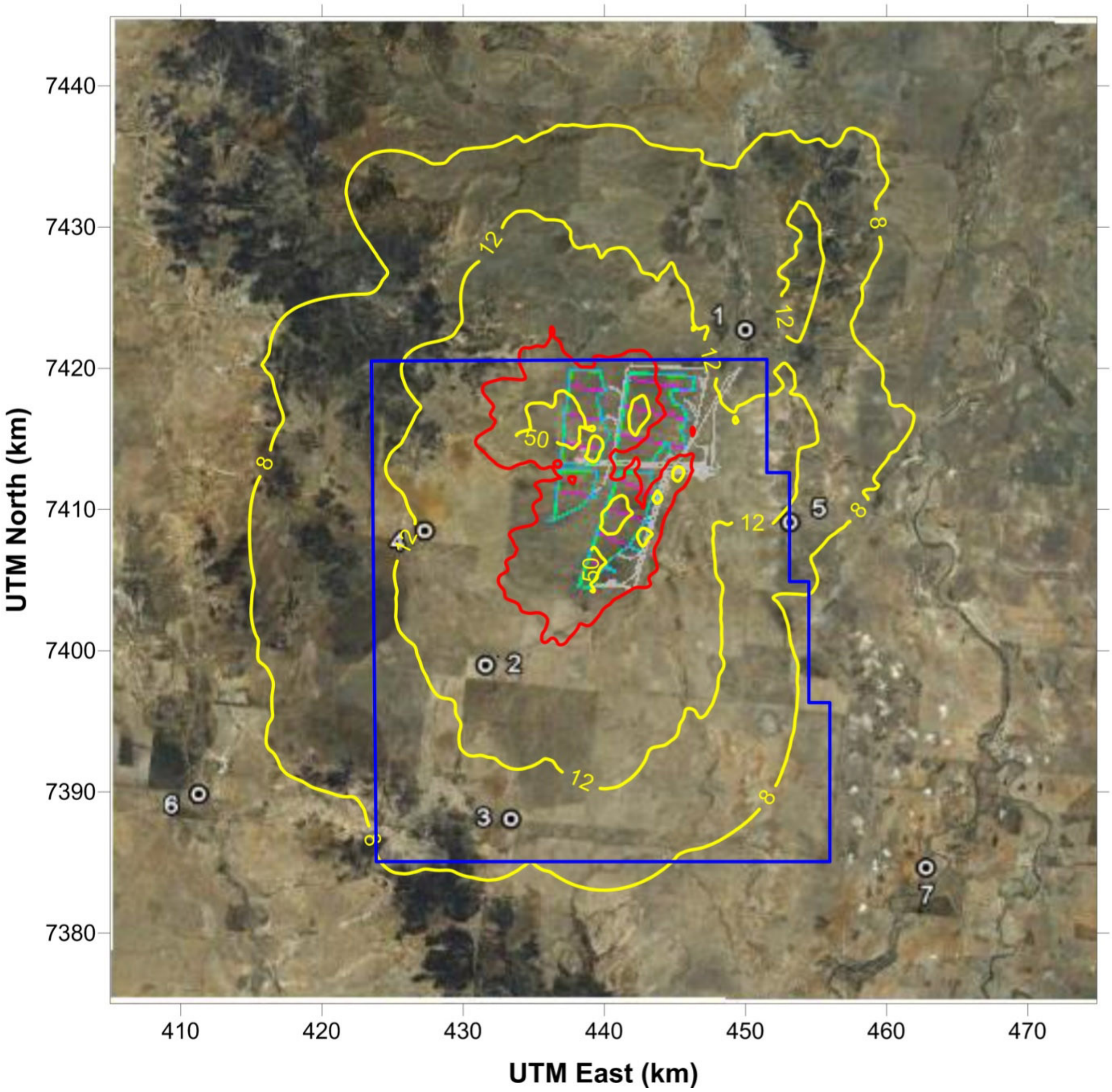


Figure 6. Predicted maximum annual ground-level concentrations of $PM_{2.5}$ (in µg/m³) – mine only

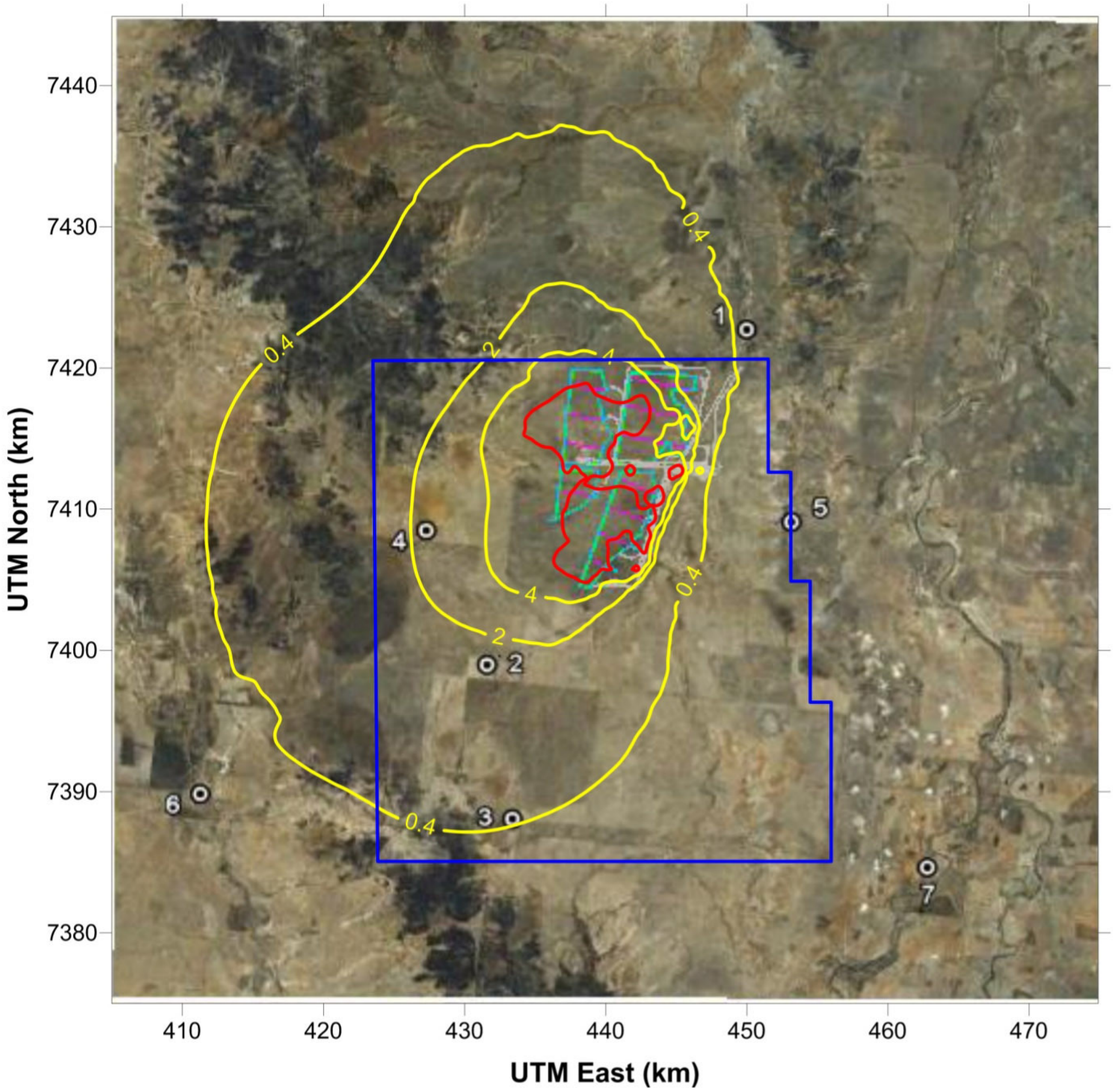
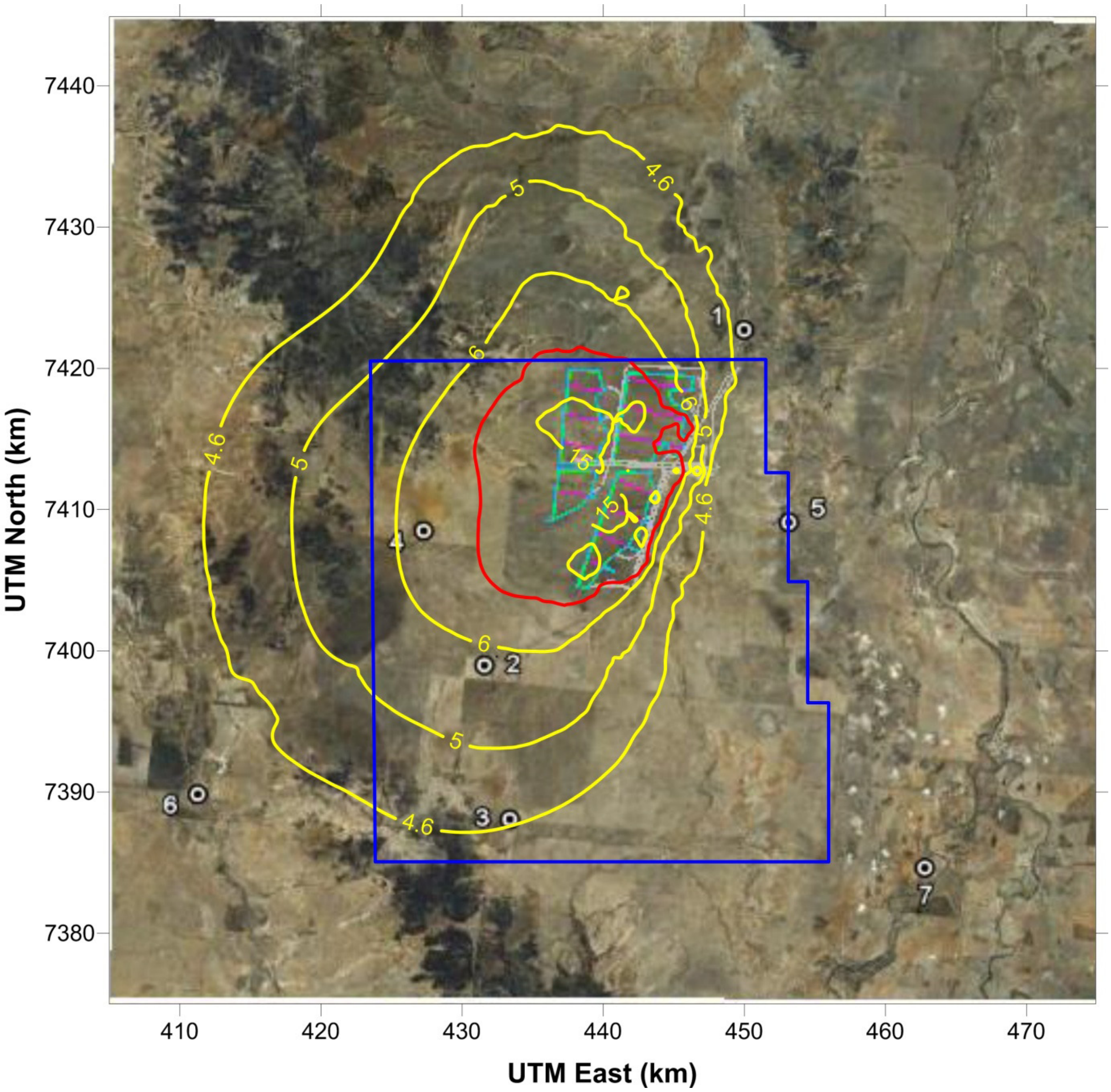


Figure 7. Predicted maximum annual ground-level concentrations of $PM_{2.5}$ (in µg/m³) – mine + background



10.2.4.5.3 TSP

The predicted ground-level annual TSP concentrations for the mine site and mine site plus background are presented in Figure 8 and Figure 9 respectively. TSP concentrations, including background, are not predicted to exceed the guideline of 90 µg/m³ outside the mine boundary or at any of the sensitive receptors.

Figure 8. Predicted maximum annual ground-level concentrations of TSP (in µg/m³) – mine only

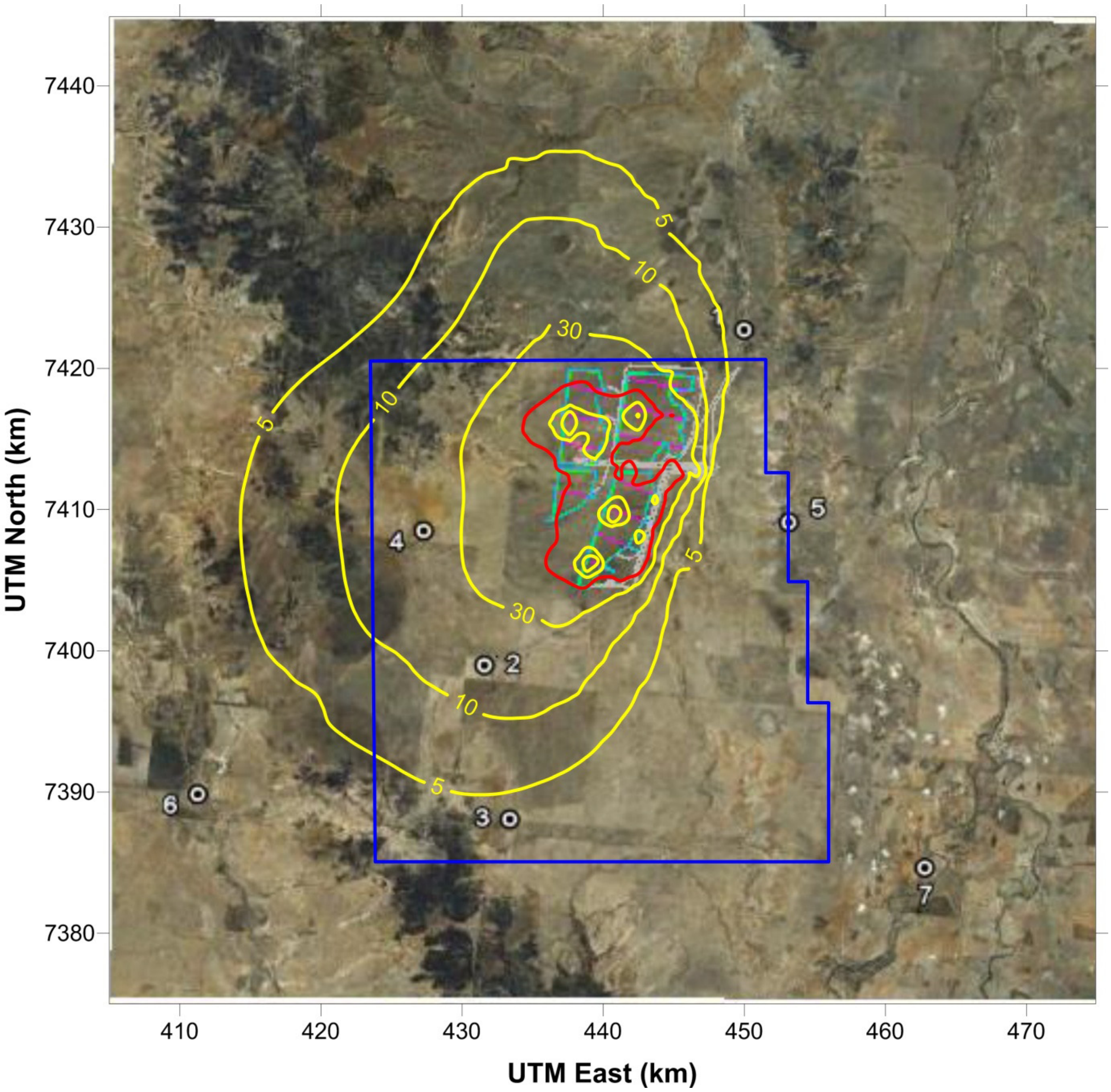
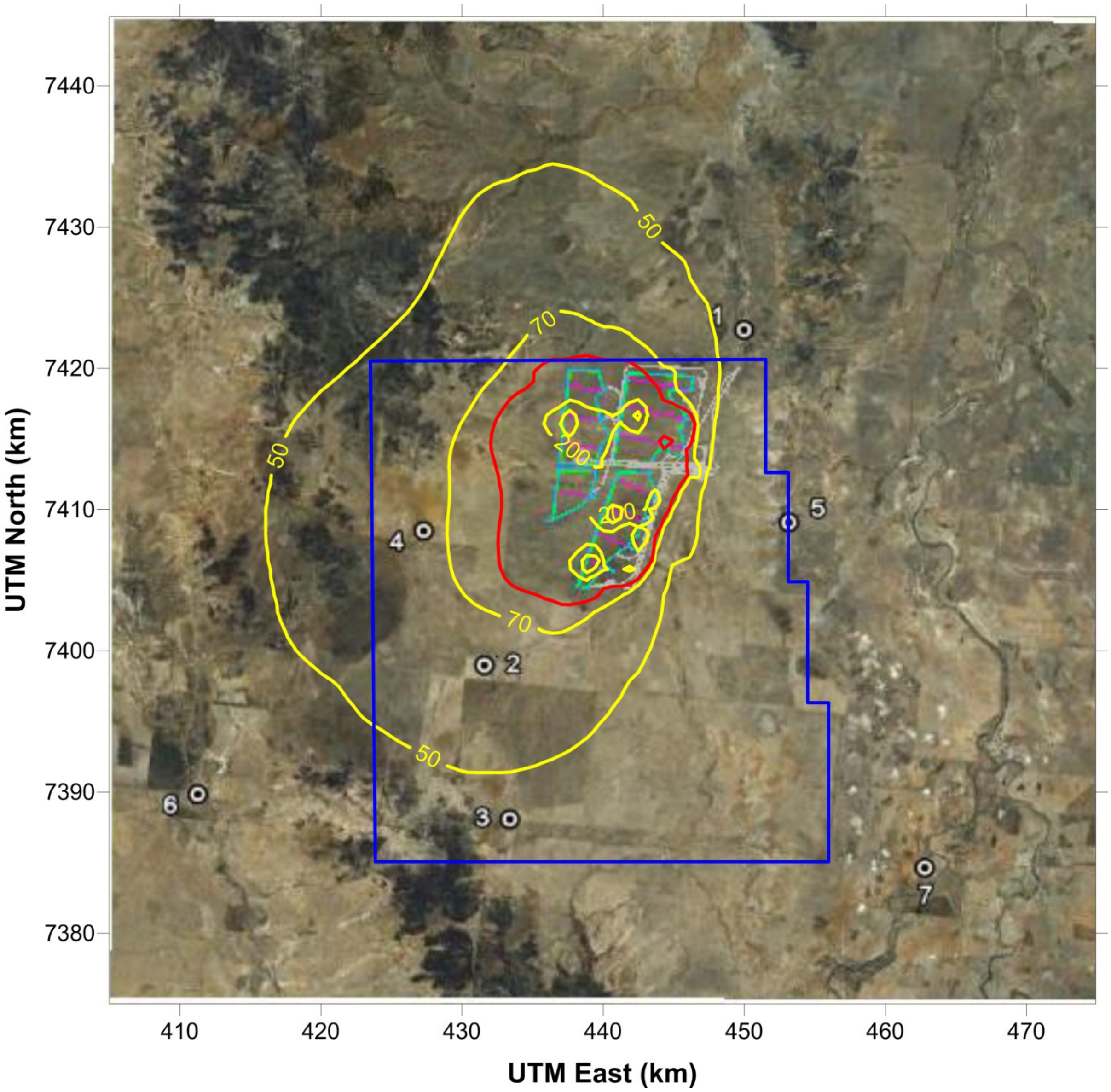


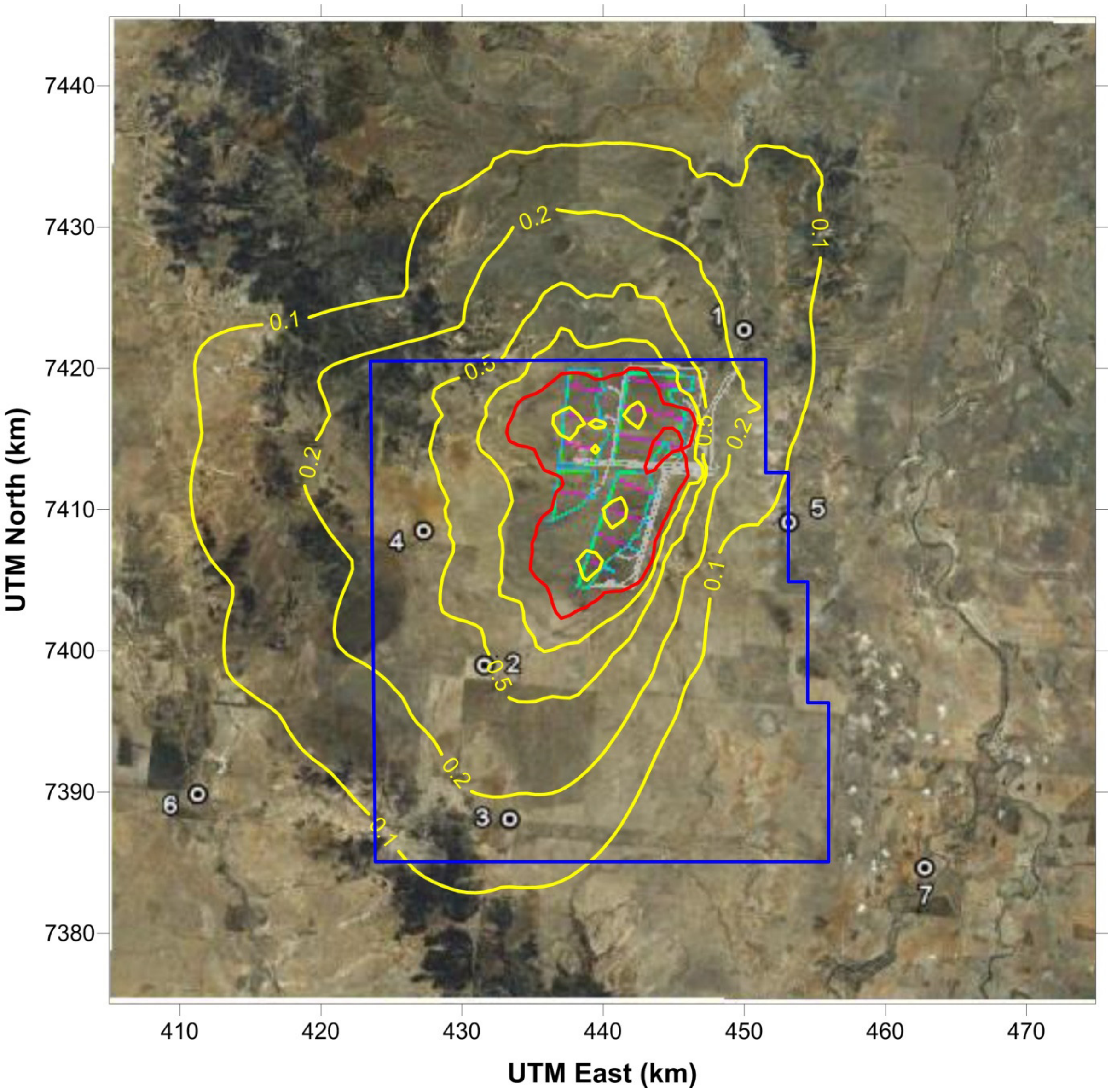
Figure 9. Predicted maximum annual ground-level concentrations of TSP (in µg/m³) – mine + background



10.2.4.5.4 Dust Deposition

The extent of dust deposition from the mine site is presented in Figure 10. Dust deposition rates are not predicted to exceed the incremental guideline level of 2 g/m²/month outside the mine boundary, nor at any of the Receptors.

Figure 10. Predicted maximum monthly dust deposition (in g/m²/month) – mine only



10.2.5 AIR QUALITY MITIGATION MEASURES

Mitigation and management measures will be developed and implemented to meet air quality objectives and guidelines during both construction and operational phase through an EMP.

10.2.5.1 Construction Activities

The site specific mitigation and field environmental measures to reduce emissions during the construction phase of the mine will include:

- coordinating construction schedules to minimise dust emissions during peak times of the construction phase;
- implementing water spray on unsealed roads, keeping vehicles to well-defined roads, and restriction on vehicle speed especially on unsealed haul roads to reduce dust generation;
- minimising vehicle distances between construction sites to spoil stockpiles, and treating or covering stockpiled materials to reduce wind erosion;
- ensuring all vehicles and machinery are regularly cleaned to prevent greater dust emissions;
- designing and developing roads to route away from any sensitive areas;
- minimising topsoil and vegetation removal, and revegetating disturbed areas as soon as possible; and
- monitoring dust emissions from the mine and other emission sources, and ramping down mine construction activities in the instance of high dust events.

10.2.5.2 Operational Activities

Mitigation and management measures to meet the air quality objectives during operation of the mine site are:

- considering a meteorological monitor to be installed at the project site to provide direct measure of weather conditions;
- a dust monitoring program will be carefully designed to quantify actual dust impacts, and will be used as a dust management tool throughout the operational phase of the project;
- implementing dust suppression measures such as watering roads and water sprays on stockpiles;
- implementing a progressive rehabilitation program to minimise the amount of disturbed areas and exposed mine and stockpile surfaces;
- ongoing vegetation of stripped areas in the open cut mine pits;
- utilising fully enclosed conveyor systems and underground loading during coal preparation on site; and
- implementing a wet process for coal handling to minimise dust emissions.

Further recommendations for ongoing management will be considered during the planning phase of the project.

10.2.5.3 Decommissioning Activities

Mitigation and management measures to meet the air quality objectives during decommissioning phase of the mine site are likely to include:

- further rehabilitation for disturbed sites after closure to minimise wind erosion; and
- revegetation of areas with ongoing monitoring and maintenance programs; and
- monitoring of the site rehabilitation success against desired final landuse objectives.

10.2.6 CONCLUSION

The impacts to air quality from the activities at the mine have been assessed against Queensland EPP ground-level concentration guidelines for TSP, PM_{10} and $PM_{2.5}$. Dust deposition rates have also been assessed against relevant guidelines.

Air dispersion modelling has been used to predict ground-level concentrations of pollutants and rates of dust deposition, based on 2008 meteorological data for the mine region and estimated emission rates for the mine's activities. The USEPA regulatory dispersion models, CALMET / CALPUFF were selected, driven by TAPM generated meteorological data.

Emission rates were estimated using methodologies sourced from the NPI and USEPA. To assess worst case conditions, emissions were estimated for year 19 of the mine's life, as this represents peak emissions. The major sources of emissions were waste handling by the draglines, the transport of waste to the out of pit waste dumps, hauling of coal and wind erosion of exposed areas.

Results from the air dispersion modelling show that emission from only the mining activities exceed the relevant guidelines for TSP, PM_{10}, $PM_{2.5}$ and dust deposition; however, only for PM_{10} does the area of exceedance extend beyond the boundary of the mine. When background concentrations (based on 70th percentile recorded PM_{10} concentrations at West Mackay) are included, the area of exceedance for all substances increases.

For TSP and dust deposition, it is not predicted that guidelines will be exceeded beyond the boundary of the mine. Annual and 24-hour $PM_{2.5}$ concentrations from only the mining activities are not predicted to exceed guidelines beyond the boundary of the mine; however, when background concentrations are included it is predicted that guideline levels will be exceeded just beyond the northern mine boundary; however, this does not affect any sensitive receptors.

PM_{10} concentrations are expected to exceed the 24-hour guidelines beyond the mine boundary for both the mine only and the mine plus background. PM_{10} concentrations are also expected to exceed guidelines at five sensitive receptors identified in the region of the mine. Two of these (Receptors 2 and 4) are within the mine boundary, while one (Receptor 1) is likely located within the boundary of another proposed coal mine. However, while these receptors are inhabited, it can be expected that any exceedance of the EPP (Air) guidelines will impact human health and wellbeing.

No exceedance of guidelines is predicted for the nearby townships of Jericho and Alpha.

The proposed mitigation measures will ensure air pollutants across both construction and operational phases of the project will not diminish or degrade the ambient air quality to the extent that it will adversely impact human health and ecological health of terrestrial flora and fauna.

Waratah will be able to sustain mining activities in accordance with its commitment principles through the introduction and continuous review of dust management and mitigation systems during the construction and operational phases of the mine. The commitment principles are detailed in Section 2.2.

10.3 GREENHOUSE GASES

10.3.1 LEGISLATIVE FRAMEWORK

Greenhouse gases (GHG) emissions and associated climate change impacts are a global issue. There are various relevant international and national legislative frameworks, with some being indirect to this project, and others being mandatory.

The Kyoto Protocol requires developed countries to meet national targets for greenhouse gas emissions over a five year period between 2008 and 2012. Australia has ratified Kyoto Protocol. Under the protocol, Australia is legally required to take domestic action to reduce greenhouse emissions. Australia's national target is to achieve an average of 108% of 1990 emissions for the five years of the first commitment period (2008-2012). Any new sources that begin emitting during this period will contribute to Australia's Kyoto target. As Kyoto Protocol is applied on a country level, it is an indirect legislation to this project.

National Greenhouse and Energy Reporting Act 2007 (NGER Act) establishes mandatory corporate and facility thresholds for GHG emissions reporting, as listed in Table 5. Based on the findings of this study, annual greenhouse gas emissions from the mine will exceed the NGERS corporate and facility thresholds. Therefore, Waratah Coal will be required to report greenhouse gas emissions and energy consumption from the overall project.

Table 5. NGER reporting thresholds

YEAR	CORPORATE THRESHOLD		FACILITY THRESHOLD	
	GHG EMISSIONS (KT CO2-E)	ENERGY USAGE (TJ)	GHG EMISSIONS (KT CO2-E)	ENERGY USAGE (TJ)
2008-2009	125	500	25	100
2009-2010	87.5	350		
2010-2011	50	200		

The Energy Efficiency Opportunities (EEO) Program is designed to improve the energy efficiency of large businesses. Participation is mandatory for corporations that use more than 0.5 PJ of energy. Participating corporations must assess their energy efficiency, and energy efficiency opportunities with a payback period less than four years, and publicly report the results. Based on expected electricity and diesel usage, the mine will exceed the EEO participation threshold of 0.5 PJ (refer to Volume 5, Appendix 19).

Other proposed legislations that may impact this project include the proposed national Carbon Pollution and Reduction Scheme (CPRS), Direct Action Plan and Carbon Tax. There are a lot of uncertainties at this stage on which will become the law eventually.

10.3.2 EMISSION INVENTORY

10.3.2.1 Assessment Methods

Greenhouse gas emissions have been estimated based upon the methods outlined in the following documents:

- *Greenhouse Gas Protocol,* by the World Resources Institute / World Business Council for Sustainable Development;
- *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines* (NGERS Technical Guidelines, 2008), by the Australian Government Department of Climate Change (DCC); and
- *National Greenhouse Accounts Factors* (NGA Factors, 2009), by DCC.

The *Greenhouse Gas Protocol* establishes an international standard for accounting and reporting of greenhouse gas emissions. It defines three 'scopes' of emissions: scope 1, scope 2 and scope 3, for greenhouse gas accounting and reporting purposes.

The scope 1 emissions are direct GHG emissions that occur from sources that are owned or controlled by the reporting entity. With respect to the project, the major sources of scope 1 emissions are fugitive methane emissions from coal mining and the combustion of fossil fuels for mining equipment. The project will only have direct control of scope 1 emissions, which include activities under the operation control of Waratah Coal.

The scope 2 emissions are a category of indirect emissions that accounts for greenhouse gas emissions from the generation of purchased energy products (principally, electricity, steam / heat and reduction materials used for smelting) by the entity. Scope 2 in relation to the project covers purchased electricity.

Scope 3 emissions are defined as those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Scope 3 emissions associated with the project have not been estimated, in accordance with the requirements of Section 3.6: Greenhouse gas abatement and emissions of the ToR.

As project-specific activity data were not available for the construction (or ramp up) stage of the project, the construction stages of other projects of similar type and scale were assessed in order to approximate the project's construction emissions. This assessment determined that for similar coal mine projects, the typical construction stage lasts about two years, with the first year having about 30% of the average operational emissions, and the second year having about 65% of the average operational emissions.

To estimate scope 1 and scope 2 emissions during operation of the mine, project-specific activity data were used. The primary references for emission factors are the NGA Factors (2009) and the NGERS Technical Guidelines (2009), using the most recent versions at the time of the assessment.

10.3.2.2 GHG Emission Sources

This greenhouse gas assessment considers the scope 1 and scope 2 greenhouse gas emissions associated with the project during construction (or ramp up) and operation, as provided in Table 6.

Emissions during construction of the mine will mainly consist of electricity and fuel combustion. In addition, greenhouse emissions associated with clearing of vegetation and changes of land use during the construction of the mine have been considered in this assessment. However, current revegetation commitments, as outlined in the project's EMP, will replace the carbon that is stored in vegetation and soils and disturbed during construction, resulting in approximately zero net emissions over the life of the project. Ongoing revegetation of the open cut mine pits will occur during the operation of the mine, not just at the end of mine life.

Table 6. Greenhouse gas emission sources during mine construction and operations

PROJECT SECTION	SCOPE 1 EMISSIONS	SCOPE 2 EMISSIONS
Construction / Ramp up	**Fuel consumption:** • Mining equipment • Auxiliary vehicles • Transport	Electricity
	Fugitive methane release from mined coal	
	Blasting	
	Spontaneous combustion of mined coal	
	Slow oxidation from mined coal	
	Wastewater treatment	
Operation	**Fuel consumption:** Mining equipment Auxiliary vehicles Transport	Electricity
	Fugitive methane release from mined coal	
	Blasting	
	Spontaneous combustion of mined coal	
	Slow oxidation from mined coal	
	Wastewater treatment	

10.3.2.3 Estimated GHG Emissions

A summary of the projected emissions for the construction/ramp-up stage of the project is presented in Table 7.

Scope 1 and 2 greenhouse gas emissions from the construction/ramp-up stage of the project are estimated to be approximately 15,378 kt CO_2-e, with scope 1 emissions contributing around 92.5% of total emissions and scope 2 contributing around 7.5%.

The bulk of the scope 1 construction emissions are from clearing vegetation (92.6%). The majority of total scope 1 emissions are CO_2 emissions, with a small amount of CH_4 emissions and a negligible amount of N_2O emissions. Note current revegetation commitments, as outlined in the project's EMP, will approximately offset clearing emissions over the life of the Project.

A summary of the projected annual emissions for the mine during normal operation is presented in Table 8.

Scope 1 and 2 greenhouse gas emissions for the mine during normal operation are estimated to be approximately 2,300 kt CO_2-e per annum, with scope 1 and 2 emissions contributing approximately 48% and 52% of total emissions respectively. These figures were based on maximum projected coal production of 56 Mt ROM per annum and 40 Mt saleable coal per annum.

The bulk of the annual scope 1 greenhouse gas emissions are associated with fugitive methane emissions released during open cut mining (31%) and during underground mines (26%). The remainder is predominately associated with diesel consumption for mining equipment (26%). The majority of total scope 1 emissions are CO_2 emissions and CH_4 emissions, with negligible amount of N_2O emissions.

Table 7. Construction GHG emission summary

SOURCE	GREENHOUSE GAS	EMISSION FACTOR	EF UNITS	CONSTRUCTION EMISSIONS YEAR 1	CONSTRUCTION EMISSIONS YEAR 2	TOTAL CONSTRUCTION EMISSIONS	UNITS
Auxiliary vehicles	CO_2	69.2	kg CO_2-e/GJ	5,988	12,556	18,545	t CO_2-e
	CH_4	0.2	kg CO_2-e/GJ	17	36	54	t CO_2-e
	N_2O	0.5	kg CO_2-e/GJ	43	91	134	t CO_2-e
	Total CO_2-e	69.9	kg CO_2-e/GJ	6,049	12,683	18,732	t CO_2-e
			Percentage of total scope 1 emissions			0.13%	
Blasting	CO_2	0.18	t CO_2-e/t	2,595	5,441	8,035	t CO_2-e
	Total CO_2-e	0.18	t CO_2-e/t	2,595	5,441	8,035	t CO_2-e
			Percentage of total scope 1 emissions			0.06%	
Fuel consumption – mining equipment	CO_2	69.2	kg CO_2-e/GJ	87,843	184,186	272,029	t CO_2-e
	CH_4	0.2	kg CO_2-e/GJ	254	532	786	t CO_2-e
	N_2O	0.5	kg CO_2-e/GJ	635	1,331	1,966	t CO_2-e
	Total CO_2-e	69.9	kg CO_2-e/GJ	88,731	186,049	274,781	t CO_2-e
			Percentage of total scope 1 emissions			1.93%	
Fugitive methane from open cut mines	CH_4	0.017	t CO_2-e/t ROM	105,400	221,000	326,400	t CO_2-e
	total CO_2-e	0.017	t CO_2-e/t ROM	105,400	221,000	326,400	t CO_2-e
			Percentage of total scope 1 emissions			2.30%	
Fugitive methane from underground mines	CH_4	0.008	t CO_2-e/t ROM	89,280	187,200	276,480	t CO_2-e
	Total CO_2-e	0.008	t CO_2-e/t ROM	89,280	187,200	276,480	t CO_2-e
			Percentage of total scope 1 emissions			1.94%	
Plane	Total CO_2-e	0.00032	t CO_2-e/km/pass	7,332	15,374	22,706	t CO_2-e
			Percentage of total scope 1 emissions			0.16%	

SOURCE	GREENHOUSE GAS	EMISSION FACTOR	EF UNITS	CONSTRUCTION EMISSIONS YEAR 1	CONSTRUCTION EMISSIONS YEAR 2	TOTAL CONSTRUCTION EMISSIONS	UNITS
Slow oxidation	CO_2	0.000125	t CO_2-e/t coal	1,550	3,250	4,800	t CO_2-e
	Total CO_2-e	0.000125	t CO_2-e/t coal	1,550	3,250	4,800	t CO_2-e
		Percentage of total scope 1 emissions				0.03%	
Spontaneous combustion	CO_2	0.003	t CO_2-e/t coal	37,200	78,000	115,200	t CO_2-e
	Total CO_2-e	0.003	t CO_2-e/t coal	37,200	78,000	115,200	t CO_2-e
		Percentage of total scope 1 emissions				0.81%	
Transport vehicles	CO_2	69.2	kg CO_2-e/GJ	1,623	3,403	5,026	t CO_2
	CH_4	0.2	kg CO_2-e/GJ	5	10	15	t CO_2
	N_2O	0.5	kg CO_2-e/GJ	12	25	36	t CO_2
	Total CO_2-e	69.9	kg CO_2-e/GJ	1,639	3,437	5,077	t CO_2
		Percentage of total scope 1 emissions				0.04%	
Land Clearing	CO_2	165	t CO_2-e/ha	4,251,281	8,913,977	13,165,258	t CO_2-e
		Percentage of total scope 1 emissions				92.60%	
Scope 2 – mine electricity consumption	Scope 2 CO_2-e	0.89	t CO_2-e/MWh	374,617	785,487	1,160,104	t CO_2-e
Total CO_2				4,388,080	9,200,813	13,588,892	t CO_2
Total CH_4				194,956	408,778	603,734	t CO_2
Total N_2O				690	1,446	2,136	t CO_2
Total Scope 1 CO_2-e				4,591,058	9,626,411	14,217,468	t CO_2
Total Scope 2 CO_2-e				374,617	785,487	1,160,104	t CO_2
TOTAL GREENHOUSE GAS EMISSIONS				**4,965,675**	**10,411,898**	**15,377,573**	**t CO_2-e**

Table 8. Annual GHG emission summary, projected for the operation of the mine

SOURCE	ACTIVITY DATA	UNITS	GREENHOUSE GAS	EMISSION FACTOR	EF UNITS	EMISSIONS	UNITS
Auxiliary vehicles	279,155	GJ fuel/a	CO_2	69.2	kg CO_2-e/GJ	19,318	t CO_2-e/a
			CH_4	0.2	kg CO_2-e/GJ	56	t CO_2-e/a
			N_2O	0.5	kg CO_2-e/GJ	140	t CO_2-e/a
			Total CO_2-e	69.9	kg CO_2-e/GJ	19,513	t CO_2-e/a
			Percentage of total scope 1 emissions			1.78%	
Blasting	46,500	t explosive/a	CO_2	0.18	t CO_2-e/t	8,370	t CO_2-e/a
			CH_4	–		–	
			N_2O	–		–	
			Total CO_2-e	0.18	t CO_2-e/t	8,370	t CO_2-e/a
			Percentage of total scope 1 emissions			0.76%	
Fuel consumption – mining equipment	4,094,847	GJ fuel/a	CO_2	69.2	kg CO_2-e/GJ	283,363	t CO_2-e/a
			CH_4	0.2	kg CO_2-e/GJ	819	t CO_2-e/a
			N_2O	0.5	kg CO_2-e/GJ	2,047	t CO_2-e/a
			Total CO_2-e	69.9	kg CO_2-e/GJ	286,230	t CO_2-e/a
			Percentage of total scope 1 emissions			26.11%	
Fugitive methane from open cut mines	20,000,000	t ROM/a	CO_2	–		–	
			CH_4	0.017	t CO_2-e/t ROM	340,000	t CO_2-e/a
			N_2O	–		–	
			total CO_2-e	0.017	t CO_2-e/t ROM	340,000	t CO_2-e/a
			Percentage of total scope 1 emissions			31.02%	
Fugitive methane from underground mines	36,000,000	t coal/a	CO_2	–			t CO_2-e/a
			CH_4	0.008	t CO_2-e/t ROM	288,000	t CO_2-e/a
			N_2O	–		–	
			Total CO_2-e	0.008	t CO_2-e/t ROM	288,000	t CO_2-e/a
			Percentage of total scope 1 emissions			26.28%	

SOURCE	ACTIVITY DATA	UNITS	GREENHOUSE GAS	EMISSION FACTOR	EF UNITS	EMISSIONS	UNITS
Plane	73,000,000	pass-km/a	CO_2	–		–	
			CH_4	–		–	
			N_2O	–		–	
			Total CO_2-e	0.00032	t CO_2-e/km/pass	23,652	t CO_2-e/a
			Percentage of total scope 1 emissions			2.16%	
Slow oxidation	40,000,000	t coal/a	CO_2	0.000125	t CO_2-e/t coal	5,000	t CO_2-e/a
			CH4	–		–	
			N_2O	–		–	
			Total CO_2-e	0.000125	t CO_2-e/t coal	5,000	t CO_2-e/a
			Percentage of total scope 1 emissions			0.46%	
Spontaneous combustion	40,000,000	t coal/a	CO_2	0.003	t CO_2-e/t coal	120,000	t CO_2-e/a
			CH_4	–		–	
			N_2O	–		–	
			Total CO_2-e	0.003	t CO_2-e/t coal	120,000	t CO_2-e/a
			Percentage of total scope 1 emissions			10.95%	
Transport vehicles	75,654	GJ fuel/a	CO_2	69.2	kg CO_2-e/GJ	5,235	t CO_2-e/a
			CH_4	0.2	kg CO_2-e/GJ	15	t CO_2-e/a
			N_2O	0.5	kg CO_2-e/GJ	38	t CO_2-e/a
			Total CO_2-e	69.9	kg CO_2-e/GJ	5,288	t CO_2-e/a
			Percentage of total scope 1 emissions			0.48%	
Scope 2 – mine electricity consumption	1,357,800	MWh/a	Scope 2 CO_2-e	0.89	t CO_2-e/MWh	1,208,442	t CO_2-e/a
					Total CO_2	441,286	t CO_2-e/a
					Total CH_4	628,890	t CO_2-e/a
					Total N_2O	2,225	t CO_2-e/a
					Total Scope 1 CO_2-e	1,096,053	t CO_2-e/a
					Total Scope 2 CO_2-e	1,208,442	t CO_2-e/a
					TOTAL GREENHOUSE GAS EMISSIONS	**2,304,495**	t CO_2-e/a

10.3.3 GHG ABATEMENT

10.3.3.1 Benchmarking

The energy and greenhouse gas emissions intensity of the mine have been benchmarked against existing Australian coal mines, using the methodology employed by the Australian Geological Survey Organisation (Deslandes, 1999). A full breakdown of the energy and greenhouse gas emissions intensities is provided in Volume 5, Appendix 19 – Appendix E.

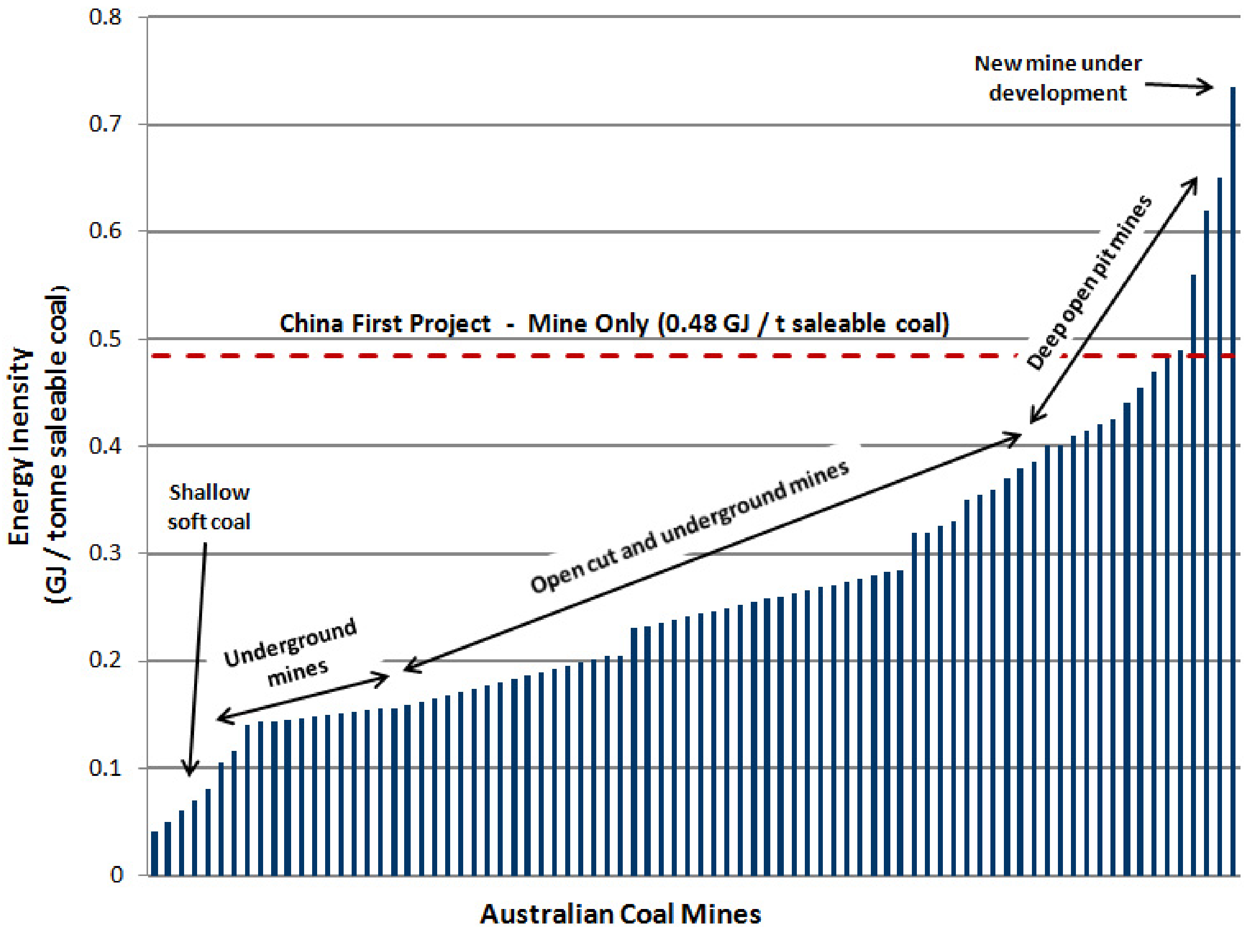
10.3.3.1.1 Energy Intensity

The estimated energy intensity of the mine is 0.48 GJ/t saleable coal, which excludes emissions from the railway and the coal terminal. This value has been compared with the energy intensity of existing Australian coal mines, as presented in Figure 11. As can be seen, the energy intensity of the mine is at the high end in comparison with existing mines. This may be due to electricity consumption estimates being based on preliminary design estimates which are typically conservative.

10.3.3.1.2 Greenhouse Gas Emissions Intensity

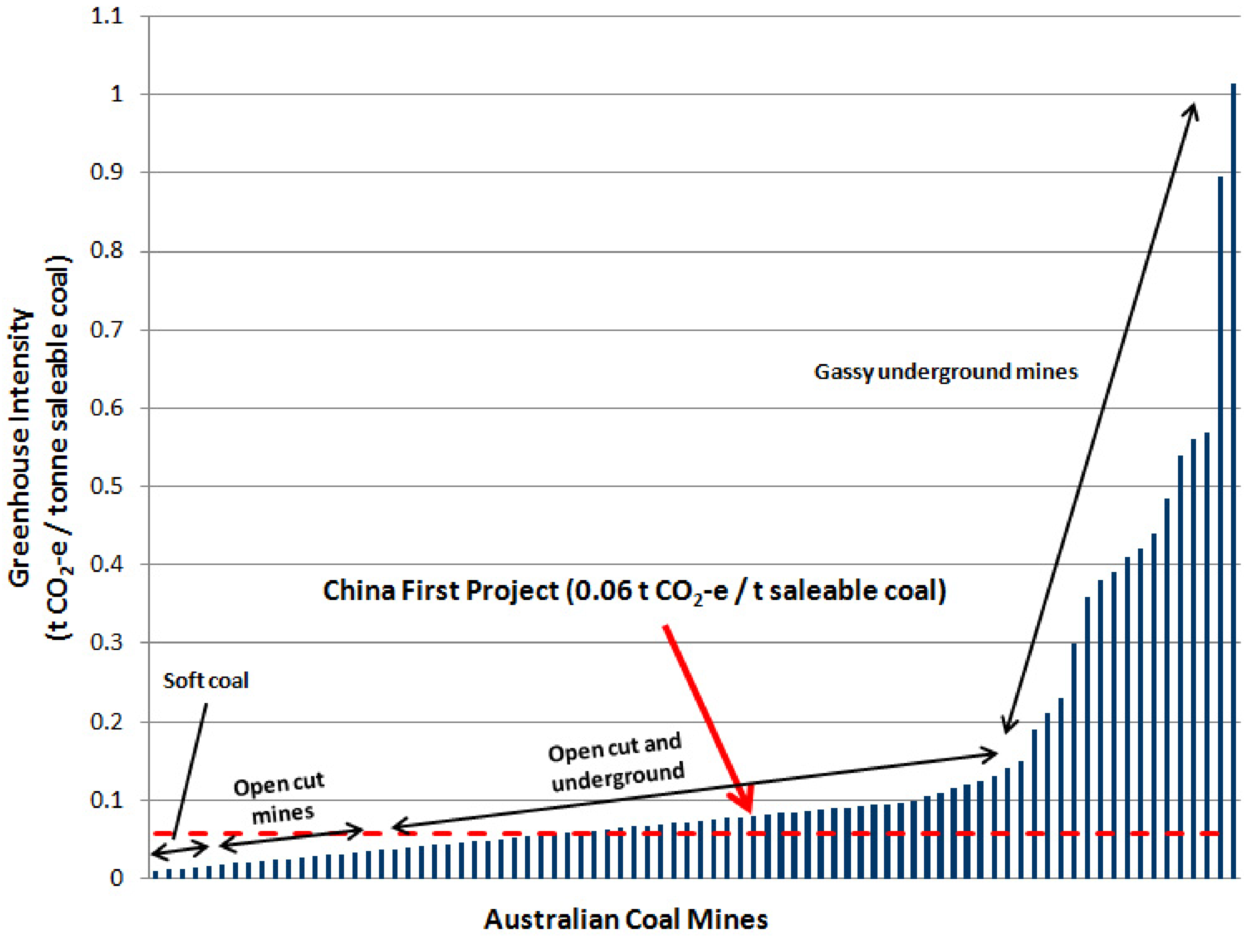
The estimated greenhouse gas emissions intensity of the mine is approximately 0.06 t CO_2-e/t saleable coal, excluding emissions associated with the railway and coal terminal. This value has been compared with the existing Australian coal mines (Deslandes, 1999), as presented Figure 12. The emissions intensity of the mine is equivalent to existing mines that have open cut and underground operations, and is significantly less than "gassy underground mines".

Figure 11. Energy Intensity of the mine in Comparison with other Australian Coal Mines



Source: Graph reproduced from Figure 3: Typical Benchmarking Result for Energy Intensity, (Deslandes, 1999)
Note: Includes electricity and diesel usage for the mine only

Figure 12. Greenhouse gas intensity of the mine in comparison with other Australian Coal Mines



Source: Graph reproduced from Figure 17: Typical Benchmarking Result for Greenhouse Intensity, (Deslandes, 1999)

10.3.3.2 Abatement Measures

Greenhouse gas emissions from the mine can be most effectively managed through:

- the identification of major sources of greenhouse gas emissions through ongoing measurement, monitoring;
- improvements in energy efficiency;
- switching to less emissions intensive fuels; and
- offsetting emissions.

In addition, opportunities to convert any methane in the ventilation air to carbon dioxide should be investigated; however, based on currently available information, it is not expected that the underground mines will be significant methane emitters.

10.3.3.2.1 Emissions Measurement

Ongoing GHG emissions measurement is the first step towards effective mitigation. Measuring emissions indicates which sources have the greatest potential for emission reductions.

Annual reporting of greenhouse gas emissions from the project will be mandatory under NGERS. Emissions reportable under NGERS are at high level, and will be attributed to total fuel and electricity consumption and total fugitive methane emissions.

NGERS reporting will likely underpin any national greenhouse gas emissions strategies. Annual emissions reported for NGERS will show Waratah Coal's liability under the CPRS, and indicate whether Waratah Coal will be financially penalised or rewarded under the Liberal Party's *Direct Action Plan*.

To target specific emission sources, the *Australian Coal Association Research Program* (ACARP) recommends that emissions be measured at the activity or equipment type level (ACARP, 2001). This includes setting 'key emissions indicators' (KEIs), to compare the emissions intensity of similar activities. KEIs recommended to be monitored for the mine include:

- t CO_2-e / tonne of coal moved - for material movement equipment (draglines, haul trucks, bulldozers etc); and
- t CO_2-e / tonne of ROM coal processed – for processing facilities.

Based on the results of monitoring KEIs, energy efficiency improvements can be made to specific equipment or process areas to achieve the maximum reductions in greenhouse gas emissions.

10.3.3.2.2 Energy Efficiency

Ongoing improvements in energy efficiency will achieve the greatest emissions reductions for non-gassy coal mines (ACARP, 2001). It is expected that the Waratah Coal will be a participant in the EEO Program, and will be required to conduct ongoing assessments of energy efficiency, and energy efficiency opportunities.

Areas where energy efficiency improvements can be made, as identified by ACARP, and their priority in terms of potential greenhouse gas emission reductions can be seen in Table 9.

10.3.3.2.3 Switching to Less Emissions Intensive Fuels

Scope 2 emissions associated with electricity consumption are the largest source of total scope 1 and 2 emissions for the project. It is expected that the emission intensity of the Queensland electricity grid will decrease, and that the associated emissions for the project will decrease accordingly. The decrease will be due to:

- the *Queensland Gas Scheme* – which prescribes that Queensland electricity retailers source a percentage (currently 13% with the option to increase to 18%) of their electricity from gas-fired generators; and
- the *Mandatory Renewable Energy Target* – which is designed to deliver 20% renewable energy in Australia's electricity supply by 2020.

Table 9. Energy efficiency strategies

CLASSIFICATION	DETAILS	PRIORITY	
		OPEN CUT	UNDERGROUND
Energy management	Annual energy audits	High	High
	Implementation of an energy management program	High	High
Energy projects	Implement a computerised energy management system to measure and monitor energy usage	High	High
	Bathhouse hot water systems with high efficiency, such as using gas heating as opposed to electric	High	High
	High efficiency electric motors for all equipment	High	High
	Ventilation systems – use air compressors with high efficiency (e.g. with variable speed drives)	N/A	High
	Minimising diesel fuel usage by haulage vehicles by minimising haul distances and optimising haul schedule to reduce idling time	Medium	Medium
	Minimise requirement of lighting systems	Medium	Medium
	Optimisation of face shovel and dragline performance to minimise rehandle	High	N/A
Mining process	Blast management to ensure that rehandle is minimised	High	Low

Source: Adapted from Table 11: Energy efficiency strategies for the coal mining industry, ACARP, 2001.

Scope 2 emissions can also be reduced by generating a proportion of the mine's electricity requirements onsite, by utilising the following:

- solar cells, particularly for mine lighting and administration buildings; and
- waste streams, such as ventilation air.

In addition, replacing diesel with less emissions-intensive fuels will be investigated, such as:

- using biodiesel in mining and transport vehicles; and
- using gas-based fuels in some vehicles.

10.3.3.2.4 Fugitive Methane Mitigation

Destruction of methane vented from the underground mines, by converting it to carbon dioxide will reduce underground fugitive emissions by a factor of 21 (as the global warming potential of methane is 21 times greater than carbon dioxide).

Methane mitigation is identified by ACARP as having the greatest potential for greenhouse gas emission reductions for gassy underground mines. Based on gas composition sampling it is not expected that the underground mines will produce significant methane emissions. Determining whether the destruction of methane will be a beneficial emissions mitigation method will be best assessed when the underground mines are operational, and actual methane emission rates are known.

10.3.3.2.5 Third Party Offsets

The project can offset its emissions by investing in third party projects that reduce greenhouse gas emissions below a demonstrated baseline. Examples of projects that reduce emissions are:

- forestry projects that reduce emissions by:
  - sequestering carbon through reforestation or afforestation;
  - prevent deforestation;
- increase the carbon contained in soils through soil management;
- renewable energy, such as wind farms, geothermal or solar; and
- destruction of methane produced from landfills and wastewater treatment plants.

10.4 CONCLUSION

Greenhouse gas emission sources from the project have been identified for the mine. Annual greenhouse gas emissions have been estimated using applicable and recognised methodologies for reporting. Emission estimates have been based on the mine operating at full capacity, where 56 Mtpa ROM and 40 Mtpa saleable coal is produced from the mine per annum.

Construction of the mine is projected to result in emissions of 15,4 Mt CO_2-e in total, with scope 1 emissions contributing around 92.5% of total emissions and scope 2 contributing around 7.5%. The majority of scope 1 construction emissions are from clearing vegetation (92.6%), which will be approximately offset in accordance with current re-vegetation commitments.

It is projected that the operation of the mine will produce 2.3 Mt CO_2-e per annum, with scope 1 and 2 emissions contributing approximately 48% and 52% of total emissions, respectively. The bulk of the annual scope 1 greenhouse gas emissions are associated with fugitive methane emissions released during open cut mining (31%) and during underground mines (26%). The remainder is predominately associated with diesel consumption for mining equipment (26%). The majority of total scope 1 emissions are CO_2 emissions and CH_4 emissions, with negligible amount of N_2O emissions.

The emissions intensity of the mine is 0.06 t CO_2-e/t saleable coal, which is approximately equivalent to the average emissions intensity of existing Australian coal mines that have both open cut and underground operations, and is less than the average emissions intensity of all coal mines (0.079 t CO_2-e/t saleable coals).

Greenhouse gas emissions from the overall project will have to be annually reported under the requirements of NGERS, and the Waratah Coal will be a direct participant in the emissions scheme included in the Carbon Pollution Reduction Scheme (CPRS) as it is currently proposed. It is also expected that Waratah Coal will have to assess the energy efficiency of the project, and identify measures to improve energy efficiency, under the EEO Program.

The project can most effectively reduce its annual emissions through improvements in energy efficiency. Waratah Coal is committed to undertaking ongoing internal measurement and monitoring of emissions, in addition to mandatory reporting under NGERS and the EEO Program. The focus on the monitoring will be to identify sources with the greatest potential for emissions reductions. Greenhouse gas emissions may also be offset through investment in third party projects that reduce emissions below a demonstrated baseline, for example, through forestry and renewable energy projects.

10.5 COMMITMENTS

In managing potential air quality impacts and implementation to various control measures in the reduction of dust emissions associated with the construction, operation and decommissioning over the life of the mine site, Waratah will meet air quality objectives by:

- managing short term dust emissions during the construction phase through a comprehensive EMP;
- achieving effective dust management during mining operations through appropriate planning and awareness of conditions during peak dust emissions. This includes minimal disturbance to the area being mined, minimising haul distances, and controlling vehicular speeds on haul roads and minimising mining activities during high wind speed events;
- implementing dust control measures during mining operations, such as watering of haul roads, water spraying at stockpiles, fully enclosed conveyor systems, underground loading of coal at the preparation phase and facilities, wet coal handling facility and ongoing revegetation of stripped areas in the open cut mines;
- implementing a comprehensive dust monitoring program across the site that includes onsite and offsite dust monitoring points and a meteorological station to provide accurate measure of local weather conditions;
- collaborating with other proposed large-scale mining developments across the region. A requirement to manage dust emissions to levels below the adopted air quality guidelines is necessary from all parties; and
- preparing specific dust control and mitigation measures as part of a mine decommissioning strategy.

In minimising the amount of greenhouse gas generated by the mine, Waratah Coal commits to:

- measure and report GHG emissions in compliance with the National NGERS;
- developing ongoing processes for minimising energy consumption and greenhouse gas emissions within the project, by investigating the use of renewable energy sources in the operation of the mine; and
- working with government on developing measures to address GHG emissions.