Report

Caval Ridge Air Quality Assessment - Supplementary Report

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Prepared for

BMA

Level 23
71 Riparian Plaza
Brisbane Qld 4000

42626420

URS

Project Manager:

Robert Storrs
Associate Environmental Scientist

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

Project Director:

Chris Pigott
Senior Principal

Author:

Darlene Heuff
Senior Associate Scientist

Reviewer:

p.p. Lisa Russ
Senior Associate
Environmental Engineer

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Abbreviations

Abbreviation	Description
@	At
CPP	Coal Processing Plant
DERM	Department of Environment and Resource Management
EPP(Air)	Queensland Environmental Protection (Air) Policy 2008
EIS	Environmental Impact Statement
kg/ha/year	Kilograms per hectare per year
kg/ha/hr	Kilograms per hectare per hour
$\mu g/m^3$	Micrograms per cubic metre
m	Metres
m/s	Metre per second
OB	Overburden
%	Percentage
PM_{10}	Particulate matter less than 10 microns in diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
ROM	Run of mine
T+S	Truck and shovel
TSP	Total suspended particulate
VKT	Vehicle kilometres travelled

1 Introduction

1.1 Changes to EPP (Air) 2008

The methodology for Caval Ridge EIS Air Quality Assessment (EIS Section 10 and Appendix L) was developed in mid 2008 at which time the Queensland EPP (Air) 1997 was under affect. These guidelines have since been updated, with the new EPP(Air) policy having taken affect on 1 January 2009. In particular, the revised EPP(Air) 2008 air quality objective for the 24-hour average concentration of PM_{10} of 50 µg/m³ is much stricter than the EPP(Air) 1997 air quality objective of 150 µg/m³.

In summary, relevant differences in the EPP(Air) 1997 and EPP(Air) 2008 include:

- PM_{10} 24 hour: 50 µg/m³ with 5 exceedances allowed per year, previously 150 µg/m³ with no allowable exceedances
- PM_{10} annual: removed in 2008 guidelines, previously 50 µg/m³
- $PM_{2.5}$ 24 hour: 25 µg/m³, previously not included
- $PM_{2.5}$ annual: 8 µg/m³, previously not included

The adopted air quality goals for the Caval Ridge Project for TSP, PM_{10}, $PM_{2.5}$ and dust deposition are included in Table 1-1.

Table 1-1 Summary of Project Goals for Particulate Matter

Pollutant	Averaging Period	Objective or Goal	Jurisdiction
Total suspended particulates	Annual	90 µg/m³	EPP(Air)
PM_{10}	24-hour	50 µg/m³ (5 exceedences allowed)	EPP(Air)
$PM_{2.5}$	24-hour	25 µg/m³	EPP(Air)
	Annual	8 µg/m³	EPP(Air)
Dust deposition	Monthly	4 g/m²/month	Queensland DERM

1.2 Modifications to Air Quality Assessment Methodology

A review of modelling results presented in Caval Ridge EIS Chapter 10 and Appendix L suggested that the methodology applied as part of the Caval Ridge EIS Air Quality Assessment has lead to excessively conservative predictions of air quality impacts of dust from Caval Ridge mine. In order to refine the modelling methodology, consideration was given to the implementation of additional operational commitments from BMA as well as changes to modelling strategies.

Changes to operations to reduce dust that have been incorporated into the revised modelling included:

- Fleet optimisation - reduced fleet and dozers (less vehicle kilometres travelled (VKT));
- Introduction of back hauling to minimise number of trucks running empty (reduced VKTs);
- Additional coal ramps in Horse Pit (reduced VKTs); and
- Redistributed tailings and rejects placement across Horse and Heyford Pits (reduced VKTs in the northern part of mine. Initially it was planned to use Horse Pit for rejects disposal.)

Changes to modelling methodology that have been incorporated in order to reduce the level of conservatism within the model include:

- Dragline drop height calculated more accurately using mine planning parameters;
- More accurate reflection of dozer utilisation;
- More accurate representation of coal moisture content with the EIS value of 8% for all coal replaced with 4% for ROM coal and 9% for product coal
- Simulations were conducted for 2008 using wind speed and wind direction data from the Caval Ridge monitoring site. Year 2007 was modelled in the Caval Ridge EIS air quality assessment (Chapter 10, Appendix L); and
- Constant emission rates associated with stockpiling and exposed area replaced with wind speed dependent emission rates for dust sources outlined in Section 1.3.4.

Presented in Table 1-2 is a summary of the changes to the parameters used in the Caval Ridge EIS air quality assessment (EIS Appendix L) that have been implemented in the Caval Ridge EIS supplementary air quality assessment.

Table 1-2 Additional Changes to Model Parameters

Parameter	Units	EIS Value	EIS Supplement Value
Moisture content of coal	%	8.1	-
Moisture content of ROM coal	%	-	4
Moisture content of product coal	%	-	9
Dozer utilisation	%	100	48.5 (1)
Dragline drop height	m	30	15
Emission factor for wind erosion	kg/ha/year	0.4	Wind speed dependent (Section 1.3)
Year modelled	-	2007	2008(2)

Note: (1) Dozers operate on average for between 4,000 and 4,500 hours per year (person. comm. with BMA).
(2) Year 2008 was modelled as site-specific wind speed and wind direction for the 12 month period was available from the Caval Ridge monitoring site

1.3 Wind Speed Dependent Wind Erosion

1.3.1 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.

$$E = 1.9\left(\frac{s}{1.5}\right)365\left(\frac{365-p}{2356}\right)\left(\frac{f}{15}\right)$$

Equation 1

1 Introduction

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 Caval Ridge 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 5.4 m/s using the methodology outlined in the following sections.

1.3.2 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)
- u_0 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.

1 Introduction

1.3.3 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.

1.3.4 Wind Speed Dependent Emission Factors

Presented in Figure 1-1 is an example of the wind speed dependent wind erosion emission factors used in the Caval Ridge supplementary air quality assessment. A summary of the annual wind speed dependent erosion for stockpiles and exposed areas for 2008 is presented in Table 1-3.

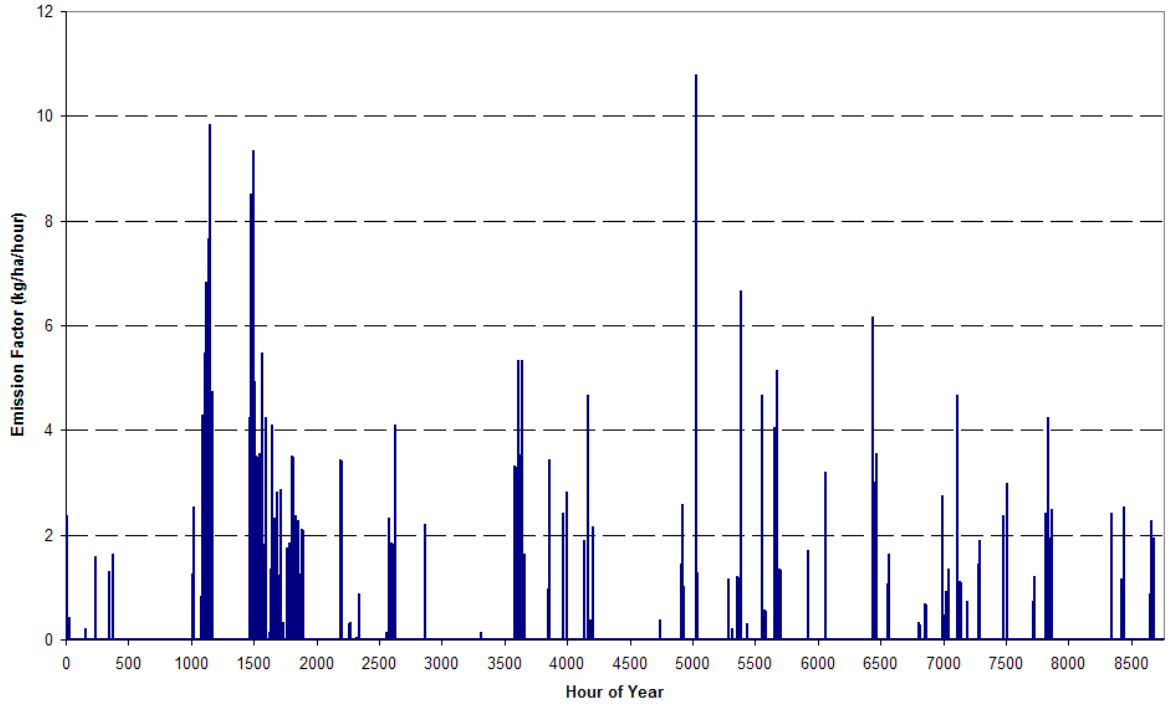

Figure 1-1 Wind Speed Dependent Emission Factor for Stockpiles

Table 1-3 Summary of Parameters used to Calculate Wind Erosion Emission Factors

Parameter	Units	Stockpiles	Exposed Areas
Source height	m	20	-
Source root mean square height	m	14.14	-
Wind speed at source height	m/s	5.40	5.40
Critical wind speed @ 10 m (m/s)	m/s	5.07	5.40 (1)
Hours over critical wind speed	%	4.4%	2.2%
Silt content	%	5	14
F (kg/ha/year)	kg/ha/year	830	1,135
k		0.0798	0.236

Note: (1) A conservative approach has been adopted which will overestimate the frequency of emissions from exposed areas.

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Site Emissions Inventory

2.1 Annual Emissions Scenarios

The updated annual emissions rates of TSP and PM_{10} for Year 1 are summarised in Table 2-1, for Year 2 in Table 2-2 and for Year 20 in Table 2-3.

Included in the tables are the percentage contributions of dust emissions from various activities to the annual emissions inventory for the project.

2 Site Emissions Inventory

Table 2-1 Year 1 Annual Emission Rate of TSP and PM_{10} (kg/year)

Activity	TSP					PM_{10}				
	Horse Pit	Heyford Pit	Peak Downs	Project Total	% of Inventory	Horse Pit	Heyford Pit	Peak Downs	Project Total	% of Inventory
Pre-strip T+S	1,346,753	544,060	-	1,890,813	26.0%	466,915	191,568	-	658,483	23.5%
Dragline	0	498,233	-	498,233	6.8%	0	168,061	-	168,061	6.0%
Coaling equipment	197,568	136,909	-	334,477	4.6%	122,271	96,143	-	218,413	7.8%
Blasting	773,413	723,396	-	1,496,809	20.6%	402,175	376,166	-	778,341	27.8%
Grading	16,650	16,650	-	33,300	0.5%	103,36	10,617	-	20,953	0.7%
Coal Hauling	161,416	165,910	-	327,327	4.5%	39,689	40,794	-	80,483	2.9%
Reject Hauling	80,894	83,146	-	164,040	2.3%	19,890	20,444	-	40,334	1.4%
Overburden hauling	970,400	398,317	-	1,368,717	18.8%	238,602	97,938	-	336,539	12.0%
Wind blown dust	328,188	192,224	-	520,412	7.1%	164,094	96,112	-	260,206	9.3%
ROM coal receiving at CPP	187,695	-	630	188,324	2.6%	59,205	-	295	59,500	2.1%
ROM coal sizing and stockpiling at Caval Ridge	177,172	-	-	177,172	2.4%	76,673	-	-	76,673	2.7%
Peak Downs ROM loading and conveying	-	-	183,725	183,725	2.5%	-	-	57,458	57,458	2.1%
Product coal handling and train load out	97,849	-	-	97,849	1.3%	42,382	-	-	42,382	1.5%
Total	**4,337,997**	**2,758,846**	**184,355**	**7,281,198**	**100%**	**1,642,232**	**1,097,842**	**57,753**	**2,797,827**	**100.0%**

2 Site Emissions Inventory

Table 2-2 Year 2 Annual Emission Rate of TSP and PM10 (kg/year)

Activity	TSP					PM_{10}				
	Horse Pit	Heyford Pit	Peak Downs	Project Total	% of Inventory	Horse Pit	Heyford Pit	Peak Downs	Project Total	% of Inventory
Pre-strip T+S	540,455	574,585	-	1,115,041	15.1%	164,609	190,031	-	354,641	14.0%
Dragline	1,771,973	549,785	-	2,321,758	31.5%	316,856	183,788	-	500,644	19.8%
Coaling equipment	214,304	152,239	-	366,543	5.0%	137,559	110,229	-	247,788	9.8%
Blasting	289,129	536,056	-	825,184	11.2%	150,347	278,749	-	429,096	17.0%
Grading	16,650	16,650	-	33,300	0.5%	10,336	10,617	-	20,953	0.8%
Coal Hauling	231,535	208,977	-	440,512	6.0%	56,930	51,383	-	108,313	4.3%
Reject Hauling	121,273	109,458	-	230,731	3.1%	29,819	26,913	-	56,732	2.2%
Overburden hauling	153,893	305,087	-	458,980	6.2%	37,839	75,015	-	112,854	4.5%
Wind blown dust	553,231	241,453	-	794,684	10.8%	276,616	120,726	-	397,342	15.7%
ROM coal receiving at CPP	200,229	-	992	201,221	2.7%	64,513	-	465	64,978	2.6%
ROM coal sizing and stockpiling at Caval Ridge	249,606	-	-	249,606	3.4%	108,019	-	-	108,019	4.3%
Peak Downs ROM loading and conveying	-	-	203,180	203,180	2.8%	-	-	65,658	65,658	2.6%
Product coal handling and train load out	139,268	-	-	139,268	1.9%	60,322	-	-	60,322	2.4%
Total	**4,481,546**	**2,694,289**	**204,172**	**7,380,007**	**100%**	**1,413,764**	**1,047,452**	**66,123**	**2,527,340**	**100%**

2 Site Emissions Inventory

Table 2-3 Year 20 Annual Emission Rate of TSP and PM10 (kg/year)

Activity	TSP					PM_{10}				
	Horse Pit	Heyford Pit	Peak Downs	Project Total	% of Inventory	Horse Pit	Heyford Pit	Peak Downs	Project Total	% of Inventory
Pre-strip T+S	752,640	904,994	-	1,657,634	19.4%	244,158	313,978	-	558,137	16.8%
Dragline	1,136,224	498,503	-	1,634,727	19.2%	379,791	167,902	-	547,692	16.5%
Coaling equipment	215,141	156,125	-	371,266	4.4%	138,323	113,793	-	252,116	7.6%
Blasting	608,906	1,029,920	-	1,638,826	19.2%	316,631	535,558	-	852,190	25.7%
Grading	16,650	16,650	-	33,300	0.4%	10,336	10,617	-	20,953	0.6%
Coal Hauling	235,042	220,142	-	455,184	5.3%	57,792	54,128	-	111,920	3.4%
Reject Hauling	137,003	128,318	-	265,321	3.1%	33,686	31,551	-	65,237	2.0%
Overburden hauling	349,003	546,471	-	895,474	10.5%	85,813	134,366	-	220,179	6.6%
Wind blown dust	529,789	210,978	-	740,767	8.7%	264,895	105,489	-	370,384	11.2%
ROM coal receiving at CPP	202,066	-	1,199	203,265	2.4%	65,291	-	562	65,853	2.0%
ROM coal sizing and stockpiling at Caval Ridge	274,000	-	-	274,000	3.2%	118,576	-	-	118,576	3.6%
Peak Downs ROM loading and conveying	-	-	214,302	214,302	2.5%	-	-	70,346	70,346	2.1%
Product coal handling and train load out	146,544	-	-	146,544	1.7%	63,474	-	-	63,474	1.9%
Total	**4,603,008**	**3,712,100**	**215,501**	**8,530,609**	**100%**	**1,778,766**	**1,467,383**	**70,908**	**3,317,057**	**100%**

2.2 Worst-Case 24-Hours Emissions Scenario

The Caval Ridge EIS air quality assessment considered two worst-case scenarios which focused on quantifying the potential impacts of dust emissions associated with specific equipment working at optimal capacity on the 24-hour average ground-level concentration of PM_{10}. One scenario considered the clustering of equipment in the northern section of Horse Pit and Heyford Pit (north scenario). The other scenario considered the clustering of equipment towards the southern ends of the pits (south scenario).

Worst-cast dust emissions scenarios were associated with optimal (full operational capacity) operational performance of draglines, truck and shovel fleets, dozers and/or excavators. It was assumed that these emissions scenarios occurred for all days of the year in order to capture worst-case meteorological conditions.

Presented in Table 2-4 is a summary of the updated annual emissions inventory of PM_{10} for the worst-case 24 hour emissions scenario outlined in Caval Ridge EIS Appendix L, Table 3-4 of Section 3.4.1.

Table 2-4 Worst-Case 24 hour Emission Rate Scenarios for PM_{10} (kg/day)

Activity	Year 1	Year 2	Year 20
Pre-strip T+S	1,726	1,712	1,733
Dragline	491	1,648	1,590
Coaling equipment	296	302	290
Blasting	2,132	1,176	2,335
Grading	57	57	57
Coal Hauling	221	297	307
Reject Hauling	111	155	179
Overburden hauling	922	309	603
Wind blown dust(1)	713(1)	1,089(1)	1,015(1)
ROM coal receiving at CPP	163	178	180
ROM coal sizing and stockpiling	210	296	325
Peak Downs ROM loading and conveying	157	180	193
Product coal handling and train load out	116	165	174
Total	**7,316**	**7,563**	**8,981**

Note (1): Figure presented is indicative of annual average. Wind blown dust is wind speed dependent and varies on an hourly basis as discussed in Section 1.3.4

3

Interpretation of Air Quality Impacts

3.1 Sensitive Receptors

Presented in Figure 3-1 are the locations of the sensitive receptors for which results of the dispersion modelling will be presented. The two enclosed polygons to the south west of the Moranbah township (Figure 3-1) represent the location of the area zoned as the emerging community area (orange polygon) and proposed expansion of the Moranbah residential area (pink polygon). There is currently no development in the emerging communities area. The emerging community area is nominated under the Planning Scheme for Belyando Shire Part 4 Zones. The Planning Scheme indicates in clause 5 that planning will be undertaken in the emerging communities area in an integrated manner, such that: *the potential impacts of any existing or future rural, mining or rail activities are adequately mitigated through the design, orientation, location and buffering of new development.*

It is also noted in the Belyando Planning Scheme Policy 3 – Structure planning guidelines (Section2.1.2, Step 2), Identification of constraints that; *Land in an Emerging Community Area is generally suitable for development. However some land may have environmental, scenic or other constraints that will influence the location, form and density of development. As a minimum, land with the following constraints must be identified, mapped and considered in the design of the overall development*.

BMA will work with the appropriate development authority to ensure that potential air quality impacts from it's mining operations on potential developments are minimised through the design, orientation, location and buffering of new development in the emerging community area.

3 Interpretation of Air Quality Impacts

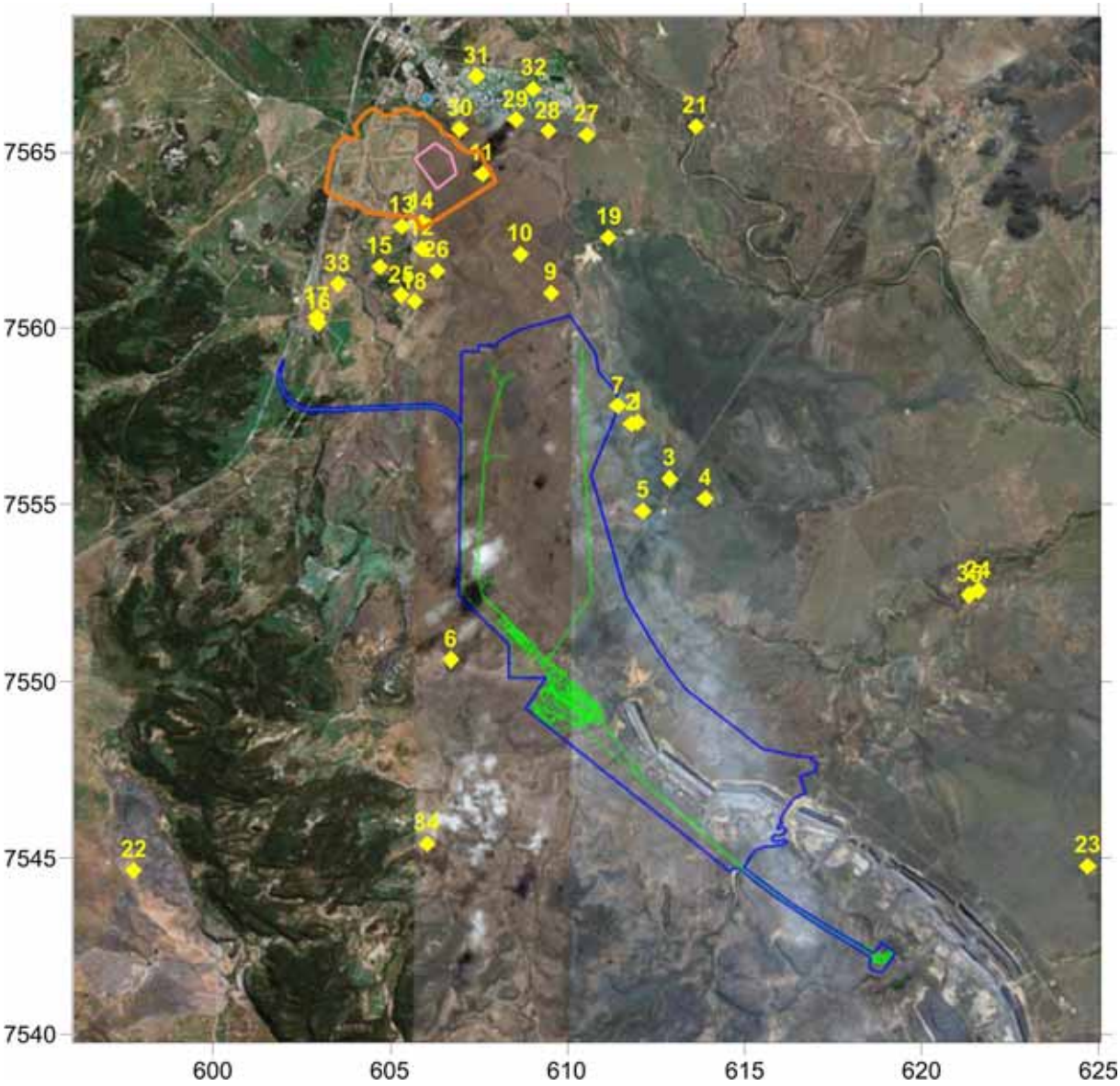

Figure 3-1 Sensitive Receptor Locations

3.2 Annual Emissions Scenario

3.2.1 Particulate Matter as TSP

Presented in Table 3-1 is a summary of the results of the dispersion modelling for the predicted annual average ground-level concentration of TSP at sensitive receptor locations. Included in the table is the incremental contribution to the annual average ground-level concentrations of TSP from the Caval Ridge project. A background level of 26.2 µg/m^3 has been included in the ground-level concentration denoted in the 'Total' column of the table.

Contour plots for Year 1, Year 2 and Year 20 are presented as Figure 3-2 through Figure 3-4 respectively.

The dispersion modelling predicts that ground-level concentrations of TSP will not exceed the EPP(Air) objective of 90 µg/m^3 at any receptor location due to emissions of dust from the Caval Ridge project for any of the three years modelled.

Table 3-1 Predicted Annual Average Ground-Level Concentrations of TSP..

Receptor	Year 1			Year 2			Year 20		
	Total	% of Guideline[1]	Caval Contri-bution	Total	% of Guideline[1]	Caval Contri-bution	Total	% of Guideline	Caval Contri-bution
1	32	35%	5	32	35%	5	32	35%	5
2	32	35%	6	32	36%	6	32	36%	6
3	31	34%	5	31	34%	5	31	34%	5
4	29	33%	3	30	33%	3	30	33%	3
5	33	36%	6	33	37%	7	33	37%	7
6	60	66%	34	63	70%	37	63	70%	37
7	32	35%	6	32	36%	6	32	36%	6
9	30	34%	4	31	35%	5	31	35%	5
10	31	34%	5	32	35%	5	32	35%	5
11	29	32%	3	29	33%	3	29	33%	3
12	39	43%	13	39	44%	13	39	44%	13
13	36	41%	10	37	41%	10	37	41%	10
14	35	39%	9	36	39%	9	36	39%	9
15	43	48%	17	43	48%	17	43	48%	17
16	46	51%	20	45	50%	19	45	50%	19
17	44	49%	18	44	49%	18	44	49%	18
18	53	58%	26	52	57%	26	52	57%	26
19	28	31%	2	28	31%	2	28	31%	2
21	27	30%	1	27	30%	1	27	30%	1
22	29	32%	3	29	32%	3	29	32%	3
23	27	30%	0	27	30%	0	27	30%	0
24	27	30%	1	27	30%	1	27	30%	1
25	50	55%	24	49	55%	23	49	55%	23
26	41	46%	15	42	46%	16	42	46%	16
27	28	31%	2	28	31%	2	28	31%	2
28	28	31%	2	28	31%	2	28	31%	2
29	28	31%	2	28	32%	2	28	32%	2
30	29	32%	2	29	32%	3	29	32%	3
31	28	31%	2	28	31%	2	28	31%	2
32	28	31%	2	28	31%	2	28	31%	2
33	42	47%	16	42	47%	16	42	47%	16
34	33	37%	7	33	37%	7	33	37%	7
35	27	30%	1	27	30%	1	27	30%	1

Note: Background values are added to model output and then rounded to the nearest whole number for the purposes of presentation.
[1]EPP (Air) objective is 90µg/m^3.

3 Interpretation of Air Quality Impacts

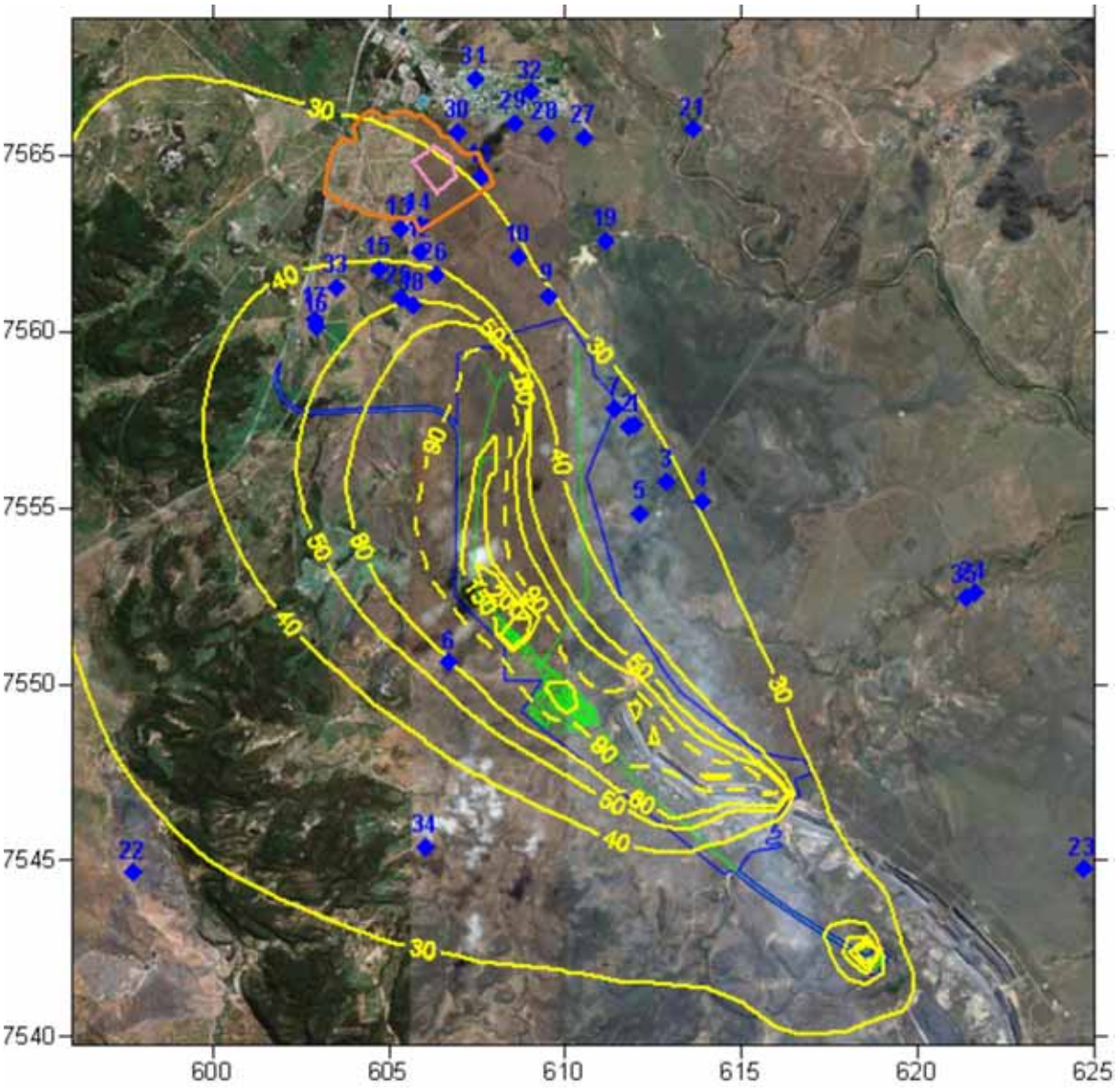

Figure 3-2 Annual Average Ground-Level Concentration of TSP for Year 1. EPP(Air) objective is 90 µg/m^3 (dashed line).

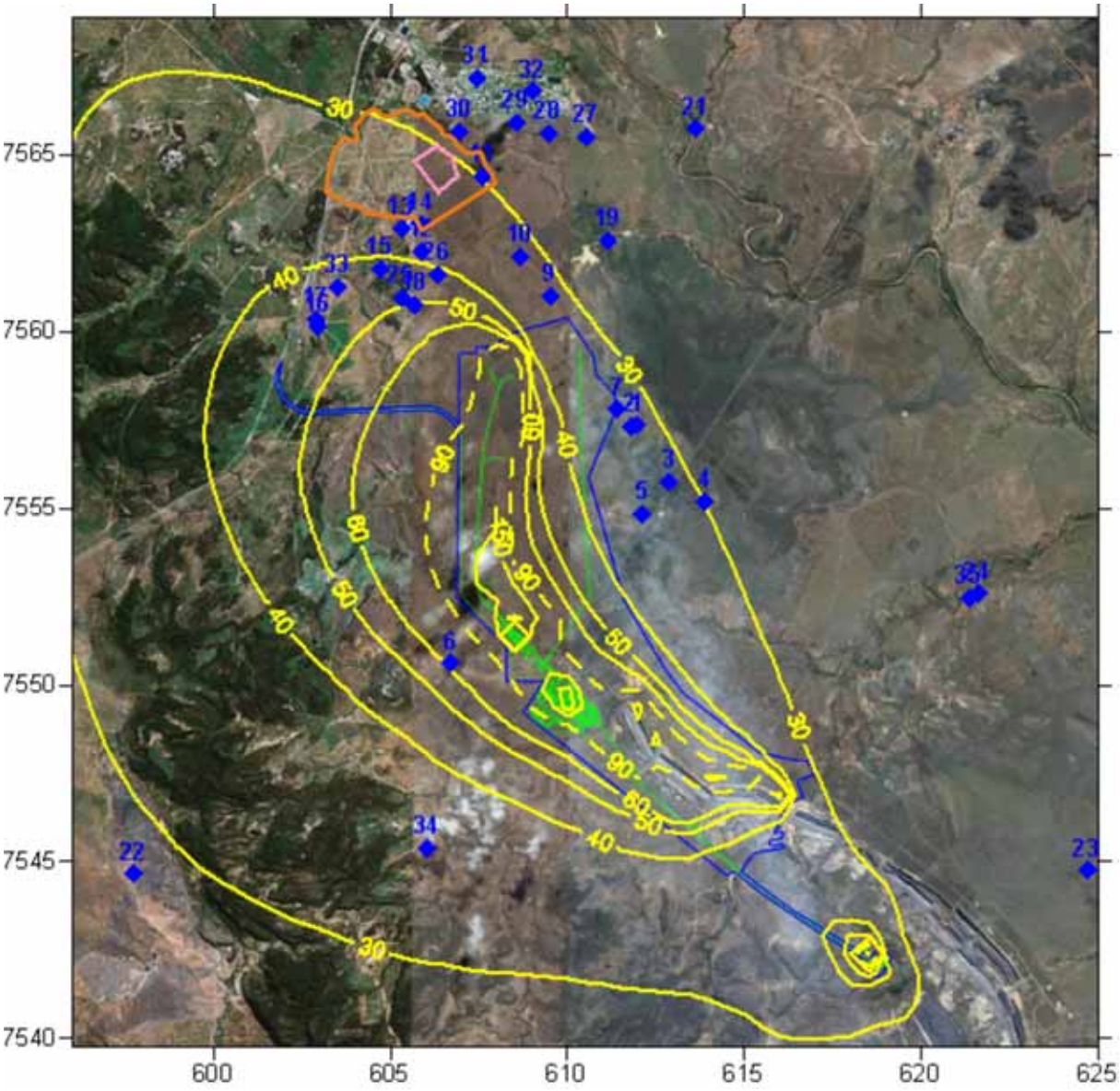

Figure 3-3 Annual Average Ground-Level Concentration of TSP for Year 2. EPP(Air) objective is 90 µg/m^3 (dashed line).

3 Interpretation of Air Quality Impacts

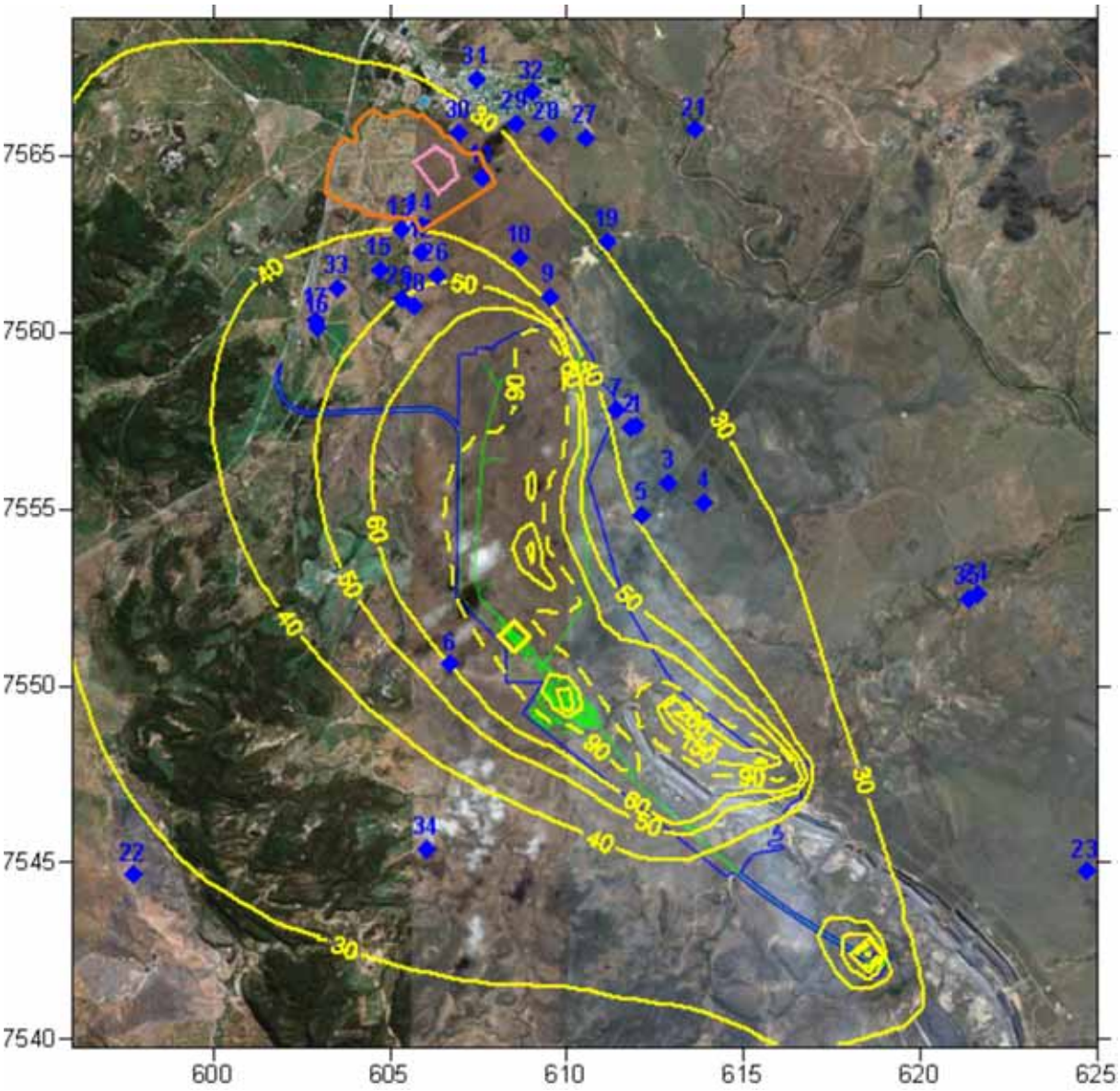

Figure 3-4 Annual Average Ground-Level Concentration of TSP for Year 20. EPP(Air) objective is 90 µg/m^3 (dashed line).

3.2.2 Particulate Matter as PM_{10}

Presented in Table 3-2 are the results of the dispersion modelling for project Year 1 and Year 2 for the fifth highest ground-level concentration of PM_{10} at receptor locations. Locations which are predicted to exceed that EPP(Air) objective of 50 µg/m^3 are highlighted in bold. Included in the table is the predicted incremental contribution of emissions of dust from the project at each of the sensitive receptor locations. As discussed in the EIS, the existing background concentration of PM_{10} is 18.8 µg/m^3 . This has been included in the ground-level concentration denoted in the 'Total' column of the table.

Results suggest that the incremental contribution of emissions at sensitive receptor locations (in isolation from background conditions) will generally be greater during Year 1 site activities compared

with Year 2. The residences located to the northwest of the site are predicted to be most affected. Year 1 activities in the northern area of the project site are associated with the construction of Horse Pit.

During Year 2 operations, all mining-related activities (such as draglines, truck and shovel, coaling) will be located near the surface of Horse Pit and will not benefit from the dust reduction potential associated with activities that are located within an established pit.

During Year 1 and Year 2, the incremental contribution of PM_{10} from project activities is predicted to be a maximum of 15 µg/m^3 to the ground-level concentrations within Moranbah (receptor locations 27 through 31).

Table 3-2 Year 1 and Year 2 Emission Scenarios – Predicted Fifth Highest 24 Hour Average Ground-Level Concentration of PM_{10} (µg/m^3). EPP(Air) Objective is 50 µg/m^3

Receptor	Year 1			Year 2		
	Total	% of Guideline[1]	Caval Contribution	Total	% of Guideline[1]	Caval Contribution
1	42	85%	24	41	81%	22
2	43	86%	24	41	83%	23
3	37	74%	18	37	74%	18
4	33	67%	15	33	66%	14
5	40	79%	21	40	80%	21
6	**66**	**132%**	47	**69**	**137%**	**50**
7	43	85%	24	41	82%	22
9	37	74%	18	38	76%	19
10	46	92%	27	44	88%	25
11	35	71%	16	35	70%	16
12	**61**	**121%**	42	**54**	**108%**	35
13	**56**	**112%**	37	**51**	**101%**	32
14	**55**	**110%**	36	49	98%	30
15	**62**	**124%**	43	**54**	**107%**	35
16	**56**	**112%**	37	**51**	**103%**	33
17	**54**	**107%**	35	49	99%	30
18	**73**	**146%**	**54**	**61**	**122%**	42
19	28	56%	9	28	57%	10
21	24	48%	5	24	49%	5
22	28	56%	9	28	56%	9
23	23	46%	4	23	46%	4
24	24	47%	5	23	47%	4
25	**70**	**140%**	**51**	**59**	**117%**	40
26	**64**	**128%**	45	**56**	**112%**	37
27	32	63%	13	31	62%	12
28	33	65%	14	32	63%	13
29	34	67%	15	31	62%	12
30	33	66%	14	31	63%	13
31	32	65%	13	31	62%	12
32	31	62%	12	30	60%	11
33	**51**	**102%**	32	46	92%	27
34	39	79%	21	38	77%	20
35	24	48%	5	24	47%	5

Note: Background values are added to model output and then rounded to the nearest whole number for the purposes of presentation.
[1]EPP (Air) objective is 50 µg/m^3

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Presented in Table 3-3 are results of the dispersion modelling during Year 20. A background level of 18.8 µg/m^3 has been included in the ground-level concentration denoted in the 'Total' column of the table.

Dust generating activities during Year 20 are predicted to contribute a maximum of 21 µg/m^3 to 24 hour ground-level concentrations of PM_{10} within the township of Moranbah (receptor locations 27 through 31).

Also included in the table is the percentage contribution of the various mining activities on predicted ground-level concentrations of PM_{10} at the receptor locations. Overburden-related dust generating activities which include draglines, overburden and rejects truck dumping, drilling and dozer activities are predicted to contribute to the majority of the predicted ground-level concentration of dust.

Table 3-3 Year 20 Emission Scenario – Fifth Highest 24 Hour Average Ground Level Concentration of PM_{10} ($\mu g/m^3$).

Rec	Total	% of Guideline [1]	Caval Contri-bution	Blast	CPP	Coal & Reject Hauling	OB Hauling	OB Activities	Wind Blown Dust
1	**55**	**110%**	36	0%	4%	5%	18%	73%	0%
2	**58**	**115%**	39	3%	7%	6%	14%	70%	0%
3	48	95%	29	4%	5%	5%	17%	68%	0%
4	42	84%	23	3%	14%	7%	11%	65%	0%
5	48	97%	30	4%	16%	8%	8%	64%	0%
6	**72**	**143%**	**53**	1%	51%	17%	7%	24%	0%
7	**61**	**123%**	43	3%	6%	5%	14%	72%	0%
9	**75**	**151%**	**57**	5%	6%	3%	10%	76%	0%
10	**63**	**126%**	44	0%	6%	4%	19%	71%	0%
11	41	83%	23	0%	8%	5%	15%	72%	0%
12	**63**	**127%**	44	0%	6%	7%	16%	71%	0%
13	**58**	**116%**	39	0%	7%	7%	15%	71%	0%
14	**60**	**119%**	41	0%	9%	8%	13%	69%	0%
15	**60**	**120%**	41	1%	15%	13%	9%	62%	0%
16	**55**	**109%**	36	1%	8%	11%	13%	68%	0%
17	**53**	**106%**	34	1%	7%	10%	13%	69%	0%
18	**68**	**135%**	49	0%	5%	10%	16%	69%	0%
19	36	72%	17	7%	1%	5%	10%	77%	0%
21	27	54%	8	2%	10%	6%	11%	72%	0%
22	29	57%	10	0%	27%	13%	8%	51%	0%
23	25	49%	6	13%	11%	5%	11%	61%	0%
24	26	51%	7	3%	8%	5%	13%	72%	0%
25	**65**	**130%**	46	1%	10%	11%	13%	65%	0%
26	**64**	**128%**	45	1%	6%	6%	16%	71%	0%
27	39	78%	20	0%	11%	6%	11%	72%	0%
28	38	77%	20	0%	10%	5%	13%	73%	0%
29	40	80%	21	0%	9%	5%	12%	74%	0%
30	38	76%	19	0%	10%	5%	11%	75%	0%
31	35	70%	16	0%	9%	7%	11%	73%	0%
32	37	74%	18	0%	10%	6%	12%	71%	0%
33	**52**	**104%**	33	1%	11%	9%	12%	67%	0%
34	40	81%	22	2%	14%	12%	8%	64%	0%
35	26	53%	8	6%	10%	6%	12%	66%	0%

Note: Numbers in bold exceed the relevant EPP(Air) objective
Note: Background values are added to model output and then rounded to the nearest whole number for the purposes of presentation.
[1]EPP(Air) Objective is 50 $\mu g/m^3$

Presented in Figure 3-5 through Figure 3-7 are contour plots of the fifth highest 24-hour average ground-level concentration of PM_{10} for Year 1, Year 2 and Year 20 respectively.

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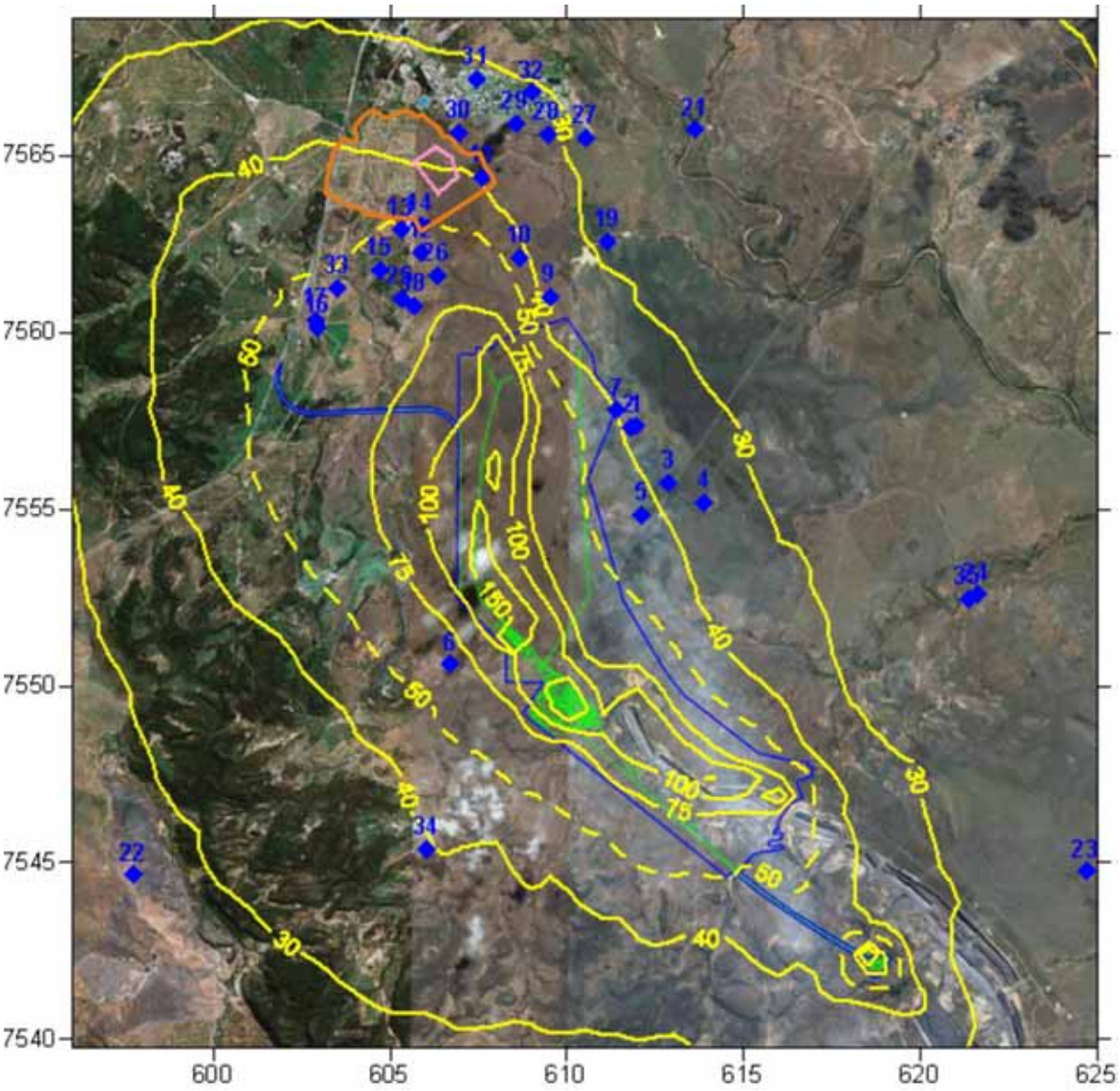

Figure 3-5 Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 1. EPP(Air) objective is 50 µg/m^3 (dashed line).

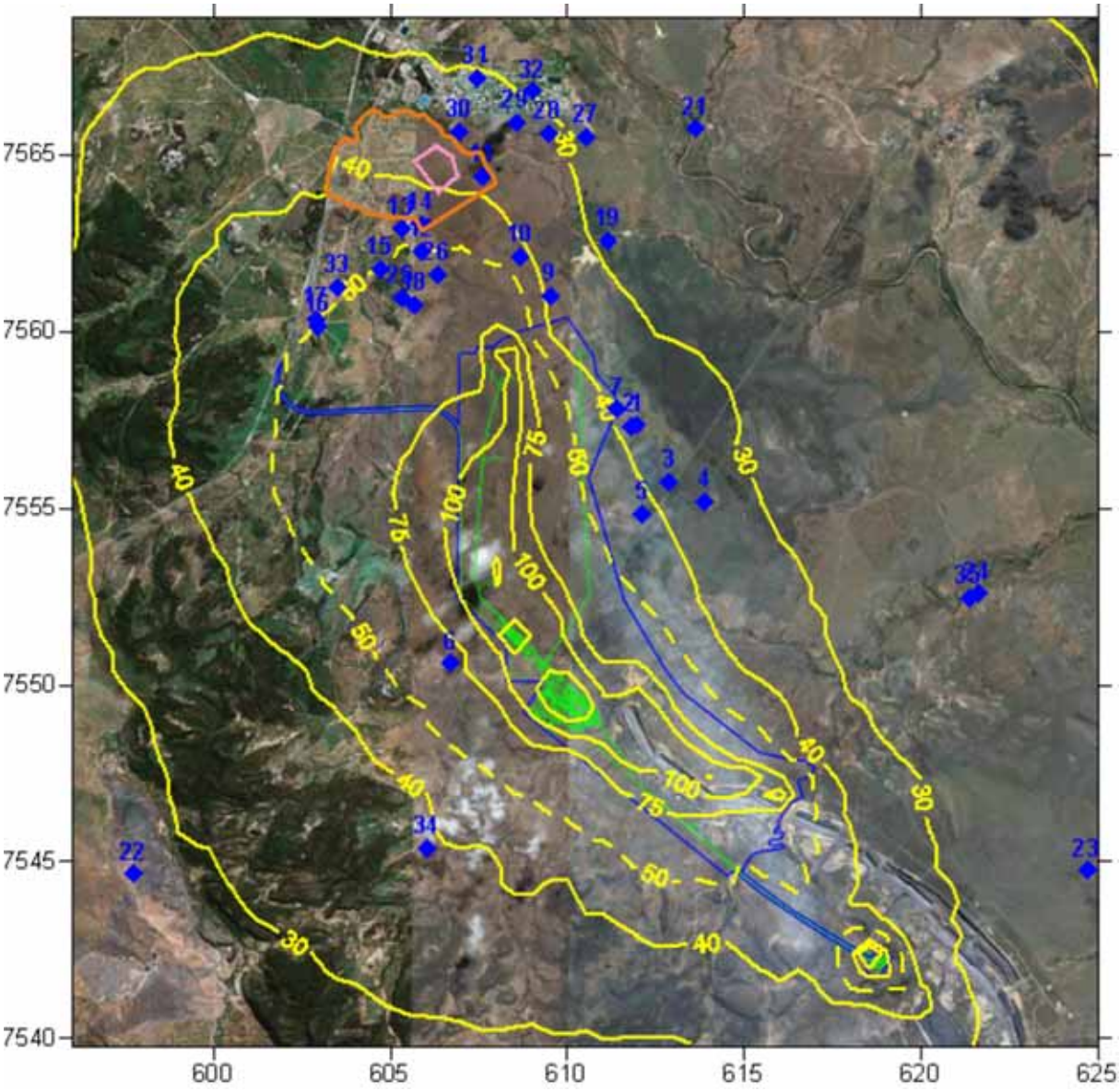

Figure 3-6 Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 2. EPP(Air) objective is 50 µg/m^3 (dashed line).

3 Interpretation of Air Quality Impacts

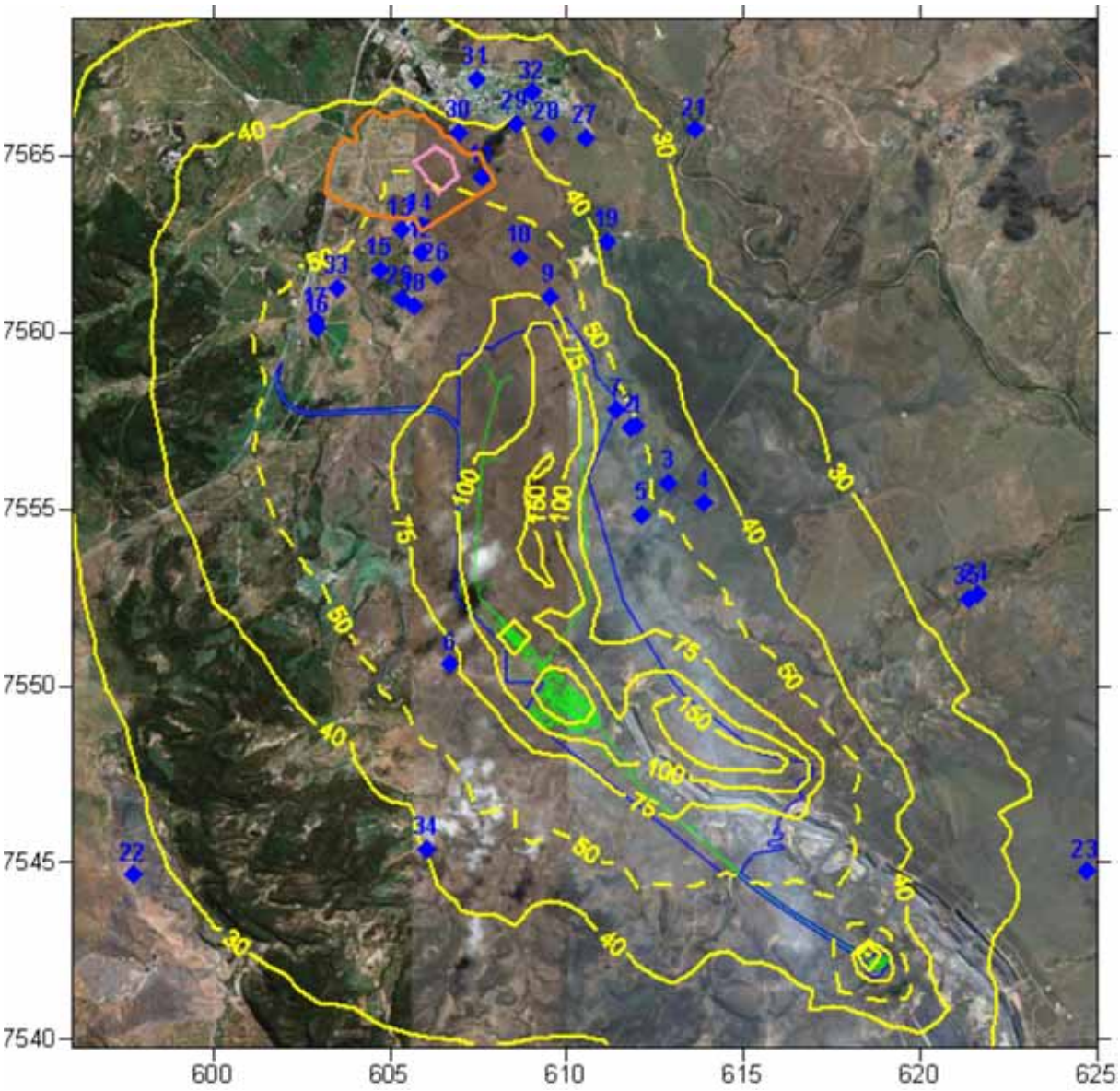

Figure 3-7 Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 20. EPP(Air) objective is 50 µg/m^3 (dashed line).

3.2.3 Particulate Matter as $PM_{2.5}$

Presented in Table 3-4 is the maximum 24-hour average ground-level concentration of $PM_{2.5}$ at the receptor locations. Results suggest that the EPP(Air) objective of 25 µg/m^3 will not be exceeded at any of the receptor locations for the three years modelled. The maximum predicted contribution to ground-level concentration of $PM_{2.5}$ due to the Caval Ridge project is 14 µg/m^3 at receptor location 9 during Year 20. The maximum predicted project contribution to the ground-level concentration of $PM_{2.5}$ within Moranbah (receptor locations 27 through 31) is 6 µg/m^3 during Year 20. As discussed in the EIS, the existing background concentration of $PM_{2.5}$ is 2.9 µg/m^3. This has been included in the ground-level concentration denoted in the 'Total' column of the table.

Presented in Table 3-5 is the annual average ground-level concentration of $PM_{2.5}$ at each of the receptor locations. Results suggest that the EPP(Air) objective of 8 µg/m^3 will not be exceeded at any of the receptor locations for the three years modelled. A background level of 1.6 µg/m^3 has been included in the ground-level concentration denoted in the 'Total' column of the table.

Presented in Figure 3-8 through Figure 3-10 are contour plots of the maximum 24-hour average ground-level concentration of $PM_{2.5}$ for Year 1, Year 2 and Year 20 respectively.

Presented in Figure 3-11 through Figure 3-13 are contour plots of the annual average ground-level concentration of $PM_{2.5}$ for Year 1, Year 2 and Year 20 respectively.

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Table 3-4 Maximum 24 Hour Average Ground Level Concentration of $PM_{2.5}$ (µg/m^3).

Rec	Year 1			Year 2			Year 20		
	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution
1	8	28%	6	8	26%	5	11	37%	8
2	9	29%	6	8	26%	5	12	39%	9
3	7	24%	4	7	24%	4	9	31%	7
4	6	21%	3	6	22%	4	8	27%	5
5	7	25%	5	7	24%	4	10	32%	7
6	14	46%	11	14	48%	12	15	51%	12
7	8	28%	6	8	26%	5	13	42%	10
9	9	29%	6	9	30%	6	17	56%	14
10	9	31%	6	9	30%	6	16	52%	13
11	8	26%	5	8	27%	5	10	33%	7
12	15	48%	12	12	41%	9	13	45%	10
13	13	42%	10	11	36%	8	12	40%	9
14	12	41%	10	11	37%	8	13	42%	10
15	12	41%	10	11	36%	8	12	40%	9
16	11	37%	8	10	32%	7	11	37%	8
17	11	35%	8	9	31%	6	11	36%	8
18	15	51%	12	13	43%	10	14	45%	11
19	6	18%	3	5	18%	3	8	27%	5
21	4	14%	1	4	14%	1	5	18%	3
22	5	16%	2	5	16%	2	5	17%	2
23	4	14%	1	4	14%	1	5	15%	2
24	4	15%	1	4	15%	2	5	17%	2
25	14	47%	11	12	41%	9	13	44%	10
26	15	50%	12	13	43%	10	13	45%	10
27	6	21%	3	6	20%	3	8	28%	6
28	7	22%	4	6	21%	3	8	28%	6
29	7	22%	4	6	21%	3	9	31%	6
30	7	25%	5	7	25%	5	9	30%	6
31	7	23%	4	7	22%	4	9	31%	6
32	6	21%	3	6	20%	3	8	26%	5
33	10	33%	7	9	30%	6	10	34%	7
34	7	25%	5	7	25%	5	8	27%	5
35	5	15%	2	5	15%	2	5	18%	3

Note: Background values are added to model output and then rounded to the nearest whole number for the purposes of presentation.
[1]EPP(Air) Objective is 25 µg/m^3.

Table 3-5 Annual Average Concentration of $PM_{2.5}$ (µg/m^3).

Rec	Year 1			Year 2			Year 20		
	Total	% of Guide-line[1]	Caval	Total	% of Guide-line[1]	Caval	Total	% of Guide-line[1]	Caval
1	2	28%	1	2	28%	1	3	35%	1
2	2	29%	1	2	28%	1	3	36%	1
3	2	27%	1	2	27%	1	3	33%	1
4	2	25%	0	2	25%	0	2	29%	1
5	2	30%	1	2	29%	1	3	38%	1
6	5	66%	4	5	68%	4	6	69%	4
7	2	29%	1	2	28%	1	3	37%	1
9	2	26%	0	2	26%	0	3	35%	1
10	2	27%	1	2	27%	1	3	35%	1
11	2	25%	0	2	24%	0	2	28%	1
12	3	39%	2	3	36%	1	4	47%	2
13	3	36%	1	3	34%	1	3	43%	2
14	3	34%	1	3	32%	1	3	41%	2
15	4	46%	2	3	41%	2	4	50%	2
16	4	51%	2	4	45%	2	4	51%	2
17	4	49%	2	3	43%	2	4	50%	2
18	5	56%	3	4	48%	2	5	59%	3
19	2	23%	0	2	23%	0	2	25%	0
21	2	21%	0	2	21%	0	2	22%	0
22	2	25%	0	2	25%	0	2	25%	0
23	2	21%	0	2	21%	0	2	21%	0
24	2	21%	0	2	21%	0	2	21%	0
25	4	54%	3	4	47%	2	4	56%	3
26	3	41%	2	3	38%	1	4	51%	2
27	2	23%	0	2	23%	0	2	25%	0
28	2	23%	0	2	23%	0	2	25%	0
29	2	23%	0	2	23%	0	2	25%	0
30	2	24%	0	2	24%	0	2	27%	1
31	2	23%	0	2	23%	0	2	25%	0
32	2	23%	0	2	23%	0	2	25%	0
33	4	44%	2	3	40%	2	4	47%	2
34	2	31%	1	3	31%	1	3	32%	1
35	2	21%	0	2	21%	0	2	21%	0

Note: Background values are added to model output and then rounded to the nearest whole number for the purposes of presentation.

[1]EPP(Air) Objective is 8 µg/m^3.

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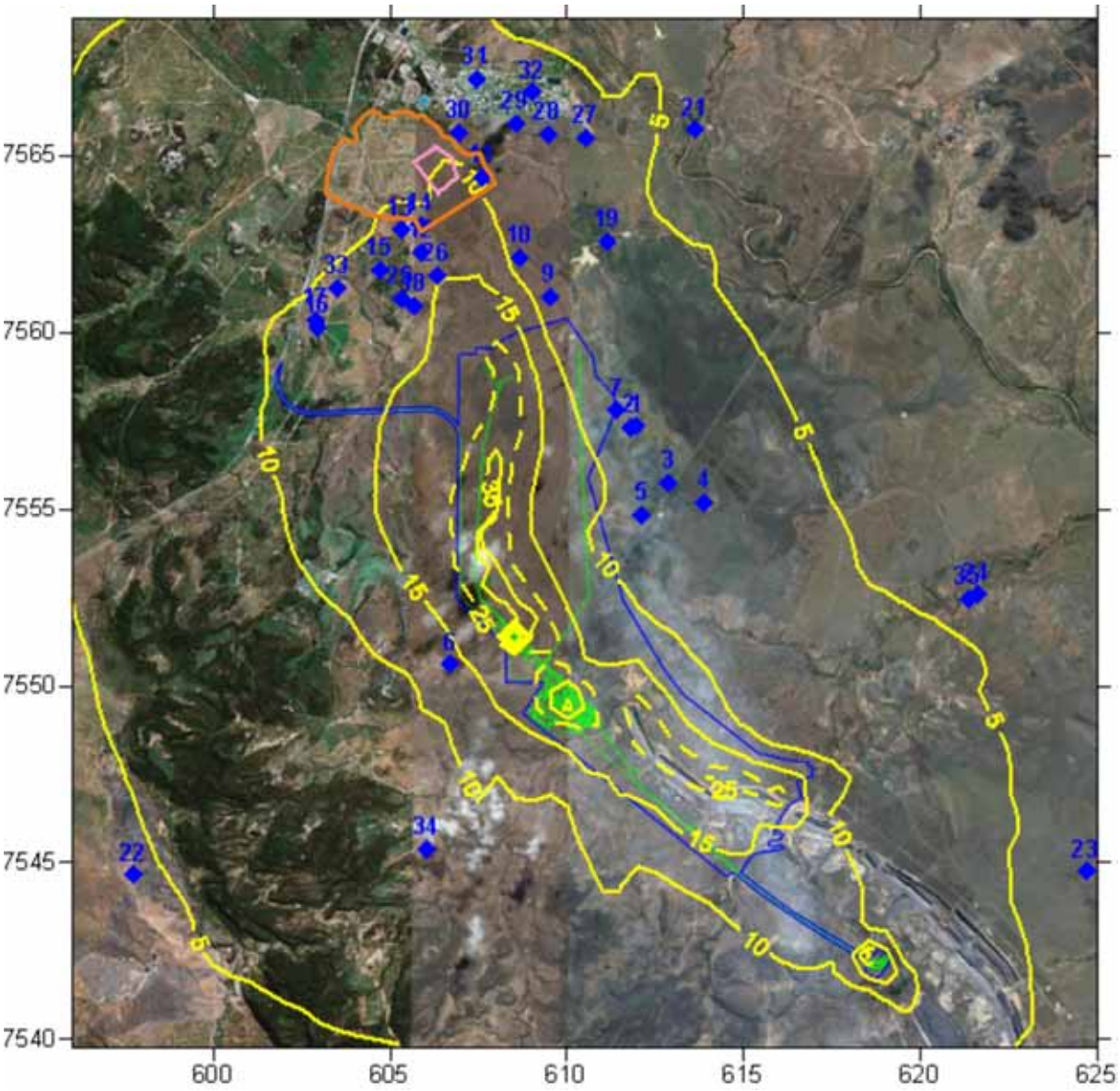

Figure 3-8 Maximum 24-hour Average Ground-Level Concentration of $PM_{2.5}$ for Year 1. EPP(Air) objective is 25 µg/m^3 (dashed line).

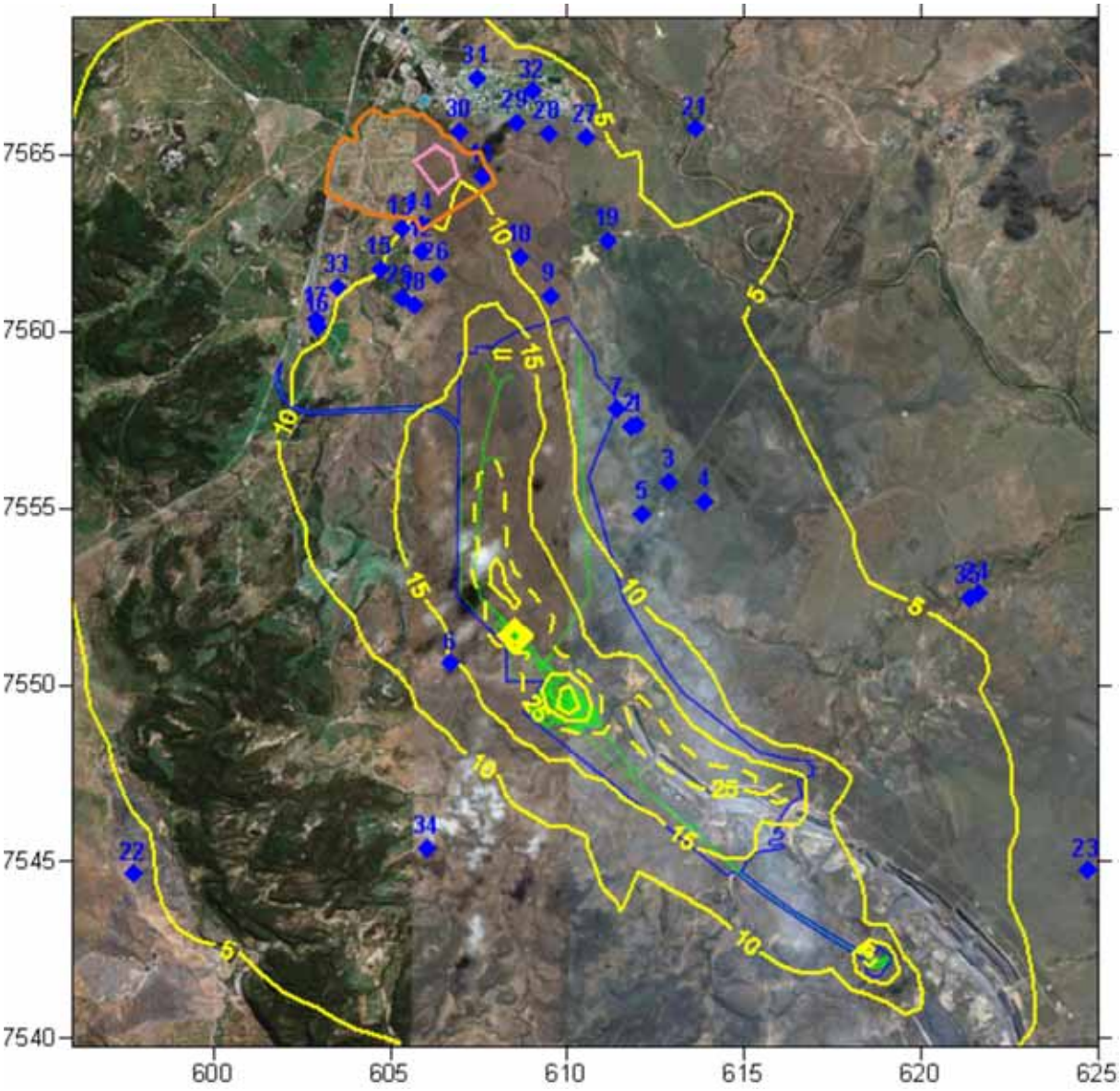

Figure 3-9 Maximum 24-hour Average Ground-Level Concentration of $PM_{2.5}$ for Year 2. EPP(Air) objective is 25 µg/m^3 (dashed line).

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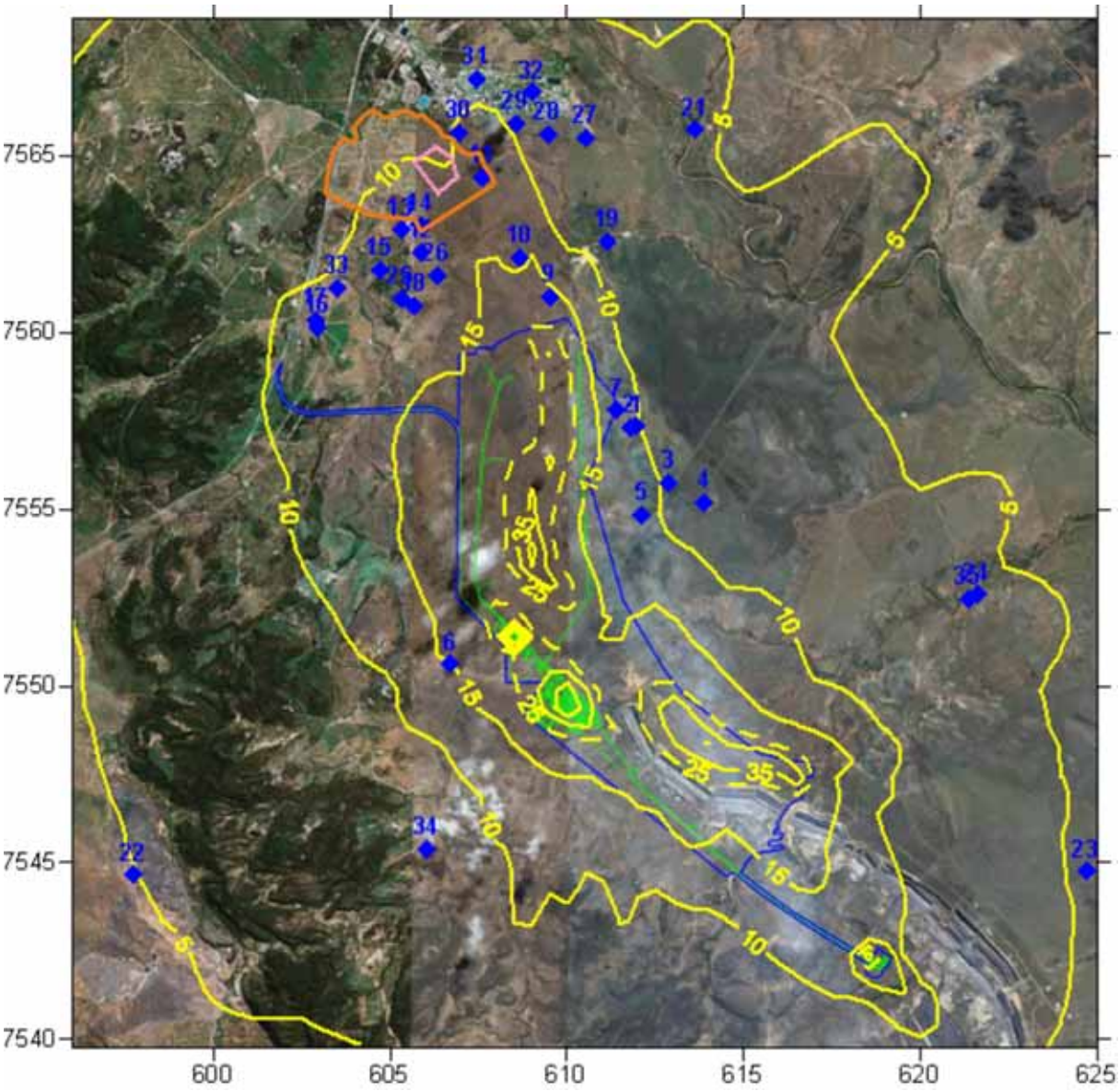

Figure 3-10 Maximum 24-hour Average Ground-Level Concentration of $PM_{2.5}$ for Year 20. EPP(Air) objective is 25 µg/m^3 (dashed line).

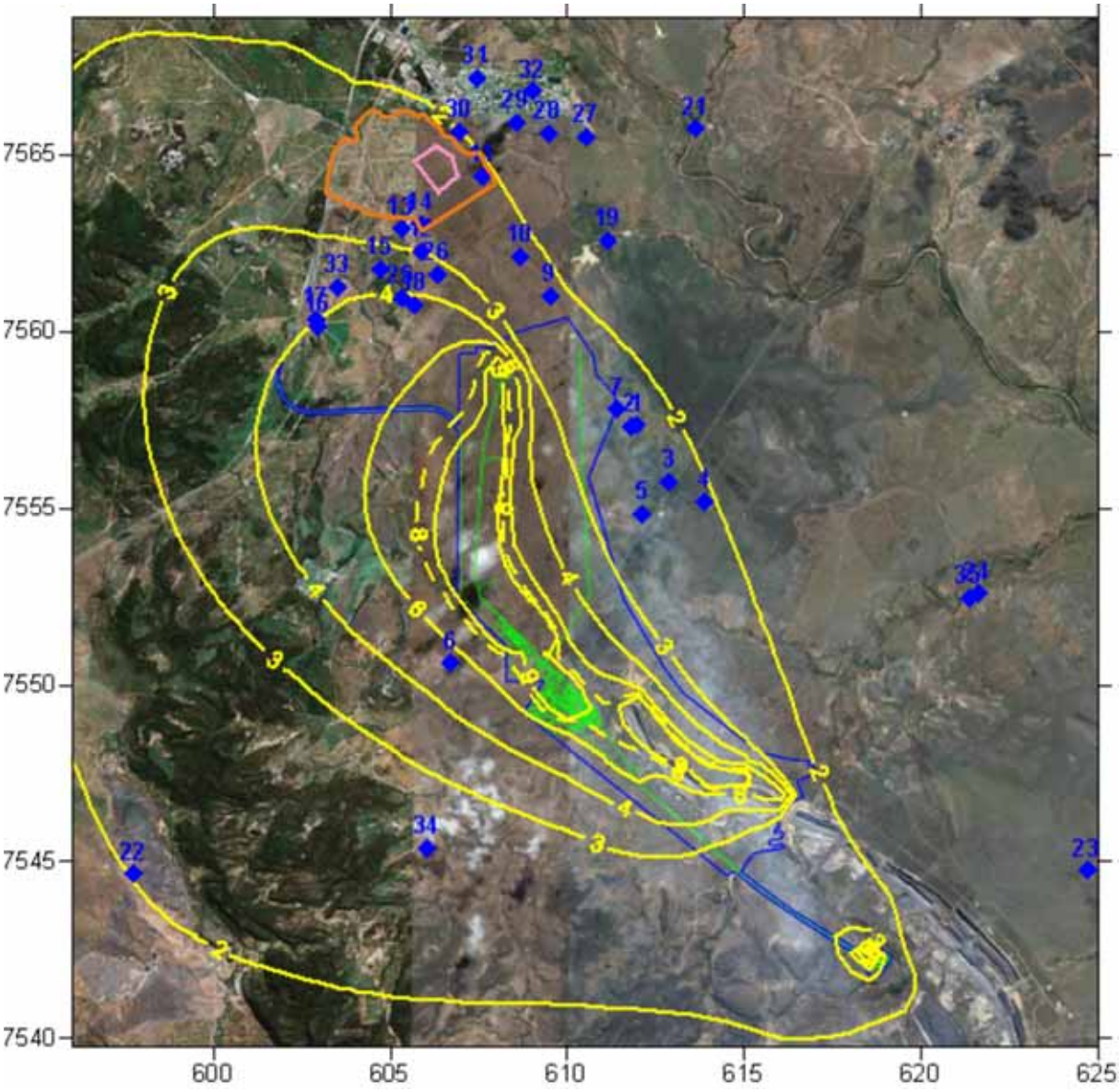

Figure 3-11 Annual Average Ground-Level Concentration of $PM_{2.5}$ for Year 1. EPP(Air) objective is 8 µg/m^3 (dashed line).

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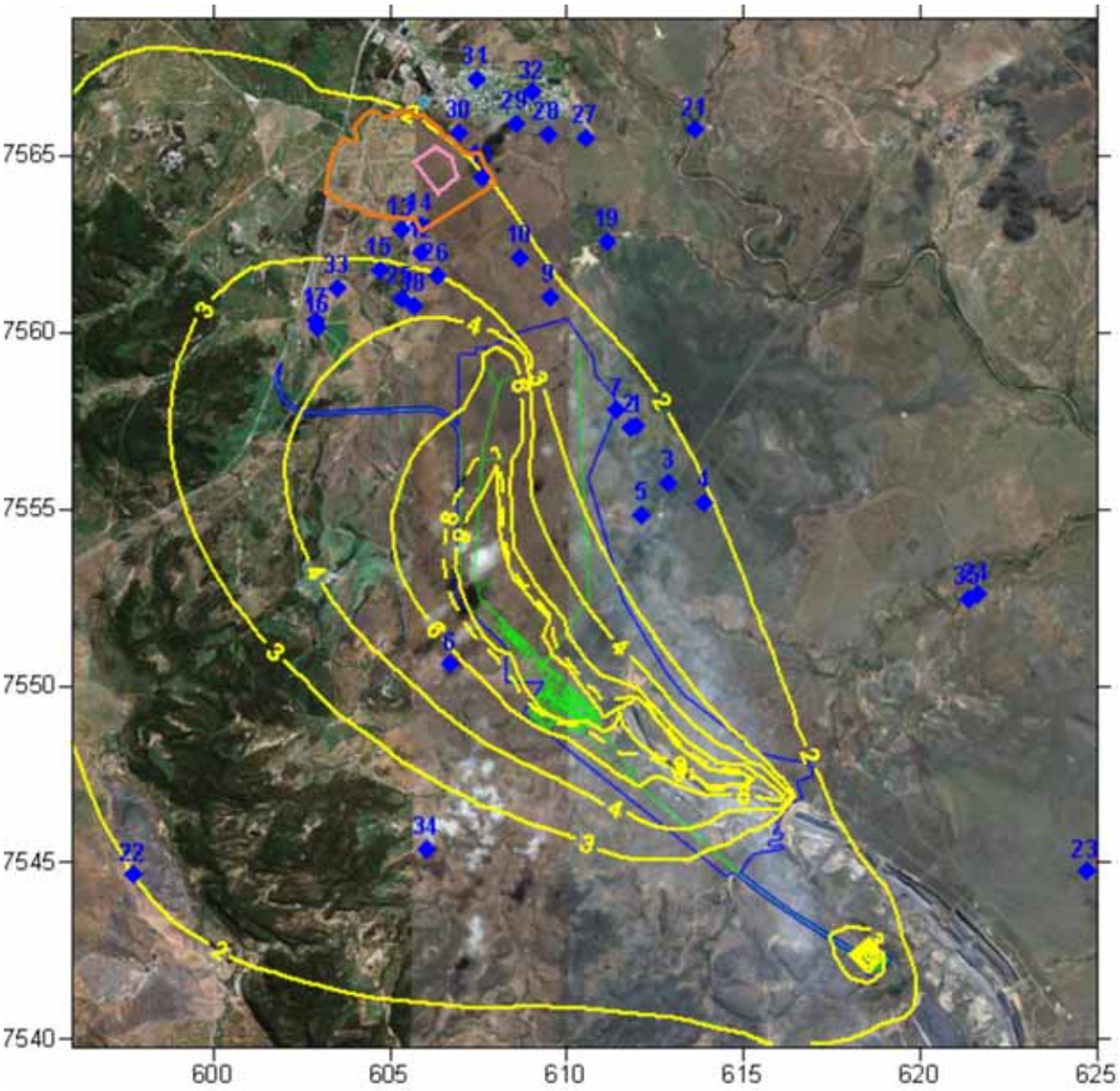

Figure 3-12 Annual Average Ground-Level Concentration of $PM_{2.5}$ for Year 2. EPP(Air) objective is 8 µg/m^3 (dashed line).

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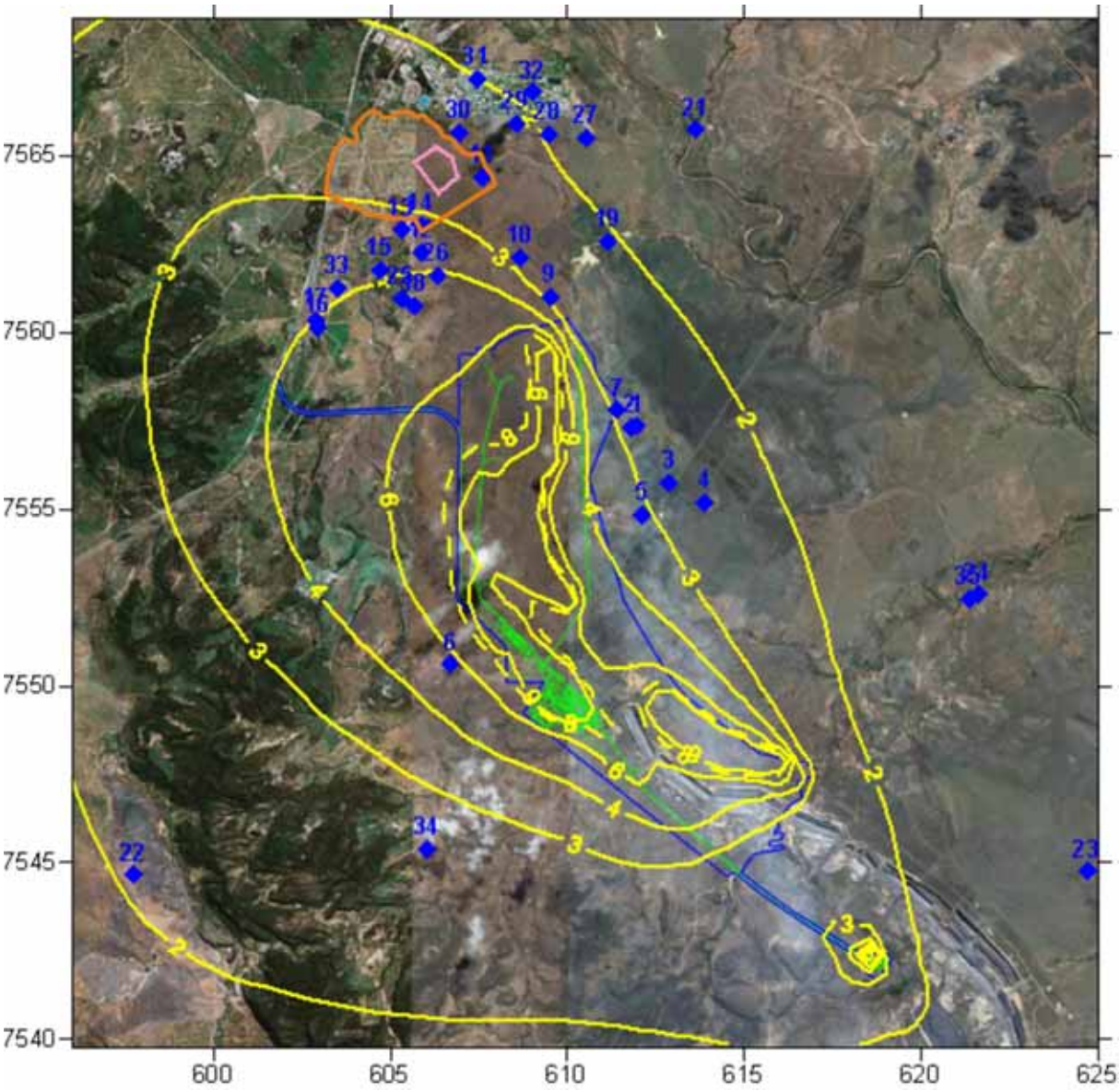

Figure 3-13 Annual Average Ground-Level Concentration of $PM_{2.5}$ for Year 20. EPP(Air) objective is 8 µg/m^3 (dashed line).

3.2.4 Dust Deposition

Presented in Table 3-6 are the results for the predicted dust deposition at receptor locations for Year 1, Year 2 and Year 20. Results suggest that dust deposition will remain below the project goal of 4 g/m^2/month at all locations. As discussed in the EIS, the existing background concentration of dust deposition is 1.5 g/m^2/month. This has been included in the 'Total' column of the table.

Presented in Figure 3-14 is a contour plot of the monthly dust deposition for Year 20.

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Table 3-6 Monthly Annual Average Dust Deposition (g/m^2/month)

Rec	Year 1			Year 2			Year 20		
	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution
1	1.6	40%	0.1	1.6	40%	0.1	1.6	40%	0.1
2	1.6	40%	0.1	1.6	40%	0.1	1.6	40%	0.1
3	1.6	40%	0.1	1.6	40%	0.1	1.6	40%	0.1
4	1.6	39%	0.1	1.6	39%	0.1	1.6	39%	0.1
5	1.6	41%	0.1	1.6	41%	0.1	1.6	41%	0.1
6	2.2	55%	0.7	2.3	57%	0.8	2.3	57%	0.8
7	1.6	40%	0.1	1.6	40%	0.1	1.6	40%	0.1
9	1.6	39%	0.1	1.6	40%	0.1	1.6	40%	0.1
10	1.6	40%	0.1	1.6	40%	0.1	1.6	40%	0.1
11	1.5	39%	0.0	1.6	39%	0.1	1.6	39%	0.1
12	1.7	43%	0.2	1.8	44%	0.3	1.8	44%	0.3
13	1.7	42%	0.2	1.7	43%	0.2	1.7	43%	0.2
14	1.6	41%	0.1	1.7	42%	0.2	1.7	42%	0.2
15	1.8	45%	0.3	1.9	47%	0.4	1.9	47%	0.4
16	1.8	46%	0.3	1.9	48%	0.4	1.9	48%	0.4
17	1.8	46%	0.3	1.9	47%	0.4	1.9	47%	0.4
18	2.0	50%	0.5	2.1	52%	0.6	2.1	52%	0.6
19	1.5	38%	0.0	1.5	38%	0.0	1.5	38%	0.0
21	1.5	38%	0.0	1.5	38%	0.0	1.5	38%	0.0
22	1.5	39%	0.0	1.5	39%	0.0	1.5	39%	0.0
23	1.5	38%	0.0	1.5	38%	0.0	1.5	38%	0.0
24	1.5	38%	0.0	1.5	38%	0.0	1.5	38%	0.0
25	1.9	49%	0.4	2.0	51%	0.5	2.0	51%	0.5
26	1.8	44%	0.3	1.8	46%	0.3	1.8	46%	0.3
27	1.5	38%	0.0	1.5	38%	0.0	1.5	38%	0.0
28	1.5	38%	0.0	1.5	39%	0.0	1.5	39%	0.0
29	1.5	38%	0.0	1.5	39%	0.0	1.5	39%	0.0
30	1.5	38%	0.0	1.6	39%	0.1	1.6	39%	0.1
31	1.5	39%	0.0	1.6	39%	0.1	1.6	39%	0.1
32	1.5	39%	0.0	1.6	39%	0.1	1.6	39%	0.1
33	1.8	45%	0.3	1.9	46%	0.4	1.9	46%	0.4
34	1.6	40%	0.1	1.6	41%	0.1	1.6	41%	0.1
35	1.5	38%	0.0	3.1	77%	1.6	3.1	77%	1.6

Note: Background values are added to model output and then rounded to the nearest whole number for the purposes of presentation.
[1]Project goal is 4g/m^2/month.

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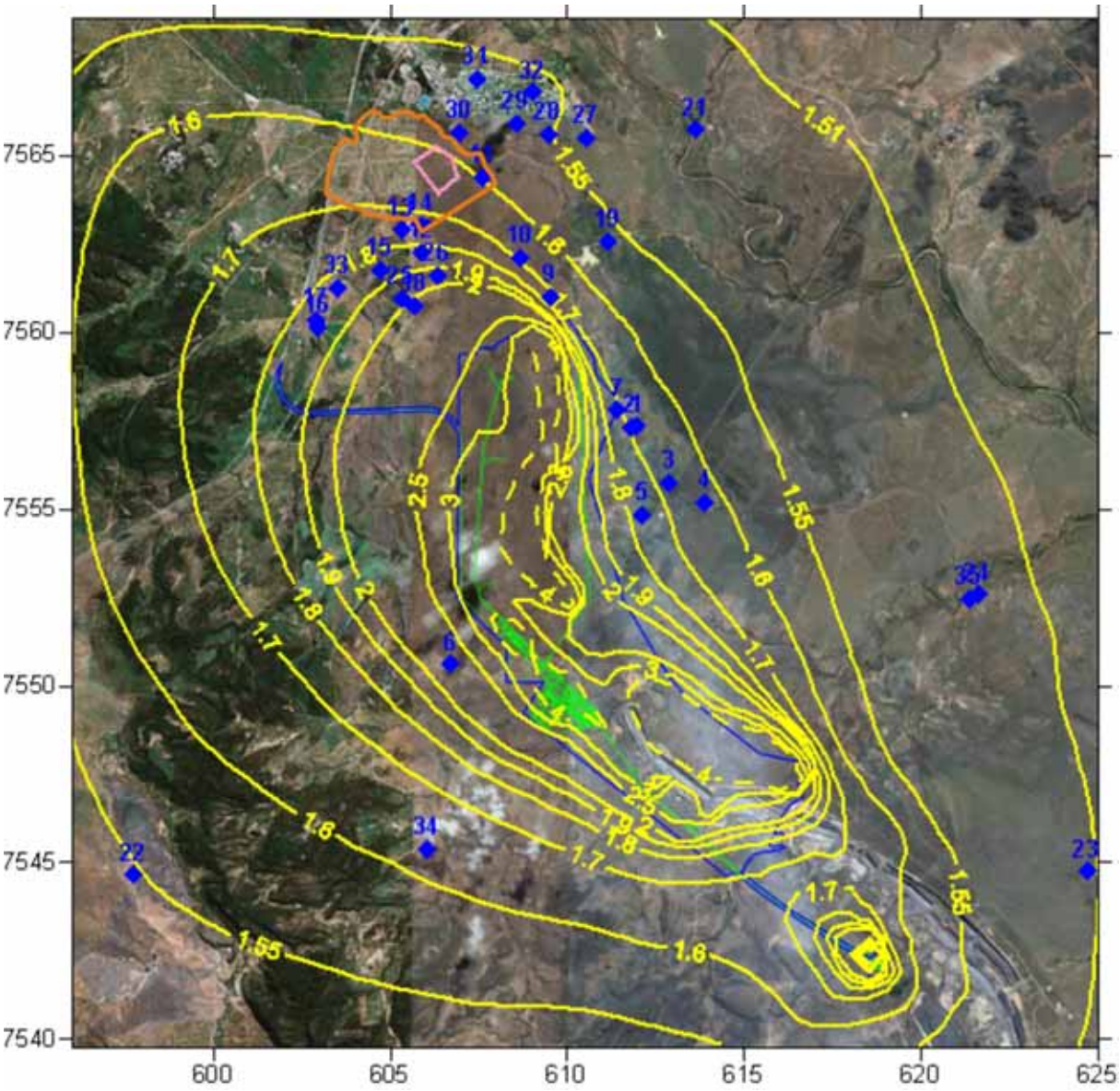

Figure 3-14 Monthly Dust Deposition for Year 20. Project goal is 4 g/m^2/month (dashed line).

3.3 Worst-Case 24 Hour Emissions Scenario

The reader is directed to Appendix L of the Caval Ridge EIS for more details of the worst-case 24 hour emissions scenarios.

A discussion regarding the likelihood of the impacts associated with these worst-case dust emission scenarios is presented in Section 3.3.3.

3.3.1 Worst-Case North Scenario

Presented in Table 3-7 are the results for the predicted fifth highest ground-level concentration of PM_{10} for Year 1, Year 2 and Year 20 based on the worst-case north scenario. A background concentration of 18.8 µg/m^3 has been included in the 'Total' column of the table.

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Results suggest that the ground-level concentrations of PM_{10} associated with the worst-case north scenario has the potential to exceed the EPP(Air) goal of 50 µg/m^3 at locations to the northwest of the Horse Pit for all years modelled.

Ground-level concentrations of PM_{10} are predicted to exceed the EPP(Air) goal of 50 µg/m^3 at receptor location 28 (51 µg/m^3) and location 29 (51 µg/m^3) which are within the Township of Moranbah (receptors 27 through 31).

Presented in Figure 3-15 through Figure 3-17 are contour plots of the fifth-highest 24-hour average ground-level concentrations of PM_{10} based on the worst-case north operational conditions. A background concentration of 18.8 µg/m^3 has been included in the figures.

Table 3-7 Worst Case North Scenario - Fifth Highest Ground-Level Concentration of PM_{10} (µg/m^3).

Rec	Year 1			Year 2			Year 20		
	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution
1	47	94%	28	47	94%	28	**75**	**150%**	**56**
2	48	96%	29	48	96%	29	**76**	**152%**	**57**
3	41	82%	22	44	88%	25	**57**	**115%**	39
4	36	72%	17	40	80%	21	45	89%	26
5	44	87%	25	44	88%	25	**53**	**106%**	34
6	**69**	**137%**	**50**	**76**	**152%**	**57**	**69**	**137%**	**50**
7	**50**	**101%**	32	44	88%	25	**89**	**178%**	**70**
9	46	93%	28	39	77%	20	**140**	**280%**	**121**
10	**59**	**118%**	40	41	82%	22	**101**	**203%**	**83**
11	44	88%	25	33	66%	14	**57**	**113%**	38
12	**85**	**171%**	**67**	**53**	**106%**	34	**80**	**160%**	**61**
13	**75**	**149%**	**56**	48	97%	30	**75**	**151%**	**56**
14	**67**	**134%**	48	47	94%	28	**79**	**158%**	**60**
15	**78**	**157%**	**60**	**59**	**117%**	40	**72**	**144%**	**53**
16	**64**	**127%**	45	**64**	**128%**	45	**59**	**118%**	40
17	**63**	**125%**	44	**61**	**122%**	42	**57**	**115%**	39
18	**96**	**191%**	**77**	**64**	**127%**	45	**81**	**162%**	**62**
19	31	63%	13	30	60%	11	44	88%	25
21	24	48%	5	26	52%	7	28	55%	9
22	27	55%	9	31	61%	12	28	57%	9
23	22	44%	3	25	50%	6	24	48%	5
24	24	48%	5	25	51%	7	26	53%	8
25	**86**	**173%**	**68**	**63**	**126%**	44	**78**	**156%**	**59**
26	**91**	**183%**	**73**	**52**	**104%**	33	**90**	**179%**	**71**
27	36	71%	17	32	65%	14	48	96%	29
28	38	75%	19	33	66%	14	**51**	**101%**	32
29	37	73%	18	32	64%	13	**52**	**103%**	33
30	39	78%	20	31	62%	12	48	97%	30
31	37	75%	19	31	63%	13	43	86%	24
32	35	70%	16	31	62%	12	46	92%	27
33	**62**	**124%**	43	**54**	**108%**	35	**61**	**121%**	42

3 Interpretation of Air Quality Impacts

Rec	Year 1			Year 2			Year 20		
	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution
34	40	81%	22	42	85%	24	41	83%	23
35	25	49%	6	26	51%	7	27	54%	8

Note (1) Numbers in bold indicate predicted levels exceed the relevant EPP(Air) objective.
[1]EPP(Air) Objective is 50 µg/m^3

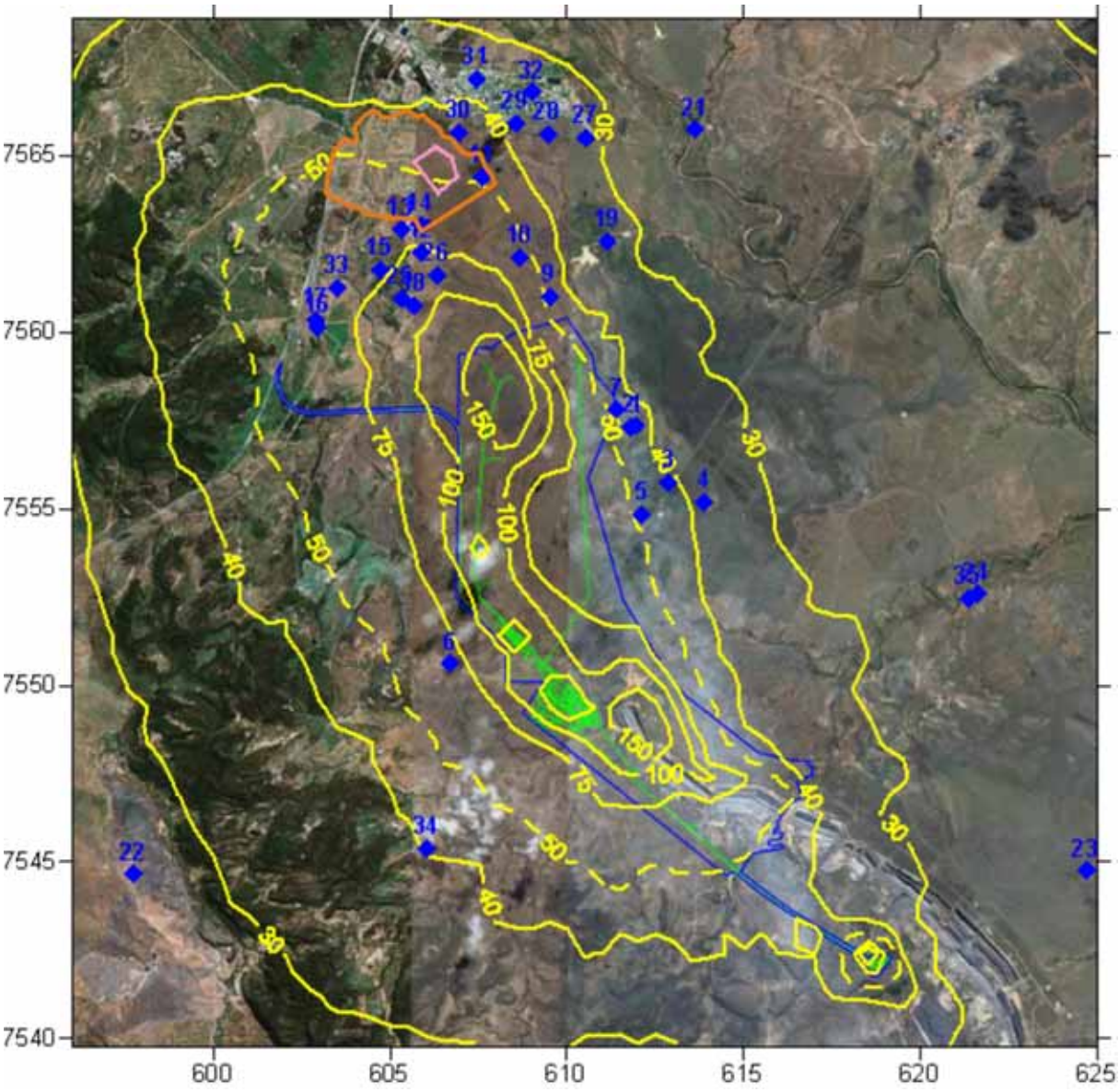


Figure 3-15 Worst-Case North Scenario - Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 1. EPP(Air) objective is 50 µg/m^3 (dashed line).

3 Interpretation of Air Quality Impacts

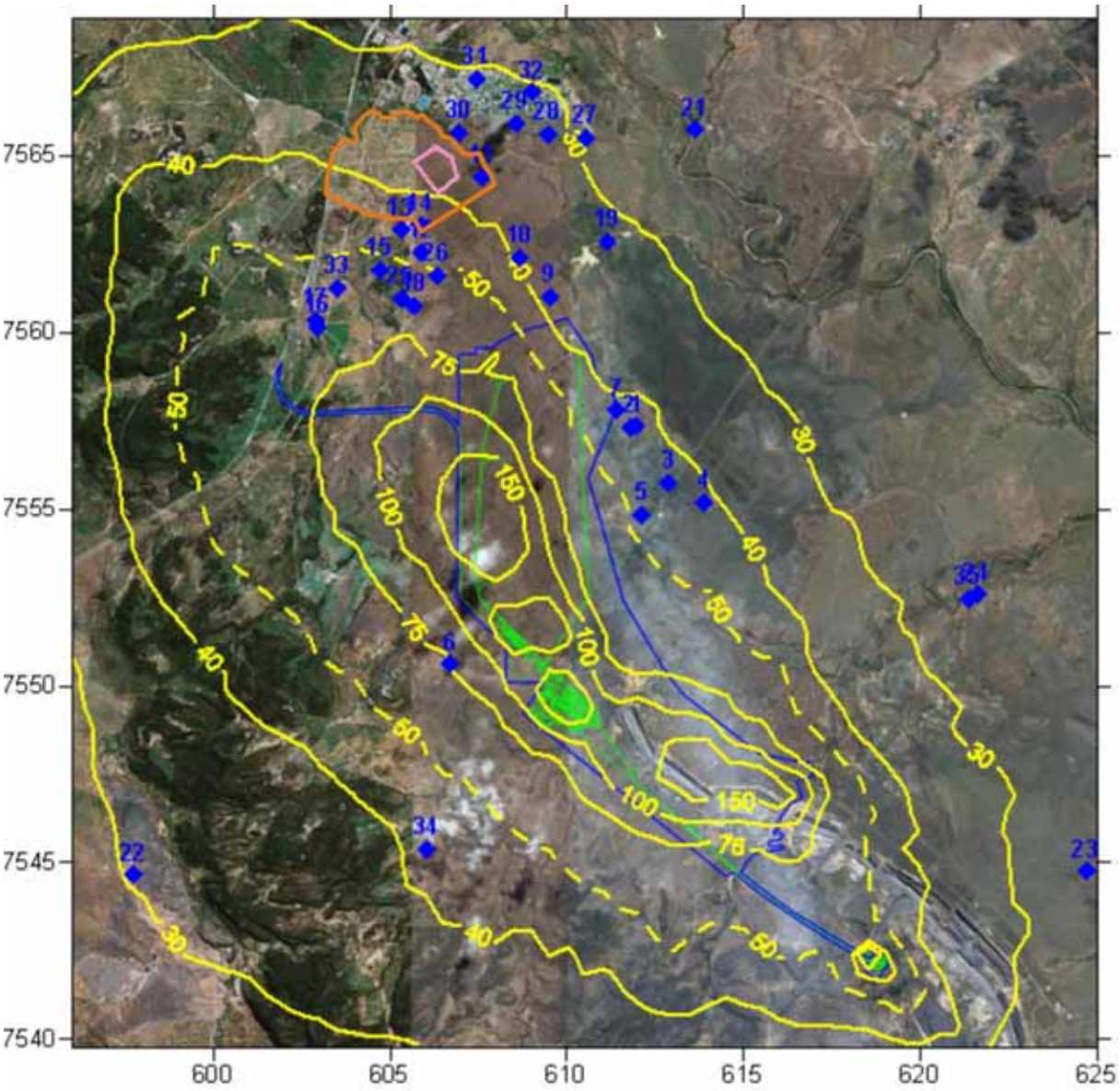


Figure 3-16 Worst-Case North Scenario - Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 2. EPP(Air) objective is 50 µg/m^3 (dashed line).

3 Interpretation of Air Quality Impacts

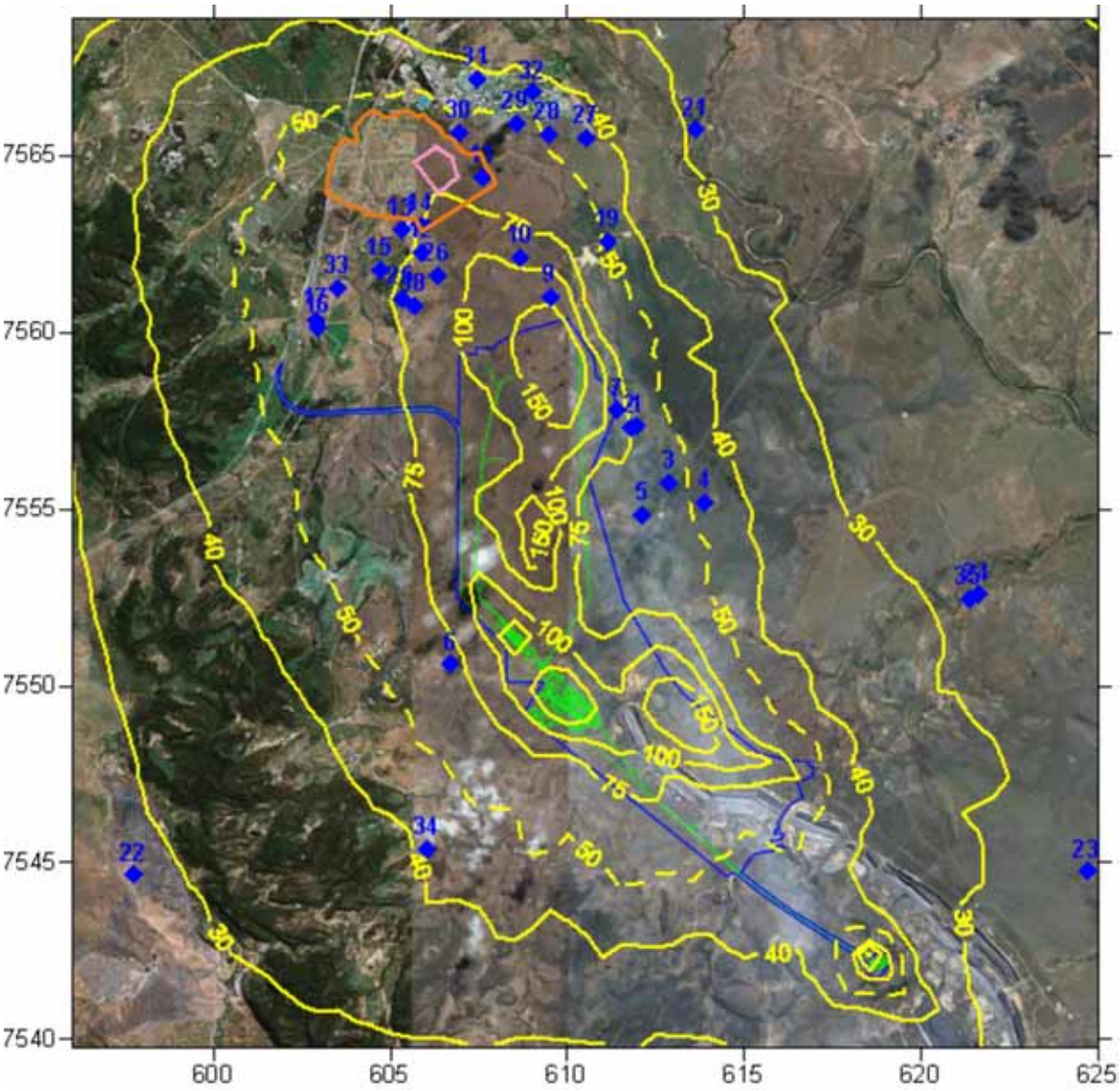


Figure 3-17 Worst-Case North Scenario - Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 20. EPP(Air) objective is 50 µg/m^3 (dashed line).

3.3.2 Worst Case South Scenario

Presented in Table 3-8 are the results for the predicted fifth highest ground-level concentration of PM_{10} for Year 1, Year 2 and Year 20 based on the worst-case south scenario. A background concentration of 18.8 µg/m^3 has been included in the 'Total' column of the table.

Results suggest that the ground-level concentration of PM_{10} associated with the worst-case south scenario has the potential to exceed the EPP(Air) goal of 50 µg/m^3 at locations to the northwest of the Horse Pit for all years modelled.

Ground-level concentrations of PM_{10} are not predicted to exceed the EPP(Air) goal of 50 µg/m^3 within the Township of Moranbah (receptors 27 through 31).

3 Interpretation of Air Quality Impacts

Presented in Figure 3-18 through Figure 3-20 are contour plots of the fifth-highest 24-hour average ground-level concentrations of PM_{10} based on the worst-case south operational conditions. A background concentration of 18.8 µg/m^3 has been included in the figures.

Table 3-8 Worst Case South Scenario - Fifth Highest Ground-Level Concentration of PM_{10} (µg/m^3).

Rec	Year 1			Year 2			Year 20		
	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution	Total	% of Guide-line[1]	Caval Contri-bution
1	49	97%	30	47	94%	28	**55**	**110%**	36
2	49	99%	31	48	96%	29	**55**	**110%**	36
3	44	89%	26	44	88%	25	**51**	**101%**	32
4	40	80%	21	40	80%	21	46	92%	27
5	45	91%	27	44	88%	25	**55**	**110%**	36
6	**76**	**151%**	**57**	**76**	**152%**	**57**	**77**	**154%**	**58**
7	49	98%	30	44	88%	25	**52**	**104%**	33
9	41	81%	22	39	77%	20	49	98%	30
10	46	92%	27	41	82%	22	47	94%	28
11	36	71%	17	33	66%	14	36	73%	18
12	**62**	**125%**	44	**53**	**106%**	34	**57**	**114%**	38
13	**57**	**114%**	38	48	97%	30	**54**	**108%**	35
14	**54**	**108%**	35	47	94%	28	**52**	**105%**	34
15	**68**	**136%**	49	**59**	**117%**	40	**63**	**125%**	44
16	**70**	**139%**	**51**	**64**	**128%**	45	**63**	**126%**	44
17	**66**	**131%**	47	**61**	**122%**	42	**61**	**122%**	42
18	**75**	**150%**	**56**	**64**	**127%**	45	**73**	**147%**	**55**
19	31	62%	12	30	60%	11	34	68%	15
21	26	52%	7	26	52%	7	28	55%	9
22	30	60%	11	31	61%	12	30	61%	12
23	25	51%	6	25	50%	6	27	55%	8
24	25	51%	7	25	51%	7	27	55%	9
25	**75**	**150%**	**56**	**63**	**126%**	44	**72**	**143%**	**53**
26	**62**	**125%**	43	**52**	**104%**	33	**57**	**115%**	39
27	34	68%	15	32	65%	14	37	74%	18
28	34	69%	16	33	66%	14	36	72%	17
29	33	67%	15	32	64%	13	36	71%	17
30	33	66%	14	31	62%	12	34	69%	16
31	34	68%	15	31	63%	13	32	65%	14
32	33	65%	14	31	62%	12	35	70%	16
33	**58**	**116%**	39	**54**	**108%**	35	**55**	**110%**	36
34	45	90%	26	42	85%	24	43	86%	24
35	26	51%	7	26	51%	7	28	56%	9

Note (1) Numbers in bold indicate predicted levels exceed the relevant EPP(Air) objective.
[1] EPP(Air) Objective is 50 µg/m^3

3 Interpretation of Air Quality Impacts

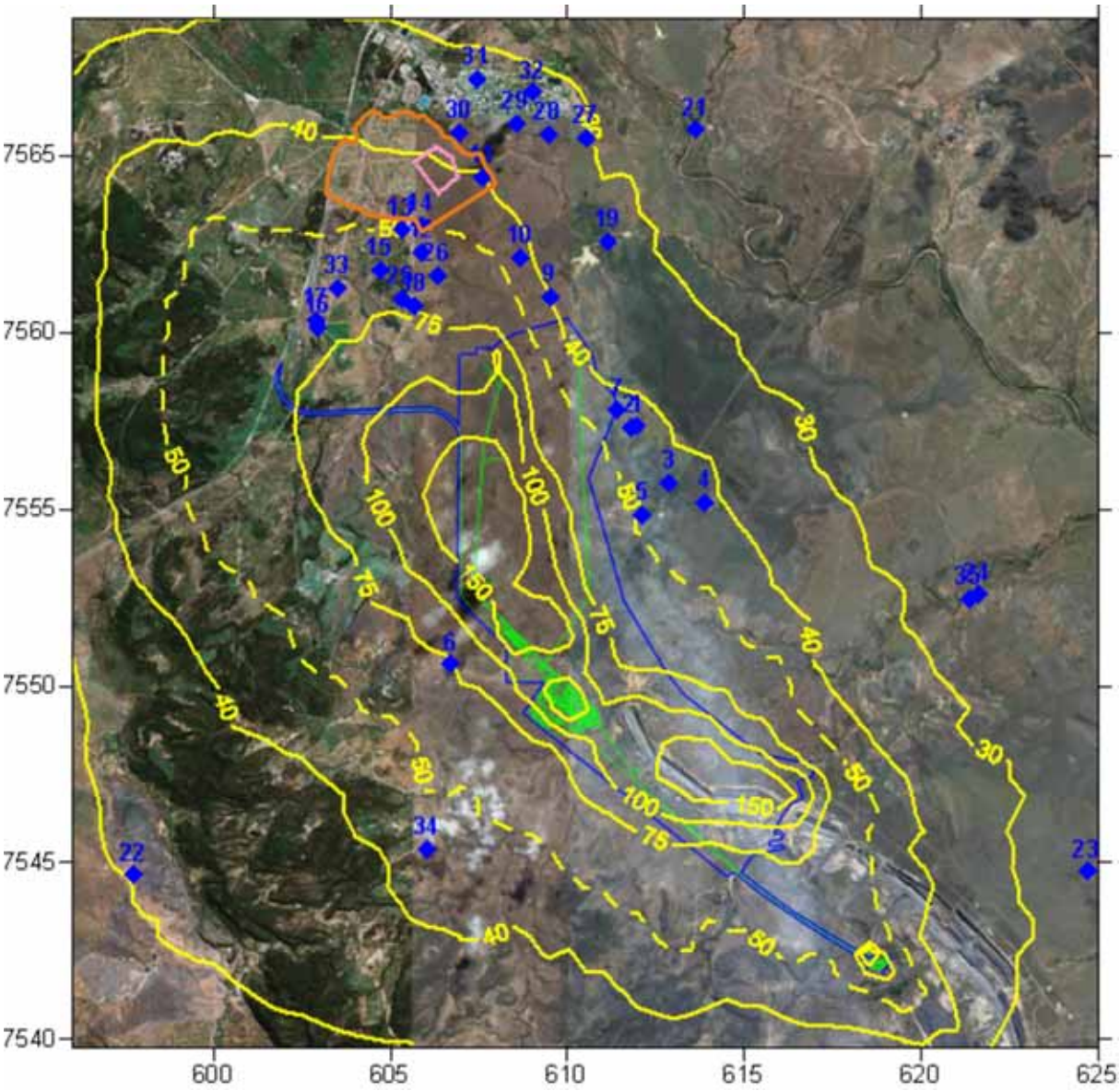


Figure 3-18 Worst-Case South Scenario - Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 1. EPP(Air) objective is 50 µg/m^3 (dashed line).

3 Interpretation of Air Quality Impacts

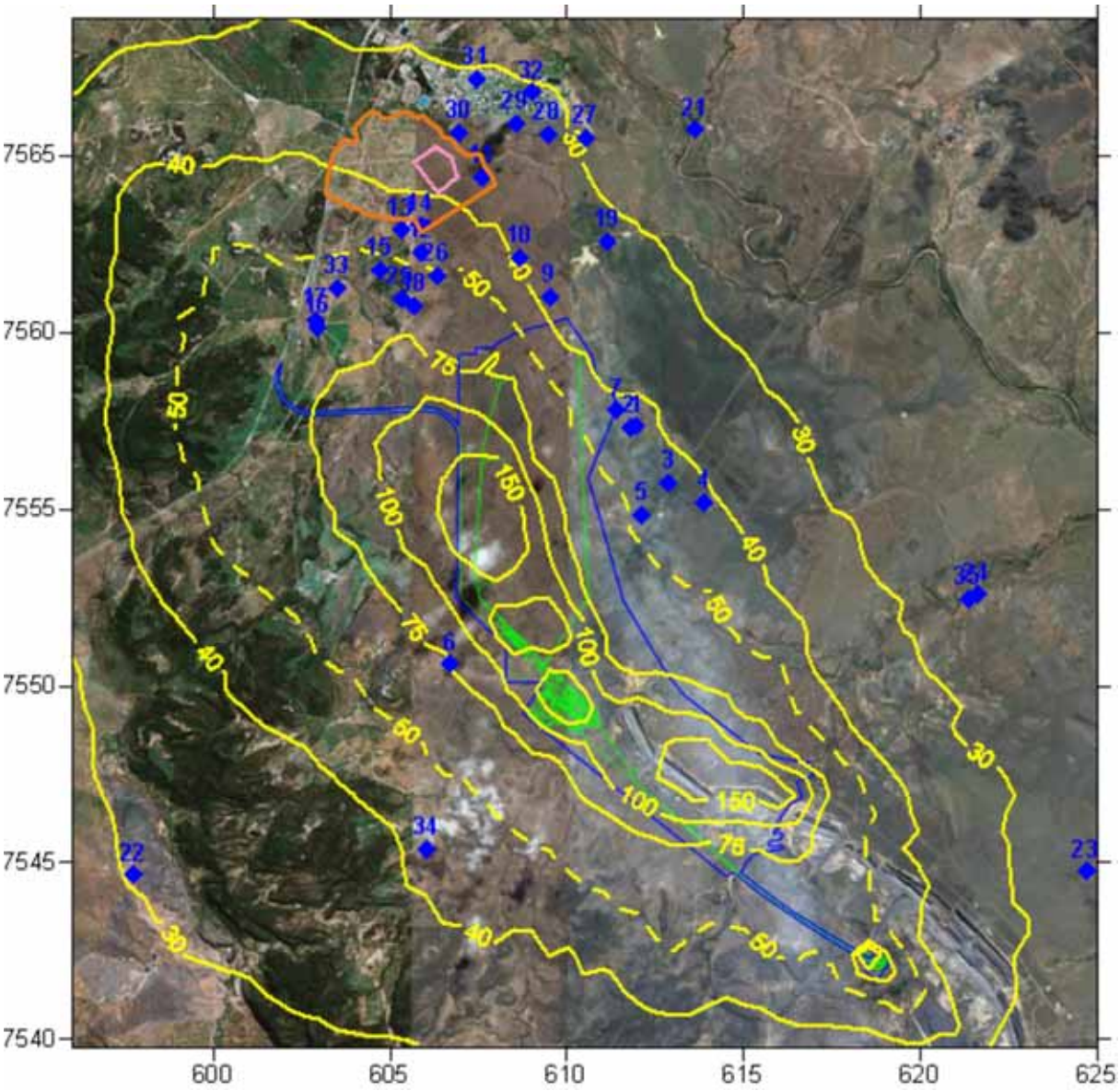


Figure 3-19 Worst-Case South Scenario - Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 2. EPP(Air) objective is 50 µg/m^3 (dashed line).

3 Interpretation of Air Quality Impacts

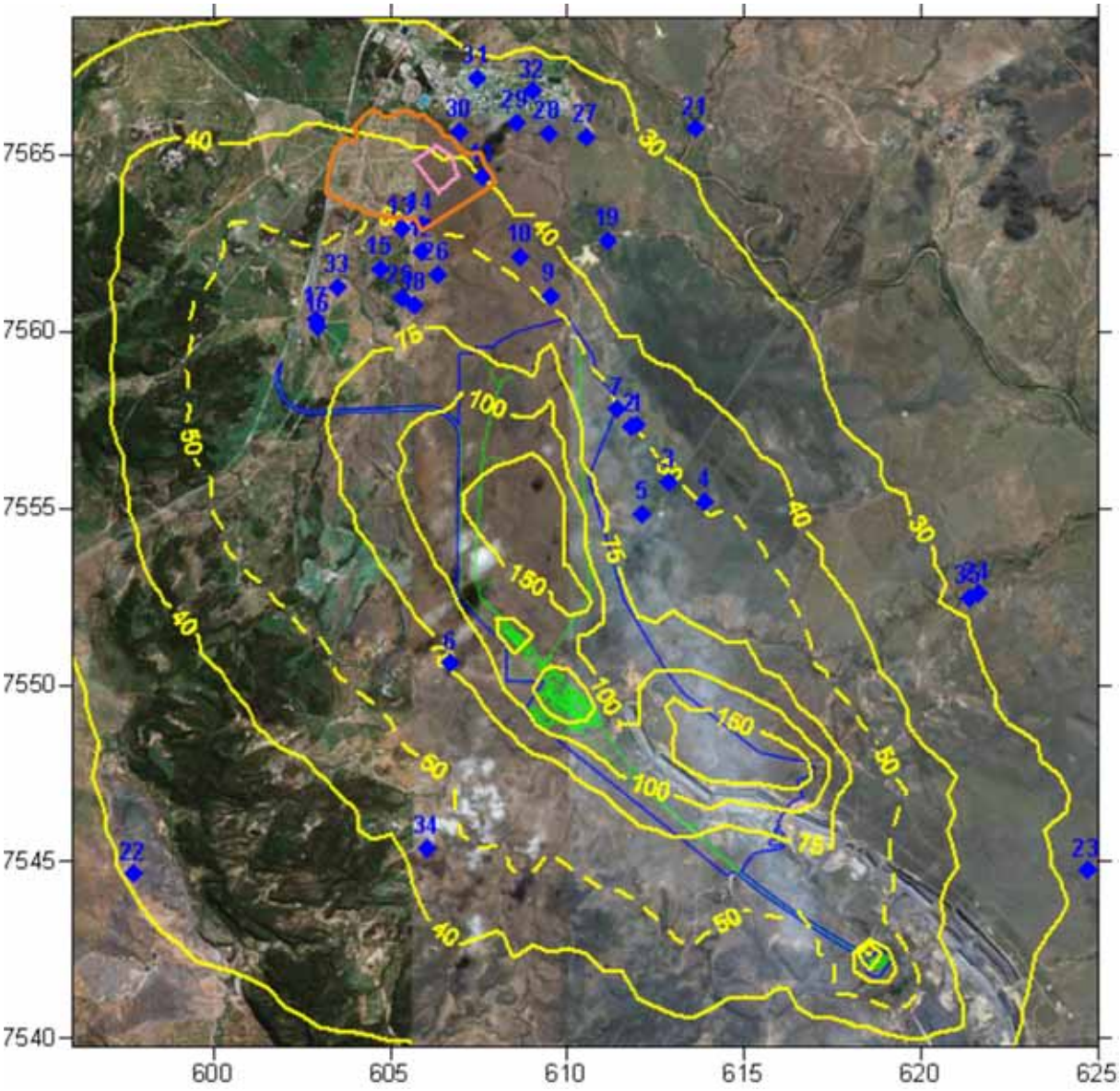


Figure 3-20 Worst-Case South Scenario - Fifth Highest 24-hour Average Ground-Level Concentration of PM_{10} for Year 20. EPP(Air) objective is 50 µg/m^3 (dashed line).

3.3.3 Likelihood of Occurrence of Worst Case Impacts

The worst-case north and south scenarios have been developed assuming that during a 24-hour period:

- One dragline is working at an optimal operational capacity of 44,000 bcm;
- One shovel and truck fleet is working at an optimal operational capacity of 147,200 tonnes; and
- One excavator is working on overburden at an optimal operational capacity of 48,300 tonnes.

3 Interpretation of Air Quality Impacts

Based on information provided by BMA, the likelihood that one of the aforementioned equipment (ie dragline, shovel and truck fleet, or excavator) is operating at optimal capacity for a 24 hour period is 5% (i.e. 1 day in 20). The likelihood that two of the three are operating at optimal operational capacity for a 24 hour period is 0.25% (i.e. 1 day in 400 days) and the likelihood that all three are operating at optimal capacity for a 24 hour period is 0.0125% (i.e. 1 day in 8,000 days or 22 years).

Presented in Figure 3-21 is a timeseries of the 24-hour average ground-level concentration of PM_{10} at receptor location 28 (on the southern edge of the Township of Moranbah). Results of the dispersion modelling suggest that due to meteorological conditions there is the potential for emissions of dust during optimal operating conditions to contribute to an exceedence of the EPP(Air) objective of 50 $\mu g/m^3$ at this location 6 days per year.

Thus the likelihood that worst-case meteorological conditions and optimal operation of two pieces of equipment is 1 day in 2,400 days (or 1 day in 6.5 years) and with three pieces of equipment (presented in Section 3.3.1 and Section 3.3.2) is 1 day in 48,000 days (or 1 day in 131.5 years).

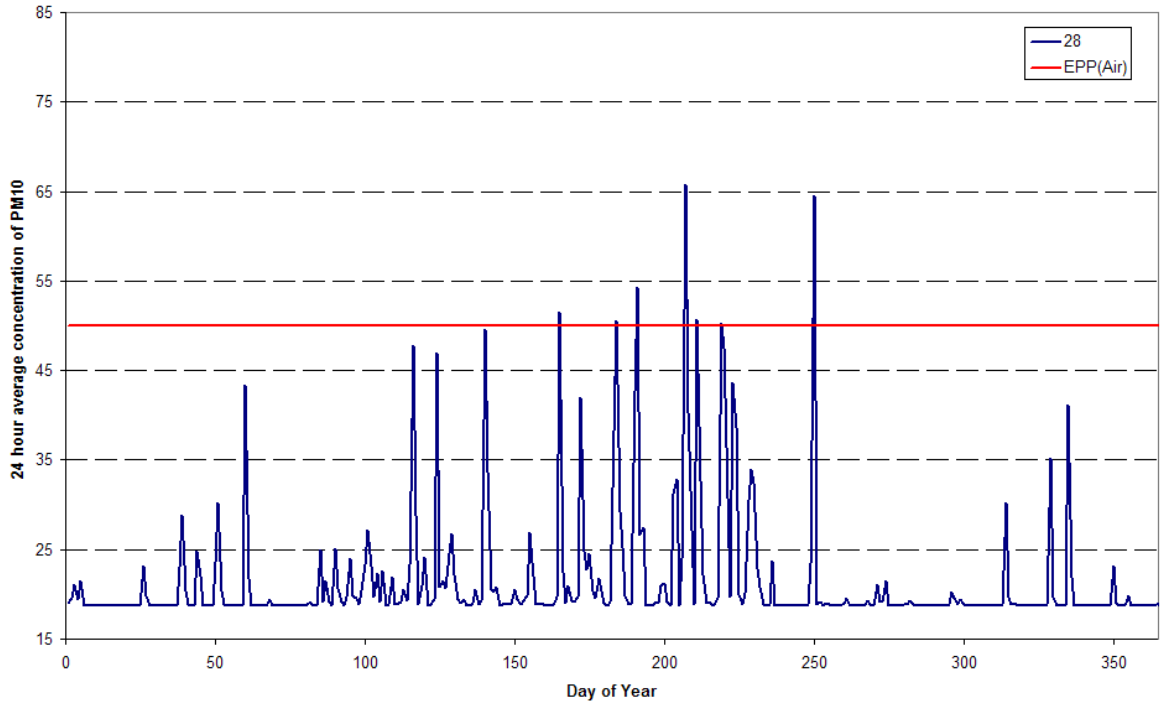


Figure 3-21 Year 20 Worst-Case North Scenario - Timeseries of Predicted 24-hour Average Ground-Level Concentration of PM_{10} at Receptor Location 28. EPP(Air) objective is 50 $\mu g/m^3$ (dashed line).

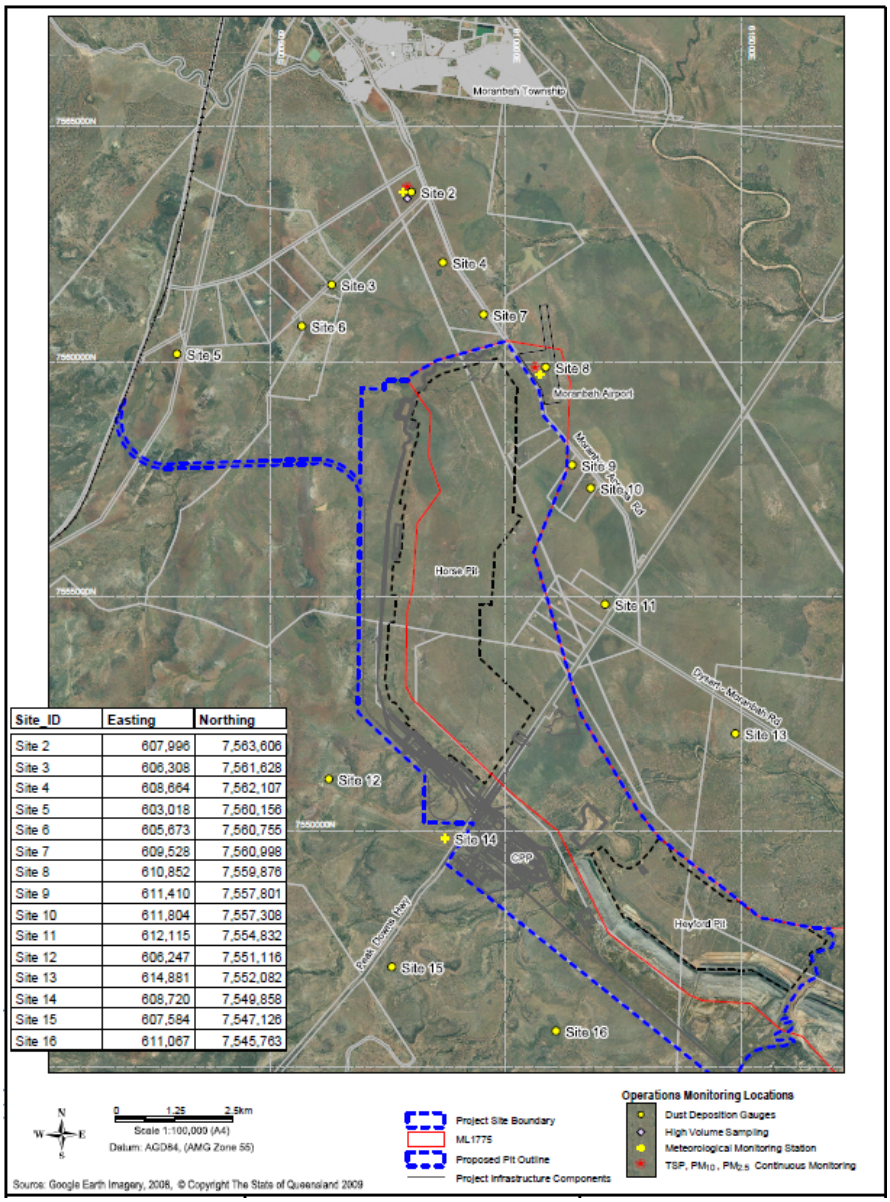
4

Comments and Summary

4.1 Ambient Air Monitoring Program

The ambient air monitoring program is proposed to be extended to include continuous monitoring of TSP, PM_{10} and/or $PM_{2.5}$ at locations surrounding the Caval Ridge Mine site. The details of the extension of the monitoring program have yet to be finalised but is proposed to include (in addition to the operational monitoring outlined the Caval Ridge EIS Appendix L):

- Continuous PM_{10}, $PM_{2.5}$ and meteorological monitoring at the Moranbah Airport; and
- Continuous TSP, PM_{10}, $PM_{2.5}$ and meteorological monitoring at a location between the Caval Ridge Mine and the Township of Moranbah as indicated in Figure 4-1.



Site_ID	Easting	Northing
Site 2	607,996	7,563,606
Site 3	606,308	7,561,628
Site 4	608,664	7,562,107
Site 5	603,018	7,560,156
Site 6	605,673	7,560,755
Site 7	609,528	7,560,998
Site 8	610,852	7,559,876
Site 9	611,410	7,557,801
Site 10	611,804	7,557,308
Site 11	612,115	7,554,832
Site 12	606,247	7,551,116
Site 13	614,881	7,552,082
Site 14	608,720	7,549,858
Site 15	607,584	7,547,126
Site 16	611,067	7,545,763

Figure 4-1 Proposed Ambient Air Monitoring Program Including Dust Deposition, Monitoring of Particulate Matter and Meteorological Parameters

4.2 Cumulative Impacts

Submissions have been raised during the Caval Ridge EIS review, expressing concerns regarding the effects of the cumulative impacts of dust on local and regional air quality as a result of an increased number of dust generating activities in the region.

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.

It should be noted 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 Township of Moranbah and proposed and existing mining operations, local quarrying activities, and other regional sources of dust, possible impacts on the 24-hour average concentration of PM_{10} within Moranbah Township include (but may not be limited to) the following:

- Impacts from activities located within a similar band of wind directions will be additive. Thus when the wind is from the east, any and all dust sources to the east of the Moranbah will be additive. Similarly, when the wind is from the south, any and all dust sources to the south of Moranbah will be additive.
- Worst-case impacts of dust from the Isaac Plains Mine will not coincide with those from the proposed Caval Ridge mine.
- Worst-case impacts of dust from the Isaac Plains Mine will not coincide with those from the other dust generating activities that are not to the west of the Township
- Moranbah may experience a higher frequency of elevated levels of PM_{10}

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

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

4.3 Summary

A review and refinement of the dispersion modelling methodology utilised in the air quality assessment of the Caval Ridge Project has been undertaken.

Changes to operations at the mine site to reduce dust have been incorporated into the revised modelling, including:

- Fleet optimisation - reduced fleet and dozers
- Introduction of back hauling to minimise the number of trucks running empty
- Additional coal ramps in Horse pit
- Redistributed tailings and rejects placement across Horse and Heyford Pits

4 Comments and Summary

Changes to the modelling methodology that have been incorporated in order to reduce the level of conservatism within the model include:

- Dragline drop height calculated more accurately using mine planning parameters
- More accurate reflection of dozer utilisation
- Constant emission rates associated with stockpiling and exposed area were replaced with wind speed dependent emission rates

Results of the revised dispersion modelling suggest that the Caval Ridge project will contribute a maximum of 21 µg/m^3 to the 24-hour average ground-level concentration of PM_{10} at receptor locations within the Township of Moranbah under normal operating conditions which is less than the guideline level of 50 µg/m^3.

During worst-case 24-hour operating conditions, dust emissions from the Caval Ridge project are predicted to contribute a maximum of 33 µg/m^3 to the 24-hour average ground-level concentration of PM_{10} at receptor locations within the Township of Moranbah. The likelihood of optimal operational conditions (as modelled) occurring in combination with meteorological conditions that are associated with worst case dust impacts is estimated at 0.002% (equivalent to 1 day in 131.5 years).

The annual average ground-level concentration of $PM_{2.5}$ is not predicted to exceed the EPP(Air) objective of 8 µg/m^3 at any of the receptor locations under typical operations.

Ground-level concentrations of TSP and dust deposition are not predicted to exceed the relevant project goals at any of the receptor locations included in the dispersion modelling.

5

References

Environmental Protection (Air) Policy 1998

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

Limitations

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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.

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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