Appendix E   Air Quality

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Delta electricity

Western Rail Coal Unloader Environmental Assessment

AIR QUALITY ASSESSMENT

- Final
- April 2007

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1. Introduction

1.1 General Introduction

Sinclair Knight Merz (SKM) has been commissioned by Delta Electricity to prepare an Environmental Assessment (EA) for the proposed Western Rail Coal Unloader (WRCU) with associated rail loop and conveyor located in the vicinity of the Mt Piper and Wallerawang Power Stations. This report provides an assessment of air quality impacts associated with this project, and forms part of the EA. A map showing the study area is provided in **Figure 1-1.**

1.2 Project Appreciation

Delta Electricity operates two power stations, Mt Piper and Wallerawang, near Lithgow in the central west of New South Wales. Coal for these stations is currently supplied from a number of local coal mines via conveyor or road transport. Delta Electricity is proposing to construct a rail coal unloader facility to enable the supply of coal by rail to Mt Piper Power Station from a wider selection of mines, predominantly north of the power stations.

The project would form a loop connecting to the Mudgee rail line branch at two points south of Portland. The rail loop would be fully contained within the Pipers Flat area, bounded by the existing Mudgee branch to the south and by the ridge that rises to the north. The area is of disturbed land isolated by manmade and natural features. The rail track's initial connection with the Mudgee branch is located east of a dammed reservoir on Piper Flat Creek. The track then follows the foot of the ridge north of the existing Mudgee branch where it curves back to the Mudgee branch with a radius of about 250 metres. Coal received from the rail unloader would be transported to the power station via a conveyor.

The WRCU would have an initial throughput of 2 million tonnes of coal per year. It is expected that ultimately the throughput would increase to 8 million tonnes of coal per year.

In this assessment it is assumed that the WRCU would:

- Unload a train consisting of four 81/82 class locomotives with up to 55 wagons in approximately one hours; and
- Deliver by overland conveyor 2,500 tonnes per hour of coal to Mt Piper power station.

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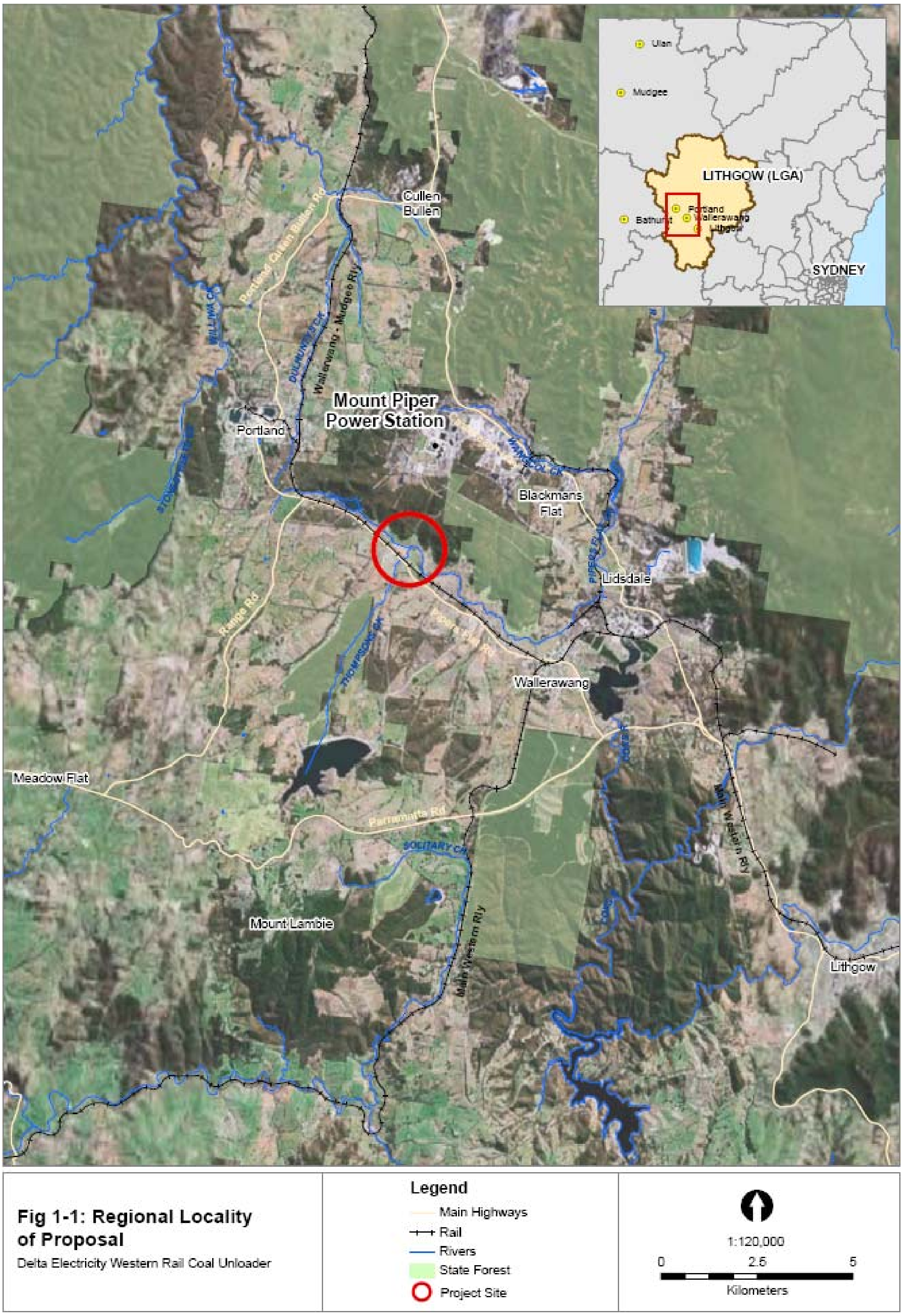
Figure 1-1: Locality Plan



Initially the WRCU would be required to unload 2 trains per day and operate for approximately 2 hours per day. When the throughput is increased to eight million tonnes per annum the facility would unload up to seven trains per day and operate for approximately 7 hours per day. The coal unloader infrastructure, that is the rail coal unloader and conveyor would be designed to handle the peak processing capacity of eight million tonnes per annum.

1.3 Study Objectives

The objective of the study is to consider the potential air quality impacts that the proposed rail unloading facility may have on air quality. This report details the:

- air quality issues associated with the development;
- existing meteorology and air quality of the study area;
- air quality criteria applicable to the proposal;
- assessment of air quality impacts during construction and operation; and
- provision for recommendations and conclusions.

2. Air Quality Issues

2.1 Overview

This section of the report describes the potential air impacts associated with the construction and operational phases of the WRCU for both options proposed.

2.2 Potential Air Impacts

The main air pollutants associated with the proposed options for the WRCU would be from:

- Earth works during construction of the rail line, rail coal unloading facility and access road along the conveyor;
- Emissions from locomotives, the unloading of coal from train wagons into the dump hopper and transport of coal to Mt Piper power station via an overland conveyor during operation; and
- Refuelling and sanding of trains at a locomotive provisional.

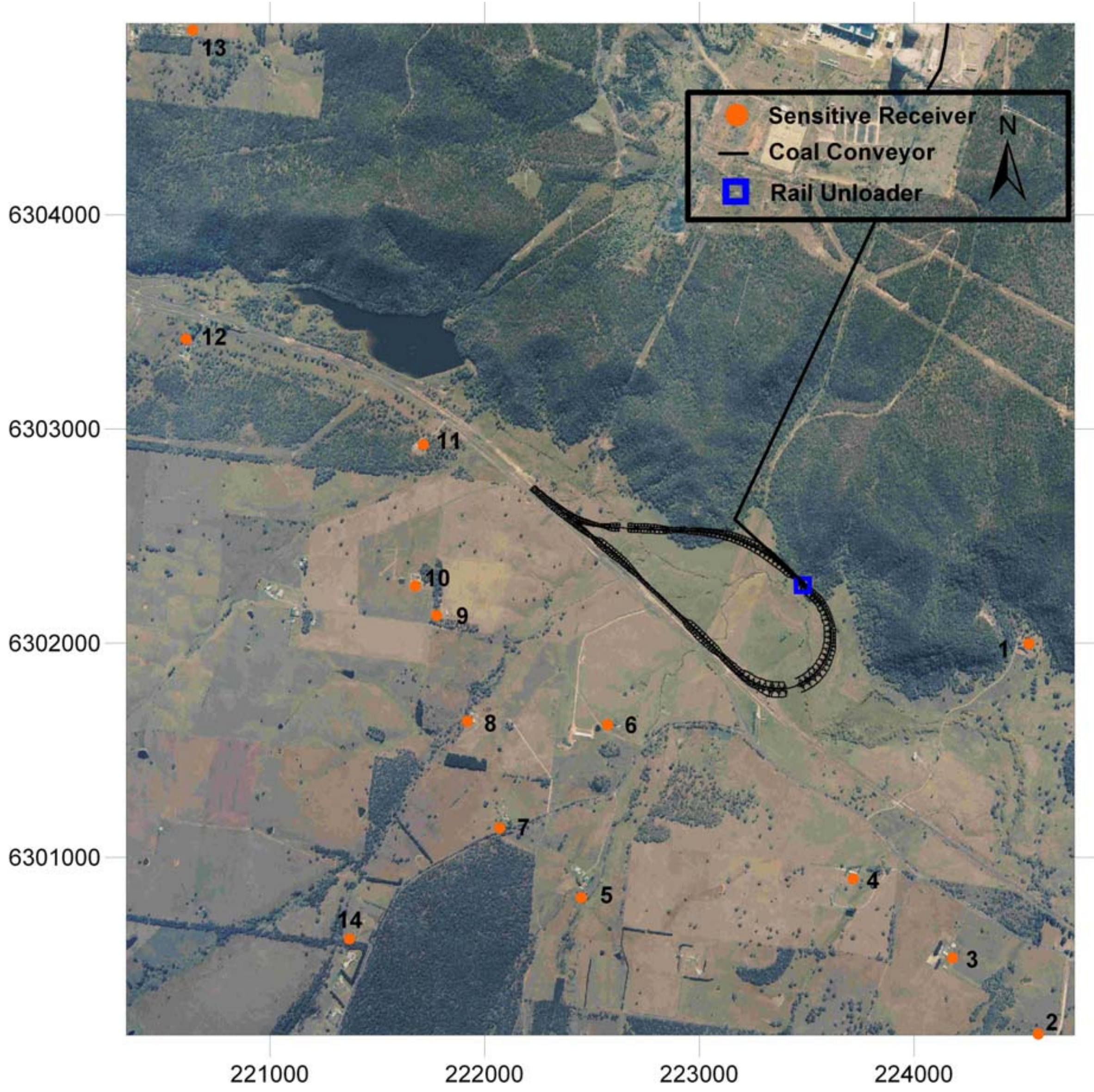
Dust emissions from coal stockpiles are not expected as stockpiles will not be used at the site. If the conveyors are out of operation, trains will not deliver coal, and any trains present will leave the site. When working to specification the overland conveyors would transport the coal from the train unloading facility to the receivable bin at Mt Piper power station stockpile.

2.3 Sensitive Receivers

The main settlements near the proposed facility are Blackmans Flat, Cullen Bullen, Portland, Lidsdale and Wallerawang. Surrounding these settlements are rural residential and agricultural properties.

Figure 2-1 shows the location of the proposed rail loop relative to residents and buildings. The rail loop and coal unloading station is shown in blue and the sensitive receivers are marked in red. All sensitive receivers in **Figure 2-1** are assigned an identification number, against which all results will be cross referenced.

Figure 2-1 Proposed Pipers Flat Rail Loop and Coal Unloading Station



2.4 Construction Phase

During the construction of the rail unloading facility the main environmental impacts would be from dust and diesel fumes generated during earth works. The construction of the facility would require importing approximity 600 000 m^3 of fill material. Fumes from the aluminothermic welding process used to join the track would also result in minor air pollution emissions during construction and while important from an Occupational Health and Safety (OH&S) perspective, these will not result in any significant environmental air quality impact.

Dust impacts may also be expected from the following activities (but not limited to):

- Construction of the coal dump hopper, approximately 15m below rail level, and associated train unloader facility infrastructure;
- Foundation works for the overland conveyor system;
- Installation of conveyor infrastructure;
- Earthworks for new access roads and the rail loop; and
- Construction of the to existing rail lines for the new rail loop.

The Pipers Flat option rail loop and train unloading station is proposed to be located on a flat cleared area at the bottom of the ridge. The associated overland conveyor would initially traverse steep topography, through bush land, and once over the ridge traverse partially cleared level ground situated to the southwest of the Mt Piper power station.

It is expected that it will take 18 months to construct the rail unloading facility, and all major earthworks will be completed within a 6 month period.

The following details the main construction phases for the proposed rail line and rail coal unloader and overland conveyor system.

2.4.1 Civil Works

The main civil woks include: earthworks, bridges, culverts, level crossings involving clearing, providing access and storage areas, excavation, levelling the area next to the existing track for the rail loop, installation of bulk earthworks and compaction, installation of a capping layer and drainage works. The types of earth moving equipment to be used would include excavators, graders, compactors, scrappers and trucks typical for any sizeable civil engineering project.

The import and distribution of soil to Pipers Flat would pose the greatest risk to air quality during construction. The material will be comprised of overburden from a coal mine at Lamberts Gully, located approximity 2 km north east of Pipers Flat. The overburden will be transported by truck via an existing unsealed road. It is anticipated that the project would require 27 000 truck loads for overburden to complete the filling operation at Pipers Flat. The fill material would be dumped at desired locations around the site then worked via bulldozer, grader and compacting machinery to achieve the formation level.

2.4.2 Track Work

The types of earth moving equipment to be used would include a backhoe, loader, welder's truck, tracklayer, ballast regulator, and a tamper.

- Laying Sleepers and Track depends on the construction methodology to be employed. Either the bottom ballast would be laid prior to or after the sleepers have been laid. Following laying the sleepers the track would be put down. If the track is put down before the ballast is unloaded it would enable a ballast train to unload the ballast on the track. Pettibone cranes and a track laying machine would be used to position the sleepers and rail in place.
- Laying Ballast generally involves using a train with ballast hoppers. As stated above a skeleton track is laid for the train with the ballast hoppers to travel along. The ballast is unloaded directly onto the track. Track jacks would then be used to lift the track to allow ballast to spread evenly under and around the track. The laying of ballast and track jacking would be conducted once again to ensure that the track is secured in place. Track resurfacing machinery would be used, such as a tamper, ballast regulator and dynamic stabiliser to profile the ballast.
- Rail welding gangs using the aluminothermic welding process would then weld out the joints in the track.

2.4.3 Signalling

This involves laying cabling to allow for effective signalling along the track. The types of equipment typically used to excavate the area where the cables are laid include trucks, backhoes and small excavators.

2.4.4 Unloading Facility and Overland Conveyor

The train unloader facility will consist of a coal unloading bin, building, belt conveyor, ventilation, services and supporting structure. Construction will involve bulk earth works for foundations, associated roads and a dump hopper. The ground conditions for each option will determine the quantity of earth works required.

Construction of the conveyor ground mounted and elevate gantry structure of the overland conveyor would include hardware such as idlers, rolls, pulleys, scrapers etc and would be similar for each option.

Limited earth works will be required for the overland conveyor.

2.5 Operational Phase

During operation the main air emissions would be from locomotives transporting coal to the facility and the processes involved in unloading the coal.

The important air pollutants associated with locomotives are particulates (particularly PM_{10}), and oxides of nitrogen (NO_x). Other pollutants emitted by locomotives, but to a lesser extent in terms of potentialair quality impact include carbon monoxide (CO) and hydrocarbons (HC) with important species being, benzene, toluene, ethylbenzene and xylene. It should be noted that the rail loop is located off the main rail line and trains accessing the loop will be located further away from sensitive receivers than through trains currently operating past the location of the proposed rail loop.

The main pollutants from the coal transfer processes would be dust and could be generated from the:

- Dumping of coal from wagons into the dump hopper;
- Discharge of coal from the dump hopper to a belt feeder, which will feed the overland conveyor system;
- Overland conveyor system where coal is transferred from one belt to another; and
- Dumping of coal from conveyors onto stockpiles.

The coal unloading station with be enclosed with an opening at either end for the train to enter and exit. A spray dust suppression system will be strategically positioned at the train wagon and bin opening interface to minimise coal dust. It is envisaged that a dust extraction system would be installed to prevent the accumulation of coal dust. A ventilation system for dust control in the facility will be incorporated into the design.

2.6 Quantitative and Qualitative Assessment of Impacts

Based on the discussion provided in the preceding sections, and the Director General's (DG) Requirements for the project it is considered that emissions of particulates (TSP and PM_{10}) during the construction earthworks and operational coal unloading will pose the greatest air quality risk. As such, these impacts are assessed quantitatively with the AUSPLUME dispersion model. Other impacts including locomotive emissions are assessed qualitatively, with a focus on air quality management measures.

3. Meteorology and Background Air Quality

3.1 Overview

This section of the report details local meteorology and ambient air quality in the Lithgow / Pipers Flat area.

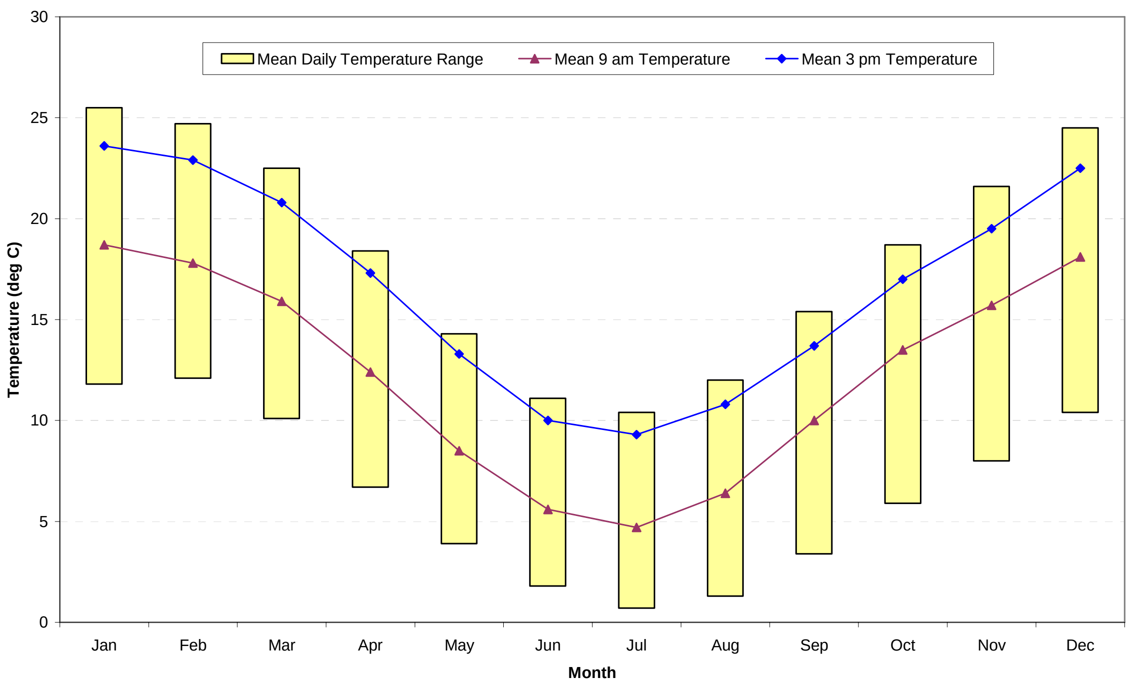
3.2 Local Meteorology

The Bureau of Meteorology operates a long term monitoring station at Lithgow, approximately 19 km to the south west of Mt Piper Power Station. A summary of the data collected here is presented in **Table 3-1**.

3.2.1 Temperature

A summary of mean monthly temperature at Lithgow is presented graphically in **Figure 3-1**. Here it can be seen that on average January is the hottest month of the year, experiencing a mean daily maximum of 25.5°C and mean daily minimum of 11.8°C. July is on average the coolest month, with a mean daily maximum of 10.4°C and a mean daily minimum of 0.7°C.

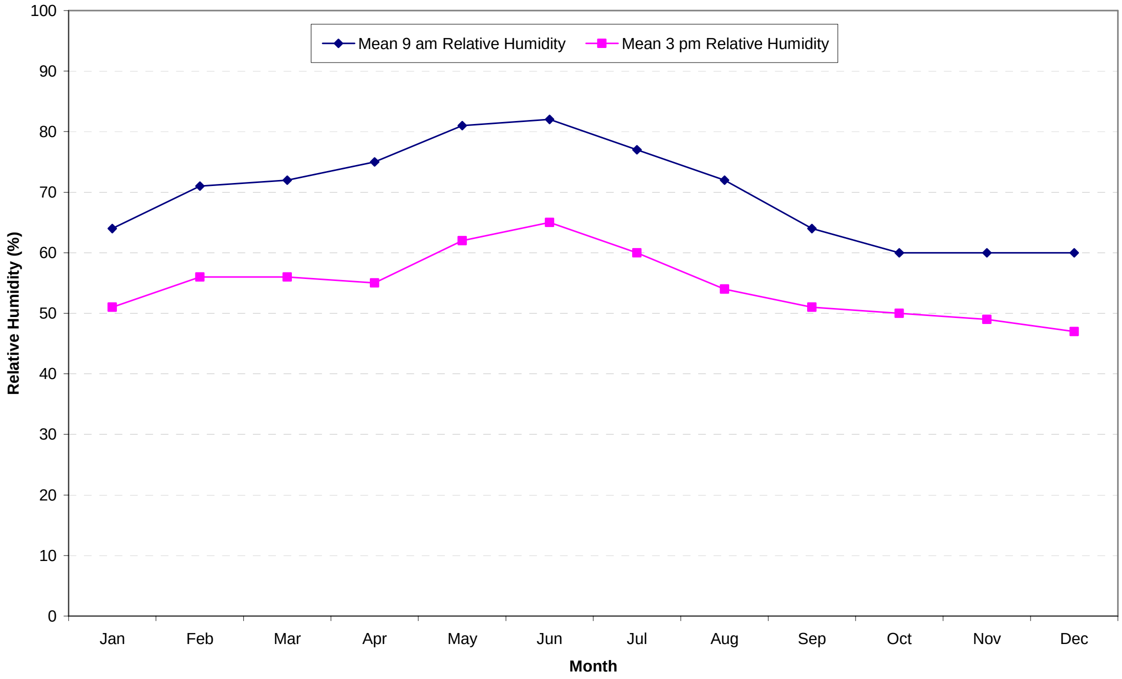
- **Figure 3-1: Mean Monthly Temperature**



3.2.2 Relative Humidity

Mean monthly 9am and 3pm relative humidity is presented graphically in **Figure 3-2**. Annual average relative humidity is 70% at 9am and 55% at 3pm. Relative humidity is on average highest during the month of June, with a reading of 82% and 65% at 9am and 3pm respectively. Lowest relative humidity is experienced during December, with 60% and 47% at 9am and 3pm respectively.

- **Figure 3-2: Mean Monthly Relative Humidity**



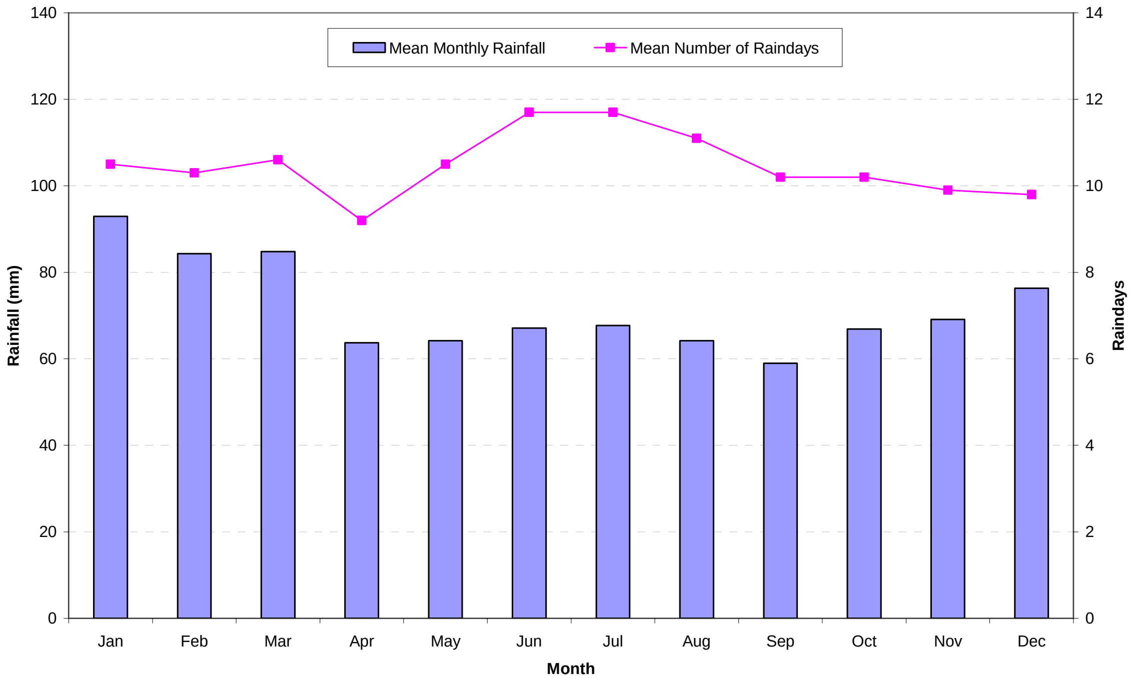
3.2.3 Rainfall

Mean monthly rainfall and mean monthly raindays are presented in **Figure 3-3**. Mean annual rainfall is 860.1 mm falling over an average of 125.7 days. Mean monthly rainfall is highest during January, with an average of 92.9mm falling over 10.5 days. While lowest monthly rainfall is in September, with an average of 59 mm falling over 10.2 days.

3.2.4 Wind Speed and Wind Direction

The local meteorology is largely affected by the local terrain. The proposed rail loop is located adjacent to Pipers Flat Creek, with hills to the north, west and south. Local winds would be influenced by this complex topography, with anabatic and katabatic winds experienced during the day and night respectively.

- **Figure 3-3: Mean Monthly Rainfall and Raindays**



An automatic weather station is located at Mt Piper Power Station. Windroses for data collected here for 2002, 2003, 2004 and 2005 are presented in **Figures 3-4, 3-5, 3-6** and **3-7** respectively. On an annual basis the predominant wind direction is from the south west. This pattern varies slightly seasonally, with the predominant wind direction in summer from the north east through to south west, during autumn and winter the predominant direction is from the south west and south east, and from the south west in spring.

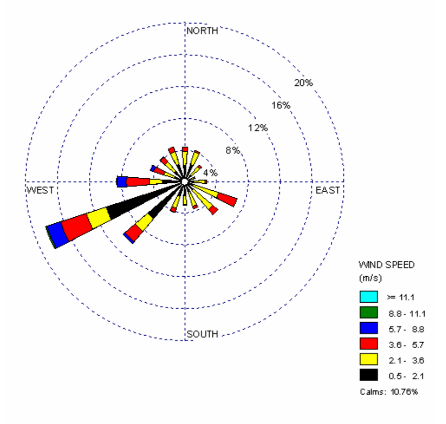
Windroses for the year 2005, from TAPM generated meteorology data, for the Pipers Flat coal unloader site are presented in **Figure 3-8.** A comparison of TAPM wind data with measured data from Mt Piper Power Station shows significant differences in wind trends. Analysis of local topographical influences indicates that the TAPM data is likely to more accurately account for local drainage flows that would occur at Pipers Flat. Specifically, the TAPM wind data replicates expected north to south drainage that would be funnelled by topography north of Pipers Flat and south of Mt Piper Power Station. As such the TAPM generated meteorological data is considered the most appropriate for the air dispersion modelling assessment to follow, as it will more accurately represent local wind fields in the Pipers Flat region where nocturnal drainage flows and associated temperature inversion conditions will be important to the prediction of air pollution dispersion patterns from the project site towards nearest sensitive receiver locations.

Table 3-1: Long Term Average Climate parameters at Lithgow (Birdwood Street, 1884-2004)

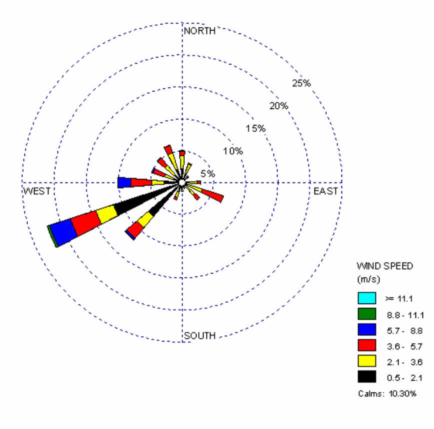
Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean daily maximum temperature - °C	25.5	24.7	22.5	18.4	14.3	11.1	10.4	12	15.4	18.7	21.6	24.5
Mean no. of days where Max Temp >= 30.0 °C	6.4	4.4	1.3	0	0	0	0	0	0	0.1	1.5	4.1
Highest daily Max Temp - °C	37.7	38.4	35.1	30.8	24.6	21.3	21.5	22.5	27.6	33.1	37.2	36.2
Mean daily minimum temperature - °C	11.8	12.1	10.1	6.7	3.9	1.8	0.7	1.3	3.4	5.9	8	10.4
Mean no. of days where Min Temp <= 2.0 °C	0	0	0.3	2.6	9.5	14.8	19.6	16.8	10.1	4	1.2	0.3
Mean no. of days where Min Temp <= 0.0 °C	0	0	0	0.9	4.4	9.1	13.3	10.3	4.6	1.1	0.2	0
Lowest daily Min Temp - °C	2.8	3.5	0	-4	-6.1	-7	-8	-7.7	-5	-2.3	-1.7	0.6
Mean 9am air temp - °C	18.7	17.8	15.9	12.4	8.5	5.6	4.7	6.4	10	13.5	15.7	18.1
Mean 9am dew point - °C	12.2	12.8	11	8.5	5.8	3.1	1.3	2	3.6	6	7.9	10.1
Mean 9am relative humidity - %	64	71	72	75	81	82	77	72	64	60	60	60
Mean 9am wind speed - km/h	6.9	6.3	6.6	7.6	7.4	8.4	8.5	10.3	11.1	9.9	9	7.9
Mean 3pm air temp - °C	23.6	22.9	20.8	17.3	13.3	10	9.3	10.8	13.7	17	19.5	22.5
Mean 3pm dew point - °C	12.1	13	11.1	8.2	6	3.7	1.8	1.6	3.2	5.8	7.7	9.6
Mean 3pm relative humidity - %	51	56	56	55	62	65	60	54	51	50	49	47
Mean 3pm wind speed - km/h	10.3	9.1	8.9	9.3	9.8	10.7	11.5	13.4	12.9	11.8	11.5	11.3
Mean monthly rainfall - mm	92.9	84.3	84.8	63.7	64.2	67.1	67.7	64.2	59	66.9	69.1	76.3
Median (5th decile) monthly rainfall - mm	79.8	65.6	66.8	50.5	45.6	52	48	48.6	53.4	58.9	65.6	67
9th decile of monthly rainfall – mm	183.5	179.6	159.4	125.6	132.3	149.2	140	136.8	105.1	133.2	144	146.8
1st decile of monthly rainfall – mm	25.2	10.8	20.9	11.3	16.3	16	15	14.7	20	19.1	17.8	18.1
Mean no. of raindays	10.5	10.3	10.6	9.2	10.5	11.7	11.7	11.1	10.2	10.2	9.9	9.8
Highest monthly rainfall - mm	242	330.1	338.8	295.2	335.9	242.4	349.5	374.4	195.6	233	187.3	235.5
Lowest monthly rainfall - mm	4.8	0.3	6.9	2.1	2.6	9	2.7	2.2	7.2	3	1.8	0.3
Highest recorded daily rainfall - mm	89.9	101.9	112	147.3	135.4	179	163.8	165.4	97.5	65	83.6	101.6
Mean no. of clear days	7.3	5.4	7.1	7.8	7.2	6	7.9	9.3	8.6	7.1	6.6	8.1
Mean no. of cloudy days	12	12.7	12.6	10.2	13.3	14.1	12.5	11	10.3	11.4	11.6	10.5

- **Figure 3-4: 2002**

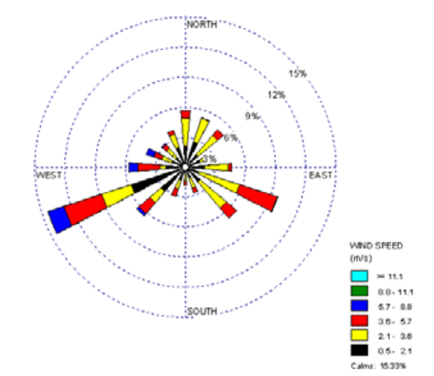
Annual



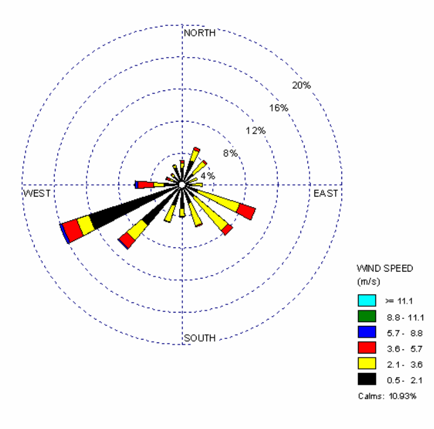
Spring



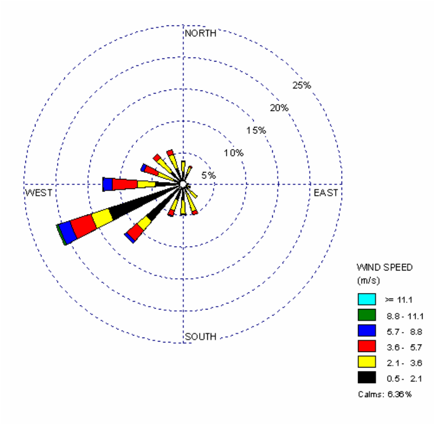
Summer



Autumn



Winter



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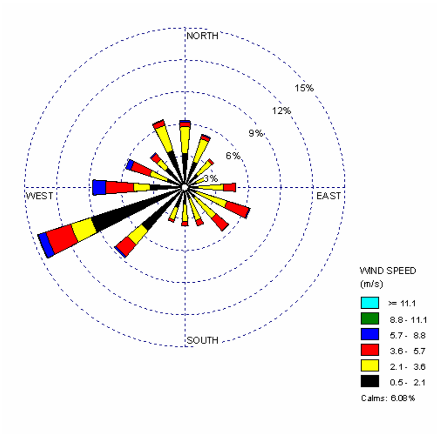
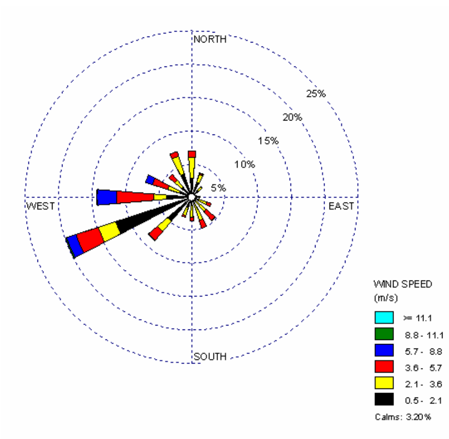
- **Figure 3-5 2003**

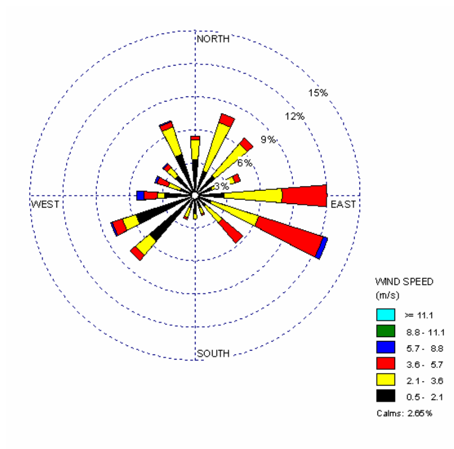
Annual



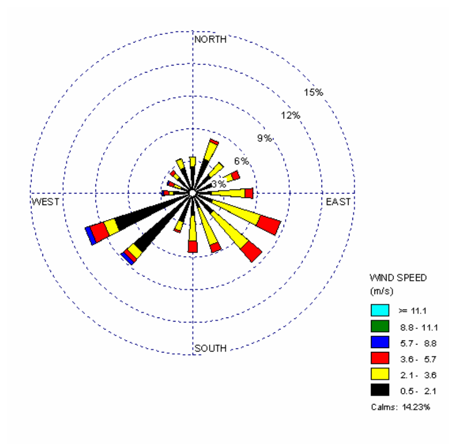
Spring



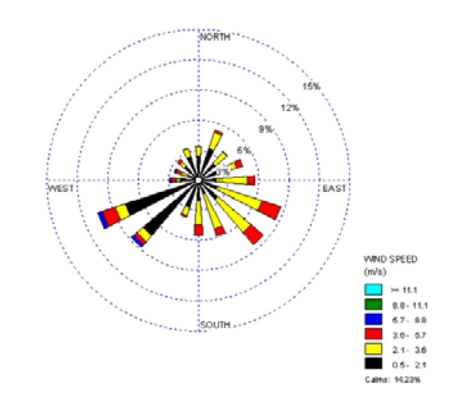
Summer



Autumn



Winter



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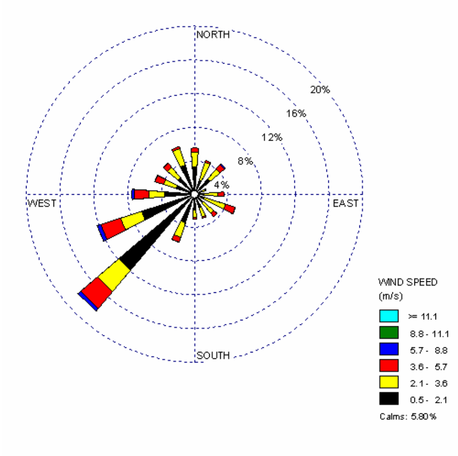
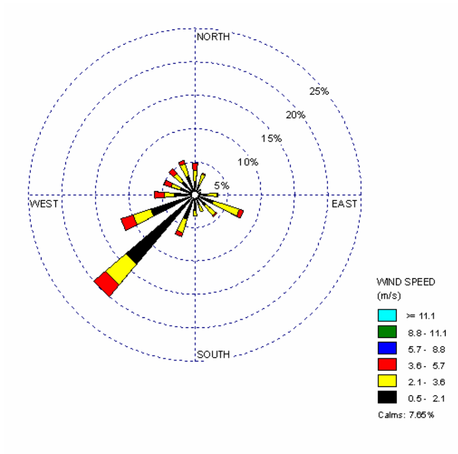
- **Figure 3-6 2004**

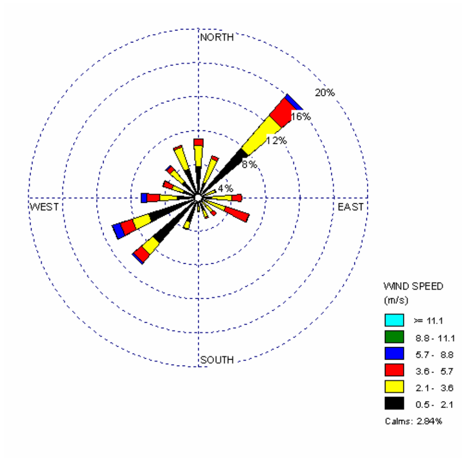
Annual



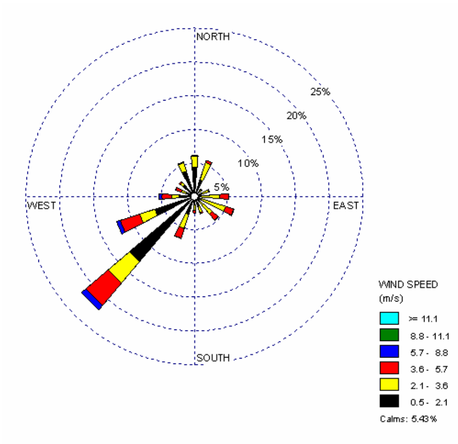
Spring



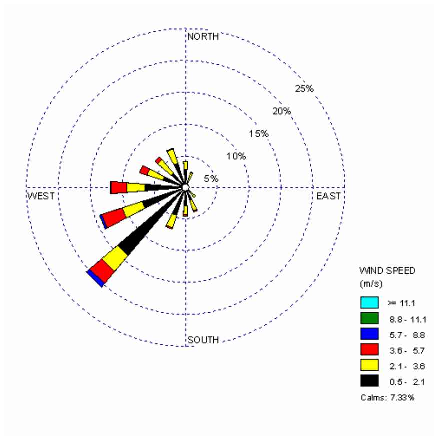
Summer



Autumn



Winter



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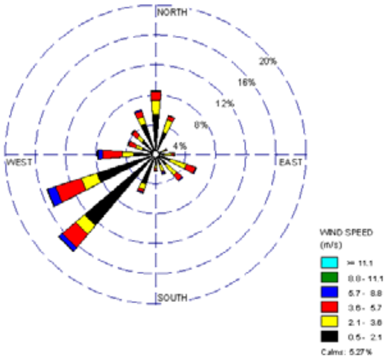
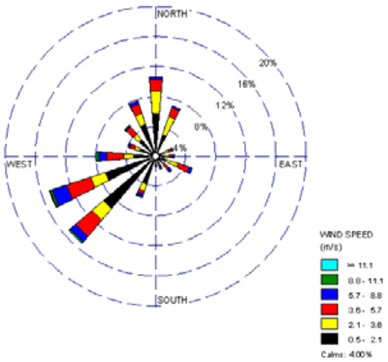
- **Figure 3-7 2005**

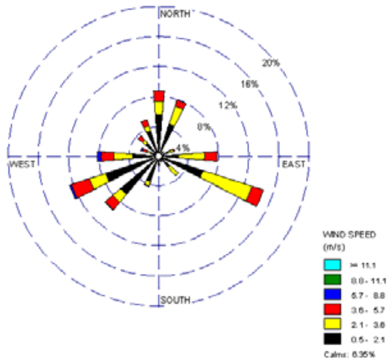
Annual



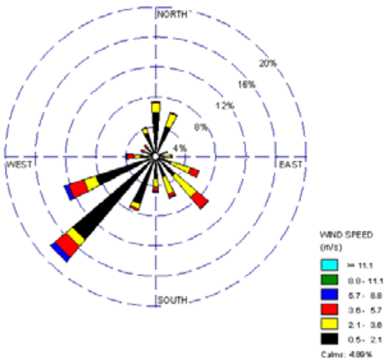
Spring



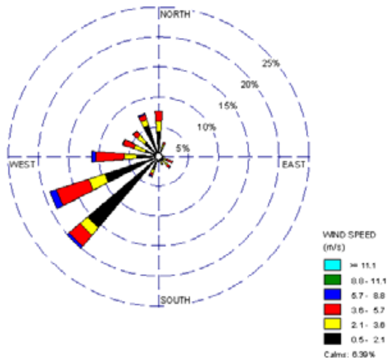
Summer



Autumn



Winter



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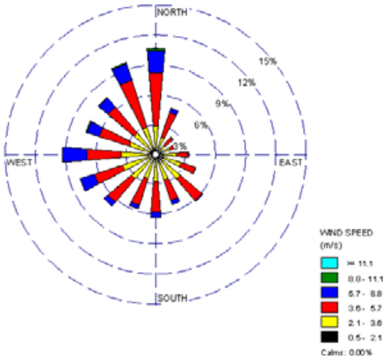
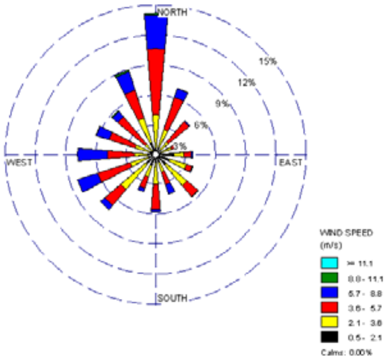
- **Figure 3-8 Coal Unloader Wind Roses – TAPM Generated 2005**

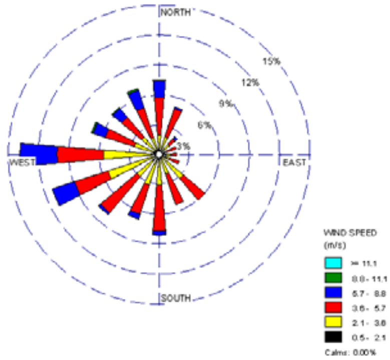
Annual



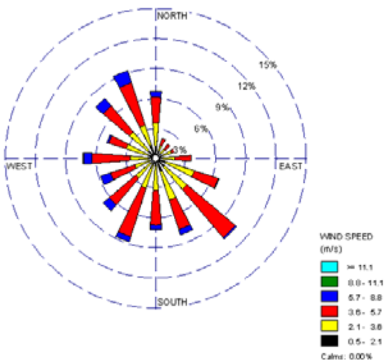
Spring



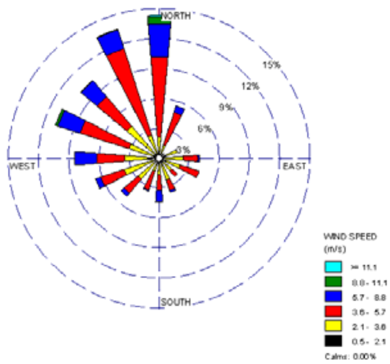
Summer



Autumn



Winter



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3.3 Background Air Quality

Delta Electricity has air quality monitoring stations which are located at Blackmans Flat and Wallerawang (refer to **Figure 1-1** for geographical location). These stations record hourly averages of total NO_x, NO_2, NO and SO_2. There is no particulate monitoring done in the local area with the nearest PM_{10} monitoring in the nearby town of Bathurst.

3.3.1 Results of PM_{10} Monitoring – Bathurst 2005

A summary of the recorded particulate monitoring data is presented in **Table 3-2.**

In general ambient particulate matter does not exceed air quality criteria. Maximum 24-hour PM_{10} measured 27µg/m^3 at the Bathurst EPA monitoring station in 2005, while annual average PM_{10} was 14µg/m^3. TSP is not measured by the EPA at Bathurst; however, experience shows TSP concentrations are generally of the order of double those recorded for PM_{10}. Following the above assumption, annual average TSP would be 28 µg/m^3 (i.e. 14*2=28).

- **Table 3-2 Summary of Ambient Particulate Matter – Bathurst 2005**

Pollutant (criteria)	Concentration (µg/m^3)
PM_{10}	
Maximum 1-hr Average	98
90th percentile 1 hour average	54
Maximum 24-hr Average (criteria = 50 µg/m^3)	27
Annual Average (criteria = 30 µg/m^3)	14

3.3.2 Results of Particulate Modelling – HAS, 2005

It is acknowledged that air quality (particulates) in Bathurst may be quite different from that in the Lithgow region including Pipers Flat. One potential difference in air quality may result from the emission of particulates from Mt Piper and Wallerawang Power Stations which are in the vicinity of Pipers Flat and may influence air quality at this locality, but would be unlikely to influence air quality at Bathurst.

In the absence of any particulate monitoring data in the Pipers Flat area, a review of air pollution modelling detailed in *Holmes Air Sciences (HAS, 2005) - Air Quality Assessment: Proposed Upgrade to Mt Piper Power Station* was undertaken. This modelling showed that worst-case particulate emissions from Mt Piper Power Station (upgraded to 2 x 750 MW coal fired units) and Wallerwang Power Station would result in the following model domain (which includes Pipers Flat) maximum concentrations:

- TSP (annual average) - 0.0482 μg/m³
- PM_{10} (24 hour max.) - 0.4490 μg/m³
- PM_{10} (annual average) - 0.0145 μg/m³

These model results demonstrate that power station emission of particulates have negligible (no) impact on ambient air quality in the Lithgow region including Pipers Flat and as such the Bathurst particulate monitoring data is considered suitable for assessment of cumulative impacts associated with the proposed rail loop and coal unloading station.

3.3.3 Results of SO_2 and NO_2 Monitoring – Wallerawang and Blackmans Flat, 2001

As per the discussion provided in **Section 2.6** it is not considered necessary to provide any quantitative assessment of emission from locomotives eg. SO_2 and NO_2 used to transport coal to the proposed unloading station. However, the following provides a discussion of ambient concentrations of these pollutants as described by *HAS, 2005* is included here as background information.

Monitoring data for the Blackmans Flat and Wallerawang for the 2001 period included hourly records of SO_2, NO_x and NO_2 at both sites. The data are presented in **Table 3-3**.

- **Table 3-3 - Summary of SO_2 and NO_2 Ambient Air quality Monitoring Data**

Measurement	Blackmans Flat 2001	Wallerawang 2001	DEC Air Quality Goal
NO_x (max. 1-hour ave. - μg/m³)	302	269	-
NO_x (annual ave. - μg/m³)	16	16	-
NO_2 (max. 1-hour ave - μg/m³)	79	59	246
NO_2 (annual ave. - μg/m³)	10	10	60
SO_2 (max. 1-hour ave - μg/m³)	353	424	570
SO_2 (max. 24-hour ave - μg/m³)	70	47	350
SO_2 (annual ave. - μg/m³)	13	7	60

Here it can be seen that measured 2001 concentrations of SO_2 and NO_2 comply with relevant air quality gaols.

4. Air Quality Criteria

4.1 Overview

This section of the report states the NSW criteria for the assessment of air quality impacts associated with the proposed Mt Piper WRCU. As detailed in **Section 2**, as particulates are the key air pollutant requiring assessment, the focus here is to determine criteria for assessment of particulate impacts.

4.2 Particulate Matter and Dust

Airborne particulate matter is any material, except uncombined water, that exists in the solid or liquid state in the atmosphere or gas stream in standard conditions. Airborne particles generally range in size from 0.001 to 500 µm, with the most significant particulate mass in the atmosphere ranging from 0.1 to 10 µm.

Common size related terms are the classes Total Suspended Particulate Matter (TSP), PM_{10} and $PM_{2.5}$. TSP refers to the mass concentration of all suspended particles in the atmosphere. PM_{10} refers to all particles with aerodynamic sizes less than 10 µm, and $PM_{2.5}$ is all particles with aerodynamic sizes less than 2.5 µm.

Particulate matter presents a health hazard to the lungs, enhances chemical reactions in the atmosphere, reduces visibility, increases the possibility of precipitation, fog and clouds and reduces solar radiation.

The health effects of particles are largely related to the extent to which they can penetrate the respiratory tract. Larger particles (those greater than 10 µm) generally adhere to the mucus in the nose, mouth, pharynx and larger bronchi and are generally removed by swallowing or expectorating. Respirable particles are particles with an aerodynamic size less than about 3 µm. Particles below 2.5 µm can reach the deepest parts of the respiratory system, where they can only be removed by the body's cellular defence system. Respirable particles have been associated with a wide range of respiratory symptoms.

Dust deposition rates are used to assess the effects of coarse particulate matter on amenity. The NSW EPA criteria[1] for dust deposition and particulate matter concentration are outlined in the sections to follow.

---

[1] *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales*, NSW EPA August 2005.

4.2.1 Particulate Matter 10

The concentration based air quality criteria for PM_{10} in NSW are provided in **Table 4-1**.

- **Table 4-1 NSW EPA Criteria for PM_{10}**

Averaging Period	Concentration ($\mu g/m^3$)
24-hour	50
Annual	30

The maximum allowable increases in PM_{10} associated with the project are provided in **Table 4-2**.

- **Table 4-2 Project Criteria for PM_{10}**

Estimate of Background Level	Project Criterion – Maximum Allowable Increase
Maximum 24-hour PM_{10}, 27 $\mu g/m^3$	23 $\mu g/m^3$
Annual average 14 $\mu g/m^3$	16 $\mu g/m^3$

4.2.2 Total Suspended Particulate Matter

The concentration based air quality criteria for TSP in NSW are provided in **Table 4-3**.

- **Table 4-3 NSW EPA Criteria for TSP**

Averaging Period	Concentration ($\mu g/m^3$)
Annual	90

The maximum allowable increase in TSP associated with the project is provided in **Table 4-4**.

- **Table 4-4 Project Criteria for TSP**

Estimate of Background Level	Project Criterion – Maximum Allowable Increase
Annual average 54 $\mu g/m^3$	46 $\mu g/m^3$

4.2.3 Dust Deposition

Deposited dust, (from particles of any size), if present at sufficiently high levels, can reduce the amenity of an area. In NSW the EPA set limits on acceptable dust deposition levels. The maximum acceptable increases in dust deposition over the existing dust levels are provided in **Table 4-5**.

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Table 4-5 NSW EPA Criteria for Dust Deposition

Existing background over existing dust deposition levels (g/m2/month)	Maximum acceptable increase
2	2
3	1
4	0

Dust deposition rates are assessed against these criteria over an annual averaging period at the nearest off-site sensitive receiver. Based on an estimated background dust deposition level of 2 g/m^2/month, the maximum allowable increase associated with the project is 2 g/m^2/month.

5. Cumulative Air Quality Impact Assessment

5.1 Overview

This section of the report sets out a cumulative assessment of air quality impacts associated with the proposed Delta Electricity rail loop and coal unloading facility. It also details management procedures that would ensure minimal air quality impacts associated with the proposed development in surrounding areas.

The assessment compares air quality impacts with project specific criteria, taking into account the influence of existing air pollution sources in the region, eg. Mt Piper and Wallerawang Power Stations on current ambient air quality. As such the assessments to follow are cumulative, considering all impacts and not just the incremental impact posed by the proposed development.

5.2 Modelling Assessment Methodology

In NSW AUSPLUME is the EPA approved default model for plume dispersion. AUSPLUME is a steady state Gaussian plume model that was developed by the Victorian EPA. The model can predict plume dispersion from a stack, area and volume source or any combination of these sources and provides an estimate of maximum concentrations which would cover the full range of seasonal and climatic conditions. AUSPLUME allows calculations of pollutant concentrations in the air as well as ground level deposition. Deposition can be specified as either dry or wet deposition. The input data required to run the AUSPLUME model is summarised in **Table 5-1**.

Table 5-1 AUSPLUME Data Requirements

AUSPLUME Data requirement	Project Model Input
Emission rate	grams/ second for TSP and PM_{10}
Source details	volume sources with vertical and horizontal spread
Receptor locations	gridded and discrete receptors
Meteorological data	TAPM generated meteorological file for 2005

The Air Pollution Model (TAPM), developed by CSIRO Atmospheric Research, was used to create synthetic meteorological data for the coal unloader site. The meteorological data created by TAPM is compatible with AUSPLUME, providing AUSPLUME with its required meteorological input. TAPM consists of coupled prognostic meteorological and air pollution concentration components, eliminating the need to have site specific meteorological observations. It predicts winds, temperature, pressure, water vapour, cloud/rain water and turbulence. The model also includes urban/vegetation canopy, soil effects and radiative fluxes The model is driven by six-hourly analysis fields of wind, temperature and specific humidity from the Bureau of Meteorology Limited Area Prediction System (LAPS) model, which account for the larger-scale synoptic variability (Hurley, 2005).

On the basis of wind analysis, from windroses presented in **Section 3.2.4,** it was determined that TAPM derived meteorological data was the most appropriate available dataset for use in modelling air pollution dispersion in the Pipers Flat area. While it is desirable to use monitored data where available in dispersion modelling, the monitored data available from Mt Piper Power Station will not adequately represent north-south drainage flows affecting particulate dispersion from Pipers Flat. It is noted that many of the identified sensitive receivers are located south of Pipers Flat. Therefore, by using the TAPM data, which captures the north to south drainage pattern, a more conservative assessment of impacts is provided.

5.3 Construction Phase Impacts

5.3.1 Emission Estimation

As set out in **Section 2.4** the construction phase of the rail unloading facility is expected to take place over a period of approximately 18 months. Construction of the facility would involve the following activities with the potential to generate dust, diesel and fumes from welding:

- Earthworks associated with dumping landfill for the rail line foundation (600 000 m^3 loose form);
- Construction of the dump hopper to a depth of approximately 15m below the rail line;
- Foundation works for overland conveyor system;
- Installation of conveyor infrastructure between the dump station and stockpiles;
- Earthworks and paving for new access road and rail loop; and
- Construction and modifications to existing rail lines.

Based on an analysis of the above activities, it is considered that fugitive particulate emissions sourced from importing landfill material present the highest risk to air quality. The 600 000 m^3 of landfill material required for site preparation would be sourced off site and transported for dumping via truck. It is estimated that 27 000 truck loads will be required to deliver the material. As well as truck movements, wind erosion and excavation/grading equipment would also contribute significantly to fugitive emissions associated with the delivery of the landfill material. Particulate emissions were modelled, using AUSPLUME v6.0. The emissions modelled were PM_{10} (as 24 hour maximum and annual averages), TSP and dust deposition. Model scenarios were developed based on a construction phase of 6 months duration and a volume of 600 000m^3 of imported landfill material. **Table 5-2** summarises average estimated particulate emissions from the construction phase of the project. These emission rates are based on USEPA and NPI emission factors for bulk earthworks activities.

- **Table 5-2 Construction Particulate Emission Rates**

Particle Size	Emission Rate ($g/s/m^2$)
PM_{10}	0.0002
TSP	0.0007

5.3.2 Predicted Impacts

As stated in **Section 5.3** the greatest threat to air quality during construction would be the processes associated with the import and distribution of fill material. Particulate emissions were modelled for the identified scenario of importing 600 000m^3 of fill material to Pipers Flat.

Figure 5-1, **Figure 5-2**, **Figure 5-3** and **Figure 5-4** show model contours for the construction phase of the coal unloader facility. Red contours represent site specific criteria, as identified in **Section 4.2**. Orange symbols indicate receiver locations. **Appendix B.1** shows tabulated concentrations predicted at sensitive receiver locations.

Figure 5-1 shows predicted monthly dust deposition. Results show the greatest rate of dust deposition at a sensitive receiver (receiver 4) is 1.2 g/m^2/month. The rate of dust deposition is within allowable project criteria of 2 g/m^2/month.

- **Figure 5-1 Dust Deposition – Fill Placement Operations (g/m^2/month)**

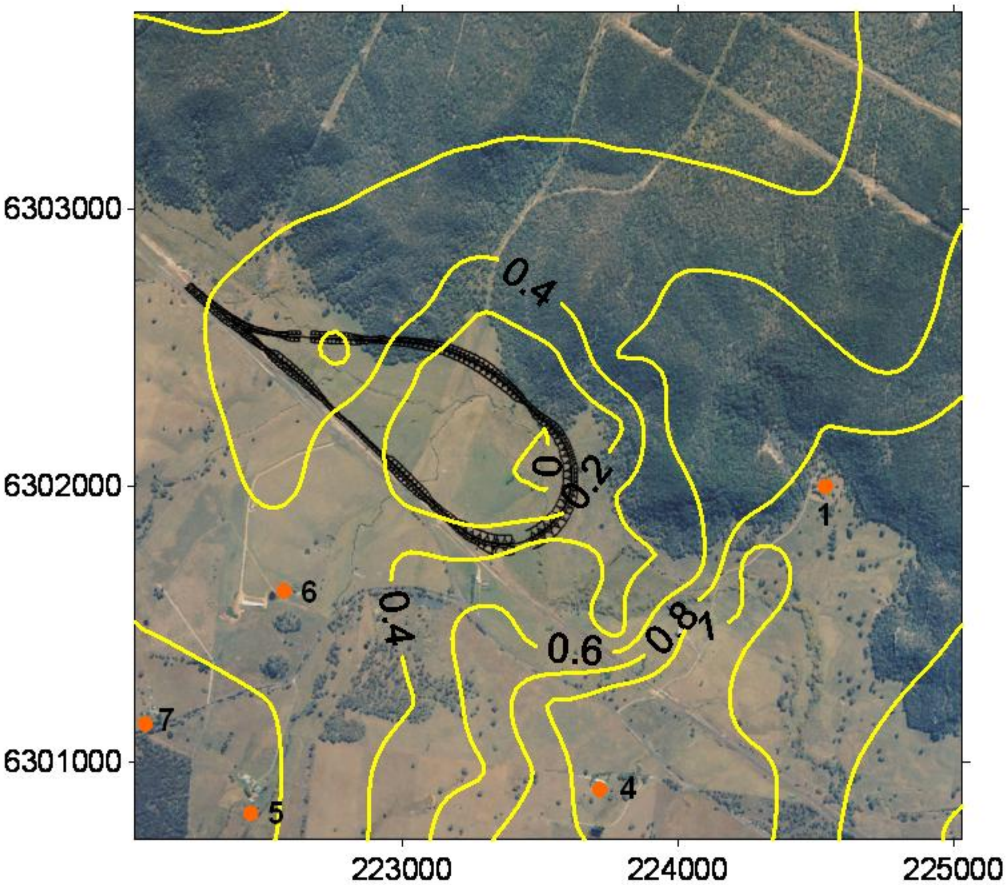


Figure 5-2 shows predicted concentrations for 24 hour PM_{10}. There are no expected exceedances of project criteria (23 µg/m^3) at identified receiver locations. The maximum increase at a sensitive receiver (4) is 11 µg/m^3.

- **Figure 5-2 24 Hour PM_{10} –Fill Placement Operations (µg/m^3)**

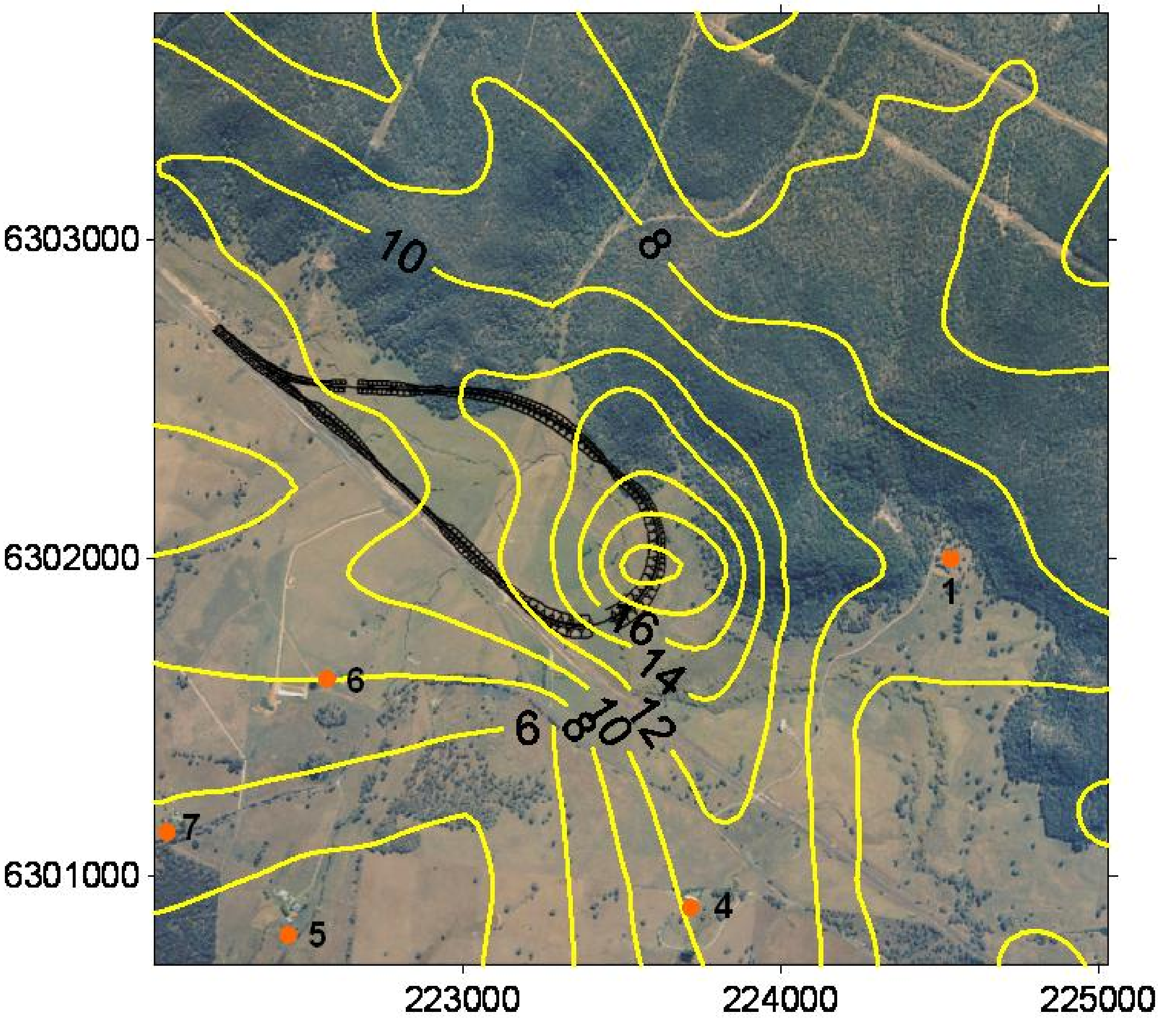


Figure 5-3 shows predicted concentrations for annual average PM_{10}. Results show that concentrations at identified receivers are within project criteria of 16 µg/m^3. The maximum concentration at an identified receiver (sensitive receiver (4)) is approximately 5 µg/m^3.

- **Figure 5-3 Annual PM_{10} –Fill Placement Operations (µg/m^3)**

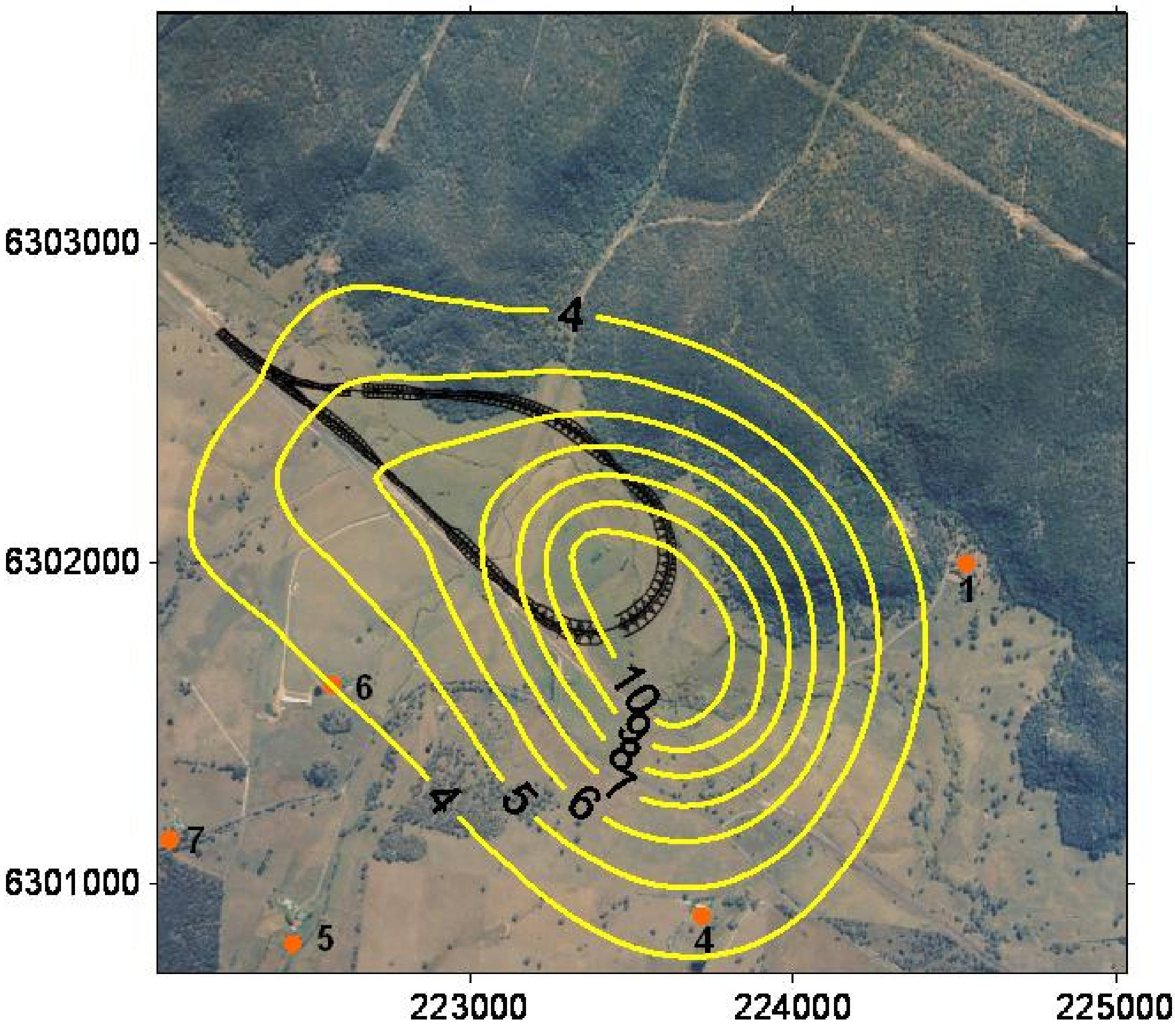
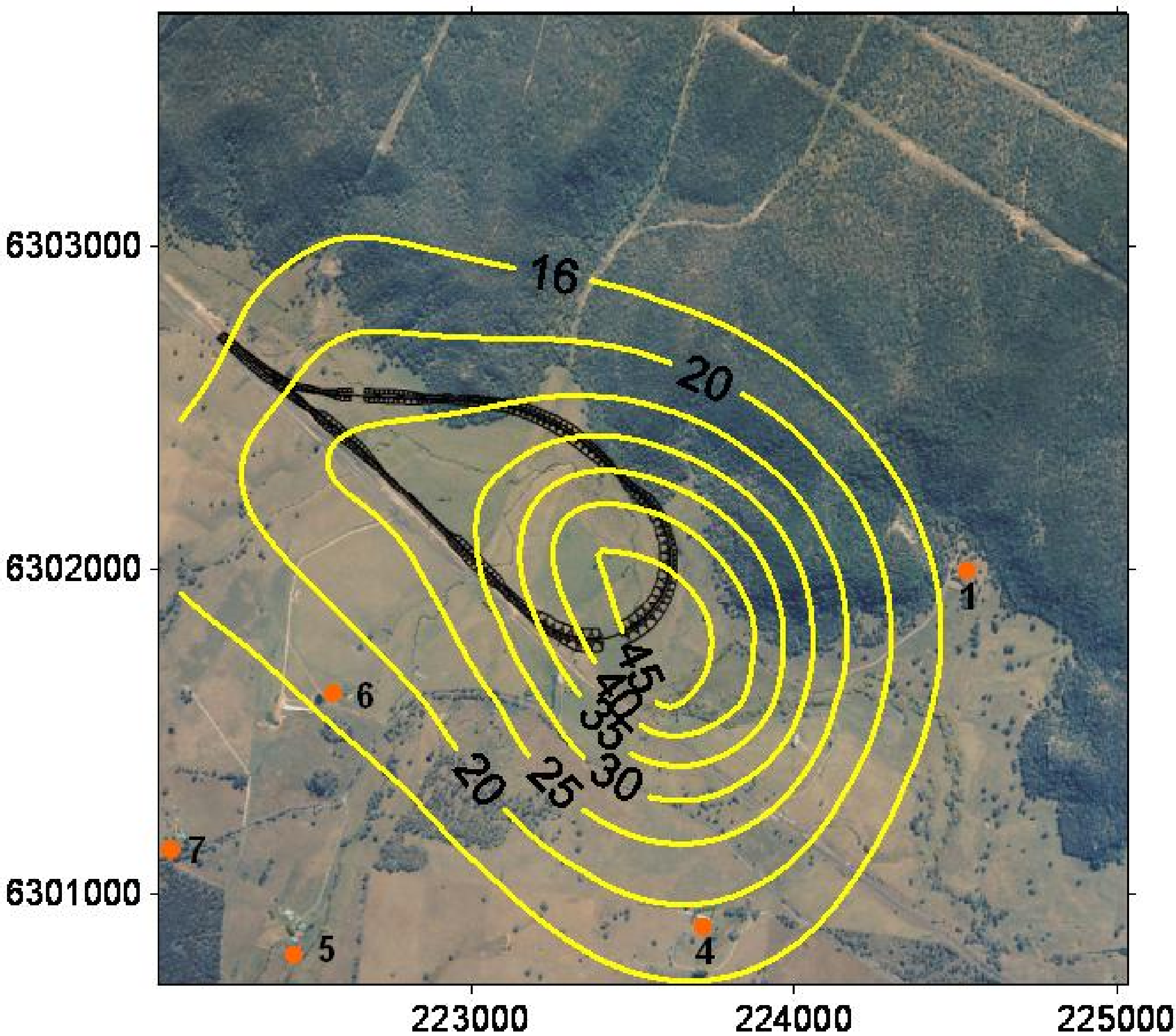


Figure 5-4 shows modelled contours of TSP concentration increases associated with the fill placement operations. There is no exceedance of project criteria (46 µg/m^3). The maximum increase in TSP concentration at an identified receiver (sensitive receiver (4)) is 20 µg/m^3.

- **Figure 5-4 TSP –Fill Placement Operations (µg/m^3)**



5.4 Operational Phase Impacts

As set out in **Section 2.5** during operation the main air emissions would be from locomotives transporting coal to the facility and the processes involved in the transfer of coal.

5.4.1 Locomotives

At any point along the line emissions during operation would depend on:

- how many trains use the rail loop;
- the speed that trains pass through the area which directly relates to fuel consumption; and
- the type of train, e.g. single, double or triple locomotives.

As detailed in **Section 1.1** it is expected that the train unloading facility would unload a train consisting of four 81/82 class locomotives with 55 wagons in approximately 1 hour. Initially the facility would be required to unload 2 trains per day and operate for approximately 2 hours per day. When the throughput is increased to up to 8 million tonnes per annum the facility would unload 7 trains per day and operate for approximately 7 hrs per day.

The following data was used to calculate emissions from current and proposed operations for the locomotives:

- percentage total of trains (e.g. single, double and triple locomotives);
- average train speed;
- current and projected train numbers; and
- emissions factors from the *Emission Estimation Technique Manual for Aggregated Emissions From Railways*, November 1999. Emission rates per litre of fuel used are shown in **Table 5-3**.

Table 5-3 Locomotive Emission Factors

Substance	Line Haul Locomotive Emission Factor (g/L)
Carbon monoxide	7.5
Oxides of Nitrogen	59.1
PM_{10}	1.39
Sulfur dioxide	2.59
Total VOCs	2.54

Source: *Emissions Estimation Technique Manual for Aggregated Emissions from Railways*, November 1999

Table 5-4 details the inputs used to calculate air emissions from the trains operating on the rail loop that deliver coal to the unloading facility based on initial proposed operations at 2 million tonnes and projected operations at 8 million tonnes.

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Table 5-4 Summary of Locomotive Emissions Inputs

Inputs	2 Million Tonnes	8 Million Tonnes
No. of locomotives	4	4
Average Fuel Consumption (Total L/Locomotive km)	6#	6#
Unloading Speed (km/hr)	0.9	0.9
Number of trains per day	2	7
Hours of Operation (hr/day)	2	7
Length of Rail Loop (km)	2	2
Days of Operation	365	365

Provided by Pacific National in discussions

The calculation sheet used to determine emissions is located in **Appendix A**. The emissions calculated are for the initial and future throughput and are detailed in **Table 5-5**. The table also includes annual tonnages of these pollutants from the nearby Mt Piper and Wallerawang Power Stations

Table 5-5 Estimated Locomotive Emissions vs Power Station Emissions

Emission	2 Million Tonnes (tonnes/annum)	8 Million Tonnes (tonnes/annum)	Power Station Emissions NPI, 2006 (tonnes/annum)
Carbon Monoxide	0.263	0.920	1540
Oxides of Nitrogen	2.071	7.248	40000
PM_{10}	0.049	0.170	1171
Sulfur Dioxide	0.091	0.318	66000
Total VOCs	0.089	0.312	190

Based on the emissions estimates provided above it can be seen that emissions of NO_x are larger in magnitude than any other pollutant emission. This result is expected for diesel locomotives.

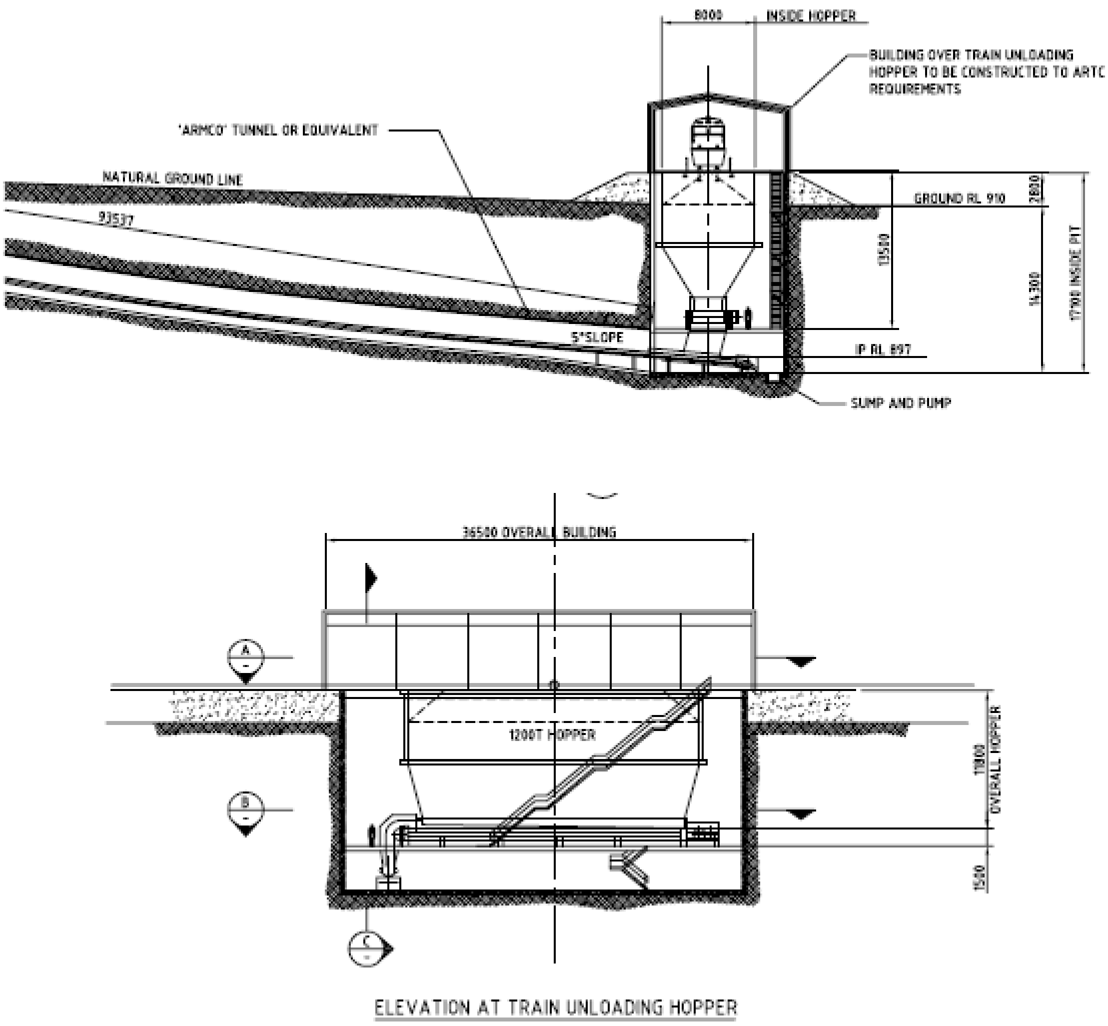
By comparing expected locomotive emissions with power station emissions it can be seen that locomotive emissions are two to three orders of magnitude lower than emissions of the same pollutants from Mt Piper and Wallerawang Power Stations. As detailed in **Section 3.3** the impact of existing power stations emissions on local air quality as measured at Wallerwang and Blackmans Flat is not significant and do not result in exceedances of air quality criteria in the local area. As such it can be deduced that the very small increase in emissions from locomotive exhausts will have no significant effect on air quality in the receiver area. As such it is not considered necessary to assess the air quality impact of locomotive emissions quantitatively (e.g. dispersion modelling).

5.4.2 Coal Transfer Processes

The coal unloading facility will be designed to unload a train with up to 55 wagons. It is envisaged that each train will take 1 hour to unload, and at its ultimate capacity, the facility will unload 7 trains per day. The unloader will consist of an automatic bottom dump, triggered by a striking trigger located at the entry and exist of the dumping station. The effective dump rate will be 3500 tonnes per hour, into the dump hopper which will be located below ground level and include forced air ventilation. **Figure 5-5** shows a preliminary design sketch of a similar unloading facility.

A spray dust suppression system will be strategically positioned at the train wagon and bin opening interface to minimise coal dust. It is envisaged that a dust extraction system would be installed to prevent the accumulation of coal dust. A ventilation system for dust control in the facility will be incorporated into the design.

- **Figure 5-5 Typical Coal Delivery and Hopper Layout**



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The proposed development is expected to have tight dust emission controls, as outlined above. Any dust emissions during this phase would be likely to occur where dust controls break down. The points selected as the most likely for this to happen are:

- Dumping of coal from train wagons into the dump hopper;
- Discharge of coal from the dump hopper to a belt feeder, which feeds the overland conveyor system;
- Overland conveyor system where coal is transferred from one belt to another; and
- Dumping of coal from conveyors onto stockpiles.

As outlined in **Section 2.6**, dumping of coal from the train wagons to the hopper was selected for detailed investigation. **Table 5-6** summarises the emission estimates for the process of dumping coal at the unloader facility, where maximum dust emissions are expected to occur.

- **Table 5-6 Total Annual Particulate Emissions**

Coal dumped per year (Mil t)	TSP (kg/ year)	TSP (g/s)	PM_{10} (kg/year)	PM10 (g/s)
2	2939	0.16	1390	0.07
8	117551	0.65	5560	0.31

The emission estimates presented above are based on the National Pollution Inventory *Emission Estimation Technique Manual for Mining*. The emission equation therein, selected for use in calculating emissions from dumping of coal to the hopper is the miscellaneous transfer and conveying equation as provided in **Equation 5-1**.

- **Equation 5-1**

$$EF = k * 0.0016 (U/2.2)^{1.3} * (M/2)^{-1.4},$$

Where; K = 0.74 (TSP)

K = 0.35 (PM_{10})

U = mean wind Speed (4.02 m/s)

M = moisture content (3%)

It is noted that the *Emission Estimation Technique Manual for Mining* prescribes the use of the above equation, stating that "For coals with a moisture content of less than 10 %, use the equation for miscellaneous transfer and conveying". By using a moisture content of 3%, the assessment provides a conservative estimate of emissions.

It is envisaged that the coal will actually have a much higher moisture content (5-10%) is typical for coal transported by rail wagon, to control dust emissions from open wagons, thereby producing less particulate emission compared with the scenario modelled.

For the modelling of 24 hour PM_{10} impacts, total emissions are calculated based on the number of hours trains are unloading, ie. daily emissions up to 7 hours for the 2 Mt/annum scenario and 14 hour per day for 8Mt/annum. However, in the modelling the calculated emission rates are activated for all hours of the day.

This approach is based on uncertainty about when train unloading will occur throughout the day. The approach also acts to provide a conservative estimate of impacts by over predicting the impact of total emissions. Fugitive particulate emissions were modelled for the process of dumping coal from train wagons to the hopper. Modelling results for the 8 million tonne scenario are presented in **Figure 5-6, Figure 5-7, Figure 5-8** and **Figure 5-9**. Site specific criteria (**Table 4-2**, **Table 4-4** and **Section 4.2.3**) are visible as a red line where emission quantities are high enough to be represented in the plots.

Orange symbols indicate the location of identified receivers. It is reasonable to assume that if emission levels from 8 million tonne scenarios are below site specific criteria, then 2 million tonne levels would also be acceptable. Tabulated concentrations for each form of particulate emission modelled are shown in **Appendix B.2**.

Figure 5-6 shows modelled increases in dust deposition. All increases are expected to be below project criteria. The greatest increase in dust deposition at an identified receiver (receiver (1)) is approximity 0.1 g/m^2/month. This is below the project criteria of 2 g/m^2/month.

- **Figure 5-6 Monthly Dust Deposition Contours – Coal Transfer Operations (g/m^2/month)**

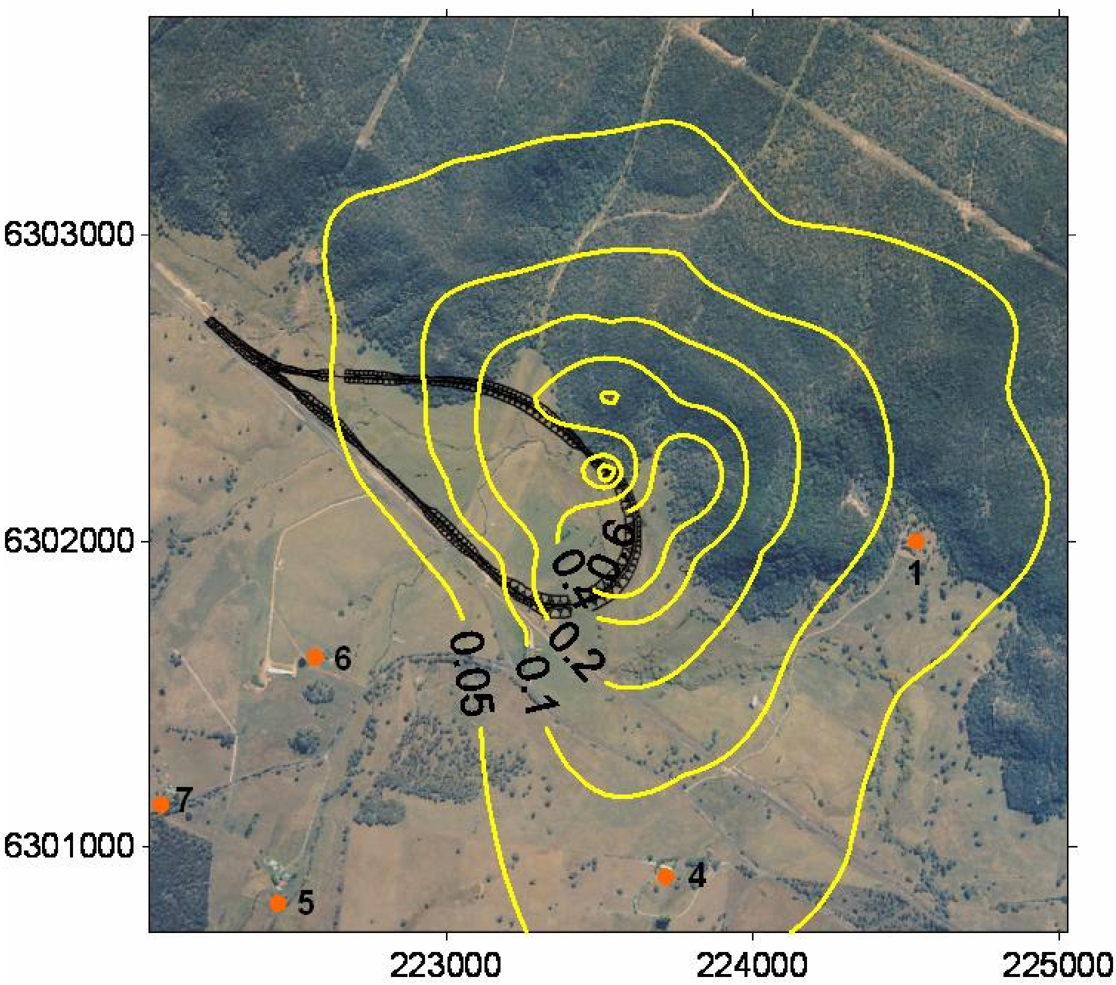

Figure 5-7 shows increases in 24 hour PM_{10} concentrations. The maximum increase at an identified receiver is 9 µg/m^3, occurring at receiver (1). This is below project criteria, which is identified as 23 µg/m^3.

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■ **Figure 5-7 24 Hour PM_{10} Contours – Coal Transfer Operations (µg/m^3)**

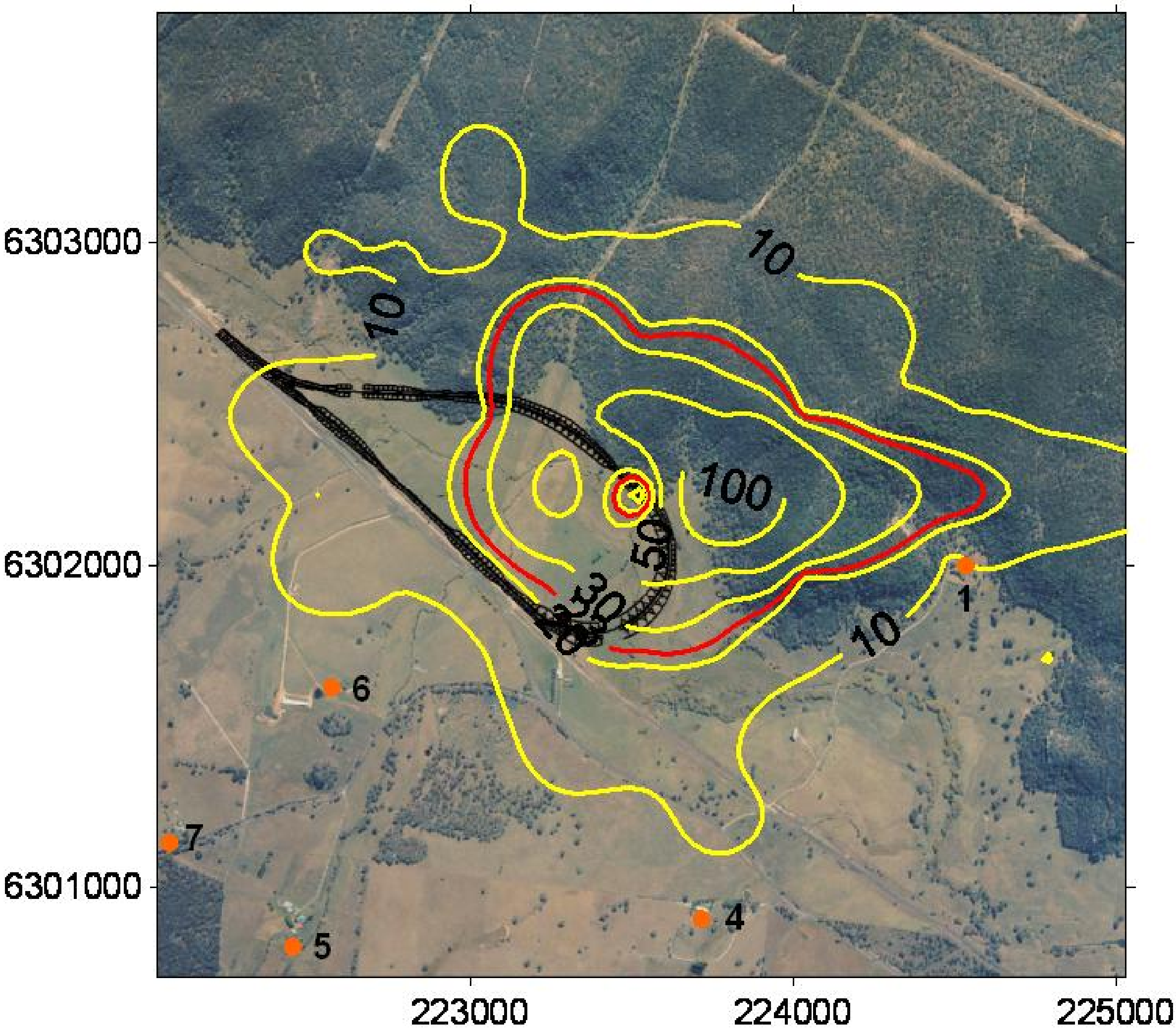

Figure 5-8 shows model contours for the increase in annual average PM_{10} concentrations. All concentration increases are below project criteria (16 µg/m^3). The maximum increase predicted at an identified receiver in 0.6 µg/m^3, occurring at receiver (1).

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- **Figure 5-8 Annual PM_{10} Contours – Coal Transfer Operations (µg/m³)**

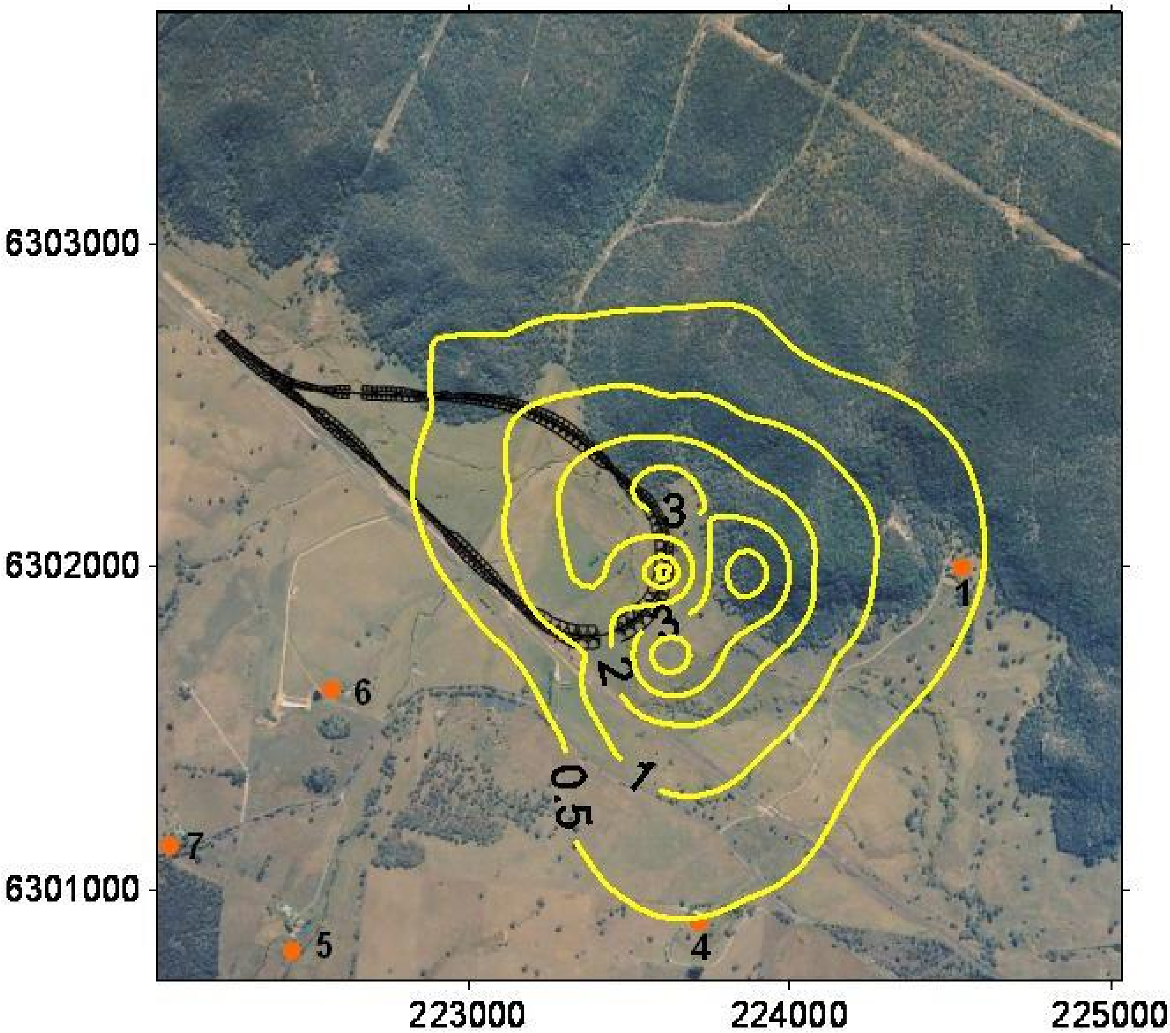
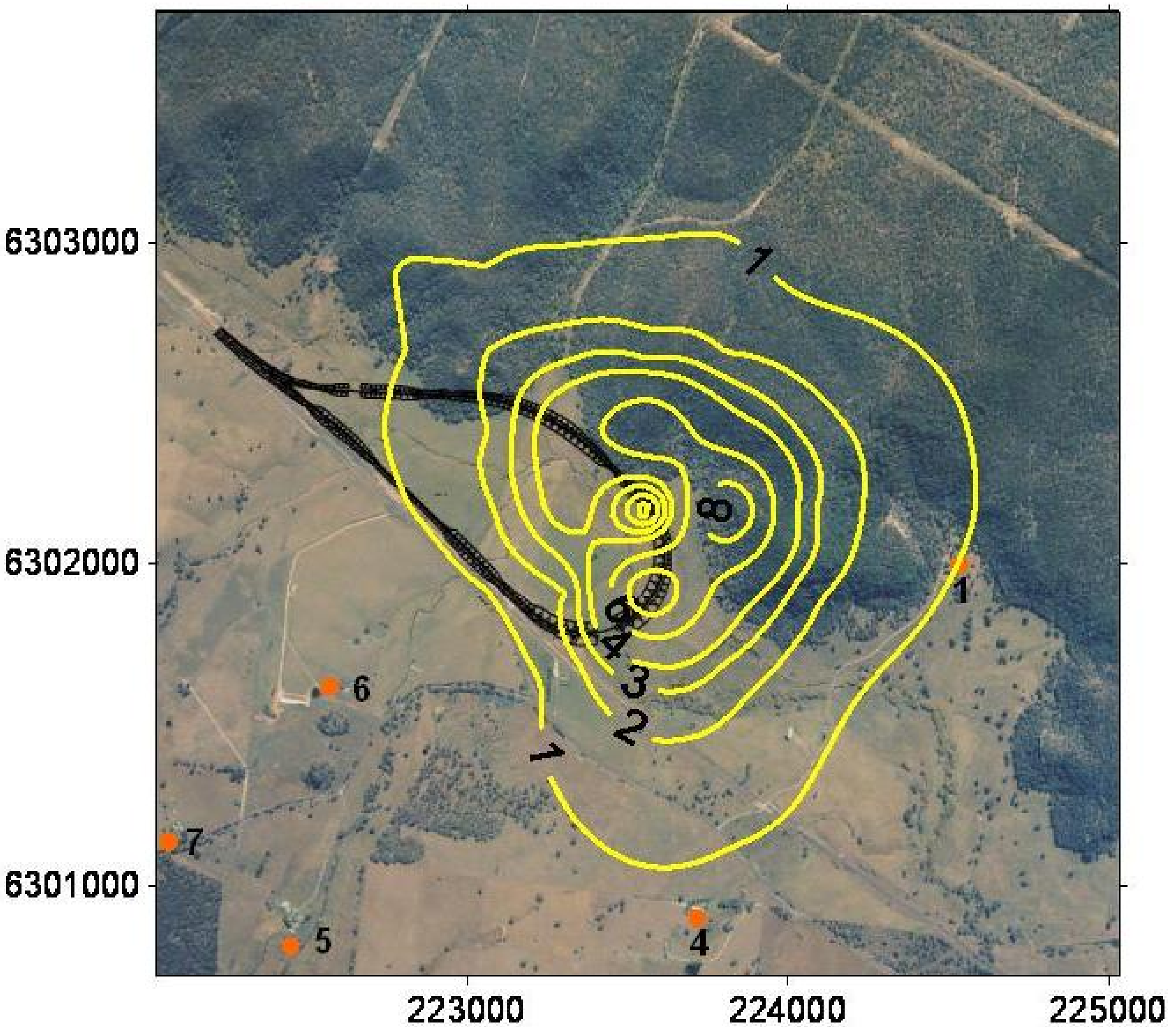


Figure 5-9 shows results of increases in TSP concentrations. The results show a no exceedance of project criteria at identified receiver locations. The maximum expected increase in TSP concentration at an identified receiver (receiver(1)) is 1 µg/m³.

▪ **Figure 5-9 TSP Contours – Coal Transfer Operations (µg/m³)**



5.5 Management of Fugitive Particulates – Operation and Construction

During construction and operation of the rail unloading facility, fugitive dust can be generated from dumping of coal from train wagons to the hopper, the movement of coal by conveyors systems, transfer points, wind erosion from spoil stockpiles, trucks and truck dumping and earth moving equipment. Measures for dust control to be implemented during operation and construction of the proposed development are outlined in **Table 5-7**.

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Table 5-7 Dust Mitigation Measures

Potential Adverse Effects	Mitigation Methods
Dust	▪ Restrict traffic to defined roads. ▪ Maintain low vehicle speeds on unsealed roads (e.g. 40km/h). ▪ Trucks transporting material to and from the premises on public roads would be covered with tailgates securely fixed to prevent wind blown emissions and spillage. The covering would be maintained until immediately before unloading. ▪ Ensure trucks exit the site via a wheel cleaning facility established at the exit of the site to prevent any dirt/soil being transported onto external public roads. ▪ Ensure no incineration or burning of any material on the premises. Prompt action would be taken to extinguish any fire. ▪ Record and action all air quality complaints ▪ Floor sweep system for rail unloader, driven by a booster fan, which would deliver the dust to the nearest collection system ▪ Ensure onsite conveyor systems remain covered by the overhead gantry to ensure wind blown dust is kept to a minimum. ▪ Ensure the spray dust suppression system strategically positioned at the train wagon and bin opening interface to minimise coal dust is maintained and working to specification. ▪ Maintain the dust extraction and ventilation system to prevent the accumulation of coal dust. ▪ Install and maintain dust deposition gauges at key locations during construction and first year of operation. Sampling will be undertaken monthly and compared against criteria outlined in Table 4-5.

The modelling assessment for operational impacts from the rail unloader does not include the dust reducing effects of the proposed mitigation measures, such as enclosure of the rail unloader in a building and the provision of an enclosed conveyor system. The dust extraction system for the unloading facility is yet to be designed. It is noted that the results of this study show that under worst case conditions, i.e. if there was no dust suppression system or if the dust suppression system had failed, impacts remain acceptable. On this basis, the scenarios modelled provided a worst case assessment.

Controls identified in **Table 5-7** would be incorporated into standard operating procedures which would form part of the operating environmental management program for the Western Rail Coal Unloader facility. As the modelling showed, air quality criteria would be met. The implementation of these further measures would ensure that any impacts would be further minimized. The implementation of the further measures was not modelled, but it is evident that the residual impacts from these measures would be minor.

6. Conclusions and Recommendations

6.1 General Conclusions

Delta Electricity is proposing to construct a rail unloading facility in the vicinity of their two power stations located at Mt Piper and Wallerawang, near Lithgow. The air quality impacts associated with this facility have been assessed at the preferred Pipers Flat site.

Impacts during construction would comprise mainly particulate matter, with earth works taking approximately 6 months to complete. Particulate emissions associated with the import of approximately 600,000m^3 of bulk material, would present the greatest risk to air quality in the area. Model results from the air quality assessment show that it is possible to manage impacts within the identified site specific criteria. It is considered that provided the dust mitigation measures, as outlined, are included with the construction works then impacts would be better than the modelled results and no adverse air quality impacts should result from the works.

With respect to operational phase air quality impacts, locomotives transporting the coal to the facility, the coal transfer process and coal stockpiles would be the primary sources of emissions. PM_{10} and TSP emissions were modelled to simulate emissions from the coal transfer process at the unloading site. Model results estimate that there would be no exceedance of project specific air quality criteria for PM_{10} and TSP at nearby receiver locations. The very small increase in emissions from locomotive exhausts will have no significant effect on air quality in the area.

6.2 Recommendations

In order to reduce dust levels at the nearest receptors the construction contractor would ensure that the following dust controls are implemented:

- Spray water with watercarts and/or hand held hoses on a regular basis, particularly during dry or windy conditions;
- Stabilise worked areas as soon as possible after earth works have been completed eg re-vegetation;
- Construct and maintain cloth fencing around work sites;
- Spray trafficable areas with water using a water cart;
- Cover all materials transported on and off site;
- Remove mud from truck wheels;
- Sweep-up mud or soil tracked onto public roads at the site entrance;
- Ensure adequate water supply is maintained on site for dust suppression; and
- Minimising machinery speeds on site.

During operation of the unloader facility, the following dust containment and suppression measures would be implemented:

- Covering of the conveyor system;
- Utilise a floor sweep system;
- Maintain an operational dust collection system;
- Maintain an operational dust extraction system;
- Install spray dust suppression system at the coal dump point and conveyor transfer points.

7. References

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Appendix A Air Emission Calculations

A.1 Emission Rates – Dumping Coal

E = K(0.0016)*((u/2.2)^1.3*(m/2)^-1.4)		
Particulate size		E
PM10		0.000695032
TSP		0.001469496
4 million tonnes per annum		
Particulate size	**kg/day**	**g/s**
PM10	7.805206625	0.154865211
TSP	16.50243687	0.327429303
8 million tonnes per annum		
Particulate size	**kg/day**	**g/s**
PM10	15.40885404	0.305731231
TSP	32.57871997	0.646403174

A.2 Emission Rates - Construction

Source Number	**% of Total Emission**	**ER / Source ($g/sec/m^2$)**	
		TSP	PM10
Source 1	54.0964	0.0008	0.0002
Source 2	11.5935	0.0008	0.0002
Source 3	14.2162	0.0007	0.0002
Source 4	7.2717	0.0006	0.0001
Source 5	12.8222	0.0006	0.0001

A.3 Emission Rates - Locomotive Air Emissions

Western Rail Coal Unloader - 2 Million Tonnes

Background Data	
Number of trains per annum	730
Number of locos per train	4
Loco fuel consumption (L/km)	6
Length of Section (km)	2

Substance	Line Haul Locomotive Emission Factor					
	(g/L)					
Carbon monoxide	7.50					
Oxides of Nitrogen	59.10					
PM_{10}	1.39					
Sulfur dioxide	2.59					
Total VOCs	2.54					

Emissions	g/annum
Carbon monoxide	262,800
Oxides of Nitrogen	2,070,864
PM10	48,706
Sulfur dioxide	90,754
Total VOCS	89,002
Emissions	kg/annum
Carbon monoxide	263
Oxides of Nitrogen	2,071
PM10	49
Sulfur dioxide	91
Total VOCS	89
Total	**2,562**

Loco numbers for >>	**1,460**	trains	(per annum)		
NR locos	All 3x.	Trains	locos/train	locos	
Single-loco trains:	0%	0	1	0	
Double-loco trains:	0%	0	2	0	
Triple-loco trains:	100%	1460	3	4380	
Totals:	100%	1460	--	4380	
				4	avg locos per train
Av. Fuel Consumption (L/km)				6	
Based on figure from Pacific National					

Western Rail Coal Unloader - 8 Million Tonnes

Background Data	
Number of trains per annum	2,555
Number of locos per train	4
Loco fuel consumption (L/km)	6
Length of Section (km)	2

Substance	Line Haul Locomotive Emission Factor					
	(g/L)					
Carbon monoxide	7.50					
Oxides of Nitrogen	59.10					
PM_{10}	1.39					
Sulfur dioxide	2.59					
Total VOCs	2.54					

Emissions	g/annum
Carbon monoxide	919,800
Oxides of Nitrogen	7,248,024
PM10	170,470
Sulfur dioxide	317,638
Total VOCS	311,506

Emissions	kg/annum
Carbon monoxide	920
Oxides of Nitrogen	7,248
PM10	170
Sulfur dioxide	318
Total VOCS	312
Total	**8,967**

Loco numbers for >>	**2,555**	trains	(per annum)		
NR locos	All 4x.	Trains	locos/train	locos	
Single-loco trains:	0%	0	1	0	
Double-loco trains:	0%	0	2	0	
Triple-loco trains:	100%	2555	3	7665	
Totals:	100%	2555	--	7665	
				4	avg locos per train
Av. Fuel Consumption (L/km)				6	

Based on figure from Pacific National

Appendix B Tabulated Results - Construction and Operation Phase of WUCU Facility

B.1 Results at Sensitive Receivers – Construction Phase

Sensitive Receiver		Emission Level			
Easting MGA	**Northing** MGA	**Dust Deposition** g/m^2/month	**24 hour PM_{10}** µg/m^3	**Annual PM_{10}** µg/m^3	**TSP** µg/m^3
222688	6301713	0.2	8.5	4.2	18.5
223707	6301120	1.0	11.2	4.7	20.3
224408	6302053	1.0	9.2	3.6	15.3
222225	6301363	0.2	6.6	2.7	11.6
222548	6301093	0.2	4.1	2.6	11.3

B.2 Results at Sensitive Receivers – Operation Phase - 8 Million Tonnes

Sensitive Receiver		Emission Level			
Easting MGA	**Northing** MGA	**Dust Deposition** g/m^2/month	**24 hour PM_{10}** µg/m^3	**Annual PM_{10}** µg/m^3	**TSP** µg/m^3
222688	6301713	0.03	6.6	0.2	0.4
223707	6301120	0.09	7.1	0.5	1.0
224408	6302053	0.1	8.9	0.6	1.2
222225	6301363	0.02	3.0	0.1	0.3
222548	6301093	0.02	2.7	0.1	0.2