



Centennial Coal



Response to Submissions

Myuna Colliery

Section 75W Modification to Project Approval PA 10_0080

January 2015



Myuna Colliery

Section 75W Modification to Project Approval PA 10_0080

Response to Submissions

Prepared By:

Centennial Myuna Pty Limited



Document Control

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1 Introduction

Myuna Colliery is an underground coal mine owned and operated by Centennial Myuna Pty Limited (CMPL). Myuna Colliery is located 25 kilometres south-west of Newcastle, New South Wales (NSW) in the Lake Macquarie and Wyong Local Government Areas (LGA).

Myuna Colliery is owned and operated by CMPL, which is a wholly owned subsidiary of Centennial Coal Company Limited (Centennial). Centennial is a wholly owned subsidiary of Banpu Public Company Limited (Banpu).

In August 2014 it became necessary to place the Newstan Colliery back into 'care and maintenance'. At the time Newstan Colliery employed 148 people. Centennial identified the ability to transfer workers from the Newstan Colliery to Myuna Colliery as a way to reduce the impact of job losses and the associated costs that might otherwise be imposed on local and regional communities and all levels of government. The additional workforce relocating to Myuna Colliery will result in the operation of additional mining equipment underground, consequently increasing the rate of production from the Myuna Colliery. The increase in production will assist in providing flexibility to Centennial in meeting local coal supply contracts that would have otherwise been provided through the ongoing operations at the Newstan Colliery. CMPL has current approval to extract up to 2 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal and employ 210 full time employees.

An Environmental Assessment (EA) has been prepared to support an application by CMPL to modify Project Approval 10_0080 pursuant to Section 75W of Part 3A of the EP&A Act to allow for:

an increase in ROM coal extraction to up to 3 million tonnes per annum; and

an increase in employment to up to 300 full time employees.

The Modification Application Area encompasses PA10_0080 which includes ML 1370, MPL334, a portion of CCL 762 and the Myuna Colliery Surface Facilities Area. The Modification Application Area is external to the Development Consent SH110_148, with the exception of the inclusion of the Surface Facilities Area.

The EA was placed on public exhibition from Friday 27 November 2014 until Friday 19 December 2014.

1.1 Scope

This Response to Submissions (RTS) has been prepared in accordance with section 75H(6) of the Environmental Planning and Assessment Act 1979 (EP&A Act) and considers the matters raised in submissions received by DP&E during the public exhibition of the EA. This report builds on information presented in the EAS and is to be read in conjunction with the EA.

2 Summary of Submissions

20 submissions were received during the public exhibition period of the EA. 12 submissions were received from community individuals. Of these:

eleven submissions were in support of the proposed modification; and

one submission was in objection to the proposed modification.

One submission was received from a special interest group/non-government organisation in objection to the proposed modification and seven submissions were received from government agencies. The seven submissions from government agencies included:

Department of Primary Industries (DPI);

Division of Resources and Energy (DRE;

Environmental Protection Authority (EPA);

Hunter New England Local Health District;

Lake Macquarie City Council (LMCC);

Office of Environment and Heritage (OEH); and

Roads and Maritime Service (RMS).

Of the government agency submissions, only the EPA, DRE and LMCC identified matters that require a response to be provided.

2.1 Summary of Issues Raised

A summary of the issues raised by the EPA is provided in **Table 1**, a summary of the issues raised by the special interest group/non government organisation is provided in **Table 2** and a summary of the issues made by the individual community members is provided in **Table 3**. Detailed responses to each of the issues raised are provided in **Section 3.0**.

Table 1 - Summary of Government Agency Submissions

Area of Concern	Raised By	Summary of Issue
Air Quality	Environmental Protection Authority	Whilst the Air Quality Impact Assessment outlines the assumptions and emission factors utilised for emission estimation, the actual calculated emission rates as inputted into the dispersion modelling stage of the assessment have not been presented. In accordance with Section 9.3 of the Approved Methods, the Air Quality Impact Assessment should provide the estimated emission rates for each source and scenario.
		The Air Quality Impact Assessment prepared for the Myuna Colliery Extension Project (Heggies, 2010)' presented a stack diameter of 3.9 m for the ventilation shaft whilst the presented AQIA has a stack diameter of 4.82 m. Clarification on the actual stack diameter is required, and any implications on the results and conclusions of the AQIA.
		The Air Quality Impact Assessment has utilised a synthetic prognostic meteorological dataset utilising MM5 and CALMET for inclusion within the quantitative component of the assessment. The EPA notes that the meteorological data utilised to represent the site contains inconsistencies with the Myuna Colliery Extension Project (Heggies, 2010)", specifically noting: Annual representation of calms of 0.3 percent , as compared with 6 percent within the assessment provided for the Extension Project; and Annual representation of F class stability of 13 percent, as compared with 25 percent within the assessment provided for the Extension Project. In accordance with the Section 9.4.2 of the Approved Methods, meteorological data must be demonstrated to be site representative.
	Lake Macquarie City Council	Emissions factor calculations provided in Section 5.3 (Table 14) of the Air Quality Impact Assessment include calculations that are not consistent with their respective references.
Rehabilitation	DRE	DRE requires staged mining and rehabilitation plans to be provided in the revised MOP should the modification be approved.
		The Proponent must rehabilitate the site to the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services.
		The proponent must carry out all surface disturbing activities in a manner that, as far is reasonably practicable, minimises potential for dust emissions and shall carry out rehabilitation of disturbed areas progressively, as soon as reasonably practicable, to

Area of Concern	Raised By	Summary of Issue
		the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services.
		The Proponent must prepare and implement a Rehabilitation Plan to the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services.

Table 2 - Summary of Community Individual Submissions

Area of Concern	Raised By (DP&E ID)	Summary of Issue
Socio - Economic	113355	Coal mining is not a sustainable source of energy. The jobs that are proposed to be created - 300 - by this submission are far outweighed by the potential employment that would be created through a range of other industries e.g. tourism, agriculture etc. that could exist if this mining extension were not approved. The Central Coast Region needs industry - how about the manufacture of products required for sustainable energy production e.g. solar or wind power?

Table 3 – Summary of Special interest Group Submissions

Area of Concern	Raised By	Summary of Issue
Air Quality	Community Environment Network	Whilst the proposed coal extraction is to take place under Lake Macquarie rather than surface extraction the grading, loading, unloading and transport of coal through the city of Lake Macquarie to power stations and to export terminals leads to an increase in air pollution especially fine particulate matter - so injurious to human health - from coal dust and rail transport, loading and unloading.
Climate Change	Community Environment Network	Contributes to increased atmospheric CO₂ levels and accelerates climate change, sea level rise and global warming. The burning of coal contributes to accelerating rates of climate change globally. Australia is one of the world's biggest contributors to rising CO₂ levels and this proposal to continue mining, burning and exporting of coal goes against global trends to reduce CO₂ emissions.
Economic	Community Environment Network	Australia should be moving away from reliance on fossil fuels. NSW government should be investing in renewable forms of energy not fossil fuels.

3 Response to Submissions

3.1 Response to Government Agency Submissions

3.1.1 Air Quality

Whilst the Air Quality Impact Assessment outlines the assumptions and emission factors utilised for emission estimation, the actual calculated emission rates as inputted into the dispersion modelling stage of the assessment have not been presented. In accordance with Section 9.3 of the Approved Methods, the Air Quality Impact Assessment should provide the estimated emission rates for each source and scenario. (EPA)

A detailed emissions inventory has been added as **Appendix C** in the revised Air Quality Impact Assessment provided as **Appendix 1** to this RTS. The total emissions are presented as annual totals as calculated using average wind speed conditions (for wind speed dependent sources). Within the modelling files, the total emissions are distributed among the relevant modelled sources, based on the location of the emission source and the hours of operation.

The Air Quality Impact Assessment prepared for the Myuna Colliery Extension Project (Heggies, 2010)' presented a stack diameter of 3.9 m for the ventilation shaft whilst the presented AQIA has a stack diameter of 4.82 m. Clarification on the actual stack diameter is required, and any implications on the results and conclusions of the AQIA. (EPA)

The ventilation parameters used in the previous report (Heggies 2010) were based on assumptions and the emissions were calculated using the emission factors listed in Table 4.4 of the Environment Australia Document Technical Report 1: Toxic Emissions from Diesel Vehicles in Australia, 2003 (page 37 of Heggies 2010).

The ventilation parameters used in this round of modelling (SLR 2014) have been adopted from the most recent round of emissions monitoring conducted at another Centennial Coal site (Mandalong mine), including the ventilation fan parameters.

The fans located at Myuna Colliery have rectangular outlets with measured dimensions being 4.45 m x 4.10 m. The CALPUFF modelling suite has the capability to model the vertical stack sources which are cylindrical in shape (with circular exit). To represent the actual rectangular shaped ventilation fan within the dispersion modelling, the equivalent circular diameter has been calculated, i.e. 4.82 m. This is considered to be appropriate as it represents a realistic assessment of the ventilation fans.

The Air Quality Impact Assessment has utilised a synthetic prognostic meteorological dataset utilising MM5 and CALMET for inclusion within the quantitative component of the assessment. The EPA notes that the meteorological data utilised to represent the site contains inconsistencies with the Myuna Colliery Extension Project (Heggies, 2010)", specifically noting:

- **Annual representation of calms of 0.3 percent , as compared with 6 percent within the assessment provided for the Extension Project; and**

- **Annual representation of F class stability of 13 percent, as compared with 25 percent within the assessment provided for the Extension Project.**

In accordance with the Section 9.4.2 of the Approved Methods, meteorological data must be demonstrated to be site representative. (EPA)

The above comments are acknowledged as a comparison between the meteorological data used in the previous assessment (Heggies, 2010) and the current assessment (SLR 2014). It is noted that significant differences exist between the two meteorological data sets, such as:

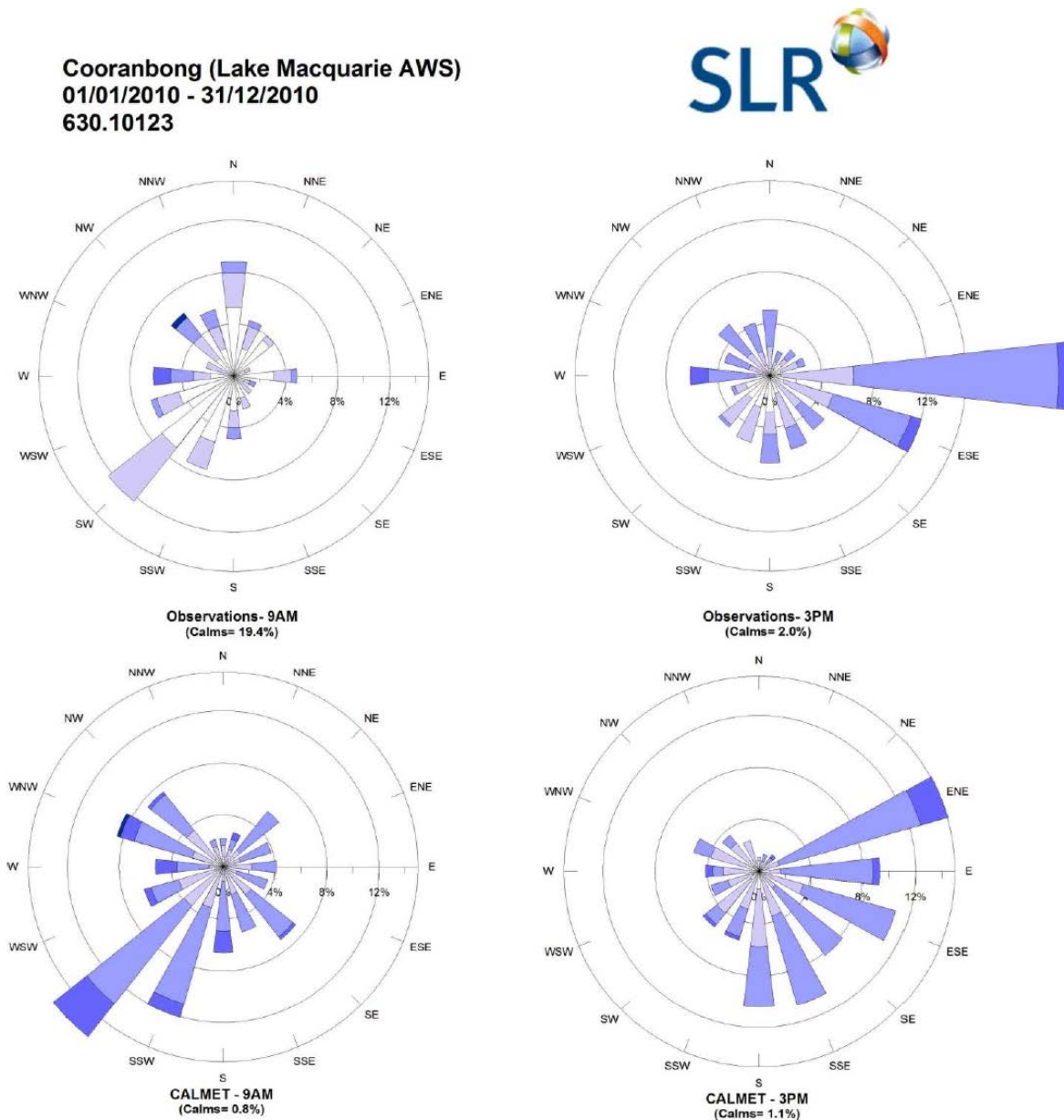
- The previous report used the dataset comprising the dates July 2005 to June 2006 (Heggies, 2010), compared to January 2010 to December 2010 (SLR 2014).
- The meteorological modelling was conducted using different modelling approaches, for example TAPM was used with observations from nearby weather stations incorporated in the previous assessment (Heggies, 2010), compared to MM5 data being used as initial guess fields for CALMET in the current assessment (SLR 2014).
- The data presented in the previous assessment report (Heggies 2010) was output from TAPM, whereas the data presented in the current assessment (SLR 2014) was output from CALMET.

Notwithstanding the above, a meteorological validation has been completed for the current assessment (SLR 2014) using the observed meteorological data from the Bureau of Meteorology Automatic Weather Station (AWS) station located at Cooranbong (Lake Macquarie AWS, station # 61412) and the modelled data extracted at the Cooranbong (Lake Macquarie) AWS. A discussion is also provided regarding the selection of the MM5 data meteorological year.

Meteorological Data Validation

A comparison of the observed and modelled 9am and 3pm meteorological data is shown in **Figure 1**.

Figure 1 - Comparison of the Modelled and Observed Meteorological Data at Cooranbong (Lake Macquarie AWS, station # 61412)



It is noted from the comparison that the observed and modelled meteorological data are largely in agreement, with the notable exception of:

- 19.4% of 9am calms observed compared to 0.8% of calms modelled.
- A higher percentage of observed winds from the eastern quadrant at 3pm compared to the modelled 3pm winds.

In SLR's opinion, the lower percentage of calm conditions predicted at 9 am using the current meteorological modelling methodology (SLR 2014), is likely to result in conservatively higher predicted concentrations of particulate matter at the receptors. This is especially true for the wind dependent

sources (for example wind erosion, material handling and miscellaneous sources) where increased wind speeds would result in greater emissions and therefore a conservative assessment of resulting impacts.

MM5 Data Year Selection

The MM5 data generated by the Pennsylvania State University/National Centre for Atmospheric Research was used for input into CALMET. The CALMET model was run for 2006, 2007, 2008, 2009 and 2010.

During the investigation, it was found that there was no apparent trend in the modelled wind speeds, wind directions or mixing heights. However for the modelled stability classes, it was found that a higher percentage of F class is predicted for the years 2006 to 2008. Stability Class F is indicative of very stable night time conditions, which is less conducive to pollutant dispersion due to reduced atmospheric mixing.

Investigations into this issue have revealed that the supplier of the MM5 data used in meteorological modelling altered the planetary boundary layer process parameterisation scheme from the Eta Turbulent Kinetic Energy (TKE) scheme to the MRF scheme between model years 2008 and 2009 as part of ongoing refinement and improvement in model outputs. The MRF scheme is a newer parameterisation scheme which better evaluates the interactions of a number of variables within the boundary layer. A study by Fernandez et al (2007) found that the Eta scheme yielded a colder bias at the surface than the MRF scheme which may result in the prevalence of more stable conditions. The changes in the stability class distribution should be viewed as an improvement in previous (2006-2008) predictions and ongoing improvements and changes in parameterisation schemes will be incorporated into modelling techniques as they become available.

The use of the 2010 meteorological year is consistent with all Centennial Coal Air Quality Impact Assessment studies performed and submitted for agency review since 2012. This approach has been adopted to allow the relevant agencies to review each assessment in the knowledge that a consistent meteorological dataset underpins each assessment and that no 'cherry-picking' of meteorological data has been performed.

Emissions factor calculations provided in Section 5.3 (Table 14) of the Air Quality Impact Assessment include calculations that are not consistent with their respective references. (LMCC)

This has been identified as a typographical error in Table 14 of the report (SLR 2014).

The full emission factor equation as shown in the NPI EET Manual for Mining v3.1 (DSEWPC 2012) is shown below. It is noted that the NPI EET manual does not prescribe the emission factors for PM_{2.5}. In the absence of PM_{2.5} emission factors, the 'k' value was sourced from the USEPA AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles, which is in line with the TSP and PM₁₀ emission factors.

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

where:

$k = 0.74$ (TSP); $k = 0.35$ (PM_{10}); $k = 0.053$ ($PM_{2.5}$)

U = mean wind speed (m/s)

M = Moisture content (%)

It is noted that the above emission factor equation is applicable to the following sources:

- Miscellaneous transfer points (including all conveyor transfer points);
- Trucks unloading coal at emergency stockpiles.

A worked example for the calculation of total emissions of TSP, PM_{10} and $PM_{2.5}$ (miscellaneous transfer points) is shown below for the scenario – 2 Mtpa - Maximum 24 hour emissions:

Note: A factor of 2.3 has been calculated for the example below using the equation $(\text{wind speed}/2.2)^{1.3}$ for each hour of the year taking into account the average of all the hours of the year. The emission factors within the modelling files vary by actual wind speed during each hour.

$$TSP_{EF} = 0.74 \times 0.0016 \times [(2.3)/(8/2)^{1.4}] = 0.00039 \text{ kg/tonne}$$

$$TSP_{\text{total emissions}} = 3,832,500 \text{ tonnes/year} \times 0.00039 \text{ kg/tonne} = 452 \text{ kg/year}$$

$$PM_{10 \text{ EF}} = 0.35 \times 0.0016 \times [(2.3)/(8/2)^{1.4}] = 0.00019 \text{ kg/tonne}$$

$$PM_{10 \text{ total emissions}} = 3,832,500 \text{ tonnes/year} \times 0.00019 \text{ kg/tonne} = 214 \text{ kg/year}$$

$$PM_{2.5 \text{ EF}} = 0.053 \times 0.0016 \times [(2.3)/(8/2)^{1.4}] = 0.00003 \text{ kg/tonne}$$

$$PM_{2.5 \text{ total emissions}} = 3,832,500 \text{ tonnes/year} \times 0.00003 \text{ kg/tonne} = 32 \text{ kg/year}$$

A detailed emissions inventory has been added as Appendix C in the revised Air Quality Impact Assessment provided as **Appendix 1** to this RTS. The total emissions are presented as annual totals as calculated using average wind speed conditions (for wind speed dependent sources). Within the modelling files, the total emissions are distributed among the relevant modelled sources, based on the location of the emission source and the hours of operation.

3.2 Rehabilitation

The Proponent must rehabilitate the site to the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services. (DRE)

Rehabilitation of the site at mine closure will be undertaken to the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services in line with the commitments and requirements of the approved Mining Operations Plan.

The proponent must carry out all surface disturbing activities in a manner that, as far is reasonably practicable, minimises potential for dust emissions and shall carry out rehabilitation of disturbed areas progressively, as soon as reasonably practicable, to the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services. (DRE)

Noted. No surface disturbance is proposed as part of the proposed modification.

The Proponent must prepare and implement a Rehabilitation Plan to the satisfaction of the Secretary of Department of Trade & Investment, Regional Infrastructure & Services. (DRE)

The approved Mining Operation Plan (which will become the Rehabilitation Management Plan once the Mining Act Amendments have commenced), required as a condition of the Mining Lease(s) issued in relation to this project, will satisfy the requirements of this condition for a Rehabilitation Management Plan.

3.3 Response to Community Individual Submissions

3.3.1 Socio – Economic

Coal mining is not a sustainable source of energy. The jobs that are proposed to be created - 300 - by this submission are far outweighed by the potential employment that would be created through a range of other industries e.g. tourism, agriculture etc. that could exist if this mining extension were not approved. The Central Coast Region needs industry - how about the manufacture of products required for sustainable energy production e.g. solar or wind power?

Myuna Colliery is a long standing existing operation and the proposed modification will see the continuation of this operation. Few complaints have been received from the community over the life of the Colliery. Myuna Colliery has supported sponsorship of initiatives at Arcadia Vale Public School, Wangi Peter Pan Kindergarten, Lake Macquarie Combined Fishing Club, Wangi Netball Club, Rathmines Public School, Powerhouse Christian Church, Wangi Lawn Bowling Club, Wangi Lions Club and the Wangi Beautification Project, Wangi Dobell Festival of Arts and Crafts, the Wangi Men's Shed and West Lake Soccer Club. The proposed modification will result in the employment of an additional 90 employees above current staff levels at the site. These jobs will principally be filled by Centennial Coal employees displaced by the placement under care and maintenance of Newstan Colliery.

Retention of these 90 employees and the positive contribution made through spending a significant proportion of their incomes in the local and regional economies also avoids costs associated with these employees becoming redundant. For example, these households will avoid economic costs and potential social dislocation relating to relocation to find alternative employment. Similarly potential costs to governments and community organisations relating to unemployment will also be avoided if the application is successful.

The potential social benefits of the proposed modification will result in ongoing and sustained employment which is found to bring a positive social and economic benefit to the community and region.

Coal mining in Australia is still warranted as the electricity generation industry remains heavily reliant on coal-fuelled generation. Recent research by Pitt & Sherry (2014) demonstrate that black coal demand for electricity generation has been declining in recent years while alternative fuel sources such as gas, wind and other renewable have been on the rise. However, their research shows that to date black coal is still the highest fuel source used for electricity generation, and they provide the following statistics:

'Shares of total generation in the year ended June 2014 were black coal 50.7 percent , brown coal 22.3 percent , gas 12.7 percent , hydro 9.6 percent and wind 4.7 percent . These are the lowest shares of both black and brown coal, and the highest shares of wind, since Cedex® data starts in 2006, and in fact, almost certainly ever'.

The observations of Pitt and Sherry (2014) are supported by data from the Australian Bureau of Statistics (ABS). **Figure 2** provides data on electricity generation by fuel type for the period 2011/2012, and shows that coal represents the highest fuel source for electricity generation in the period 2011/2012. Approximately 65 percent of the total electricity generated in Australia was from coal while natural gas provided approximately 23 percent of the total demand. In comparison the combined renewable fuel sources met less than 10 percent of Australia's fuel source demand for electricity generation.

While it can be anticipated, based on research by Pitt and Sherry (2014), that use of alternative and renewable sources will continue to increase, the transition to a point where these sources supplant coal as the predominant fuel source in the future will clearly take a significant period of time. This is especially the case given the availability of coal resources, the simplistic methods of mining of coal and conversion

to electricity compared to renewables, and the extensive investment already sunk into coal-fired generation capacity in Australia.

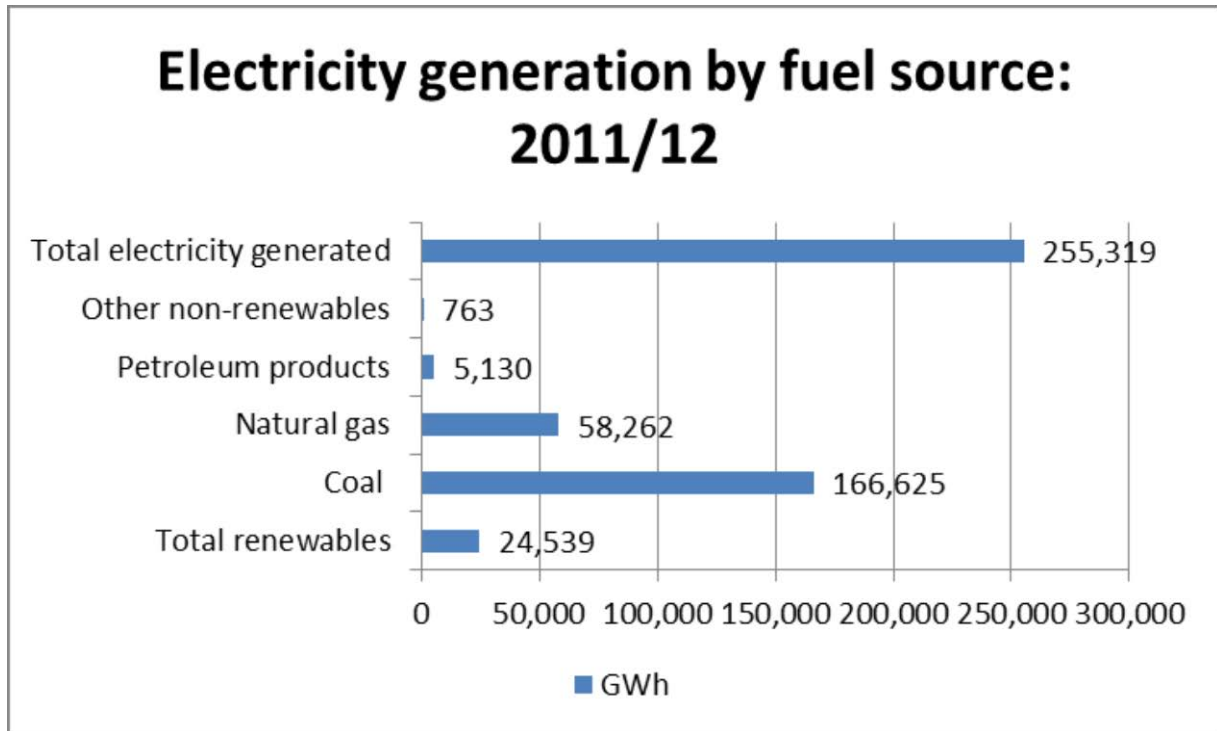


Figure 2 - Electricity Generation by Fuel Source 2011/2012

3.4 Response to Special Interest Group Submissions

3.4.1 Air Quality

Whilst the proposed coal extraction is to take place under Lake Macquarie rather than surface extraction the grading, loading, unloading and transport of coal through the city of Lake Macquarie to power stations and to export terminals leads to an increase in air pollution especially fine particulate matter - so injurious to human health - from coal dust and rail transport, loading and unloading.

All coal produced at the Myuna Colliery is transported via a dedicated overland conveyor to the Eraring Power Station. No coal is transported off site by road. An Air Quality Impact Assessment was prepared to support the proposed modification by SLR Consulting Pty Ltd and provided as Appendix C to the EA. The Air Quality Impact Assessment concluded that

All annual average particulate impacts (dust deposition, PM₁₀, PM_{2.5}, TSP) are in compliance with advisory reporting standards, NSW EPA and World Health Organisation (WHO) criteria at all receptors assessed;

Maximum 24-hour PM_{2.5} concentrations are predicted to be below the advisory reporting standard at all receptors assessed, including an approximation of background (i.e. existing air quality); and

Maximum 24-hour PM₁₀ concentrations are predicted to be below the NSW EPA criterion of 50 µg/m³ (and the potential criterion of 40 µg/m³) at all receptors including an approximation of background (i.e. existing air quality).

Existing dust control measures implemented at Myuna Colliery will continue to be implemented throughout the life of the operation. Air quality monitoring (1-in-6 day High Volume Air Sampler for PM₁₀ and TSP and dust deposition monitoring) will continue to be performed by CMPL to monitor air quality impacts due to the operations at the Myuna Colliery Surface Facilities Area. The results of the monitoring data will be used to inform the efficacy of control measures.

3.4.2 Climate Change

The proposed modification contributes to increased atmospheric CO₂ levels and accelerates climate change, sea level rise and global warming. The burning of coal contributes to accelerating rates of climate change globally.

Australia is one of the world's biggest contributors to rising CO₂ levels and this proposal to continue mining, burning and exporting of coal goes against global trends to reduce CO₂ emissions.

A Greenhouse Gas Assessment (GHG) was prepared by AECOM Australia Pty Ltd as part of the original Myuna Colliery Extension of Mining Project EA. The GHG Assessment determined that GHG emission levels of the on-site activities represent approximately 0.1 percent of total Australian emissions and 2 percent of mining emissions in Australia (based on 2008 data from Australian Greenhouse Emissions Information System, Department of Climate Change and Energy Efficiency).

Australia's net greenhouse gas emissions account for 1.47 percent of the global emission balance. With the Myuna Collieries Scope 1 and Scope 2 emissions accounting for 0.1 percent of Australia's total emissions, it will have an undetectable effect on global climate change.

3.4.3 Economic

Australia should be moving away from reliance on fossil fuels. NSW government should be investing in renewable forms of energy not fossil fuels. (Community Environment Network)

Coal mining in Australia is still warranted as the electricity generation industry remains heavily reliant on coal-fuelled generation. Recent research by Pitt & Sherry (2014) demonstrate that black coal demand for electricity generation has been declining in recent years while alternative fuel sources such as gas, wind and other renewable have been on the rise. However, their research shows that to date black coal is still the highest fuel source used for electricity generation, and they provide the following statistics:

'Shares of total generation in the year ended June 2014 were black coal 50.7 percent , brown coal 22.3 percent , gas 12.7 percent , hydro 9.6 percent and wind 4.7 percent . These are the lowest shares of both black and brown coal, and the highest shares of wind, since Cedex® data starts in 2006, and in fact, almost certainly ever'.

The observations of Pitt and Sherry (2014) are supported by data from the Australian Bureau of Statistics (ABS). **Figure 2** provides data on electricity generation by fuel type for the period 2011/2012, and shows that coal represents the highest fuel source for electricity generation in the period 2011/2012. Approximately 65 percent of the total electricity generated in Australia was from coal while natural gas provided approximately 23 percent of the total demand. In comparison the combined renewable fuel sources met less than 10 percent of Australia's fuel source demand for electricity generation.

While it can be anticipated, based on research by Pitt and Sherry (2014), that use of alternative and renewable sources will continue to increase, the transition to a point where these sources supplant coal as the predominant fuel source in the future will clearly take a significant period of time. This is especially the case given the availability of coal resources, the simplistic methods of mining of coal and conversion to electricity compared to renewables, and the extensive investment already sunk into coal-fired generation capacity in Australia.

4 References

- SLR Consulting Australia Pty Ltd (2014), Myuna Colliery Modification - Air Quality Impact Assessment.
- AECOM Australia Pty Ltd (2010), Myuna Colliery Extension of Mining - Greenhouse Gas Assessment.
- Pitt and Sherry (2014). CEDEX: Electricity emissions update - data to 30 June 2014; Looking back over two years with a price on emissions.
- Fernandez et al 2007, Sensitivity of the MM5 mesoscale model to physical parameterizations for regional climate studies: Annual Cycle, published 16 February 2007, Journal of Geophysical Research, Volume 112, D04101.
- DSEWPC, 2012, National Pollutant Inventory Emission Estimation Technique Manual for Mining version 3.1 published by the Department of Sustainability, Environment, Water, Population and Communities. January 2012.

5 Abbreviations

Banpu	Banpu Public Company Limited
CMPL	Centennial Myuna Pty Limited
CO ₂	Carbon dioxide
DP&E	Department of Planning and Environment
EA	Environmental Assessment
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environmental Protection Authority
GHG	Greenhouse Gas
Mtpa	Million tonnes per annum
NSW	New South Wales
OEH	Office of Environment and Heritage
RMS	Roads and Maritime Service
ROM	run of mine
RTS	Response to Submissions
TSP	Total Suspended Particulates
µg/m ³	micrograms per cubic metre
WHO	World Health Organisation

6 Appendices

Appendix 1 – Revised Air Quality Impact Assessment



global environmental solutions

Myuna Colliery Modification Air Quality Impact Assessment

Report Number 630.10123.05000-R1

14 January 2015

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14 Summerhill Drive
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Version: Revision 1

Myuna Colliery Modification

Air Quality Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
630.10123.05000-R1	Revision 1	14 January 2015	Martin Doyle Varun Marwaha	Martin Doyle	Martin Doyle
630.10123.05000-R1	Revision 0	29 October 2014	Martin Doyle Varun Marwaha	Gary Graham	Martin Doyle

Executive Summary

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Centennial Myuna Pty Ltd (CMPL) to conduct an Air Quality Impact Assessment (AQIA) for the Myuna Colliery Modification Project (the Project) located within the Northern Coalfield of NSW approximately 90 kilometres (km) northeast of Sydney. Myuna Colliery's Surface Facilities Area is located in Wangi Wangi on the western side of Lake Macquarie, 25 km southwest of Newcastle.

CMPL currently operate under Project Approval (PA) 10_0080 which was granted in January 2012 and allows extraction of up to 2 million tonnes of ROM coal from the site per calendar year. CMPL wishes to modify this PA to allow extraction of up to 3 million tonnes of ROM coal per calendar year.

The assessment of the potential impacts on air quality resulting from Project operation has included an assessment of impacts during both currently approved and proposed mining activities, with emissions of particulate matter (or dust) and odour resulting from each scenario calculated to reflect the possible worst case operation of the Project (i.e. the operation of the emergency coal stockpile).

A dispersion modelling assessment has been performed in which the calculated and controlled emissions were used as input, as was meteorological data which has been shown to represent the area appropriately. In addition, an estimate of the existing air quality (i.e. that without the impact of the Project) was made using data collected in the immediate area and an inclusion of the potential impacts of power station operation has also been included.

An assessment of the impacts of the Northern Coal Logistics Project has also been performed to ensure that the operation of the Project is not limited by operations of this nearby operation.

The findings of the dispersion modelling assessment indicate that (under both the currently approved and proposed Project operation):

- All annual average particulate impacts (dust deposition, PM₁₀, PM_{2.5}, TSP) are in compliance with advisory reporting standards, NSW EPA and WHO criteria at all receptors assessed;
- All annual average criteria remain in compliance with advisory reporting standards, NSW EPA and WHO criteria when taking into account the Northern Coal Logistics Project;
- Maximum 24-hour PM_{2.5} concentrations are predicted to be below the advisory reporting standard at all receptors assessed, including an approximation of background (i.e. existing air quality); and
- Maximum 24-hour PM₁₀ concentrations are predicted to be below the NSW EPA criterion of 50 µg/m³ (and the potential criterion of 40 µg/m³) at all receptors including an approximation of background (i.e. existing air quality).
- Odour concentrations are predicted to be below the NSW EPA criterion of 2 OU at all receptors assessed.

Through this dispersion modelling exercise, it has been shown that the operation of the Project under both the 2 Mtpa and 3 Mtpa production rates will not cause any exceedances of the adopted criteria at any receptor assessed. Additionally, changes in the air quality resulting from the proposed production increase are predicted to be minimal with impacts dominated by operations at the emergency coal stockpiles, at which operations are not proposed to change.

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ABBREVIATIONS

%	percent
°C	degrees Celsius
µg	microgram
µg/m ³	microgram per cubic metre of air
µg/Nm ³	microgram per normalised cubic metre of air (273K, 101.3kPa)
µm	micrometre or micron
AGL	above ground level
AHD	Australian Height Datum
AP-42	US EPA Emission Factor Handbook
AQIA	air quality impact assessment
AWS	automatic weather station
BMP	best management practice
CMPL	Centennial Myuna Pty Ltd
CSIRO	Australian Commonwealth Scientific and Industrial Research Organisation
DECC	NSW Department of Environment and Climate Change (see OEH)
DECCW	NSW Department of Environment, Climate Change and Water (see OEH)
DDG	dust deposition gauge
DP&I	Department of Planning and Infrastructure
DGRs	Director General's Requirements
EETM	Emission Estimation Technique Manual
EF	Emission Factor
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EPS	Eraring Power Station
FEL	front-end loader
g	gram
g/m ² /month	grams per square metre per month
GMR	Greater Metropolitan Region
HVAS	High Volume Air Sampler
ha	hectare
J	joule
K	degrees Kelvin
kg	kilogram
kg/hr	kilogram per hour
km	kilometre
km E	kilometres east
km N	kilometres north
kPa	kiloPascal
kV	kilovolt
L	litre
m	metre
M	million
m/s	metre per second
m ²	square metre
m ³	cubic metre
min	minute
mm	millimetre
Mt	million tonnes
Mtpa	million tonnes per annum
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NPI	National Pollutant Inventory (Australia)
NSW	New South Wales
OEH	NSW Office of Environment and Heritage

PM	Particulate Matter
PM ₁₀	particular matter with an equivalent aerodynamic diameter of 10 microns or less
PM _{2.5}	particular matter with an equivalent aerodynamic diameter of 2.5 microns or less
ppb	parts per billion (10 ⁹)
ppm	parts per million (10 ⁶)
ROM	run of mine
SI	Système International
t	tonne
tpa	tonnes per annum
TEOM	tapered element oscillating microbalance
tpa	tonnes per annum
TSP	total suspended particulate matter
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
WGS	World Geodetic System
WHO	World Health Organisation

GLOSSARY

air dispersion model	A computer-based software program which provides a mathematical prediction of how pollutants from a source will be distributed in the surrounding area under specific conditions of wind, temperature, humidity and other environmental factors
airshed	The geographical area associated with a given air supply
algorithms	A step-by-step problem-solving procedure, especially an established, recursive computational procedure for solving a problem in a finite number of steps
ambient	Pertaining to the surrounding environment or prevailing conditions
anemometer	An instrument for measuring wind force and velocity
atmosphere	A gaseous mass surrounding the planet Earth that is retained by Earth's gravity. It is divided into five layers. Most of the weather and clouds are found in the first layer
atmospheric stability	The tendency of the atmosphere to resist or enhance vertical motion
atmospheric pressure	The force per unit area exerted against a surface by the weight of air above that surface in the Earth's atmosphere
background	The existing air quality in the Project area excluding the impacts from the proposed development
baseline monitoring program	A monitoring program designed to measure the ambient concentration levels which currently exist prior to the proposed development
CALMET	A meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain
CALPOST	A post-processor used to process CALPUFF files, producing tabulations that summarize results of the simulation for user-selected averaging periods
CALPUFF	A transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes
climatological	The science dealing with climate and climatic phenomena
combustion	The process of thermal oxidation. A chemical change, especially oxidation, accompanied by the production of heat and light
commissioning	A systematic process of ensuring that a new facility performs according to the documented design intent and the owner's operational needs, and that specified system documentation and training are provided to the facility staff
crushers	A machine designed to reduce large rocks into smaller rocks, gravel, or rock dust
decommissioning	Planned shut-down or removal of a building, equipment, plant, etc., from operation or usage
dust deposition	Settling of particulate matter out of the air through gravitational effects (dry deposition) and scavenging by rain and snow (wet deposition)
dispersion	The spreading and dilution of substances emitted in a medium (e.g. air or water) through turbulence and mixing effects
diurnal	Relating to or occurring in a 24-hour period; daily
downwash	The grounding of an air pollution plume as it flows over nearby buildings or other structures due to turbulent eddies being formed in the downwind side of the building, resulting in elevated ground level concentrations.
downwind	The direction in which the wind is blowing

emission factor	A measure of the amount of a specific pollutant or material emitted by a specific process, fuel, equipment, or source based on activity data such as the quantity of fuel burnt, hours of operation or quantity of raw material consumed.
emissions inventory	A database that lists, by source, the amount of air pollutants discharged into the atmosphere from a facility over a set period of time (e.g. per annum, per hour)
erodible	A term used to describe a soil that is vulnerable to erosion by the agents of wind, water, ice
evapotranspiration	The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces
epidemiological	The branch of medicine that deals with the study of the causes, distribution, and control of disease in populations
fossil fuel	A natural fuel such as coal, diesel or gas, formed in the geological past from the remains of living organisms
fugitive emissions	Pollutants which escape from an industrial process due to leakage, materials handling, transfer, or storage
guideline	A general rule, principle, or piece of advice. A statement or other indication of policy or procedure by which to determine a course of action.
meteorological	The science that deals with the phenomena of the atmosphere, especially weather and weather conditions
mixing height	The height to which the lower atmosphere will undergo mechanical or turbulent mixing, producing a nearly homogeneous air mass
modelling domain	The area over which the model is making predictions
particulate	Of, relating to, or formed of minute separate particles. A minute separate particle, as of a granular substance or powder
plume	A space in air, water, or soil containing pollutants released from a point source
point source	A pollution source that is fixed and/or uniquely identifiable, such as a stack, chimney, outlet pipe or vent
pollutant	A substance or energy introduced into the environment that has undesired effects, or adversely affects the usefulness of a resource
prognostic	A prediction of the value of variables for some time in the future on the basis of the values at the current or previous times
qualitative assessment	An assessment of impacts based on a subjective, non-statistical oriented analysis
quantitative assessment	An assessment of impacts based on estimates of emission rates and air dispersion modelling techniques to provide estimate values of ground level pollutant concentrations.
receptor	Coordinate locations specified in an air dispersion model where ground level pollutant concentrations are calculated by the model
sensitive receptor	Locations such as residential dwellings, hospitals, churches, schools, recreation areas etc where people (particularly the young and elderly) may often be present, or locations with sensitive vegetation and crops.
spatial variation	Pertaining to variations across an area
standard	The prescribed level of a pollutant in the outside air that should not be exceeded during a specific time period to protect public health
standard deviation of wind direction	A measure of the variation in wind direction

synoptic meteorological data	A surface weather observation, made at periodic times (usually at 3-hourly and 6-hourly intervals), of sky cover, state of the sky, cloud height, atmospheric pressure reduced to sea level, temperature, dew point, wind speed and direction, amount of precipitation, hydrometeors and lithometeors, and special phenomena that prevail at the time of the observation or have been observed since the previous specified observation
temporal variation	Pertaining to variations with time
topography	Detailed mapping or charting of the features of a relatively small area, district, or locality
wind direction	The direction from which the wind is blowing
wind erosion	Detachment and transportation of loose topsoil or sand due to action by the wind
wind rose	A meteorological diagram depicting the distribution of wind direction and speed at a location over a period of time

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Centennial Myuna Pty Ltd (CMPL) to conduct an Air Quality Impact Assessment (AQIA) for the Myuna Colliery Modification Project (the Project) located within the Northern Coalfield of NSW approximately 90 kilometres (km) northeast of Sydney. Myuna Colliery's Surface Facilities Area is located in Wangi Wangi on the western side of Lake Macquarie, 25 km southwest of Newcastle.

Continuous miner bord and pillar operations have occurred at Myuna Colliery in the Wallarah, Great Northern and Fassifern seams since 1981. Centennial Myuna was granted approval in January 2012 under Project Approval (PA) 10_0080 to extract up to 2 million tonnes per annum (Mtpa) of run of mine (ROM) coal until 31 December 2032 within Consolidated Coal Lease 762 (CCL762) and Mining Lease 1370.

CMPL wishes to modify this PA to allow:

- an increase in coal extraction to not more than 3 million tonnes; and
- increase employment to 300 full time employees.

The aim of this AQIA is to assess the potential air quality impacts on surrounding sensitive receivers associated with the Project.

The New South Wales Environment Protection Authority (NSW EPA) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (DEC, 2005) (the Approved Methods) outline the requirements for conducting an AQIA (and the Sections of this report where the requirements are met), as follows:

- Description of local topographic features and sensitive receptor locations (**Section 3.1** and **Section 3.2** respectively);
- Establishment of air quality assessment criteria (**Section 4**);
- Analysis of climate and dispersion meteorology for the region (**Section 6.2**);
- Description of existing air quality environment (**Section 7**);
- Compilation of a comprehensive emissions inventory for the existing and proposed activities (**Section 5**);
- Completion of atmospheric dispersion modelling and analysis of results (**Section 8**); and
- Preparation of an air quality impact assessment report comprising the above.

The scope for this AQIA has been designed to address the requirements of the NSW Department of Planning and Infrastructure (DP&I) who have requested

"...a revised Air Quality Impact Assessment that models the effects of the increase in coal movements on the site and any relevant changes to surface activities or changes to mine ventilation volumes' (8 August 2014)."

The assessment has been performed in accordance with relevant policies, guidelines and plans including:

- Protection of Environment Operations (Clean Air) Regulation 2002;
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005); and,
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (2006).

2 PROJECT OVERVIEW

2.1 Background

Myuna Colliery is an underground coal mine owned and operated by Centennial Myuna Pty Limited (CMPL), a wholly owned subsidiary of Centennial Coal Company Limited (Centennial). Myuna Colliery is located 25 km south-west of Newcastle, New South Wales (NSW) in the Lake Macquarie and Wyong Local Government Areas (LGA).

Continuous miner bord and pillar operations have occurred at Myuna Colliery in the Wallarah, Great Northern and Fassifern seams since 1981. Centennial Myuna was granted approval in January 2012 under PA 10_0080 to extract up to 2 Mtpa of ROM coal until 31 December 2032 within Consolidated Coal Lease 762 (CCL762) and Mining Lease 1370.

The consolidated Project Approval area is shown on **Figure 1**.

2.2 Project Description

CMPL has current approval to extract up to 2 Mtpa of ROM coal. CMPL are seeking to modify Project Approval 10_0080 pursuant to Section 75W of Part 3A of the EP&A Act to allow:

- an increase in coal extraction to not more than 3 million tonnes; and
- increase employment to 300 full time employees.

Table 1 details the current approved operations at the Myuna Colliery and the proposed changes to those operations as a result of the Project.

Table 1 Comparison of Approved and Proposed Operations at Myuna Colliery

Aspect	Approved Operations	Proposed Modifications
Life of Mine	31st December 2032	No change
Operational Hours	24 hours a day, seven days per week.	No change
Operational Employment	Up to 210 full-time personnel.	Increase in full time personnel to 300. An additional 90.
Mine Access	Myuna Colliery Surface Site men and materials drift.	No change
Mine Plan and Mining Method	Zone A first workings only. Zone B second workings are limited to partial pillar extraction within Great Northern and Fassifern seams.	No change No change
Surface Infrastructure	Myuna Colliery Surface Site.	No change
Servicing	Existing connections to Hunter Water Corporation's reticulated potable water system, Ausgrid's reticulated electricity network, and Telstra's telecommunications networks.	No change
Coal Extraction	The proponent shall not extract more than 2 million tonnes of ROM coal from the site in any calendar year.	Increase in ROM coal extraction from 2Mtpa to 3Mtpa.
Coal Transport	All coal is transported from the site via the enclosed overland coal conveyor to Eraring Power Station	No change
Water Management	In accordance with the Myuna Colliery Water Management Plan.	No change
General Waste Management	Management systems in place for the various non-production waste streams, including general waste, maintenance consumables, waste oils and grease and sewage.	No change
Post Mining Closure and Rehabilitation	In accordance with the Myuna Colliery Mine Operations Plan.	No change
Environmental Management	Myuna Colliery EMS provides a framework under which environmental matters are managed at the Myuna Colliery.	No change
Subsidence Management	As per Schedule 3 of Project Approval 10_0080, Condition : The proponent shall ensure that vertical subsidence within zone A is limited to a maximum of 20mm and that extraction methods are limited to first workings only. The proponent shall ensure that vertical subsidence within Zone B is limited to 650mm and second workings are limited to partial pillar extraction within Great Northern and Fassifern seams The proponent shall seek approval from the DSC prior to mining within the Eraring Dam Notification Area.	No change

Figure 1 Myuna Colliery Consolidated Approval Area



2.3 Identification of Emission Sources

During the operation of the Project, the equipment and operations identified in **Table 2** will be used and performed.

Table 2 Processes and Equipment used during Myuna Colliery Operations

Process / Operation	Equipment	Number
Transfer of coal from underground workings to surface ROM bin	Conveyor	1
Transfer of coal from ROM bin to breaker	Conveyor	1
Coal breaking	Breaker	1
Transfer of coal from breaker to screen	Conveyor	1
Coal screening	Screen	1
Transfer of coal from screen to crusher	Conveyor	1
Coal crushing	Crusher	1
Transfer of coal from crusher to finished product bin	Conveyor	1
Transfer of finished product to Eraring Power Station	Conveyor	1
Loading of coal from ROM bin to trucks	Road trucks	-
Hauling of coal from ROM bin to Emergency Stockpile (and return)	Road trucks	-
Unloading/loading of coal at Emergency Stockpile	Road trucks	-
Movement of coal at Emergency Stockpile	Front end loader	1
Truck unloading to reclaim bin	Road trucks	-
Upcast ventilation	Upcast ventilation fans	1
Wind erosion of Emergency Stockpile and two water storage dams (when not at capacity)	-	-

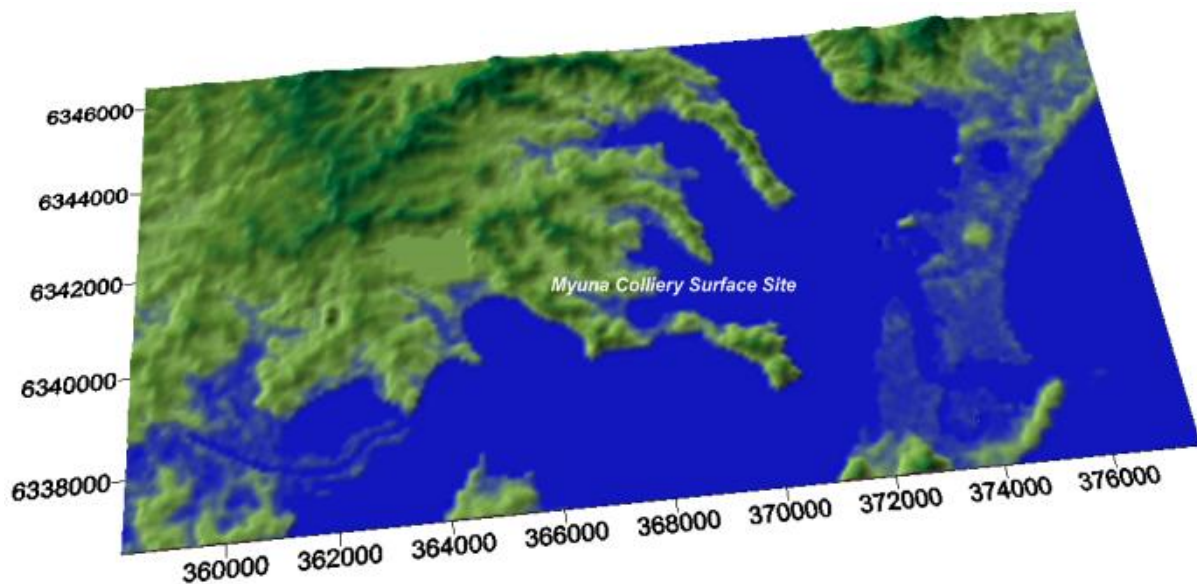
3 STUDY AREA

3.1 Local Topography

The topographical data used in the meteorological and dispersion modelling was sourced from the United States Geological Service's Shuttle Radar Topography Mission database that has recorded topography across Australia with a 3 arc second (~90 m) spacing.

The topography of the local region surrounding the Project Application Area and surrounds is presented in **Figure 2**.

Figure 2 Local and Regional Topography



3.2 Sensitive Receptors

A number of residences are located immediately adjacent to the boundary of the Surface Facilities Area. The nearest residences have been identified as sensitive receptor locations to be taken into account during the assessment.

The nearest sensitive receiver is located approximately 0.5 km south east of the infrastructure at Myuna Colliery's Surface Facilities Area. A list of the nearest sensitive receptors (nominated as 'R1' to 'R8') identified in the immediate vicinity of the Surface Facilities Area, and their respective distances from the Surface Facilities Area boundary, are presented in **Table 3** and **Figure 3**.

Table 3 Nearest Sensitive Receptors

Receptor ID	Location	Receptor Location		Distance (km) and Direction from Mine Infrastructure
		Easting (m, UTM)	Northing (m, UTM)	
R1	2 Turruma Street, Wangi Wangi	366,858	6,340,370	0.5 SW
R2	2 Moani Street, Wangi Wangi	366,652	6,340,175	0.5 SE
R3	3 Sunset Close, Wangi Wangi	365,707	6,340,844	0.5 W
R4	119 Donnelly Road, Arcadia Vale	366,662	6,341,662	0.9 N
R5	93 Donnelly Road, Arcadia Vale	366,857	6,341,348	0.7 NNE
R6	83 Donnelly Road, Arcadia Vale	367,049	6,341,185	0.7 NE
R7	63 Donnelly Road, Arcadia Vale	367,091	6,340,965	0.6 NE
R8	53 Donnelly Road, Arcadia Vale	367,072	6,340,821	0.5 NE

Figure 3 Surrounding Sensitive Receptor Locations



4 AMBIENT AIR QUALITY CRITERIA

State air quality guidelines adopted by the NSW EPA are published in the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005).

The Approved Methods has been consulted during the preparation of this assessment report. The Approved Methods lists the statutory methods that are to be used to model and assess emissions of air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Project. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC, WHO and ANZEEC). The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW, and are considered to be appropriate for the setting.

4.1 Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (μm) in diameter and ranging down to 0.1 μm and is termed total suspended particulate (TSP). The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air ($\mu\text{g}/\text{m}^3$).

The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

Emissions of particulate matter less than 10 μm and 2.5 μm in diameter (referred to as PM_{10} and $\text{PM}_{2.5}$ respectively) are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $\text{PM}_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $\text{PM}_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

The NSW EPA PM_{10} assessment goals set out in the Approved Methods are as follows:

- a 24-hour maximum of 50 $\mu\text{g}/\text{m}^3$; and
- an annual average of 30 $\mu\text{g}/\text{m}^3$.

The World Health Organisation (WHO) also set goals for PM_{10} which are as follows:

- a 24-hour maximum of 50 $\mu\text{g}/\text{m}^3$; and
- an annual average of 20 $\mu\text{g}/\text{m}^3$.

It is noted that the annual average goal for PM_{10} set by the WHO is more stringent than that set by the NSW EPA. Both goals are assessed within this report even considering that the 30 $\mu\text{g}/\text{m}^3$ annual average PM_{10} goal is appropriate for the setting.

The Approved Methods currently do not set any assessment goals for $\text{PM}_{2.5}$. In December 2000, the National Environment Protection Council (NEPC) initiated a review to determine whether a national ambient air quality criterion for $\text{PM}_{2.5}$ was required in Australia, and the feasibility of developing such a criterion. The review found that:

- there are health effects associated with these fine particles;
- the health effects observed overseas are supported by Australian studies; and
- fine particle standards have been set in Canada and the USA, and an interim criterion is proposed for New Zealand.

The review concluded that there is sufficient community concern regarding PM_{2.5} to consider it an entity separate from PM₁₀.

As such, in July 2003, a variation to the Ambient Air Quality NEPM was made to extend its coverage to PM_{2.5}, setting the following Interim Advisory Reporting Standards for PM_{2.5}:

- a 24-hour average concentration of 25 µg/m³; and
- an annual average concentration of 8 µg/m³.

The World Health Organisation also set goals for PM_{2.5} which are as follows:

- a 24-hour maximum of 25 µg/m³; and
- an annual average of 10 µg/m³.

The WHO goals for PM_{2.5} are either the same (24 hour maximum) or less stringent (annual average) than those advised within the NEPM.

It is noted that the NEPM Advisory Reporting Standards relating to PM_{2.5} particles are reporting guidelines only at the present time and not intended to represent air quality criteria. A summary of the particulate guidelines is shown in **Table 4**.

Table 4 EPA Goals for Particulates

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m ³
PM ₁₀	24 Hours	50 µg/m ³
	Annual	30 µg/m ³
PM _{2.5}	24 Hours	25 µg/m ³ (interim advisory reporting standard only)
	Annual	8 µg/m ³ (interim advisory reporting standard only)

Reference should be made to **Section 4.4** regarding to the current status of assessment criteria for particulates in NSW.

4.2 Nuisance Impacts

4.2.1 Fugitive Emissions of Dust

The preceding section is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts need also to be considered, mainly in relation to deposited dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m²/month).

Table 5 presents the impact assessment goals set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 5 EPA Goals for Allowable Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m ² /month	4 g/m ² /month

Source: Approved Methods, NSW DEC 2005.

4.2.2 Odour Emissions

According to NSW EPA, impact assessment criteria for complex mixtures of odours have been designed to take into account the range of sensitivity to odours within the community and to provide additional protection for individuals with a heightened response to odours. Where a number of the factors simultaneously contribute to making an odour “offensive”, an odour goal of 2 OU at the nearest residence (existing or any likely future residences) is appropriate, which generally occurs for affected populations equal or above 2,000 people.

The equation used by the NSW EPA to determine the appropriate impact assessment criteria for complex mixtures of odorous air pollutants, as specified in the Approved Methods, is expressed as follows:

$$\text{Impact assessment criterion (OU)} = (\log_{10}(\text{population}) - 4.5) / -0.6$$

A summary of appropriate impact assessment criteria for various population densities is provided **Table 6**.

Table 6 Impact assessment criteria for complex mixtures of odorous air pollutants

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (Odour Units, OU)
Urban ($\geq \sim 2000$) and/or schools and hospitals	2.0
~ 500	3.0
~ 125	4.0
~ 30	5.0
~ 10	6.0
Single rural residence ($\leq \sim 2$)	7.0

The impact assessment criterion to be used for this assessment is calculated using the procedures described in the Approved Methods. Based on the number of identified sensitive receptors to the southeast and east of the Project Site, it is considered that an odour criterion of 2 OU would be applicable for the Project.

4.3 Summary of Project Air Quality Goals

The air quality goals adopted for this assessment, which confirm to current EPA and Federal air quality criteria, are summarised in **Table 7**.

Table 7 Project Air Quality Goals

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m ³ (NSW EPA)
PM ₁₀	24 Hours	50 µg/m ³ (NSW EPA)
	Annual	30 µg/m ³ (NSW EPA)
	Annual	20 µg/m ³ (WHO)
PM _{2.5}	24 Hours	25 µg/m ³ (NEPM interim <u>advisory</u> reporting standard only)
	Annual	8 µg/m ³ (NEPM interim <u>advisory</u> reporting standard only)
Dust Deposition	Annual	Maximum Incremental (Project only) increase of 2 g/m ² /month Maximum Total of 4 g/m ² /month (Project and other sources)
Odour	1-hour	2 OU (99 th percentile)

Source: Approved Methods, NSW DEC 2005, WHO 2005.

4.4 Potential Changes to the Ambient Air Quality NEPM

On 29 April 2014, Environment Ministers signalled their intent to vary the Ambient Air Quality NEPM based on the latest scientific understanding of the health risks resulting from airborne particulate pollution. The variation to the Ambient Air Quality NEPM is the subject of consultation with the wider affected community until 10 October 2014 although the standards presented in **Table 8** have been proposed as a potential 'preferred option'.

Table 8 Proposed Variation to the Ambient Air Quality NEPM

Metric	Averaging Period	Current Standard	Options for Standard	Allowed Exceedances
PM ₁₀	Annual average	None	No standards with consideration of 20 µg/m ³	N/A
	24-hour mean	50 µg/m ³	50 µg/m ³ , with consideration of 45 µg/m ³ and 40 µg/m ³	See note below
PM _{2.5}	Annual average	8 µg/m ³ (advisory)	8 µg/m ³	N/A
	24-hour mean	25 µg/m ³ (advisory)	25 µg/m ³	See note below

The four options for the form of the 24-hour standards, and specifically the treatment of exceedances, for both PM₁₀ and PM_{2.5} are as follows:

- Business as usual option; a rule that allows a fixed number of exceedances of a PM standard in a given year, with no exclusion of data for exceptional events.
- A rule that allows a fixed number of exceedances of a PM standard in a given year, but with exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, with no exclusion of data for exceptional events.
- A rule in which the 98th percentile PM concentration in a given year is compared with a standard, but with exclusion of data for exceptional events.

It has been identified by the NEPC that it is likely that jurisdictions will want to identify local issues that affect the form of the standards and therefore the options for this standard have been left open for the consultation phase.

For the purposes of this assessment, discussion is provided on the basis of an adopted annual average PM_{10} concentration of $20 \mu g/m^3$ (numerically identical to the WHO PM_{10} annual average standard), and adoption of the current advisory $PM_{2.5}$ standards (24-hour and annual average).

Limited discussion is provided on the potential for exceedance of the proposed 24-hour PM_{10} standard of $40 \mu g/m^3$ (in addition to the current standard of $50 \mu g/m^3$).

5 EMISSIONS ESTIMATION

This section describes the operational scenarios assessed (**Section 5.1**), the assumptions used in the calculation of emissions (**Section 5.2**) and the methodology used to estimate emissions (**Section 5.3**).

5.1 Scenarios Assessed

Two scenarios have been quantified to assess the pollutant emissions due to currently approved operations (at 2 Mtpa) and proposed operations (at 3 Mtpa). A scenario to assess the impacts of operations at 2 Mtpa extraction rate was presented in “Myuna Colliery Extension of Mining Project, Air Quality Impact Assessment” (SLR (previously Heggies), October 2010). Since the publication of this assessment, a number of emission factors have been updated, and further work has been performed at the site with regard to emission control which warrants a re-assessment of these impacts.

A summary of the emission sources assessed in both scenarios is shown in **Table 9**. Emission sources for both the current and proposed operation of the Myuna Colliery will remain constant, although the intensity at which each source operates may change.

Table 9 Summary of the Scenarios Assessed

Emission Source	Pollutants
Transfer of coal from underground workings to surface ROM bin	TSP, PM ₁₀ , PM _{2.5} and deposited dust
Transfer of coal from ROM bin to breaker	
Coal breaking	
Transfer of coal from breaker to screen	
Coal screening	
Transfer of coal from screen to crusher	
Coal crushing	
Transfer of coal from crusher to finished product bin	
Transfer of finished product to Eraring Power Station	
Loading of coal from ROM bin to trucks	
Hauling of coal from ROM bin to Emergency Stockpile (and return)	
Unloading/loading of coal at Emergency Stockpile	
Movement of coal at Emergency Stockpile	
Wind erosion of Emergency Stockpile and two water storage dams (when not at capacity)	
Truck unloading to reclaim bin	
Upcast ventilation	TSP, PM ₁₀ , PM _{2.5} , deposited dust and odour

5.2 Assumptions used in Emission Calculations

The assumptions used in the construction of the emissions inventory for the scenario are presented in **Table 10**. These assumptions have been provided by Centennial, or are taken from the ‘Dust Stop’ Pollution Reduction Program Assessment performed by SLR (2012).

Table 10 Assumptions used in Air Quality Impact Assessment

Parameter	Value	Units	Reference
General – Current and Proposed Operations			
Operating hours	168	hours/week	-
Operating days	365	days/year	-
Coal – Current Operations			
Total coal production	2,000,000	tonnes/year	
Maximum daily coal production	10,500	tonnes/day	
Total reject	2,000	tonnes/year	Assumed 0.1% of production (SLR, 2012c)
Maximum daily reject	105	tonnes/day	
Total product	1,998,000	tonnes/year	Assumed 99.9% of production (SLR, 2012c)
Maximum daily product	10,395	tonnes/day	
Silt content	6	%	Centennial (2014)
Moisture content	8	%	SLR, 2012c
Coal – Proposed Operations			
Total coal production	3,000,000	tonnes/year	
Maximum daily coal production	15,000	tonnes/day	
Total reject	3,000	tonnes/year	Assumed 0.1% of production (SLR, 2012c)
Maximum daily reject	150	tonnes/day	
Total product	2,997,000	tonnes/year	Assumed 99.9% of production (SLR, 2012c)
Maximum daily product	14,850	tonnes/day	
Silt content	6	%	Centennial (2014)
Moisture content	8	%	SLR, 2012c
Haulage - Current and Proposed Operations			
Length of road to Emergency Coal Stockpile	300	metres	Calculated from Google Earth (2014)
Quantity of coal to Emergency Coal Stockpile	7,000	tonnes/year	Assumed maximum
Number of truck trips from ROM bin to Emergency Coal Stockpile	140	trips/year	Assumed payload of road trucks of 50 t
Mean truck weight	75	tonnes	SLR, 2012c
Silt content of roads	25	%	SLR, 2012c
Wind Erosion- Current and Proposed Operations			
Area of combined Dam 1-3	0.048	ha	Assumed 20% of total area (SLR, 2012c)
Area of Dam 4 at Emergency Coal Stockpile	0.012	ha	Assumed 20% of total area (SLR, 2012c)
Area of Emergency Coal Stockpile	0.48	ha	Assumed to be active for only 4 days per year
Ventilation Fans - Current and Proposed Operations			
Ventilation fan diameter	4.82	metres	Calculated from Google Earth (2014)
Volumetric flow rate (per fan)	153	m ³ /s	Centennial (2014)

5.2.1 Particulate Emission Controls

CMPL operate an Air Quality and Greenhouse Gas Management Plan (August, 2012) with the measures identified below being implemented at Myuna Colliery as part of that plan. Where relevant, emission control factors for each dust suppression activity are outlined and have been applied to the estimation of emissions resulting from the operation of the (1) currently approved and (2) proposed Project. Control factors are sourced from Australian Government Department of Sustainability, Environment, Water, Population and Communities 2012, "*National Pollutant Inventory Emission Estimation Technique for Mining*", Version 3.1, (DSEWPC, 2012).

Behaviour and Operation Modification

When conditions are identified as being likely to cause dust impacts, Myuna Colliery implements proactive dust control measures (e.g. increased watering rates) to prevent dust events from occurring. In the event that excessive dust is noted on site, the following steps are required to be taken:

- Identify the major sources of dust; and,
- Assign water cart to high priority areas.

As no particular wind conditions or measured dust levels are identified as triggers for modification of activities, particulate control efficiencies cannot be calculated.

Rehabilitation

All surface infrastructure associated with Myuna Colliery's operations is located at the Surface Facilities Area. The Surface Facilities Area encompasses a footprint of approximately 89 ha, of which 21 ha includes the surface infrastructure. This 21 ha is the total area currently requiring rehabilitation prior to mine closure. The remainder of the Surface Facilities Area is predominantly natural bushland vegetation, the Wangi Creek watercourse and existing cleared easement corridors (AEMR, 2012 p33).

In the AEMR reporting period (2012), no rehabilitation works were performed.

Sealing and Sweeping of Haul Roads

The distance travelled by trucks at Myuna Colliery is very low, and these movements are generally limited to periods when the Eraring Power Station is unable accept coal, requiring excess ROM coal from the underground operations to be transferred from the ROM Bin into trucks for placement at the Emergency Stockpile Area.

The haul roads between the ROM Bin and the Emergency Stockpile area and between the ROM Bin and the Waste Bin are sealed and are swept/watered as required when in use. This represents best practice for dust control and a control factor of 100% has been assumed (DSEWPC, 2012).

Vehicle Speeds

The vehicle speeds on the haul road are controlled at Myuna Colliery and will not exceed 40 km/hr, with the site-wide average speed estimated to be 20 km/hr. No emission control factor from DSEWPC (2012) is applicable to vehicle speed restrictions, although it is noted that the use of a sealed (and swept) road represents maximum possible emission control.

Water Sprays and Enclosure of CHP and Conveyors

The CHP is enclosed and water sprays are used on major transfer points. Emission control factors are quoted in DSEWPC (2012), and include:

- 70% for enclosure; and,
- 90% for use of water sprays with chemicals.

For this assessment a control factor of 70% has been assumed.

Watering of Active Stockpiles

Watering is the principal means of dust suppression for active stockpile areas at Myuna Colliery, which is reported in the literature to provide a control factor of 50% (DSEWPC, 2012). As noted previously, the Emergency Coal Stockpile Area is only used in the event that coal cannot be sent directly to Eraring Power Station via the overland conveyor.

Summary of Control Factors Assumed

A summary of the existing control measures identified as currently being implemented at Myuna Colliery is provided in **Table 11**. These controls will also be implemented as part of the proposed Project operation.

Table 11 Control Factors Assumed for Existing Control Measures

Dust Mitigation Measure	Applied Control Factor	Notes
Induction training	NA	No quantification can be made
Modification of operations in unfavourable weather conditions	NA	No quantification can be made
Sealing of haul roads	100%	-
Vehicle speed restrictions	NA	No quantification can be made
Servicing of water carts	NA	No quantification can be made
Use of additional water trucks as required around CHP and Emergency Coal Stockpile	NA	No quantification can be made
Cleaning up coal spillage at CHP	NA	No quantification can be made
Water sprays and enclosure of conveyor transfer points and Breaker/Crusher/Screen	70%	-
Watering of Emergency Coal Stockpile when in use	50%	Also applied to other operations at the Emergency Coal Stockpile: Truck unloading to ROM stockpile; Front end loader on coal; and, Loading coal to truck:

5.3 Calculation of Particulate Emissions

Based on the activity data for each source presented in **Table 10**, emissions of TSP, PM₁₀ and PM_{2.5} have been calculated for each source for each scenario. Emission controls have been applied to each source as outlined in **Section 5.2.1**.

Particulate emissions from the operational activities have been calculated using default or calculated emission factors for the relevant emission sources. Emission factors were sourced from the National Pollutant Inventory (NPI) *Emission Estimation Technique Manual (EETM) for Mining* version 3.1 (DSEWPC, 2012), or from the US EPA AP-42 Emission Factor Handbook (US EPA, 2006 and 2011) where suitable factors do not exist within the NPI documentation.

The NPI *EETM for Mining* (DSEWPC 2012) and US EPA AP 42 contain emission factors for TSP and PM₁₀. No emission factors for PM_{2.5} are provided within the NPI *EETM for Mining* and only limited emission factors for PM_{2.5} are provided in US EPA AP 42.

Limited research has been undertaken to assess the fraction of PM₁₀ from the wide range of sources which would be emitted as PM_{2.5}. Research has been conducted by the Midwest Research Institute (MRI) on behalf of the Western Regional Air Partnership (WRAP) with findings published within the document entitled '*Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*' (MRI 2006). This document provides six proposed PM_{2.5}/PM₁₀ ratios for fugitive dust source categories as presented in **Table 12**.

Table 12 Proposed Particle Size Ratios for AP-42

Fugitive Dust Source	AP-42 Section	Proposed PM _{2.5} /PM ₁₀ Ratio
Paved roads	13.2.1	0.15
Unpaved roads (public & industrial)	13.2.2	0.1
Aggregate handling and storage piles	13.2.4	0.1
Industrial wind erosion	13.2.5	0.15
Agricultural tilling	-	0.2
Open area wind erosion	-	0.15

The PM_{2.5} / PM₁₀ ratios presented in **Table 12** have been used within this assessment to calculate the emissions of PM_{2.5} attributable to the Project operations. The most appropriate ratio has been applied to each of the sources.

The emission factors used for the estimation of TSP, PM₁₀ and PM_{2.5} emissions from the operational activities are presented in **Table 14**.

Emissions of particulate matter and odour from the operation of the upcast ventilation fans have been quantified using actual measurements of the particulate and odour emissions from the ventilation fans at the Mandalong Mine Access Site in 2012. The monitoring of particulate and odour emissions was undertaken during a period of normal underground mining operations. The results of the monitoring of the ventilation fans at the existing Mandalong Mine Access Site have been adopted to assess potential impacts from the existing ventilation fans at the Myuna Colliery Surface Site.

Specifically, to estimate emissions from the ventilation fans, a monitoring program was conducted by SLR at the Mandalong Mine Access Site in June 2012 and August 2012 (SLR 2012a and SLR 2012b respectively). The pollutant emissions that were monitored were:

- TSP;
- PM₁₀;
- PM_{2.5}; and,
- Odour.

The monitored emissions from ventilation fans (SLR 2012b) are shown in **Table 13**.

Table 13 Monitored Pollutant Emissions from the Ventilation Fans at the Mandalong Mine

Pollutant	Emission Rate	Units
TSP ¹	0.99	g/s
PM ₁₀ ¹	0.16	g/s
PM _{2.5} ¹	0.17	g/s
Odour ²	30,282	OU.m ³ /s

¹ Source: SLR 2012b

² Source: SLR 2012a, the average of three samples is adopted as the odour emission rate.

Volumetric flow rates measured at the Mandalong Mine Access Site ventilation fans were 136.8 m³/s (SLR, 2012b).

Information from Centennial regarding the volumetric flow rate experienced at the Myuna Colliery Surface Site ventilation fans indicates that the average flow rate per fan is 153 m³/s (306 m³/s in total through 2 fans). Emissions of particulate matter and odour have therefore been scaled to reflect the higher volumetric flow rate experienced at the Myuna Colliery.

The fans located at Myuna Colliery have rectangular outlets with measured dimensions being 4.45 m x 4.10 m. The CALPUFF modelling suite has the capability to model the vertical stack sources which are cylindrical in shape (with circular exit). To represent the actual rectangular shaped ventilation fan within the dispersion modelling, the equivalent circular diameter has been calculated, i.e 4.82 m. This is considered to be appropriate as it represents a realistic assessment of the ventilation fans.

Table 14 Summary of Emission Factors Used to Estimate Uncontrolled Emissions

Activity	Emission Factor Equation	Units ¹	Variables ²	Emission Controls Applied to Source	Source of Emission Factor
Conveyor: 1) UG conveyor to ROM bin 2) ROM bin to breaker 3) Breaker to screen 4) Coarse Reject conveyor 5) Screen to crusher 6) Crusher to finished product bin 7) Finished product bin to Eraring overland conveyor	$EF = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$	kg/t	k = 0.74 (TSP) k = 0.35 (PM ₁₀) k = 0.053 (PM _{2.5}) U = mean wind speed (m/s) M = Moisture content (%)	70% - (DSEWPC, 2012) refer Table 11	Miscellaneous Transfer Points (including conveying) NPI EETM Mining v3.1 (DSEWPC 2012) MRI 2006
Coal breaking	$EF_{TSP} = 0.00060$	kg/t	n/a	Tertiary crushing (controlled) ³	US EPA AP42 Chapter 11.19.2 (USEPA 2004)
Coal crushing	$EF_{PM10} = 0.00027$ $EF_{PM2.5} = 0.00005$				
Coal screening	$EF_{TSP} = 0.0011$ $EF_{PM10} = 0.00037$ $EF_{PM2.5} = 0.000025$	kg/t	n/a	Screening (controlled) ³	US EPA AP42 Chapter 11.19.2 (USEPA 2004)
Coal handling: 1) ROM bin to truck loading 2) truck unloading to reclaim bin	$EF = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$	kg/t	k = 0.74 (TSP) k = 0.35 (PM ₁₀) k = 0.053 (PM _{2.5}) U = mean wind speed (m/s) M = Moisture content (%)	No control	Miscellaneous Transfer Points (including conveying) NPI EETM Mining v3.1 (DSEWPC 2012) MRI 2006
Trucks unloading coal at emergency stockpile	$EF = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$	kg/t	k = 0.74 (TSP) k = 0.35 (PM ₁₀) k = 0.053 (PM _{2.5}) U = mean wind speed (m/s) M = Moisture content (%)	50% - (DSEWPC, 2012) refer Table 11	Miscellaneous Transfer Points (including conveying) NPI EETM Mining v3.1 (DSEWPC 2012)

Activity	Emission Factor Equation	Units ¹	Variables ²	Emission Controls Applied to Source	Source of Emission Factor
Hauling of coal to/from the emergency stockpile area	$EF = 0.281 \times k \times \left(\frac{s}{12}\right)^a \times \left(\frac{W}{3}\right)^b$	kg/VKT	k = 4.9 (TSP) k = 1.5 (PM ₁₀) k = 0.15 (PM _{2.5}) a = 0.7 (TSP) a = 0.9 (PM ₁₀) a = 0.9 (PM _{2.5}) b = 0.45 (TSP, PM ₁₀ , PM _{2.5}) s = silt content (%) W = average weight of the vehicles traveling the road (tonnes)	100% - (DSEWPC, 2012) refer Table 11	AP42 Chapter 13.2.2 (unpaved roads)
Front end loader on coal at the emergency stockpile area	$EF_{TSP} = \frac{0.580}{M^{1.2}}$	kg/t	M = Moisture content (%)	50% - (DSEWPC, 2012) refer Table 11	Front end loader on coal NPI EETM Mining v3.1 (DSEWPC 2012)
Loading trucks with front end loader	$EF_{PM10} = \frac{0.75 \times 0.0596}{M^{0.9}}$ $EF_{PM2.5} = 0.019 \times EF_{TSP}$				MRI 2006
Erosion of material on emergency coal stockpile and dam areas	$EF_{TSP} = 0.4$ $EF_{PM10} = 0.2$ $EF_{PM2.5} = EF_{PM10} \times 0.1$	kg/ha/hr	n/a	50% - (DSEWPC, 2012) refer Table 11 on emergency stockpile only.	Wind erosion NPI EETM Mining v3.1 (DSEWPC 2012) MRI 2006

Note 1: kg/t = kilogram per tonne, kg/VKT = kilogram per vehicle kilometre travelled, kg/ha/hr = kilogram per hectare per hour

Note 2: Refer to **Table 10** for assumptions used in emissions calculations

Note 3: Controlled sources (with wet suppression) are those that are part of the processing plant that employs current wet suppression technology

6 AIR DISPERSION MODELLING METHODOLOGY

6.1 Model Selection

Emissions from the Project operations have been modelled using the US EPA's CALPUFF (Version 6.267) modelling system. CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain either hourly concentration or hourly deposition fluxes evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

The advantages of using CALPUFF (rather than using a steady state Gaussian dispersion model such as AUSPLUME) is its ability to handle calm wind speeds (<0.5 m/s) and the effects of complicated terrain on plume dispersion. Steady state models assume that meteorology is unchanged by topography over the modelling domain and may result in significant over or under estimation of air quality impacts.

More advanced dispersion models (such as CALPUFF) are approved for use by many regulatory authorities in situations where these models may be more appropriate than use of steady-state Gaussian models, such as AUSPLUME. Such situations include those noted above (i.e. high frequency of calm wind conditions and/or complicated terrain).

6.2 Meteorological Modelling

6.2.1 Meteorological Modelling Approach

To adequately characterise the dispersion meteorology of the Project Application Area, information is needed on the prevailing wind regime, ambient temperature, rainfall, relative humidity, mixing height and atmospheric stability. The meteorology of the study area was characterised based on a 3-Dimensional prognostic meteorological dataset for the region surrounding the Project Application Area.

MM5

The three dimensional prognostic dataset generated by the Pennsylvania State University/National Centre for Atmospheric Research, or MM5, model was created and assimilated in the CALMET modelling process. The MM5 model is a prognostic mesoscale wind field model with four-dimensional data assimilation. CALMET's wind model allows MM5 generated data to be used as initial pseudo-observations (Scire *et al.*, 2006).

For this study, an MM5 meteorological dataset was obtained for a 120 km x 120 km domain for the 2010 calendar year, centred over the study area, with a spatial grid resolution of 12 km. 2010 was selected as the appropriate modelling assessment meteorology data to maintain consistency with all other Centennial EIS studies.

The model has 40 vertical levels, with the lowest level beginning at 11 m above ground level ranging to 3,500 m. The MM5 dataset contains the two-dimensional and three-dimensional parameters listed in **Table 15**.

Table 15 MM5 Dataset Parameters

Hourly 3-Dimensional Parameters	Hourly 2-Dimensional Parameters
Wind speed and direction	Sea-level pressure
Temperature	Rainfall amount
Pressure	Snow cover
Geopotential height	Short wave and long wave radiation at the surface
Vertical velocity	Air temperature and specific humidity at 2m
Relative humidity	Wind speed and direction at 10m
Mixing ratios for water vapour, cloud water, rain and other precipitation	Sea surface temperature

CALMET

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and land uses.

Table 16 details the parameters used in the meteorological modelling. No surface, upper air or buoy observations were used in the CALMET model ('No-Obs Mode' hereafter). This approach is recommended by NSW EPA (2010) as:

- No-Obs mode allows the important benefits of the non-steady-state approach in CALPUFF to be included in the dispersion modelling (e.g., spatially varying meteorology and dispersion, causality, recirculation, stagnation, pollutant build-up, fumigation, etc.);
- No-Obs mode makes use of three-dimensional, hourly prognostic meteorological data often available at high resolution to drive CALMET and CALPUFF;
- No-Obs mode greatly simplifies the preparation of the CALMET inputs because a large number of input variables dealing with observational data are not required and the difficulties of dealing with potentially incomplete observational datasets are eliminated; and
- No-Obs mode provides a relatively straightforward approach that facilitates agency review and approval of the CALMET/CALPUFF simulations;

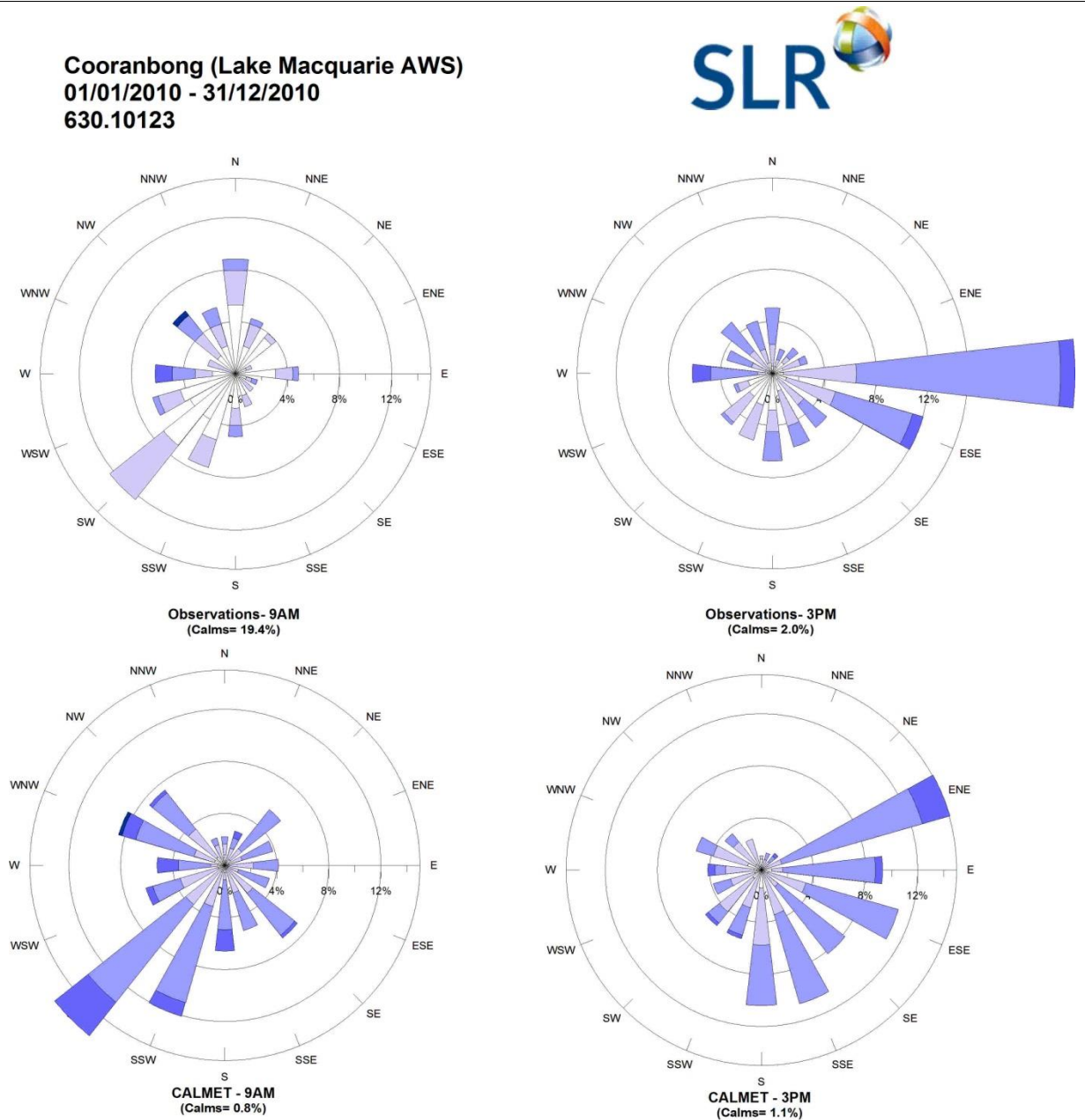
Table 16 CALMET Configuration Used for this Study

Meteorological grid domain	40 km x 40 km
Meteorological grid resolution	0.3 km
TERRAD Value	1.5 km
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1,200 m, 2,000 m, 3,000 m and 4,000m)
Modelling Year	2010

6.2.2 Validation of Meteorological Modelling Approach

In the absence of any site specific meteorological data available, the modelled meteorological data is compared to the 9am and 3pm meteorological data at BoM station located at Cooranbong (Lake Macquarie AWS, station # 61412). A summary of the comparison is shown in **Figure 4**. Modelled Data has been extracted at the Cooranbong (Lake Macquarie AWS) BoM station.

Figure 4 Comparison of Wind Roses – 9am and 3pm – Cooranbong (Lake Macquarie AWS)



It is noted from the comparison that the observed and modelled meteorological data are largely in agreement, with the exception of:

- 19.4% of 9am calms observed compared to 0.8% of calms modelled.

- A higher percentage of observed winds from the eastern quadrant at 3pm compared to the modelled 3pm winds.

The lower percentage of calm conditions predicted at 9 am is likely to result in conservatively higher predicted concentrations of particulate matter at the receptors. This is especially true for the wind dependent sources (for example wind erosion, material handling and miscellaneous sources) where increased wind speeds would result in greater emissions and therefore a conservative assessment of resulting impacts.

6.2.3 Meteorological Data Used in Modelling

Wind Speed and Direction

A summary of the annual wind behaviour predicted by CALMET for the Project for the year 2010 is presented as wind roses in **Figure 5**.

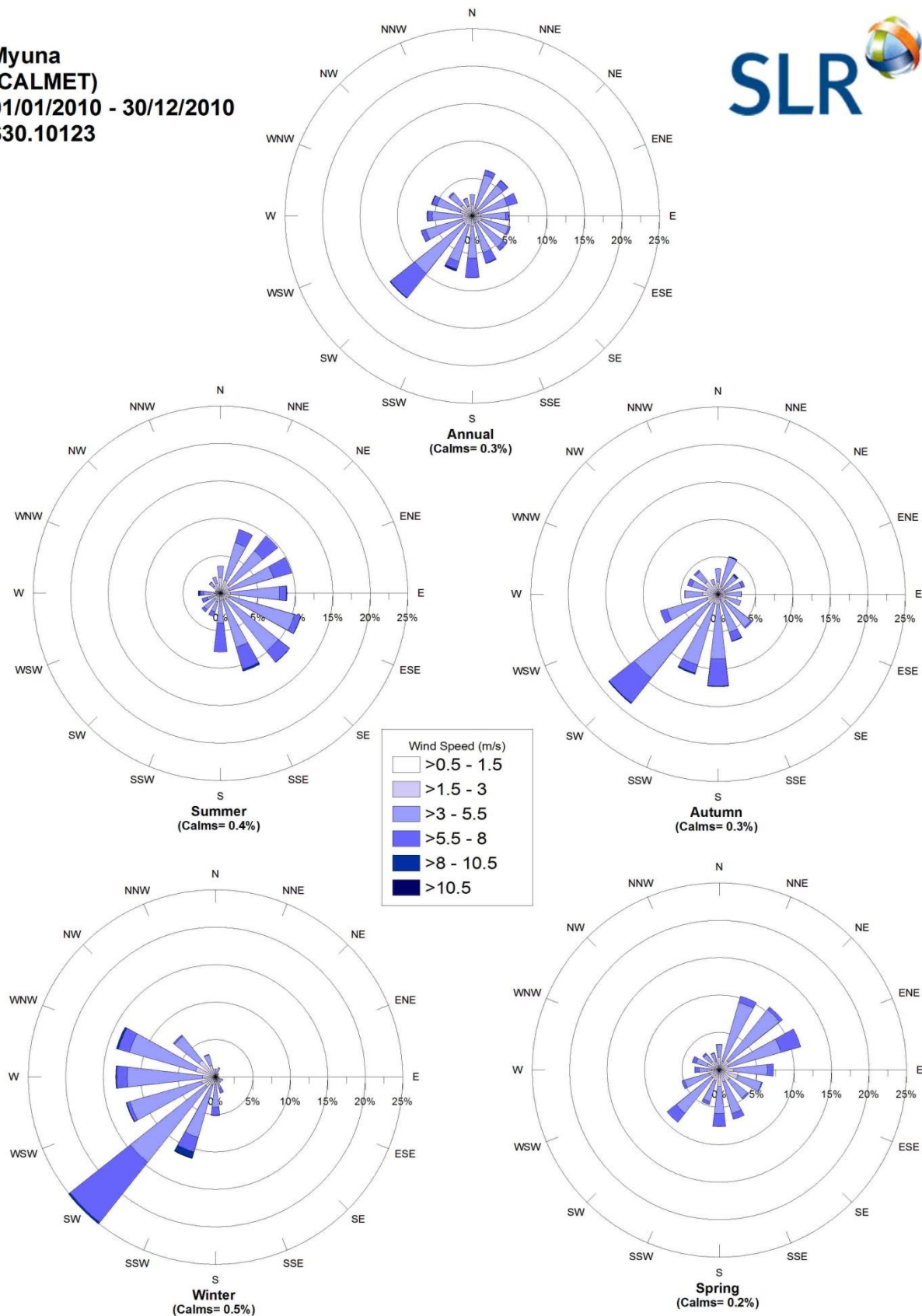
These wind roses indicate that the region predominantly experiences light to moderate (between 1.5 m/s and 8 m/s) winds with high speed winds (> 8m/s) prevailing for a low fraction of time during the year. Winds occur reasonably evenly from southwest and east-northeast quadrants.

The seasonal wind roses indicated that typically:

- In summer, winds are light to moderate predominantly from between north northeast and south quadrant (approximately 80% combined), with low frequency of winds from between south southwest and north quadrants;
- In autumn, winds are light to moderate predominantly from the southwest quadrant (approximately 40% combined);
- In winter, winds are mostly light to moderate and are experienced predominantly from between south southwest to northwest quadrants (approximately 85% combined) with a low frequency of high winds (>8 m/s) from south southwest and west northwest; and
- In spring, winds are light to moderate from between north northeast and east northeast (approximately 33% combined).

Figure 5 Annual Wind Roses for –Myuna (CALMET predictions, 2010)

**Myuna
(CALMET)
01/01/2010 - 30/12/2010
630.10123**



Atmospheric Stability

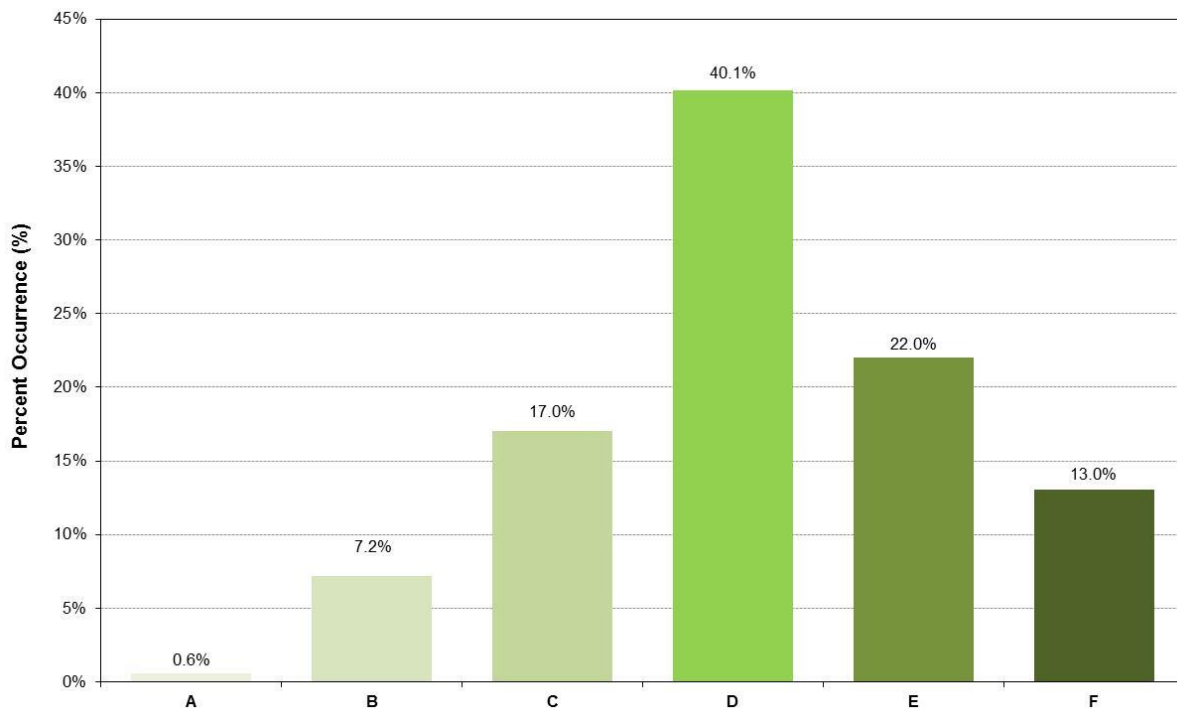
Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Turner assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability (see **Table 17**). These classes indicate the characteristics of the prevailing meteorological conditions and are used as input into various air dispersion models.

The frequency of each stability class predicted by CALMET at the Project site during 2010 is presented in **Figure 6**. The results indicate a high frequency of conditions typical to Stability Class D. Stability Class D is indicative of neutral conditions, conducive to a moderate level of pollutant dispersion due to mechanical mixing.

Table 17 Description of Atmospheric Stability Classes

Atmospheric Stability Class	Category Description
A	Very unstable low wind, clear skies, hot daytime conditions
B	Unstable clear skies, daytime conditions
C	Moderately unstable moderate wind, slightly overcast daytime conditions
D	Neutral high winds or cloudy days and nights
E	Stable moderate wind, slightly overcast night-time conditions
F	Very stable low winds, clear skies, cold night-time conditions

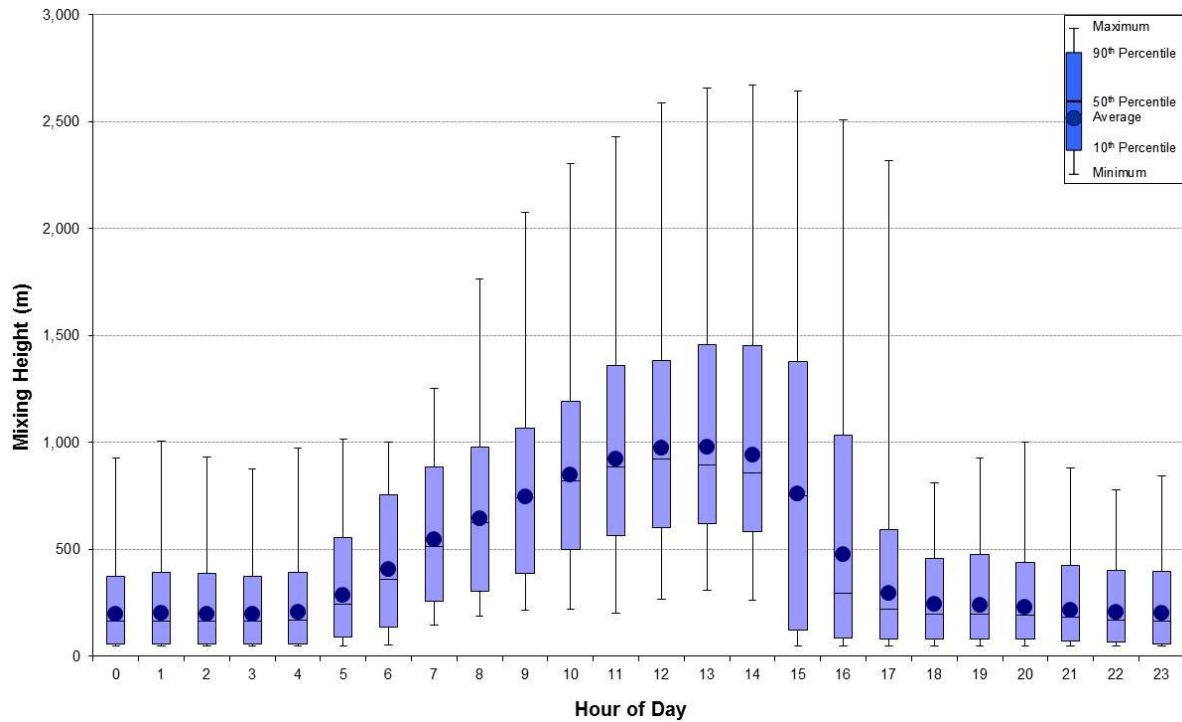
Figure 6 Stability Class Frequencies for Myuna (CALMET predictions, 2010)



Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Project site during 2010 are illustrated in **Figure 7**. As would be expected, an increase in the mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

Figure 7 Mixing Heights for Myuna (CALMET predictions, 2010)



6.2.4 Compatibility of Modelled Meteorological Data to Other Assessments

This section describes compatibility of modelled meteorological data (refer to **Section 6.2**) for air quality impact assessments to other assessments such as the noise & vibration assessment.

Whilst the starting point for each assessment may be similar, the requirements for meteorological data vary as stated in guidance documentation from the appropriate regulatory authorities.

The meteorological dataset developed for use in the air quality impact assessment has been compiled to provide a robust and conservative assessment of potential downwind impacts due to particulate and other pollutant emissions from activities occurring within Myuna Colliery. The factors considered in selecting the meteorological data for use in an air quality impact assessment can be considerably different to those that need to be considered when compiling data for a noise impact assessment, or even an air quality impact assessment which is addressing other issues, such as the potential for odour nuisance impacts.

For example, impacts resulting from particulate emissions tend to be greatest under moderate to strong wind speeds, when wind-blown dust is generated and particulate matter can be carried significant distances before settling out of the air. In comparison, worst-case noise and odour impacts tend to occur under calm wind conditions when there is little atmospheric turbulence to dissipate the noise/odours.

Dust impacts are also assessed based on longer term averages (24-hour and annual averages), whereas noise and odour nuisance impacts are more likely to be associated with peak events.

Also, the dataset as a whole is required to contain different meteorological parameters to assess the noise impacts or air quality impacts. For example, for air quality impacts, the mixing heights in the dataset are required to assess the potential limits for the vertical dispersion of pollutants which can have a significant impact on the resultant ground level concentration at the discrete receptors. Whereas for noise impacts, the mixing heights do not directly influence the noise impacts experienced.

For these reasons, the meteorological data used in this assessment is likely to differ from that used in the assessment of noise impacts from the site and possibly incompatible with the modelled meteorological data for the noise and vibration assessment.

7 EXISTING AIR QUALITY

The air quality in the region surrounding the Myuna Colliery is influenced by emissions generated by a range of sources, originating from both within and outside of the local area. Specifically, for the area surrounding the Myuna Colliery, air quality will be influenced by pollution transported into the area from more distant sources, emissions from power stations in the area, traffic-generated pollution and pollution generated by the Project itself.

To determine the *incremental* impact of particulate emissions from the Project on the surrounding environment and sensitive receptors, a dispersion modelling exercise has been performed.

To appropriately assess the *cumulative* impact of the Project, the incremental impact needs to be added to a dataset which includes the contributions of all other significant sources of particulate in the region. Given that air quality monitoring locations in the local area are limited to those close to major particulate sources (such as mine sites) the use of an alternative dataset has been investigated to avoid possible double-counting of Project-related emissions.

This section outlines the methodology used to generate the background pollutant dataset used in this assessment. It involves the following steps:

- 1 Selection of an appropriate background dataset representative of regional air quality without the influence of major industrial sources in the local area (i.e. power stations and Project-related emissions) – **Section 7.1**;
- 2 Addition of an appropriate incremental contribution to ambient particulate levels due to controlled process and fugitive emissions from power stations in the local area (such as Eraring, Munmorah and Vales Point power stations) – **Section 7.2**; and,
- 3 Assessment of an appropriate incremental contribution (if any) to ambient particulate levels due to controlled process and fugitive emissions from other mining and ancillary operations in the local area (such as the Northern Coal Logistics Project) – **Section 7.3**.

7.1 Regional Background Air Quality

7.1.1 Particulates (PM₁₀ and PM_{2.5})

Particulate data (PM₁₀ and PM_{2.5}) from three NSW EPA air quality monitoring stations (AQMS) were obtained to assist in the determination of the background particulate environment excluding the impacts of power stations and Project-related sources. Data for the years 2006, 2007, 2008, 2009 and 2010 (concurrent with the meteorological modelling performed) was obtained for Newcastle AQMS, Beresfield AQMS and Wallsend AQMS. PM_{2.5} is not monitored at the EPA Newcastle AQMS. The locations of these three sites are presented in **Figure 2**.

Statistics for each site for each of the three years are presented in **Table 18**, **Table 19** and **Table 20**. All data is presented as 24-hour average concentrations in µg/m³, except averaging period (hours), skew and kurtosis (dimensionless) and data capture (percentage of the monitoring period). Presented in **Figure 8** and **Figure 9** are time series plots for PM₁₀ and PM_{2.5}, respectively.

It is noted that on 23 September 2009, a dust storm was experienced in the region (DECC 2009), resulting in very high 24 hour averages for PM₁₀ and PM_{2.5}. The recorded concentrations shown in **Figure 8** and **Figure 9** include the concentrations recorded on 23 September 2009 but the graphs have been truncated at appropriate levels to show the variations.

Figure 8 24-hour Average PM₁₀ Concentrations Measured at NSW EPA Beresfield, Wallsend and Newcastle AQMS (2006 – 2010)

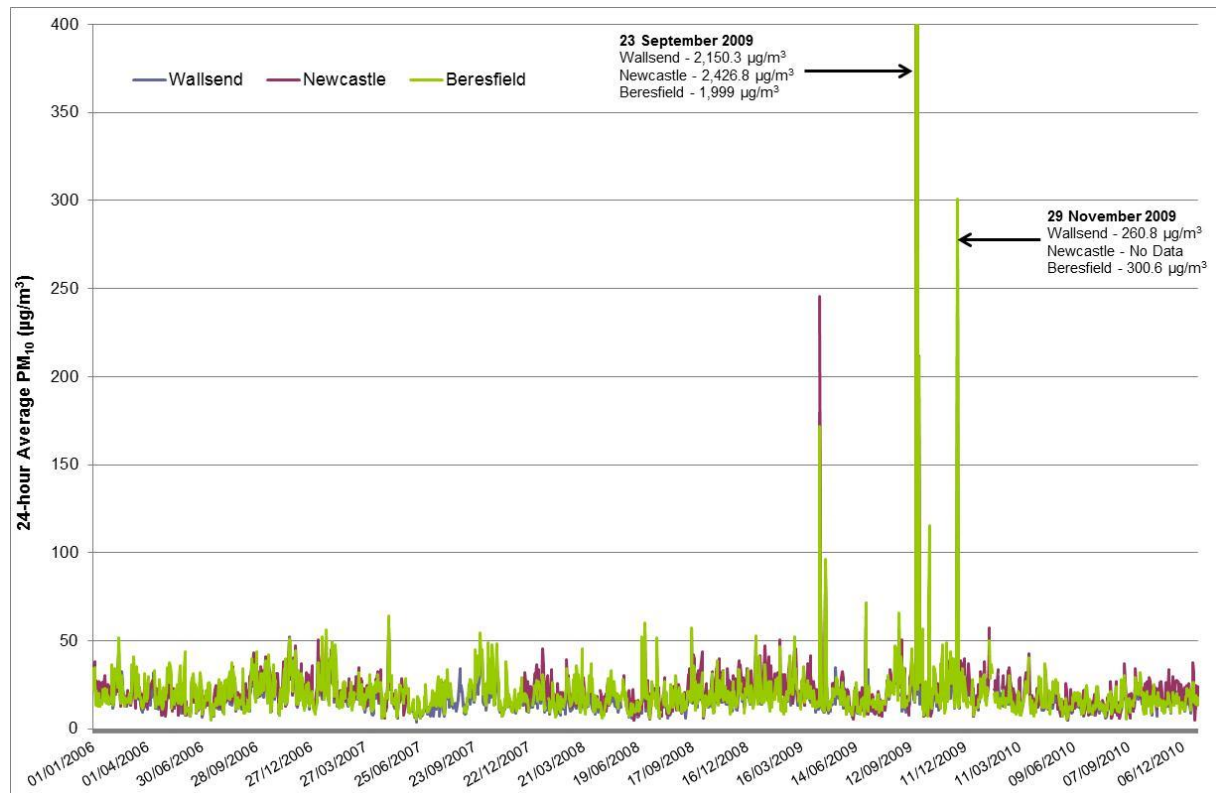


Figure 9 24-hour Average PM_{2.5} Concentrations Measured at NSW EPA Beresfield and Wallsend AQMS (2006 – 2010)

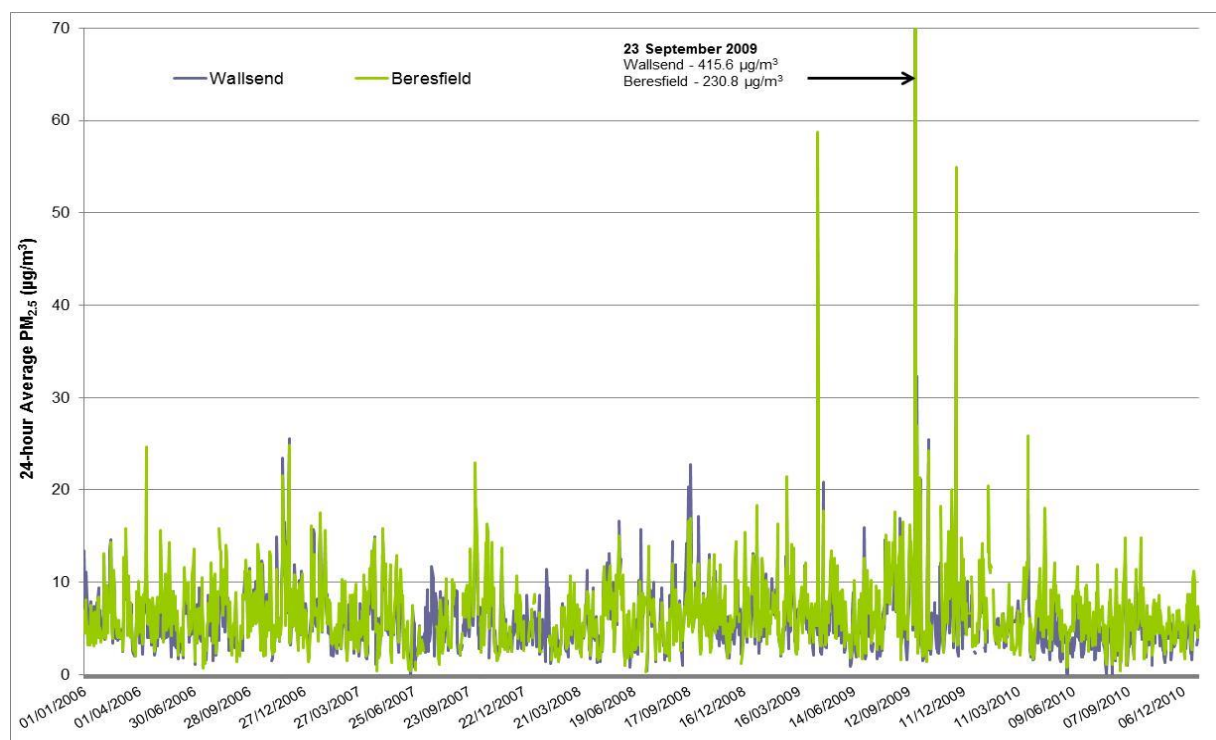


Table 18 Statistical Summary of Wallsend AQMS Background Monitoring Data

Statistic	2006		2007		2008		2009		2010	
	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
Averaging Period	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour
Data Points	359	362	341	337	303	320	333	323	318	338
Mean (µg/m ³)	18.6	6.4	17.4	5.8	15.7	5.8	19.9	6.8	14.7	4.6
Standard Deviation (µg/m ³)	± 7.1	± 3.3	± 7.4	± 3.2	± 6.4	± 3.4	±15.6	±5.3	±4.7	±2.3
Skew ¹	+1.1	+1.5	+1.4	+1.0	+2.0	+1.4	+6.7	+4.1	+0.7	+1.4
Kurtosis ²	+2.0	+4.9	+2.9	+1.0	+7.5	+3.4	+61.3	+27.6	+0.6	+4.7
Minimum (µg/m ³)	5.6	1.1	3.6	-0.1	5.0	0.1	6.9	0.9	5	-0.2
Percentiles (µg/m³)										
25 th	13.6	4.0	12.7	3.3	11.8	3.4	12.7	3.9	11.4	3.1
50 th	17.4	5.9	16.0	5.1	14.8	5.2	16.5	5.6	14.0	4.2
75 th	22.7	8.1	20.8	7.5	18.6	7.4	23.2	8.4	17.7	5.7
90 th	27.5	10.5	26.5	10.0	23.2	10.0	31.0	12.4	20.8	7.4
95 th	31.4	11.9	33.3	12.2	26.4	11.9	35.1	14.3	23.6	9.0
97 th	34.2	13.5	35.0	13.9	30.1	13.0	38.2	16.9	25.3	10.1
98 th	35.8	14.4	36.7	14.8	31.9	14.3	54.8	18.7	26.5	10.7
99 th	40.7	15.5	40.0	15.2	39.9	17.0	73.1	24.6	28.0	11.7
Maximum 1 (µg/m ³)	52.0	25.6	50.9	18.2	56.5	22.8	179.5	50.5	32.8	18.8
Maximum 2 (µg/m ³)	45.3	23.5	50.8	15.7	43.6	20.3	173.9	49.8	29.5	13.7
Maximum 3 (µg/m ³)	45.1	18.4	46.5	20.3	43.0	19.6	81.1	32.3	28.6	12.0
Data Capture	98.4%	99.2%	93.4%	92.3%	82.8%	87.4%	90.4%	87.0%	85.2%	92.0%

- Notes 1 Skew represents an expression of the distribution of measured values around the derived mean. Positive skew represents a distribution tending towards values higher than the mean, and negative skew represents a distribution tending towards values lower than the mean. Skew is dimensionless.
- 2 Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive skew represents a more pointed distribution, and negative skew represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

Table 19 Statistical Summary of Beresfield AQMS Background Monitoring Data

Statistic	2006		2007		2008		2009		2010	
	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
Averaging Period	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour	24-hour
Data Points	352	361.0	329	314	349	336	358	341	318	338
Mean (µg/m ³)	21.2	6.8	20.4	6.3	18.4	5.9	22.7	7.9	14.7	4.6
Standard Deviation (µg/m ³)	± 8.7	± 3.5	± 10.0	± 3.7	± 7.9	± 3.0	±17.7	±5.6	±6.3	±3.1
Skew ¹	+0.8	+1.5	+1.4	+1.1	+1.8	+0.8	+6.0	+4.4	+0.7	+1.4
Kurtosis ²	+0.2	+4.0	+2.4	+1.4	+5.8	+0.8	+51.2	+32.9	+0.6	+4.7
Minimum (µg/m ³)	4.8	0.7	5.7	0.3	5.8	0.2	7.2	1.4	5	-0.2
Percentiles (µg/m³)										
25 th	14.6	4.3	13.1	3.5	13.4	3.6	14.2	4.8	11.4	3.1
50 th	18.8	5.9	18.4	5.5	16.9	5.7	18.4	6.6	14.0	4.2
75 th	26.6	8.6	25.2	8.4	21.5	7.6	26.1	9.6	17.7	5.7
90 th	34.1	11.3	32.0	11.5	27.2	9.6	35.1	13.4	20.8	7.4
95 th	36.7	13.3	41.3	13.6	32.1	11.5	46.3	15.7	23.6	9.0
97 th	39.1	14.1	47.7	14.6	34.5	12.1	53.1	18.1	25.3	10.1
98 th	42.1	15.2	49.1	15.7	36.9	13.7	65.4	20.3	26.5	10.7
99 th	44.1	16.5	53.8	16.9	52.1	14.8	82.0	25.9	28.0	11.7
Maximum 1 (µg/m ³)	51.9	24.9	64.0	23.0	59.9	16.9	211.4	58.8	32.8	18.8
Maximum 2 (µg/m ³)	51.4	24.7	57.9	17.9	57.6	16.6	171.8	55.0	29.5	13.7
Maximum 3 (µg/m ³)	46.3	21.6	56.2	17.5	53.1	15.4	115.2	28.1	28.6	12.0
Data Capture	96.4%	98.9%	90.1%	86.0%	95.4%	91.8%	98.0%	93.0%	85.2%	92.0%

- Notes
- 1 Skew represents an expression of the distribution of measured values around the derived mean. Positive skew represents a distribution tending towards values higher than the mean, and negative skew represents a distribution tending towards values lower than the mean. Skew is dimensionless.
 - 2 Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive skew represents a more pointed distribution, and negative skew represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

Table 20 Statistical Summary of Newcastle AQMS Background Monitoring Data

Statistic	2006	2007	2008	2009	2010
	PM ₁₀	PM ₁₀	PM ₁₀	PM ₁₀	PM ₁₀
Averaging Period	24-hour	24-hour	24-hour	24-hour	24-hour
Data Points	355	172	341	339	365
Mean (µg/m ³)	21.1	22.8	20.5	24.9	17.9
Standard Deviation (µg/m ³)	±7.4	±8.9	±7.9	±19.3	±7.9
Skew ¹	+0.7	+1.2	+0.9	+7.4	+0.5
Kurtosis ²	+0.8	+2.5	+1.2	+75.3	+2.0
Minimum (µg/m ³)	6.5	6.1	4.9	5.6	0.0
Percentiles (µg/m³)					
25 th	15.8	17.2	15.1	16.5	13.2
50 th	20.5	21.6	19.1	22.3	17.4
75 th	25.6	26.8	24.6	27.8	22.8
90 th	30.7	33.4	31.1	36.1	27.1
95 th	34.1	39.2	34.3	43.1	30.1
97 th	36.1	43.4	38.1	50.7	33.8
98 th	38.0	47.8	39.2	60.3	34.6
99 th	42.0	52.4	43.1	80.8	37.6
Maximum 1 (µg/m ³)	51.2	58.1	54.4	245.4	57.1
Maximum 2 (µg/m ³)	47.2	57.2	50.6	211.6	48.3
Maximum 3 (µg/m ³)	43.3	50.4	45.6	86.6	42.5
Data Capture	97.3%	47.1%	93.2%	92.3%	100.0%

- Notes
- 1 Skew represents an expression of the distribution of measured values around the derived mean. Positive skew represents a distribution tending towards values higher than the mean, and negative skew represents a distribution tending towards values lower than the mean. Skew is dimensionless.
 - 2 Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive skew represents a more pointed distribution, and negative skew represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

The statistics presented in **Table 18**, **Table 19** and **Table 20** indicate that in general, higher concentrations of PM₁₀ and PM_{2.5} are measured at the Beresfield AQMS when compared with Wallsend AQMS. Also, higher concentrations of PM₁₀ are measured at Newcastle AQMS when compared with Wallsend AQMS.

This is unsurprising given the location of the Newcastle AQMS site in an urban location, with a not insignificant contribution to particulate concentrations from vehicle traffic and industrial sources located in the area. The Beresfield AQMS is also located near to a major road and the influence from vehicle traffic in the particulate monitoring record will be observed.

Data from the Wallsend AQMS shows lower maximum concentrations and lower annual average particulate concentrations than the other two sites in the area. The Wallsend AQMS is located approximately 9 km from the urban centre of Newcastle and although it will experience some contribution from vehicle traffic, the impact will not be as significant as that experienced within Newcastle. Additionally, impacts from industry will be markedly lower at Wallsend.

Based on the statistical analysis and discussion of the particulate monitoring data for the three stations, it is concluded that the use of the Wallsend AQMS PM₁₀ and PM_{2.5} data as a “regional background” dataset is appropriate and valid. The prevailing air quality conditions experienced in the area surrounding the Project Application Area (not considering the effects of nearby power stations or Project activities) is expected to be most similar to those experienced at Wallsend.

Air quality monitoring of PM₁₀ has been performed at the Myuna Colliery since August 2013 using a High Volume Air Sampler (HVAS) operating on a 1-in-6 day cycle. This monitoring is performed to assess the compliance of the Project with Project Approval conditions and is not appropriate to be used as a suitable background dataset for this assessment given that the dataset is not continuous, and it also includes the impact of the Project. However, it is useful to assess the suitability of the adoption of the Wallsend AQMS data as a background dataset for the Project.

Table 21 Comparison of Myuna and Wallsend PM₁₀ data

Date	Myuna Colliery		Wallsend AQMS	
	Average (µg/m ³)	Maximum (µg/m ³)	Average (µg/m ³)	Maximum (µg/m ³)
August 2013 to August 2014 1 in 6 day	14.5	38.0	17.6	46.7
August 2013 to August 2014 Daily	-	-	17.2	52.5
2010 Daily	-	-	14.7	32.8

Measurements of PM₁₀ measured at the Myuna Colliery include the impacts of power station and Project related emissions. During the period August 2013 to August 2014 these measurements indicate generally lower PM₁₀ concentrations were measured at the Myuna Colliery than were measured at the Wallsend AQMS site. The year of assessment for this Project has been selected as 2010, and data measured at Wallsend AQMS during 2010 is lower than that measured at the site during the August 2013 to August 2014 period. It is considered that the use of the Wallsend AQMS dataset for 2010 is appropriate and represents a suitable background air quality dataset for use within this assessment.

7.1.2 TSP

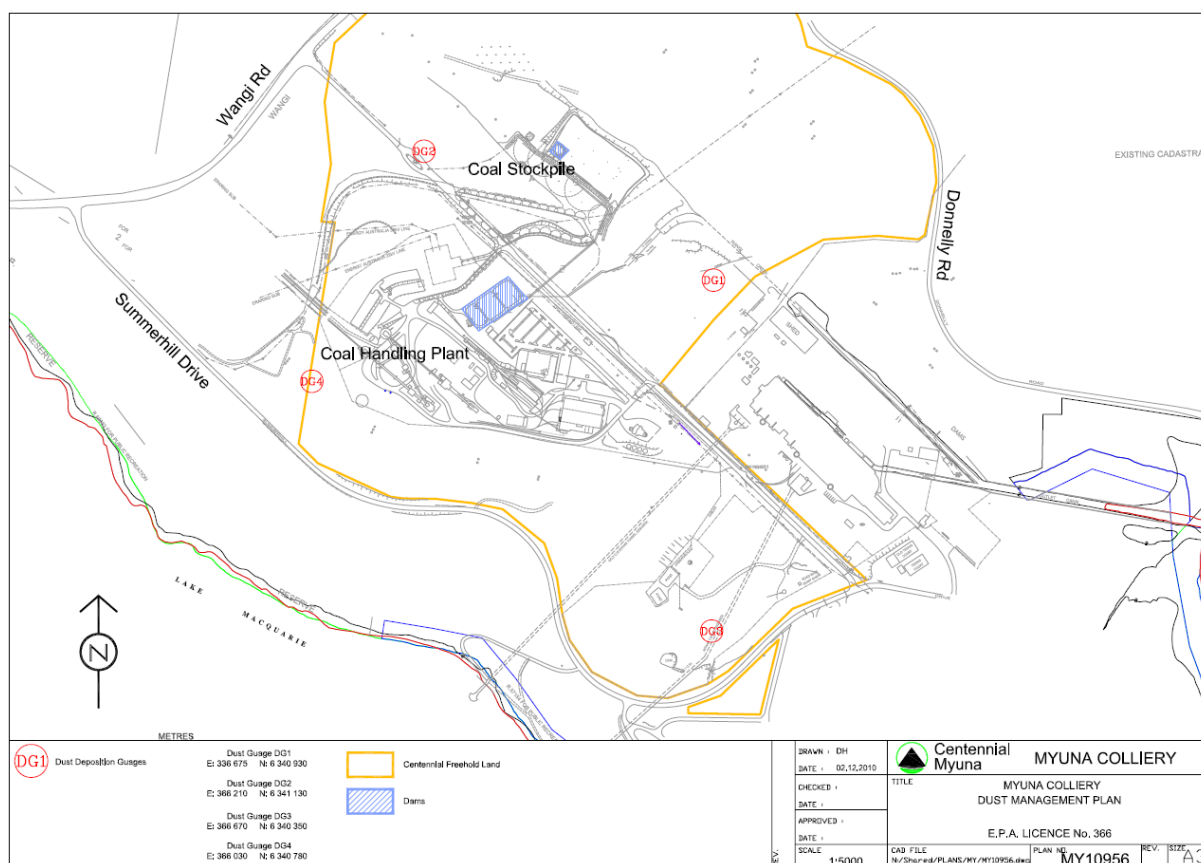
No TSP monitoring is performed by the NSW EPA at any of the three nearby AQMS locations. In this instance, TSP concentrations have been assumed to be twice those of the measured PM₁₀ concentrations at Wallsend AQMS. It is noted that the PM₁₀ sub-set is typically 50% of TSP mass in regions where road traffic is not the dominant particulate source (USEPA, 2001) and therefore a background TSP concentration of 29.4 µg/m³ has been adopted.

TSP monitoring performed on a 1-in-6 day cycle at the Myuna Colliery between August 2013 and August 2014 indicates that the annual average TSP concentration was 29.6 µg/m³ inclusive of power station and Project operations and therefore the adoption of a value of 29.4 µg/m³ is considered to be conservative.

7.1.3 Dust

For dust deposition, no regional background datasets are available for use. CMPL has a current dust deposition monitoring program in place which covers the Myuna Surface Facilities Site. The locations of the dust deposition gauge (DDG) sites relevant to the Project are shown in **Figure 10**.

Figure 10 Locations of Dust Deposition Gauges – Myuna Colliery



Source: Centennial 2012b

A summary of the dust deposition monitoring program is shown in **Table 22**.

Table 22 Summary of the Dust Deposition Monitoring Program at Myuna Colliery

Gauge #	Monitoring Period	Average Deposition Rate (g/m ² /month)
D1	July 2002 – August 2014	0.7
D2	July 2002 – August 2014	1.0
D3	July 2002 – August 2014	1.7
D4	July 2002 – August 2014	1.3
Overall Average		1.2

Source: Centennial 2014

It is noted that the long term average dust deposition rates shown in **Table 22** include the contribution of mining operations and the background dust levels. A conservative dust deposition rate of **2 g/m²/month** is adopted as a background dust deposition rate.

7.1.4 Odour

The monitoring program conducted by SLR Consulting (SLR 2012a) identified the characteristics of the odour from the ventilation fans at the Mandalong Mine as yeast, exhaust and metallic. It is considered that there are no similar odour sources in the vicinity of Myuna Colliery. In the absence of any similar odour sources, the background odour concentration is assumed to be negligible (i.e zero).

7.2 Power Stations

To determine the background particulate concentrations experienced across the domain, the increment from power stations located in the area needs to be added to the regional background particulate concentrations from **Section 7.1**.

A dispersion modelling exercise has been performed using publicly available information to determine the contribution from power station emissions to particulate concentrations within the modelling domain. The information in **Table 23** has been obtained for stack sources associated with Eraring, Vales Point and Munmorah power stations. Emission rates of PM_{2.5} were not publicly available and therefore the WRAPAIR factor (refer **Section 5**) of 0.1 have been applied to the PM₁₀ emission rates for all particulate emissions sources to estimate the rate of PM_{2.5} emissions from these power station sources.

Table 23 Point Source Emissions from Eraring, Munmorah and Vales Point Power Stations

Source	ID	Easting (m)	Northing (m)	Height (m)	Diameter (m)	Temperature (°C)	Velocity (m/s)	TSP (g/s)	PM ₁₀ (g/s)	PM _{2.5} (g/s)
Eraring	ES1	361,938	6,340,750	200	10.5	107	17	64.0	12.7	1.3
Eraring	ES2	361,975	6,340,938	200	10.5	107	17	64.0	12.7	1.3
Munmorah ¹	MS1	364,190	6,324,292	150	7.9	153	19	30.5	30.5	3.1
Vales Point ²	VPS1	364,347	6,329,916	178	11	110	15.4	60.0	12.5	1.3

Notes 1 No information on TSP emissions rate available – taken to be the same as PM₁₀ (equivalent to 50 mg/m³ stack concentration).

2 Vales Point B Station (A Station decommissioned and two associated 138 m stacks now redundant).

The influence of building wake effects on the power station stack emissions has been taken into account in the dispersion modelling. Building dimensions were estimated using Google Earth images and the relationship between known stack heights and associated shadow lengths. This relationship has then been applied to the building shadow lengths to estimate building heights. The building heights used in the modelling assessment are presented in **Table 24**.

Table 24 Details of Building Coordinates and Dimensions at Eraring, Munmorah and Vales Point Power Stations

Site	Building	ID	Easting (m)	Northing (m)	Assumed Height (m)
Eraring	Powerhouse	EB1	361,836	6,341,059	40
			361,985	6,341,040	
			361,924	6,340,658	
			361,783	6,340,675	
Munmorah	Powerhouse	MB1	364,147	6,324,453	42
			364,190	6,324,393	
			364,010	6,324,241	
			363,961	6,324,294	
Vales Point	Powerhouse	VPB1	364,169	6,330,013	39
			364,335	6,330,136	
			364,364	6,330,099	
			364,199	6,329,976	
	Coal units	VPB3	364,239	6,329,993	59
			364,317	6,330,055	
			364,348	6,330,031	
			364,261	6,329,973	

In addition to emissions from stack sources, emissions from coal stockpiles and ash dams have also been considered. The location and surface area of coal stockpiles have been obtained from Google Earth imagery. Heights of all coal stockpiles have been assumed to be 5 m above ground level (AGL). For ash dams, half of the total area observed in Google Earth imagery has been taken to be available for wind erosion. For modelling purposes, the height of the ash dams has been taken to be 0 m AGL.

Emission rates for all stockpiles and ash dams have been taken to be the National Pollutant Inventory (NPI) default for wind erosion of 0.4 kg/ha/hr for TSP and 0.2 kg/ha/hr for PM₁₀ and 0.02 kg/ha/hr for PM_{2.5}. The emission rate for PM_{2.5} has been calculated using the WRAPAIR emission factors as discussed in **Section 5**.

It is acknowledged that the use of the default value may result in under- or over-estimation of 24-hour particulate concentrations at some locations, although taking into account the nature and scale of this assessment and the availability of data to perform alternative methodologies, it is considered to be appropriate.

Details of stockpile and ash dam locations are presented in **Table 25**.

Table 25 Details of Stockpile and Ash Dam Locations at Eraring, Munmorah and Vales Point Power Stations

Site	Stockpile	ID	Easting (m)	Northing (m)	Assumed Height (m)
Eraring	Coal	ESP1	361,715	6,341,677	5
			361,715	6,341,345	
			362,097	6,341,345	
			362,097	6,341,677	
	Coal	ESP2	362,161	6,341,677	5
			361,897	6,341,674	
			361,897	6,341,935	
			362,161	6,341,935	
	Ash Dam	EAD1	363,128	6,342,672	0
			362,915	6,342,178	
			364,080	6,341,921	
			364,142	6,342,278	
Munmorah	Coal	MSP1	364,158	6,324,004	5
			364,374	6,324,048	
			364,418	6,323,861	
			364,226	6,323,811	
Vales Point	Coal	VPSP1	363,648	6,329,355	5
			363,937	6,329,204	
			363,815	6,328,965	
			363,519	6,329,106	
	Coal	VPSP2	364,787	6,329,587	5
			364,852	6,329,562	
			364,760	6,329,398	
			364,700	6,329,429	
	Ash Dam	VPAD1	362,437	6,328,584	0
			363,447	6,327,984	
			362,433	6,326,172	
			361,976	6,327,423	

Through the dispersion modelling exercise, particulate concentrations experienced at each of the identified sensitive receptor locations (refer **Section 3.2**) due to emissions from the power stations have been estimated. Additionally, impacts have also been predicted at the Wallsend AQMS (refer **Section 7.1**) to verify that concentrations of particulate measured at the station do not include a significant contribution from power station related emissions.

The maximum modelled 24-hour average PM₁₀ concentration at the Wallsend AQMS from power station operations was predicted to be 0.8 µg/m³, and it is therefore concluded that the PM₁₀ monitoring data derived from Wallsend AQMS data does not include a significant contribution from power station operations, and that data may be used as a “regional background” dataset for the domain.

The maximum modelled 24-hour average $PM_{2.5}$ concentration at the Wallsend AQMS from power station operations was predicted to be $0.01 \mu\text{g}/\text{m}^3$. It is therefore concluded that the $PM_{2.5}$ monitoring data from Wallsend AQMS does not include a significant contribution from power station operations and therefore the data can be used as a “regional background” dataset for the domain.

Figure 11 presents the predicted incremental PM_{10} concentrations from power station operations at the sensitive receptors during 2010. **Figure 12** presents the predicted incremental $PM_{2.5}$ concentrations from power station operations at the sensitive receptors during 2010.

Figure 11 shows that over the modelling year 2010, the maximum predicted 24-hour average PM_{10} concentration due to the power station emissions was $4.0 \mu\text{g}/\text{m}^3$ on 9 August 2010 at Receptor R5.

Figure 11 Predicted Power Station Related PM_{10} Concentrations at Receptors - 2010

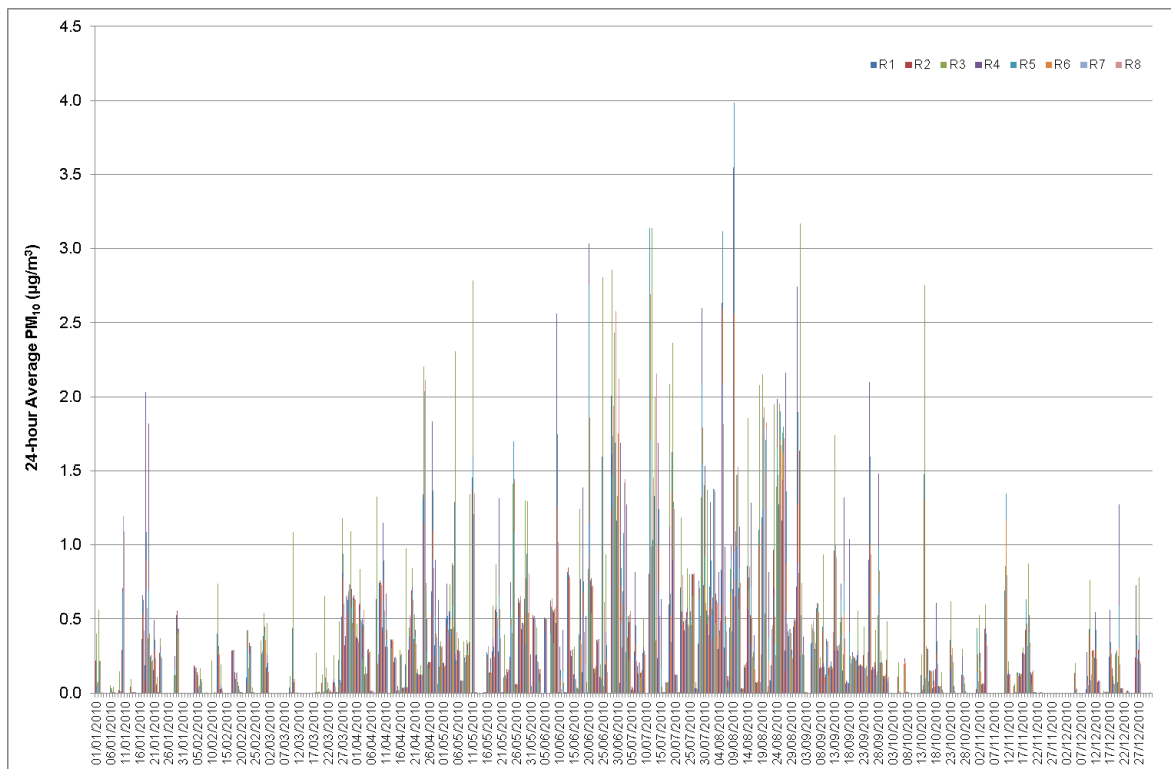
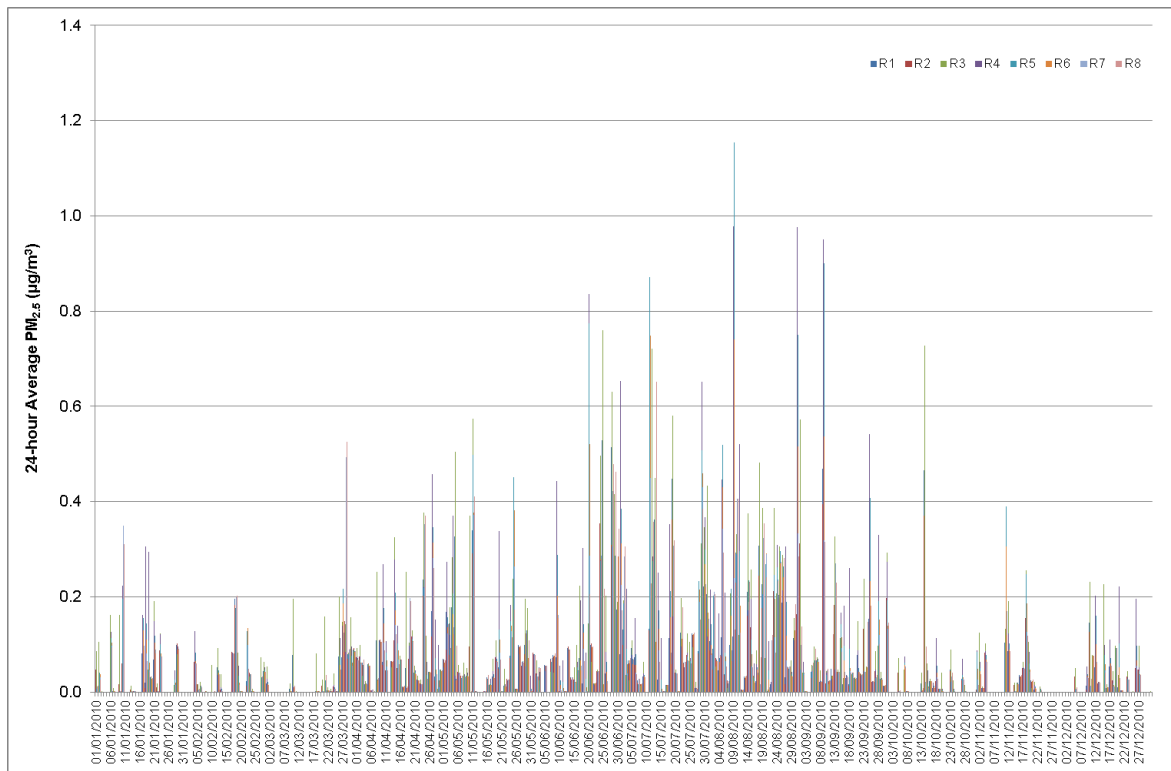


Figure 12 shows that during the year 2010, the maximum predicted 24-hour average $PM_{2.5}$ concentration due to the power station emissions was approximately $1.2 \mu\text{g}/\text{m}^3$ on 9 August 2010 at Receptor R5.

Figure 12 Predicted Power Station Related PM_{2.5} Concentrations at Receptors - 2010



For each receptor location, daily-varying background PM₁₀ and PM_{2.5} concentration files have been constructed, using the regional background particulate data from Wallsend, added to the predicted incremental particulate concentrations from modelling of the power stations.

Presented in **Figure 13** and **Figure 14** are the time series of background PM₁₀ and PM_{2.5} concentrations for Receptor R5 respectively.

Figure 13 Regional Background and Power Station Increment at Receptor R5 (PM₁₀)

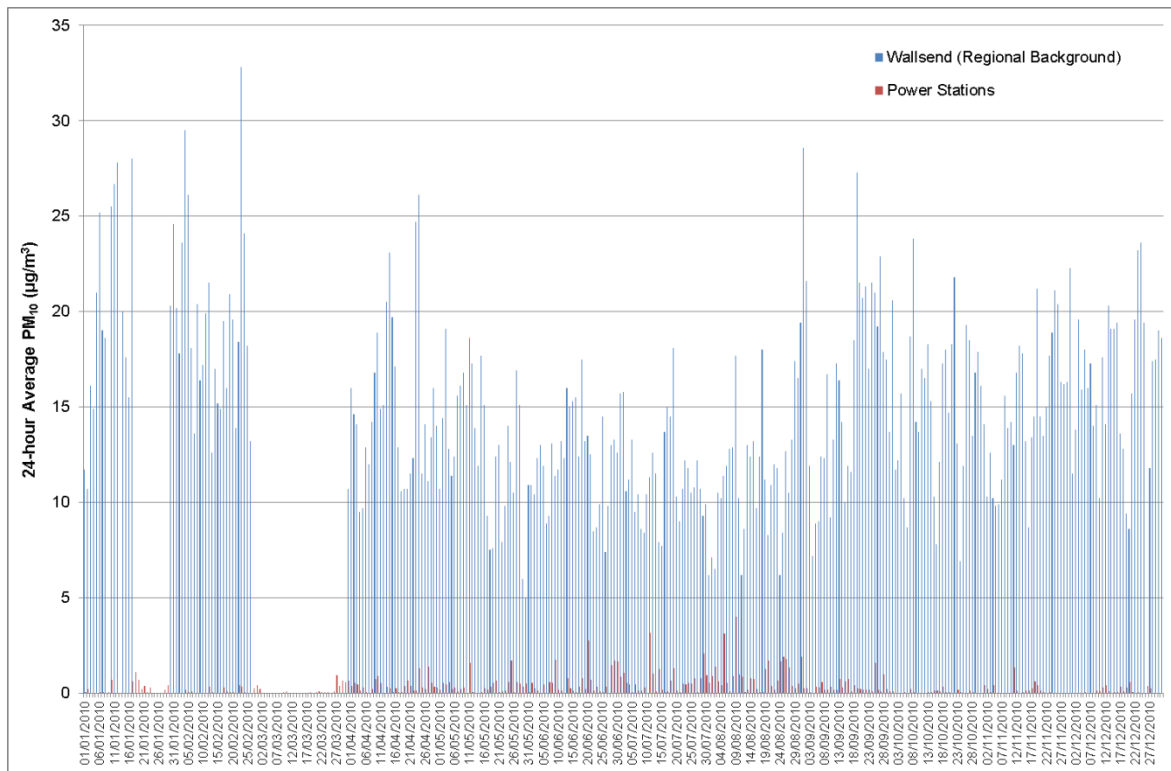
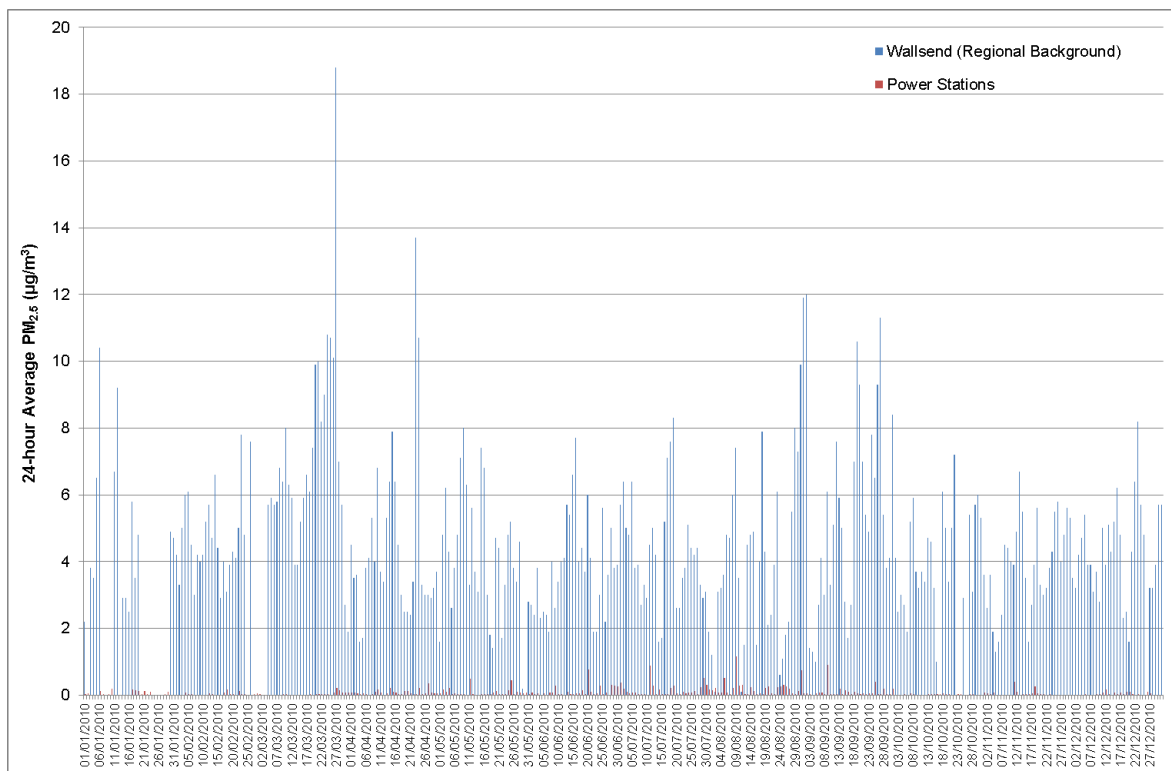


Figure 14 Regional Background and Power Station Increment at Receptor R5 (PM_{2.5})



The derived background concentration files (regional plus power station) vary spatially across the modelling domain based on the results of the power station emission modelling results.

For the assessment of cumulative TSP concentrations, the annual average predictions given by the power station modelling study were added to an estimated annual average regional background value of $29.4 \mu\text{g}/\text{m}^3$. This regional value was derived from the annual average PM_{10} concentration measured at Wallsend AQMS in 2010 multiplied by a factor of two, based on information reported by US EPA (US EPA, 2001) that in non-urban areas without significant impacts from vehicle emissions, $\text{PM}_{10}/\text{TSP}$ ratios are generally in the order of 50% (see **Section 7.1.2**).

7.3 Surrounding Mining Industries

A few surrounding industries have been identified in the region, which are anticipated to have a cumulative impact on the identified sensitive receptors. This section identifies those industries and assesses the possibility of them having a cumulative impact on the sensitive receptors. A summary of the industries considered in this regards is shown in **Table 26**.

Table 26 A Summary of the Mining Industries in the Region

Industry	Location	Section
Awaba Colliery Surface Site (part of the Northern Coal Logistics Project)	~ 5.5 km north-northwest of Myuna	Section 7.3.1
Newstan Colliery Surface Site (part of the Northern Coal Logistics Project)	~ 10 km north of Myuna	
Cooranbong Entry Site (part of the Northern Coal Logistics Project)	~6 km west of Myuna	
Hawkmount Quarry (part of the Northern Coal Logistics Project)	~ 5 km northwest of Myuna	

Note: Eraring, Vales Point and Munmorah Power Stations assessed in **Section 7.2**

7.3.1 Northern Coal Logistics Project

The Northern Coal Logistics Project is part of a long term strategy developed by Centennial for its future operations in the Newcastle Coalfield to provide the infrastructure and flexibility required to meet future opportunities in both the domestic and export coal markets.

The Northern Coal Logistics Project comprises both a continuation of existing operations and an upgrade to the surface coal handling and processing infrastructure at the Newstan Colliery Surface Site and Cooranbong Entry Site, along with the existing private haul roads and rail loading infrastructure.

The Northern Coal Logistics Project comprises (refer also **Figure 15**):

Newstan Colliery Surface Site - Newstan Colliery Surface Site comprises coal handling and processing infrastructure, the Southern Reject Emplacement Area, Northern Reject Emplacement Area, water management infrastructure and rail loading infrastructure. The Project proposes to extend and redevelop the Newstan Colliery Surface Site to accommodate new coal handling and processing infrastructure.

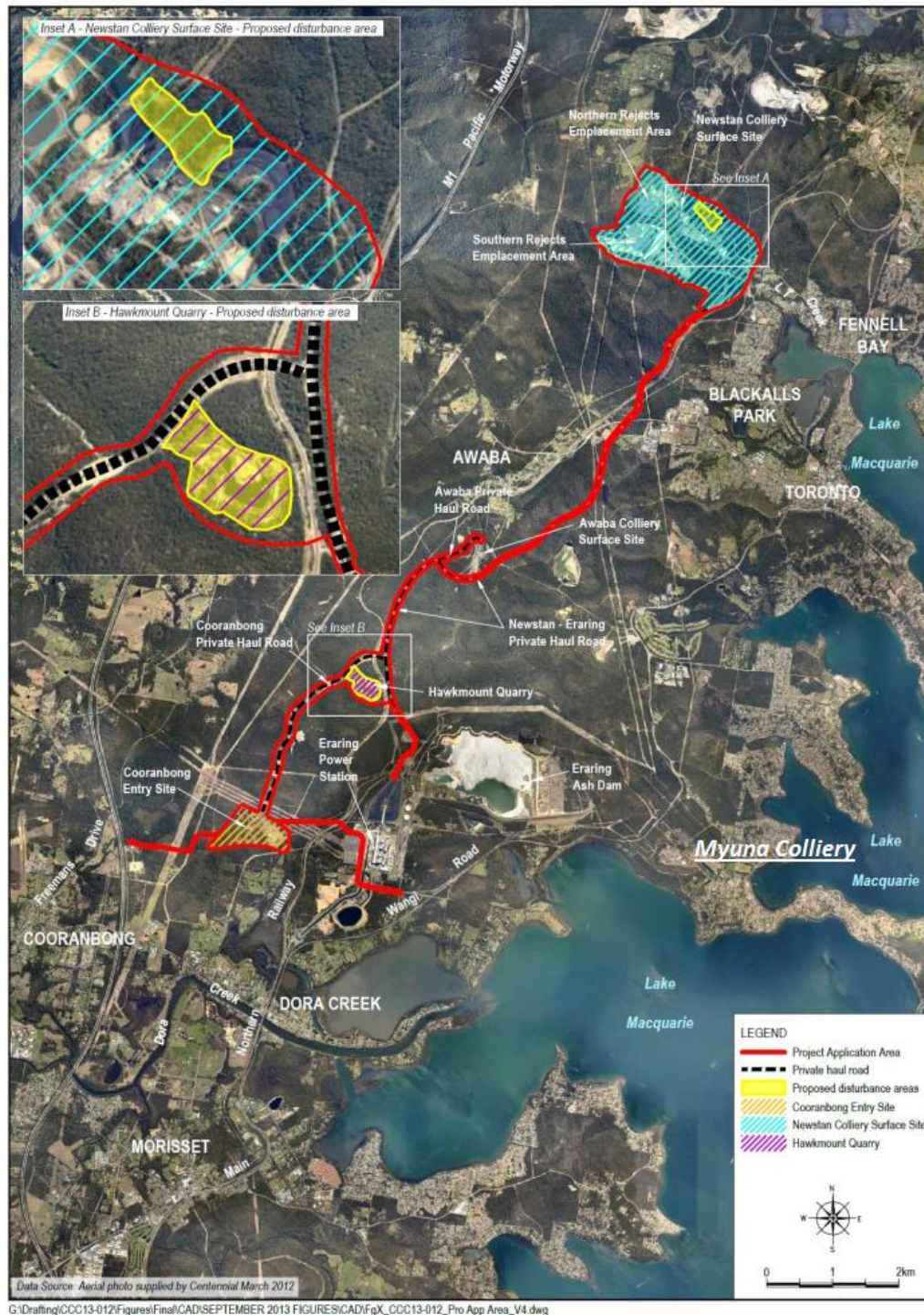
Cooranbong Entry Site - Cooranbong Entry Site comprises a coal handling plant, coal stockpiles, workshop building and water management infrastructure.

Private Haul Roads - The Cooranbong Private Haul Road owned by Centennial Mandalong links the Newstan Colliery Surface Site and the Cooranbong Entry Site via the Newstan-Eraring Private Haul Road. The Newstan-Eraring Private Haul Road links the Newstan Colliery Surface Site to the Eraring Power Station and is owned by Eraring Energy. The Awaba Private Haul Road links the Awaba Colliery Surface Site to the Newstan-Eraring Private Haul Road and is owned by Centennial Newstan Pty Limited.

Hawkmount Quarry – Hawkmount Quarry is an abandoned gravel quarry (Crown land under permissive occupancy held by Lake Macquarie City Council). Hawkmount Quarry has not been used for extraction purposes for several years but is proposed to be used as coarse rejects emplacement area for the Northern Coal Logistics Project.

As part of the Northern Coal Logistics Project, Centennial are seeking to continue to transport up to 0.88 Mtpa of material (including coal and stone from construction activities undertaken as part of the Newstan Colliery Extension of Mining Project) by truck via private haul roads from the Awaba Colliery Surface Site to the reject emplacement areas at the Newstan Colliery Surface Site.

Figure 15 Northern Coal Logistics Project



SLR performed an AQIA for the Northern Coal Logistics Project EIS in March 2014 which examined the potential impacts on air quality resulting from the operation of the Project. To adequately assess these impacts, a total of ten scenarios were modelled; eight of which examined operations at the Newstan Colliery Surface Site and two of which examined the impacts of operations at the Cooranbong Entry Site. All scenarios examined the impact of coal transport.

Of the two scenarios which examined impacts due to operations at the Cooranbong Entry Site, the scenario which reflected the transport of up to 6 Mtpa of coal to the Newstan Colliery Surface Site by trucks (rather than 6 Mtpa of coal to Eraring Power Station by overland conveyor) indicated the greatest impacts on surrounding receptors.

Examination of contour plots of incremental increases in particulate resulting from the operation of these two scenarios in conjunction indicates the following (at a location most representative of receptor R4 (119 Donnelly Road, Arcadia Vale, refer **Table 3**). Impacts at all other receptors assessed as part of this study can be considered to be lower than those presented below:

- Increases in annual average dust deposition were predicted to be less than 0.1 g/m²/month.
- Increases in maximum 24-hour PM₁₀ concentrations were predicted to be approximately 1 µg/m³.
- Increases in annual average PM₁₀ concentrations were predicted to be significantly less than 1 µg/m³.
- Increases in maximum 24-hour PM_{2.5} concentrations were predicted to be significantly less than 1 µg/m³.
- Increases in annual average PM₁₀ concentrations were predicted to be significantly less than 1 µg/m³.
- Increases in annual average TSP concentrations were predicted to be approximately 1 µg/m³.

7.4 Background Air Quality for Assessment Purposes

For the purposes of assessing the potential air quality impacts from the Myuna Colliery (at 2 Mtpa and 3 Mtpa production rate), an estimation of ambient air quality concentrations is required. The site-specific ambient air quality concentrations adopted for this assessment are summarised in **Table 27**.

Table 27 Ambient Air Quality Environment for Assessment Purposes

Air Quality Parameter	Averaging Period	Assumed Background Ambient Level	Notes
TSP	Annual	29.4 µg/m ³ PLUS Power Station Increments	Maximum Increment due to Power Station is 8 µg/m ³ at Receptor R5
PM ₁₀	24-hour	Varying	Maximum Increment due to Power Station is 4 µg/m ³ at Receptor R5
	Annual	14.7 µg/m ³ PLUS Power Station Increments	
PM _{2.5}	24-hour	Varying	Maximum Increment due to Power Station is 1.2 µg/m ³ at Receptor R5
	Annual	4.6 µg/m ³ PLUS Power Station Increments	
Deposited Dust	Annual	2 g/m ² /month	Assumed
Odour	1-hour	0 OU	Assumed

8 AIR QUALITY IMPACT ASSESSMENT RESULTS

The following Sections detail the dispersion modelling results for dust deposition (**Section 8.1**), TSP (**Section 8.2**), PM₁₀ (**Section 8.3**), PM_{2.5} (**Section 8.4**) and odour (**Section 8.5**).

Results are presented for the increment due to Project operations plus the derived background particulate concentration as calculated and discussed in **Section 7.4**.

A discussion of the potential cumulative impacts due to other operations is also provided.

8.1 Dust Deposition

Model predictions of the annual average dust deposition rate experienced at all receptors presented in **Table 3** during currently approved (2 Mtpa) and proposed (3 Mtpa) mining activities are presented in **Table 28**. The background deposition rate of 2 g/m²/month has been included to determine the cumulative deposition rate associated with all existing operations in the area and the predicted impact from power stations has also been included as described in **Section 7.2**.

Where impacts are predicted to be <0.1 g/m²/month, these are taken to be 0.1 g/m²/month when assessing the potential cumulative impacts.

Table 28 Predicted Annual Average Dust Deposition (g/m²/month)

Receptor	Currently Approved (2 Mtpa)				Proposed (3 Mtpa)			
	B/G	Inc	PS	Cumu	B/G	Inc	PS	Cumu
R1	2.0	<0.1	<0.1	2.2	2.0	<0.1	<0.1	2.2
R2	2.0	<0.1	<0.1	2.2	2.0	<0.1	<0.1	2.2
R3	2.0	<0.1	<0.1	2.2	2.0	<0.1	<0.1	2.2
R4	2.0	0.1	<0.1	2.2	2.0	0.1	<0.1	2.2
R5	2.0	0.1	<0.1	2.2	2.0	0.1	<0.1	2.2
R6	2.0	0.1	<0.1	2.2	2.0	0.1	<0.1	2.2
R7	2.0	<0.1	0.1	2.2	2.0	<0.1	0.1	2.2
R8	2.0	<0.1	<0.1	2.2	2.0	<0.1	<0.1	2.2
Criterion	-	2.0		4.0	-	2.0		4.0

Note: B/G = Background, Inc = modelled increment from the Project, PS = modelled increment from Power Stations, Cumu = cumulative impact

Contour plots of the incremental (Project only) dust deposition rates predicted are presented as pollutant isopleth plots in **Appendix A**.

Incremental dust deposition rates under both the currently approved and proposed scenarios are predicted to be well below the criterion of 2 g/m²/month at all modelled receptors. With the addition of a background dust deposition rate which takes into account all existing operations in the area, the criterion is also easily achieved at all modelled receptors. Inclusion of the minor increment due to the Northern Coal Logistics Project (approximately 0.1 g/m²/month) results in negligible increases to the dust deposition rate and no changes to the predicted compliance of the Project.

The incremental contribution to the dust deposition rate in the local area is predicted to be small (<0.2 g/m²/month) in both scenarios assessed. Increasing production rate from 2 Mtpa to 3 Mtpa is shown through dispersion modelling to not result in any detrimental impacts upon surrounding receptors.

8.2 Particles (as TSP)

Model predictions of the annual average TSP concentration experienced at all receptors presented in **Table 3** during currently approved (2 Mtpa) and proposed (3 Mtpa) mining activities are presented in **Table 29**. The background TSP concentration of $29.5 \mu\text{g}/\text{m}^3$ has been included to determine the cumulative TSP concentration associated with all existing operations in the area and the predicted impact from power stations has also been included as described in **Section 7.2**.

Where impacts are predicted to be $<0.1 \mu\text{g}/\text{m}^3$, these are taken to be $0.1 \mu\text{g}/\text{m}^3$ when assessing the potential cumulative impacts.

Table 29 Predicted Annual Average TSP Concentration ($\mu\text{g}/\text{m}^3$)

Receptor	Currently Approved (2 Mtpa)				Proposed (3 Mtpa)			
	B/G	Inc	PS	Cumu	B/G	Inc	PS	Cumu
R1	29.5	0.6	<0.1	30.2	29.5	0.7	<0.1	30.3
R2	29.5	0.4	<0.1	30.0	29.5	0.5	<0.1	30.1
R3	29.5	1.1	<0.1	30.7	29.5	1.4	<0.1	31.0
R4	29.5	1.0	<0.1	30.6	29.5	1.1	<0.1	30.7
R5	29.5	1.3	0.1	30.9	29.5	1.6	0.1	31.1
R6	29.5	1.7	0.2	31.4	29.5	1.8	0.2	31.5
R7	29.5	0.8	0.5	30.7	29.5	0.9	0.5	30.9
R8	29.5	0.7	0.1	30.2	29.5	0.8	0.1	30.3
Criterion	-	-	-	90	-	-	-	90

Note: B/G = Background, Inc = modelled increment from the Project, PS = modelled increment from Power Stations, Cumu = cumulative impact

Contour plots of the incremental (Project only) TSP concentrations predicted are presented as pollutant isopleth plots in **Appendix A**.

Cumulative annual average TSP concentrations under both the currently approved and proposed scenarios are predicted to be well below the criterion of $90 \mu\text{g}/\text{m}^3$ at all modelled receptors even with the inclusion of a predicted annual average TSP concentration of $1 \mu\text{g}/\text{m}^3$ to account for the Northern Coal Logistics Project.

Increasing production rate from 2 Mtpa to 3 Mtpa is shown through dispersion modelling to not result in any detrimental impacts upon surrounding receptors.

8.3 Particles (as PM₁₀)

8.3.1 Annual Average

Model predictions of the annual average PM₁₀ concentration experienced at all receptors presented in **Table 3** during currently approved (2 Mtpa) and proposed (3 Mtpa) mining activities are presented in **Table 30**. The background PM₁₀ concentration of 14.7 µg/m³ has been included to determine the cumulative PM₁₀ concentration associated with all existing operations in the area and the predicted impact from power stations has also been included as described in **Section 7.2**.

Where impacts are predicted to be <0.1 µg/m³, these are taken to be 0.1 µg/m³ when assessing the potential cumulative impacts.

Table 30 Predicted Annual Average PM₁₀ Concentration (µg/m³)

Receptor	Currently Approved (2 Mtpa)				Proposed (3 Mtpa)			
	B/G	Inc	PS	Cumu	B/G	Inc	PS	Cumu
R1	14.7	0.2	<0.1	15.0	14.7	0.2	<0.1	15.0
R2	14.7	0.1	<0.1	14.9	14.7	0.1	<0.1	14.9
R3	14.7	0.4	<0.1	15.2	14.7	0.4	<0.1	15.2
R4	14.7	0.2	<0.1	15.0	14.7	0.2	<0.1	15.0
R5	14.7	0.3	0.1	15.1	14.7	0.3	0.1	15.1
R6	14.7	0.4	0.1	15.2	14.7	0.4	0.1	15.2
R7	14.7	0.2	0.3	15.2	14.7	0.2	0.3	15.2
R8	14.7	0.2	0.0	14.9	14.7	0.2	0.0	14.9
Criterion	-	-	-	30	-	-	-	30

Note: B/G = Background, Inc = modelled increment from the Project, PS = modelled increment from Power Stations, Cumu = cumulative impact

Contour plots of the incremental (Project only) annual average PM₁₀ concentrations predicted are presented as pollutant isopleth plots in **Appendix A**. Cumulative annual average PM₁₀ concentrations under both the currently approved and proposed scenarios are predicted to be well below the NSW EPA criterion of 30 µg/m³ and the WHO criterion of 20 µg/m³ at all modelled receptors even taking into account the negligible impact (<1 µg/m³) from the Northern Coal Logistics Project. Increasing production rate from 2 Mtpa to 3 Mtpa is shown through dispersion modelling to not result in any detrimental impacts upon surrounding receptors.

8.3.2 Maximum 24-hour Average

Model predictions of the maximum 24-hour average PM₁₀ concentration experienced at all receptors presented in **Table 3** during currently approved (2 Mtpa) and proposed (3 Mtpa) mining activities are presented in **Table 31** and **Table 32** respectively.

Please note that further description and clarification of the data presented in the results tables is included in **Appendix B**.

The background PM₁₀ concentration varies by day and therefore the tables include an assessment of the following:

- The maximum cumulative 24-hour average PM₁₀ concentration to enable assessment of compliance against the EPA criterion of 50 µg/m³; and
- The cumulative 24-hour average PM₁₀ concentration during the day when the maximum increment is experienced from the Project operation.

The background PM₁₀ data has been generated as discussed in detail in **Section 7**. This has been generated to include all existing operations in the area.

It is shown that the maximum cumulative concentrations under both Scenarios are dominated by background PM₁₀ concentrations. Maximum increments due to the Project are shown to be up to 19 µg/m³. With the inclusion of an additional approximately 1 µg/m³ resulting from the Northern Coal Logistics Project, the Project is not predicted to result in any exceedances of the 50 µg/m³ criterion, nor the proposed 40 µg/m³ criterion.

Where impacts are predicted to be <0.1 µg/m³, these are taken to be 0.1 µg/m³ when assessing the potential cumulative impacts.

Table 31 Predicted Maximum 24-hour Average PM₁₀ Concentration (µg/m³) – 2 Mtpa

Receptor	Assessment of Maximum Cumulative Impact					Assessment of Maximum Incremental Impact				
	Date	B/G	Inc.	PS	Maximum Cumu.	Date	B/G	Maximum Inc.	PS	Cumu.
R1	01-09-2010	28.6	3.0	1.5	33.2	24-06-2010	9.9	8.5	0.1	18.5
R2	23-02-2010	32.8	<0.1	0.3	33.2	24-06-2010	9.9	7.7	0.1	17.7
R3	23-02-2010	32.8	<0.1	0.3	33.2	23-11-2010	17.7	14.0	<0.1	31.8
R4	23-02-2010	32.8	1.7	0.3	34.8	10-08-2010	10.2	7.7	0.6	18.4
R5	23-02-2010	32.8	1.9	0.3	35.0	05-07-2010	13.3	18.8	<0.1	32.2
R6	23-02-2010	32.8	0.4	0.3	33.5	05-07-2010	13.3	8.8	<0.1	22.2
R7	23-02-2010	32.8	0.1	0.3	33.2	01-07-2010	15.7	6.5	0.5	22.7
R8	23-02-2010	32.8	<0.1	0.3	33.1	09-09-2010	16.7	7.5	0.1	24.3
Criterion					50.0					50.0

Note: B/G = Background, Inc = modelled increment from the Project, Cumu = cumulative impact

Table 32 Predicted Maximum 24-hour Average PM₁₀ Concentration (µg/m³) – 3 Mtpa

Receptor	Assessment of Maximum Cumulative Impact					Assessment of Maximum Incremental Impact				
	Date	B/G	Inc.	PS	Maximum Cumu.	Date	B/G	Maximum Inc.	PS	Cumu.
R1	01/09/2010	28.6	3.6	1.5	33.8	24/06/2010	9.9	8.7	0.1	18.8
R2	23/02/2010	32.8	<0.1	0.3	33.2	24/06/2010	9.9	8.7	0.1	18.7
R3	06/01/2010	25.2	8.3	0.1	33.6	21/11/2010	13.5	15.9	<0.1	29.5
R4	23/02/2010	32.8	1.9	0.3	35.0	10/08/2010	10.2	8.4	0.6	19.2
R5	23/02/2010	32.8	1.9	0.3	35.1	05/07/2010	13.3	20.0	<0.1	33.4
R6	23/02/2010	32.8	0.5	0.3	33.6	05/07/2010	13.3	9.9	<0.1	23.3
R7	23/02/2010	32.8	0.1	0.3	33.2	01/07/2010	15.7	7.2	0.5	23.3
R8	23/02/2010	32.8	<0.1	0.3	33.2	09/09/2010	16.7	7.8	0.1	24.6
Criterion					50.0					50.0

Note: B/G = Background, Inc = modelled increment from the Project, Cumu = cumulative impact

Increasing production rate from 2 Mtpa to 3 Mtpa is shown through dispersion modelling to not result in any detrimental impacts upon surrounding receptors. Maximum 24-hour PM₁₀ concentrations are dominated by activities at the emergency coal stockpile which have been modelled to occur on every day of the year to assess maximum potential impacts. Under some years, these operations may not occur, and the concentrations of PM₁₀ may be significantly lower than those modelled.

8.4 Particles (as PM_{2.5})

Annual Average

Model predictions of the annual average PM_{2.5} concentration experienced at all receptors presented in **Table 3** during currently approved (2 Mtpa) and proposed (3 Mtpa) mining activities are presented in **Table 33**. The background PM_{2.5} concentration of 4.6 µg/m³ has been included to determine the cumulative PM_{2.5} concentration associated with all existing operations in the area and the predicted impact from power stations has also been included as described in **Section 7.2**.

Where impacts are predicted to be <0.1 µg/m³, these are taken to be 0.1 µg/m³ when assessing the potential cumulative impacts.

Table 33 Predicted Annual Average PM_{2.5} Concentration (µg/m³)

Receptor	Currently Approved (2 Mtpa)				Proposed (3 Mtpa)			
	B/G	Inc	PS	Cumu	B/G	Inc	PS	Cumu
R1	4.6	0.1	<0.1	4.8	4.6	0.1	<0.1	4.8
R2	4.6	<0.1	<0.1	4.8	4.6	0.1	<0.1	4.8
R3	4.6	0.1	<0.1	4.8	4.6	0.1	<0.1	4.8
R4	4.6	0.1	<0.1	4.8	4.6	0.2	<0.1	4.9
R5	4.6	0.2	<0.1	4.9	4.6	0.2	<0.1	4.9
R6	4.6	0.3	<0.1	5.0	4.6	0.3	<0.1	5.0
R7	4.6	0.1	<0.1	4.8	4.6	0.1	<0.1	4.8
R8	4.6	0.1	<0.1	4.8	4.6	0.1	<0.1	4.8
Criterion	-	-	-	8	-	-	-	8

Note: B/G = Background, Inc = modelled increment from the Project, PS = modelled increment from Power Stations, Cumu = cumulative impact

Contour plots of the incremental (Project only) annual average PM_{2.5} concentrations predicted are presented as pollutant isopleth plots in **Appendix A**. Cumulative annual average PM_{2.5} concentrations under both the currently approved and proposed scenarios are predicted to be well below the advisory reporting standard of 8 µg/m³. Increasing production rate from 2 Mtpa to 3 Mtpa is shown through dispersion modelling to not result in any detrimental impacts upon surrounding receptors.

Maximum 24-hour Average

Model predictions of the maximum 24-hour average PM_{2.5} concentration experienced at all receptors presented in **Table 3** during currently approved (2 Mtpa) and proposed (3 Mtpa) mining activities are presented in **Table 34** and **Table 35** respectively.

Please note that further description and clarification of the data presented in the results tables is included in **Appendix B**.

The background PM_{2.5} concentration varies by day and therefore the tables include an assessment of the following:

- The maximum cumulative 24-hour average PM_{2.5} concentration to enable assessment of compliance against the advisory standard of 25 µg/m³; and
- The cumulative 24-hour average PM_{2.5} concentration during the day when the maximum increment is experienced from the Project operation.

The background PM_{2.5} data has been generated as discussed in detail in **Section 7**. This has been generated to include all existing operations in the area.

It is shown that the maximum cumulative concentrations under both Scenarios are dominated by background PM_{2.5} concentrations. Maximum increments due to the Project are shown to be up to 3 µg/m³. With the inclusion of an additional <1 µg/m³ resulting from the Northern Coal Logistics Project, concentrations of 24-hour maximum PM_{2.5} are not predicted to be in exceedance of the 25 µg/m³ advisory (and recommended to be adopted) standard at any receptor locations under any scenario assessed.

Where impacts are predicted to be <0.1 µg/m³, these are taken to be 0.1 µg/m³ when assessing the potential cumulative impacts.

Table 34 Predicted Maximum 24-hour Average PM_{2.5} Concentration (µg/m³) – 2 Mtpa

Receptor	Assessment of Maximum Cumulative Impact					Assessment of Maximum Incremental Impact				
	Date	B/G	Inc.	PS	Maximum Cumu.	Date	B/G	Maximum Inc.	PS	Cumu.
R1	27-03-2010	18.8	<0.1	0.1	19.0	29-05-2010	0.2	1.8	0.1	2.1
R2	27-03-2010	18.8	<0.1	0.1	19.0	24-06-2010	3.0	1.1	0.4	4.5
R3	27-03-2010	18.8	0.3	0.1	19.3	25-12-2010	4.8	2.6	<0.1	7.5
R4	27-03-2010	18.8	0.9	0.1	19.9	24-07-2010	5.1	1.8	0.1	7.0
R5	27-03-2010	18.8	0.9	0.2	19.9	05-07-2010	6.4	2.6	0.1	9.0
R6	27-03-2010	18.8	0.1	0.2	19.1	06-06-2010	2.4	2.2	<0.1	4.7
R7	27-03-2010	18.8	0.1	0.1	19.0	20-05-2010	4.7	1.4	0.1	6.2
R8	27-03-2010	18.8	0.1	0.1	19.0	31-05-2010	2.8	1.7	<0.1	4.6
Criterion					25.0					25.0

Note: B/G = Background, Inc = modelled increment from the Project, Cumu = cumulative impact

Table 35 Predicted Maximum 24-hour Average PM_{2.5} Concentration (µg/m³) – 3 Mtpa

Receptor	Assessment of Maximum Cumulative Impact					Assessment of Maximum Incremental Impact				
	Date	B/G	Inc.	PS	Maximum Cumu.	Date	B/G	Maximum Inc.	PS	Cumu.
R1	27-03-2010	18.8	<0.1	0.1	19.0	29-05-2010	0.2	1.8	0.1	2.1
R2	27-03-2010	18.8	<0.1	0.1	19.0	24-06-2010	3.0	1.3	0.4	4.6
R3	27-03-2010	18.8	0.4	0.1	19.3	25-12-2010	4.8	2.9	<0.1	7.8
R4	27-03-2010	18.8	1.0	0.1	19.9	24-07-2010	5.1	1.9	0.1	7.1
R5	27-03-2010	18.8	0.9	0.2	19.9	05-07-2010	6.4	2.8	0.1	9.2
R6	27-03-2010	18.8	0.1	0.2	19.1	06-06-2010	2.4	2.3	<0.1	4.8
R7	27-03-2010	18.8	0.1	0.1	19.0	20-05-2010	4.7	1.5	0.1	6.3
R8	27-03-2010	18.8	0.1	0.1	19.0	31-05-2010	2.8	1.7	<0.1	4.6
Criterion					25.0					25.0

Note: B/G = Background, Inc = modelled increment from the Project, Cumu = cumulative impact

Increasing production rate from 2 Mtpa to 3 Mtpa is shown through dispersion modelling to not result in any detrimental impacts upon surrounding receptors. Maximum 24-hour PM_{2.5} concentrations are dominated by activities at the emergency coal stockpile which have been modelled to occur on every day of the year to assess maximum potential impacts. Under some years, these operations may not occur, and the concentrations of PM_{2.5} may be significantly lower than those modelled.

8.5 Odour

Table 36 presents the 99th percentile 1-hour average odour concentrations predicted by the dispersion modelling at each of the nominated residences/properties using the odour emission rates listed in **Section 5.3**. It is noted that the background odour concentration is assumed to be zero.

Contour plots of the predicted odour concentrations are presented in **Appendix A**.

Table 36 99th percentile 1-hour Average Odour Concentrations

Receptor ID	Increment (OU)
R1	1.2
R2	0.6
R3	0.9
R4	1.4
R5	1.5
R6	1.9
R7	1.2
R8	1.1

Note: Project criterion – 2 OU

It is noted that the 99th percentile 1-hour average odour concentration are predicted to be below the Project criterion of 2 OU at all eight sensitive receptors.

8.6 Air Quality Monitoring

Air quality monitoring (1-in-6 day HVAS for PM₁₀ and TSP and dust deposition monitoring) will continue to be performed by Centennial Myuna Colliery to monitor air quality impacts due to the operation of the Myuna Colliery.

The data will be used to inform the efficacy of control measures as outlined in **Section 5.2.1**.

9 CONCLUSION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Centennial Myuna Pty Ltd (CMPL) to conduct an Air Quality Impact Assessment (AQIA) for the Myuna Colliery Modification Project (the Project) located within the Northern Coalfield of NSW approximately 90 kilometres (km) northeast of Sydney. Myuna Colliery's Surface Facilities Area is located in Wangi Wangi on the western side of Lake Macquarie, 25 km southwest of Newcastle.

CMPL currently operate under Project Approval (PA) 10_0080 which was granted in January 2012 and allows extraction of up to 2 million tonnes of ROM coal from the site per calendar year. CMPL wishes to modify this PA to allow extraction of up to 3 million tonnes of ROM coal per calendar year.

The assessment of the potential impacts on air quality resulting from Project operation has included an assessment of impacts during both currently approved and proposed mining activities, with emissions of particulate matter (or dust) and odour resulting from each scenario calculated to reflect the possible worst case operation of the Project (i.e. the operation of the emergency coal stockpile).

A dispersion modelling assessment has been performed in which the calculated and controlled emissions were used as input, as was meteorological data which has been shown to represent the area appropriately. In addition, an estimate of the existing air quality (i.e. that without the impact of the Project) was made using data collected in the immediate area and an inclusion of the potential impacts of power station operation has also been included.

An assessment of the impacts of the Northern Coal Logistics Project has also been performed to ensure that the operation of the Project is not limited by operations of this nearby operation.

The findings of the dispersion modelling assessment indicate that (under both the currently approved and proposed Project operation):

- All annual average particulate impacts (dust deposition, PM₁₀, PM_{2.5}, TSP) are in compliance with advisory reporting standards, NSW EPA and WHO criteria at all receptors assessed;
- All annual average criteria remain in compliance with advisory reporting standards, NSW EPA and WHO criteria when taking into account the Northern Coal Logistics Project;
- Maximum 24-hour PM_{2.5} concentrations are predicted to be below the advisory reporting standard at all receptors assessed, including an approximation of background (i.e. existing air quality); and
- Maximum 24-hour PM₁₀ concentrations are predicted to be below the NSW EPA criterion of 50 µg/m³ (and the potential criterion of 40 µg/m³) at all receptors including an approximation of background (i.e. existing air quality).
- Odour concentrations are predicted to be below the NSW EPA criterion of 2 OU at all receptors assessed.

Through this dispersion modelling exercise, it has been shown that the operation of the Project under both the 2 Mtpa and 3 Mtpa production rates will not cause any exceedances of the adopted criteria at any receptor assessed. Additionally, changes in the air quality resulting from the proposed production increase are predicted to be minimal with impacts dominated by operations at the emergency coal stockpiles, at which operations are not proposed to change.

10 REFERENCES

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Appendix A

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Contour Plots

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LEGEND

Dust (DFLX_g/m2/month)

0.01

0.02

0.1

0.2

Sensitive Receptors

Myuna Colliery Surface Facility



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Centennial Myuna Pty Ltd

Myuna Air Quality Impact Assessment

Dust
2Mt per annum

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LEGEND

Dust (DFLX_g/m2/month)

0.01

0.02

0.1

0.2

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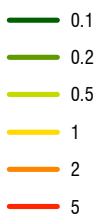
Dust
3Mt per annum

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LEGEND

TSP Annual Concentration ($\mu\text{g}/\text{m}^3$)



- Sensitive Receptors
- Myuna Colliery Surface Facility



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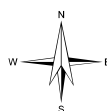
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**TSP (Annual)
2Mt per annum**

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LEGEND

TSP Annual Concentration ($\mu\text{g}/\text{m}^3$)

- 0.1
- 0.2
- 0.5
- 1
- 2
- 5

- Sensitive Receptors
- Myuna Colliery Surface Facility



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Myuna Air Quality Impact Assessment

**TSP (Annual)
3Mt per annum**

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LEGEND

PM 10 Annual Concentration ($\mu\text{g}/\text{m}^3$)

- 0.1
- 0.2
- 0.5
- 1
- 2

- Sensitive Receptors
- Myuna Colliery Surface Facility



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**PM10 (Annual)
2Mt per annum**

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LEGEND

PM 10 Annual Concentration ($\mu\text{g}/\text{m}^3$)

- 0.1
- 0.2
- 0.5
- 1
- 2

- Sensitive Receptors
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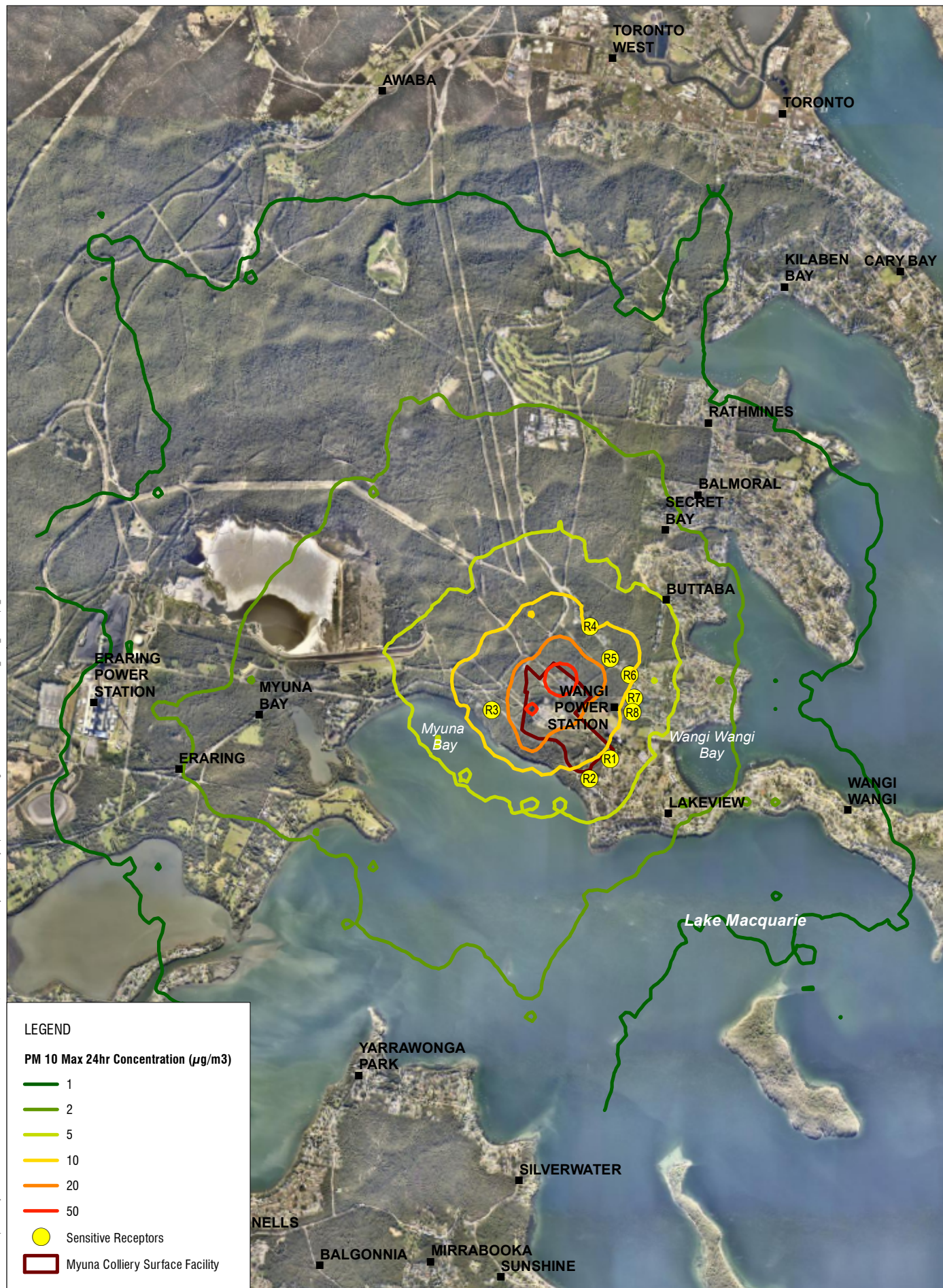


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**PM10 (Annual)
3Mt per annum**

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LEGEND

PM 10 Max 24hr Concentration ($\mu\text{g}/\text{m}^3$)

- 1
- 2
- 5
- 10
- 20
- 50

- Sensitive Receptors
- Myuna Colliery Surface Facility



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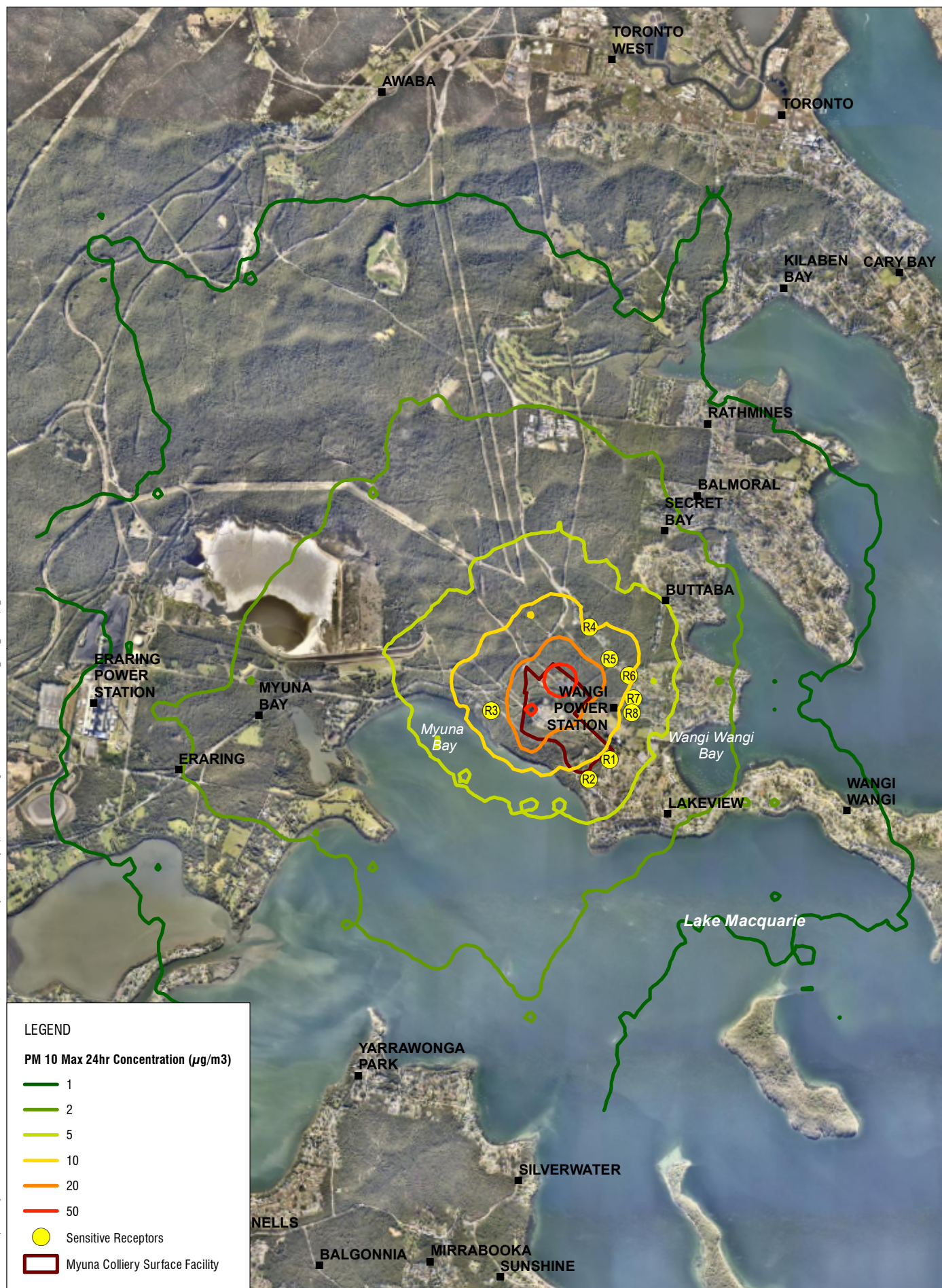


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**PM10 (Max 24hr)
2Mt per annum**

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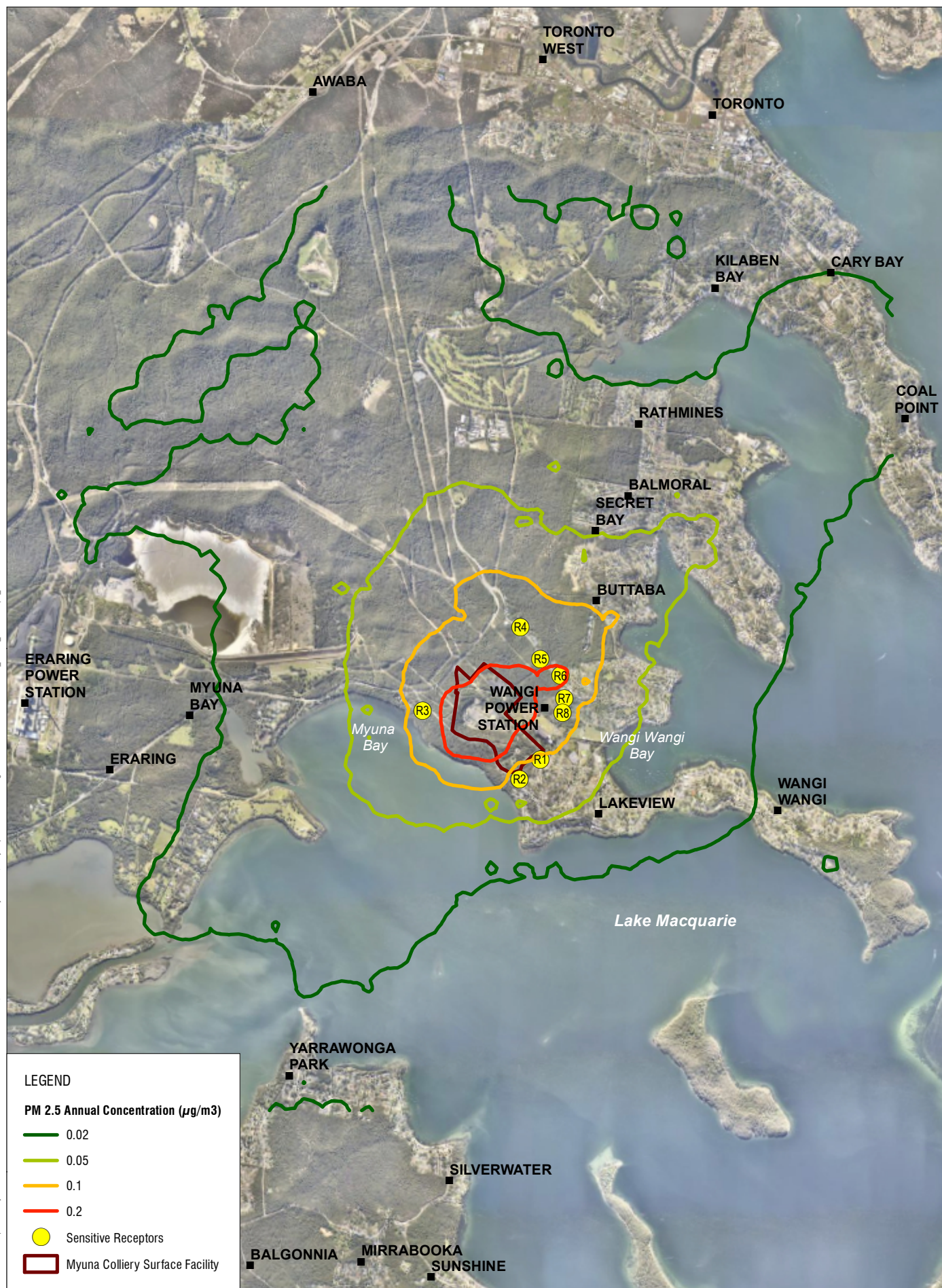


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**PM10 (Max 24hr)
3Mt per annum**

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LEGEND

PM 2.5 Annual Concentration ($\mu\text{g}/\text{m}^3$)

- 0.02
- 0.05
- 0.1
- 0.2

- Sensitive Receptors
- Myuna Colliery Surface Facility



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**PM2.5 (Annual)
2Mt per annum**



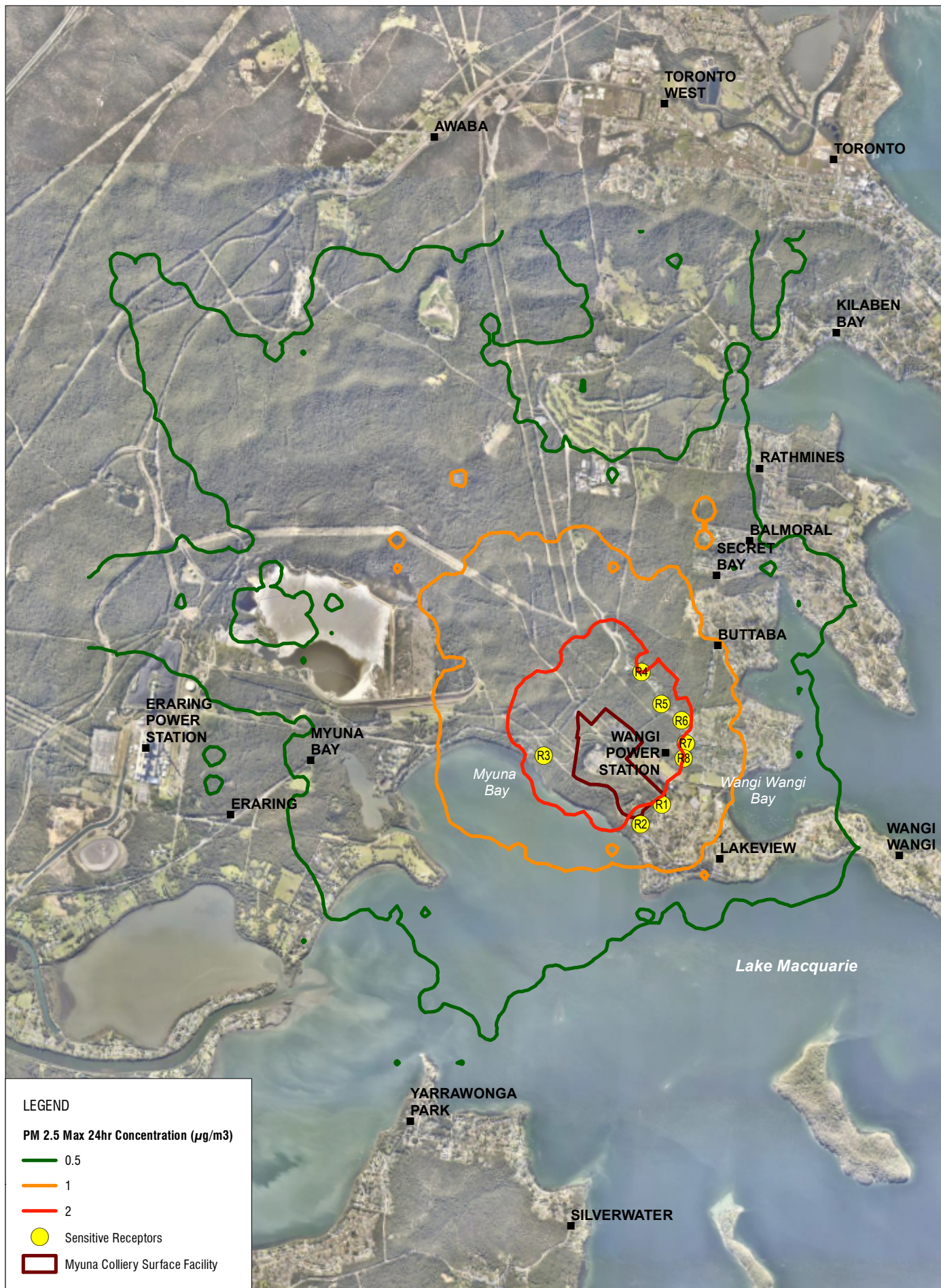
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LEGEND

PM 2.5 Max 24hr Concentration ($\mu\text{g}/\text{m}^3$)

0.5

1

2

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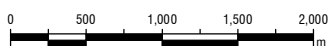
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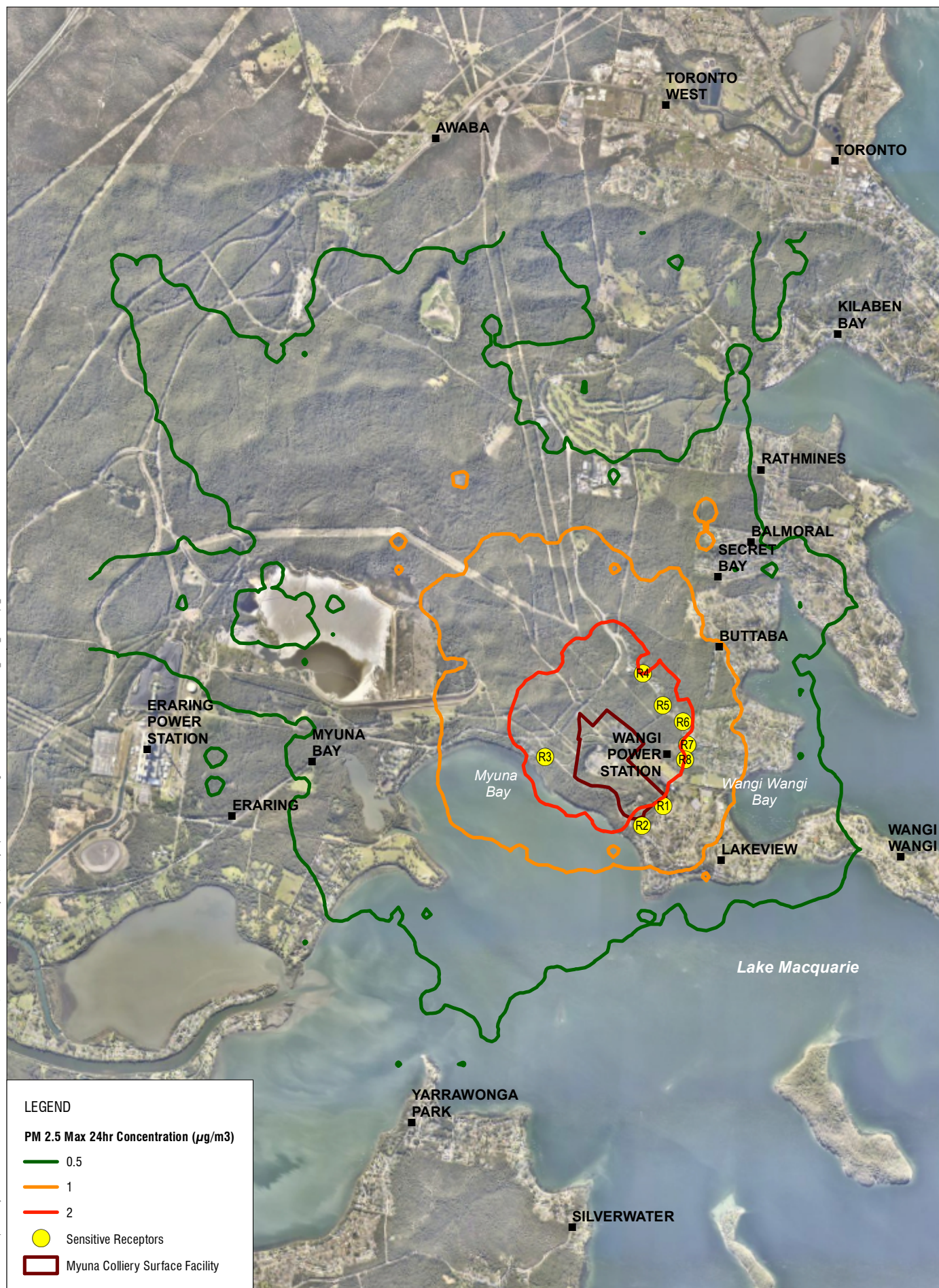


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Myuna Air Quality Impact Assessment

**PM2.5 (Max 24hr)
2Mt per annum**

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Description of Results Tables for Maximum 24-hr Particulate Impacts

Maximum Cumulative Impacts

This is an assessment of the day by day variation in background concentration PLUS the day by day variation in the contribution from the Project, added together. The maximum cumulative concentration is used to assess compliance with the relevant 24-hr criterion.

The date on which the maximum cumulative concentration occurs can very often be determined by the date on which the maximum background concentration occurs. In the case of PM₁₀, maximum 24-hour background concentrations occurred on 23 October 2010 (32.8 µg/m³). The increments from the Project on these days are added to determine the maximum cumulative impact.

Receptor	Assessment of Maximum Cumulative Impact				Assessment of Maximum Incremental Impact			
	Date	B/G	Inc.	Maximum Cumu.	Date	B/G	Maximum Inc.	Cumu.

The maximum cumulative impact from the Project PLUS the background concentration. Daily varying background concentration is added to the daily varying contribution from the Project. It can often be driven by large background concentrations

The contribution from the Project on the day of maximum cumulative impact

The background concentration on the day of maximum cumulative impact

The date on which the maximum cumulative impact (background PLUS Project) occurs

Maximum Incremental Impacts

This is an assessment of the maximum predicted impacts due to the Project. It is not an assessment of compliance but provides an indication of the likely maximum impacts due to the Project at each receptor. The corresponding background concentration on the day of maximum Project impact is extracted and reported.

The date on which the maximum incremental concentration occurs varies by receptor, or group of receptors.

Receptor	Assessment of Maximum Cumulative Impact				Assessment of Maximum Incremental Impact			
	Date	B/G	Inc.	Maximum Cumu.	Date	B/G	Maximum Inc.	Cumu.

The date on which the maximum incremental impact (Project impact) occurs

The background concentration on the day of maximum incremental (Project) impact

The maximum predicted contribution from the Project

The cumulative impact related to the maximum Project impact plus the background concentration on that day

Emissions Inventory

Scenario – 2 Mtpa – Maximum 24 hour Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units	Source	Comments
COAL																											
Misc Transfer Point 1 - UG conveyor to ROM bin		452	214	32	3,832,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.1	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 2 - ROM bin to Breaker		452	214	32	3,832,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.2	100% of ROM Coal (PRP, 2012)
Coal Breaking		2,300	1,035	192	3,832,500	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.3	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 3 - Breaker to Screening		452	214	32	3,832,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.4	100% of ROM Coal (PRP, 2012)
Coal Screening		4,216	1,418	96	3,832,500	tonnes/year	0.00110	0.00037	0.000025	kg/t											Controlled EF				%	Table 4 NPI Mining V3.5	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 4 - Coarse Reject Conveyor - Reject bin		0.4521	0.2138	0.0324	3,833	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.6	Assumed 0.1% of ROM Coal Rejected (PRP, 2012)
Misc Transfer Point 5 - Screening to Crusher		452	214	32	3,828,668	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.7	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Coal Crushing		2,297	1,034	191	3,828,668	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.8	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 6 - Crusher to Finished Product Bin		452	214	32	3,828,668	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.9	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 7 - Finished Product Bin to Eraring Overland Conveyor		452	214	32	3,828,668	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.10	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
EMERGENCY COAL STOCKPILE OPERATIONS																											
ROM Bin to Truck Loading		502	238	36	1,277,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													
ROM Hauling to Stockpile		0	0	0	7,665	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)						25	Silt content (%)		Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), occurs over a 2 day period
Truck unloading ROM Coal to Stockpile		251	119	18	1,277,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Moist material from spraying	50	50	50	%		Assumed to occur over a 2 day period
Front End Loader on Coal		30,553	4,394	581	1,277,500.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							No control available	50	50	50			Assumed to occur over a 2 day period
Loading Coal to Truck		30,553	4,394	581	1,277,500.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							No control available	50	50	50			Assumed to occur over a 4 day period
Return Stockpile Hauling		0	0	0	7,665.00	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)						25	Silt content (%)		Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), assumed to occur over a 4 day period
Truck unloading to Reclaim Bin		502	238	36	1,277,500.00	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													Assumed to occur over a 4 day period
WIND EROSION																											
Combined Dam 1 - 3		169	84	13	0.05	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Dam 4 at Stockpile		42	21	3	0.01	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Emergency Stockpile		9	5	1	0.48	ha	0.400	0.2000	0.03000	kg/ha/hr											Water sprays	50	50	50	%		Assumed only active for 4 days per year

Emissions Inventory

Scenario – 2 Mtpa – Maximum 24 hour Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units		
																										Source	Comments
VENTILATION FANS																											
Emissions from Ventilation Fans		34,627	5,771	5,771	8,760.00	hrs/yr	1,098	0.1830	0.18300	g/s																	
Total emissions (kg/yr)		108,732	20,032	7,712																							

Emissions Inventory

Scenario – 2 Mtpa – Annual Average Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units	Source	Comments
COAL																											
Misc Transfer Point 1 - UG conveyor to ROM bin		236	112	17	2,000,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.1	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 2 - ROM bin to Breaker		236	112	17	2,000,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.2	100% of ROM Coal (PRP, 2012)
Coal Breaking		1,200	540	100	2,000,000	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.3	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 3 - Breaker to Screening		236	112	17	2,000,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.4	100% of ROM Coal (PRP, 2012)
Coal Screening		2,200	740	50	2,000,000	tonnes/year	0.00110	0.00037	0.000025	kg/t											Controlled EF				%	Table 4 NPI Mining V3.5	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 4 - Coarse Reject Conveyor - Reject bin		0.2359	0.1116	0.0169	2,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.6	Assumed 0.1% of ROM Coal Rejected (PRP, 2012)
Misc Transfer Point 5 - Screening to Crusher		236	111	17	1,998,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.7	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Coal Crushing		1,199	539	100	1,998,000	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.8	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 6 - Crusher to Finished Product Bin		236	111	17	1,998,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.9	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 7 - Finished Product Bin to Eraring Overland Conveyor		236	111	17	1,998,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.10	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
EMERGENCY COAL STOCKPILE OPERATIONS																											
ROM Bin to Truck Loading		3	1	0	7,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													
ROM Hauling to Stockpile		0	0	0	42	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)							25	Silt content (%)	Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), occurs over a 2 day period
Truck unloading ROM Coal to Stockpile		1.4	0.7	0.1	7,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Moist material from	50	50	50	%		Assumed to occur over a 2 day period

Emissions Inventory

Scenario – 2 Mtpa – Annual Average Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units		
												in m/s									spraying						
Front End Loader on Coal		167	24	3	7,000.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							No control available	50	50	50			Assumed to occur over a 2 day period
Loading Coal to Truck		167	24	3	7,000.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							No control available	50	50	50			Assumed to occur over a 4 day period
Return Stockpile Hauling		0	0	0	42.00	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GVM (tonnes)							25	Silt content (%)	Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), assumed to occur over a 4 day period
Truck unloading to Reclaim Bin		2.8	1.3	0.2	7,000.00	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													Assumed to occur over a 4 day period
WIND EROSION																											
Combined Dam 1 - 3		169	84	13	0.05	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Dam 4 at Stockpile		42	21	3	0.01	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Emergency Stockpile		9	5	1	0.48	ha	0.400	0.2000	0.03000	kg/ha/hr											Water sprays	50	50	50	%		Assumed only active for 4 days per year
VENTILATION FANS																											
Emissions from Ventilation Fans		34,627	5,771	5,771	8,760.00	hrs/yr	1.098	0.1830	0.18300	g/s																	
Total emissions (kg/yr)		41,202	8,421	6,146																							

Emissions Inventory

Scenario – 3 Mtpa – Maximum 24 hour Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units	Source	Comments
COAL																											
Misc Transfer Point 1 - UG conveyor to ROM bin		646	305	46	5,475,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.1	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 2 - ROM bin to Breaker		646	305	46	5,475,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.2	100% of ROM Coal (PRP, 2012)
Coal Breaking		3,285	1,478	274	5,475,000	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.3	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 3 - Breaker to Screening		646	305	46	5,475,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.4	100% of ROM Coal (PRP, 2012)
Coal Screening		6,023	2,026	137	5,475,000	tonnes/year	0.00110	0.00037	0.000025	kg/t											Controlled EF				%	Table 4 NPI Mining V3.5	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 4 - Coarse Reject Conveyor - Reject bin		0.6	0.3	0.05	5,475	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.6	Assumed 0.1% of ROM Coal Rejected (PRP, 2012)
Misc Transfer Point 5 - Screening to Crusher		645	305	46	5,469,525	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.7	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Coal Crushing		3,282	1,477	273	5,469,525	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.8	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 6 - Crusher to Finished Product Bin		645	305	46	5,469,525	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.9	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 7 - Finished Product Bin to Eraring Overland Conveyor		645	305	46	5,469,525	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.10	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
EMERGENCY COAL STOCKPILE OPERATIONS																											
ROM Bin to Truck Loading		502	238	36	1,277,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													
ROM Hauling to Stockpile		0	0	0	7,665	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)							25	Silt content (%)	Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), occurs over a 2 day period
Truck unloading ROM Coal to Stockpile		251	119	18	1,277,500	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Moist material from	50	50	50	%		Assumed to occur over a 2 day period

Emissions Inventory

Scenario – 3 Mtpa – Maximum 24 hour Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units	Source	Comments
												in m/s									spraying						
Front End Loader on Coal		30,553	4,394	581	1,277,500.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							Moist material from spraying	50	50	50	%		Assumed to occur over a 2 day period
Loading Coal to Truck		30,553	4,394	581	1,277,500.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							Moist material from spraying	50	50	50	%		Assumed to occur over a 4 day period
Return Stockpile Hauling		0	0	0	7,665.00	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)							25	Silt content (%)	Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), assumed to occur over a 4 day period
Truck unloading to Reclaim Bin		502	238	36	1,277,500.00	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													Assumed to occur over a 4 day period
WIND EROSION																											
Combined Dam 1 - 3		169	84	13	0.05	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Dam 4 at Stockpile		42	21	3	0.01	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Emergency Stockpile		9	5	1	0.48	ha	0.400	0.2000	0.03000	kg/ha/hr											Water sprays	50	50	50	%		Assumed only active for 4 days per year
VENTILATION FANS																											
Emissions from Ventilation Fans		34,627	5,771	5,771	8,760.00	hrs/yr	1.098	0.1830	0.18300	g/s																	
Total emissions (kg/yr)		113,671	22,076	8,000																							

Emissions Inventory

Scenario – 3 Mtpa – Annual Average Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units	Source	Comments
COAL																											
Misc Transfer Point 1 - UG conveyor to ROM bin		354	167	25	3,000,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.1	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 2 - ROM bin to Breaker		354	167	25	3,000,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.2	100% of ROM Coal (PRP, 2012)
Coal Breaking		1,800	810	150	3,000,000	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.3	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 3 - Breaker to Screening		354	167	25	3,000,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.4	100% of ROM Coal (PRP, 2012)
Coal Screening		3,300	1,110	75	3,000,000	tonnes/year	0.00110	0.00037	0.000025	kg/t											Controlled EF				%	Table 4 NPI Mining V3.5	100% of ROM Coal (PRP, 2012)
Misc Transfer Point 4 - Coarse Reject Conveyor - Reject bin		0.4	0.2	0.03	3,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.6	Assumed 0.1% of ROM Coal Rejected (PRP, 2012)
Misc Transfer Point 5 - Screening to Crusher		354	167	25	2,997,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.7	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Coal Crushing		1,798	809	150	2,997,000	tonnes/year	0.00060	0.00027	0.00005	kg/t											Controlled EF				%	Table 4 NPI Mining V3.8	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 6 - Crusher to Finished Product Bin		354	167	25	2,997,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.9	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
Misc Transfer Point 7 - Finished Product Bin to Eraring Overland Conveyor		354	167	25	2,997,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Enclosed	70	70	70	%	Table 4 NPI Mining V3.10	Assumed 99.9% of ROM Coal is Product (PRP, 2012)
EMERGENCY COAL STOCKPILE OPERATIONS																											
ROM Bin to Truck Loading		3	1	0.2	7,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													
ROM Hauling to Stockpile		0	0	0	42	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)							25	Silt content (%)	Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), occurs over a 2 day period
Truck unloading ROM Coal to Stockpile		1	1	0.1	7,000	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %							Moist material from	50	50	50	%		Assumed to occur over a 2 day period

Emissions Inventory

Scenario – 3 Mtpa – Annual Average Emissions																											
ACTIVITY	Material	TSP emission (kg/y)	PM10 emission (kg/y)	PM2.5 emission (kg/y)	Intensity	Units	TSP Emission Factor	PM10 emission factor	PM2.5 emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Control Technology	TSP Control	PM10 Control	PM2.5 Control	Units		
												in m/s									spraying						
Front End Loader on Coal		167	24	3	7,000.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							No control available	50	50	50			Assumed to occur over a 2 day period
Loading Coal to Truck		167	24	3	7,000.00	tonnes/year	0.04783	0.00688	0.00091	kg/t			8	moisture content in %							No control available	50	50	50			Assumed to occur over a 4 day period
Return Stockpile Hauling		0	0	0	42.00	VKT/yr	36.428	12.915	1.29146	kg/VKT	75.00	Ave GMV (tonnes)							25	Silt content (%)	Sealed	100	100	100	%	PRP (2012)	25% silt assumed from PRP (2014), 100% control taken from Table 4 of NPI (sealed roads), assumed to occur over a 4 day period
Truck unloading to Reclaim Bin		3	1	0.2	7,000.00	tonnes/year	0.00039	0.00019	0.00003	kg/t	2.31	average of (wind speed/2.2)^1.3 in m/s	8	moisture content in %													Assumed to occur over a 4 day period
WIND EROSION																											
Combined Dam 1 - 3		169	84	13	0.05	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Dam 4 at Stockpile		42	21	3	0.01	ha	0.400	0.2000	0.03000	kg/ha/hr																	
Emergency Stockpile		9	5	1	0.48	ha	0.400	0.2000	0.03000	kg/ha/hr											Water sprays	50	50	50	%		Assumed only active for 4 days per year
VENTILATION FANS																											
Emissions from Ventilation Fans		34,627	5,771	5,771	8,760.00	hrs/yr	1.098	0.1830	0.18300	g/s																	
Total emissions (kg/yr)		44,209	9,666	6,321																							



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