APPENDIX 13

Air Quality Impact Assessment

Glendell Continued Operations Project

Mt Owen Pty Ltd

Air Quality Impact Assessment

Final | Revision 1

29 November 2019

Umwelt 4166

Glendell Continued Operations Project

Project No:	IA160700
Document Title:	Air Quality Impact Assessment
Document No.:	Final
Revision:	Revision 1
Date:	29 November 2019
Client Name:	Mt Owen Pty Ltd
Client No:	Umwelt 4166
Project Manager:	Shane Lakmaker
Author:	Shane Lakmaker
File Name:	IA160700_Jacobs_AQIA

Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Level 4, 12 Stewart Avenue
Newcastle West NSW 2302 Australia
PO Box 2147 Dangar NSW 2309 Australia
T +61 2 4979 2600
F +61 2 4979 2666
www.jacobs.com

Document history and status

Revision	Date	Description	By	Review	Approved
D1R0	9/08/19	Draft report	SL	-	-
D2R0	19/08/19	Draft report	SL	LS	PH
D3R0	18/09/19	Draft report	SL	Umw, MTO	PH
D4R0	19/09/19	Draft report	SL	Umw, MTO	PH
D5R0	11/10/19	Draft report	SL	Umw, MTO	PH
D6R0	22/11/19	Draft report following adequacy review	SL	Umw, MTO	PH
D7R2	27/11/19	Draft report	SL	Umw, MTO	PH
D8R0	29/11/19	Draft report	SL	Umw, MTO	PH
Final R1	29/11/19	Final report	SL	-	PH

Contents

List of tables

List of figures

Acronyms and definitions

Abbreviation	Definition
BAM	Beta attenuation monitor
BoM	Bureau of Meteorology
CALPUFF	Computer-based air dispersion model
CHPP	Coal handling and preparation plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPIE	Department of Planning, Industry and Environment
EPA	NSW Environment Protection Authority
H_2S	Hydrogen sulphide
HVAS	High volume air sampler
Jacobs	Jacobs Group (Australia) Pty. Limited
Mtpa	Million tonnes per annum
NEPM	National Environment Protection Measure
NEPC	National Environmental Protection Council of Australia
NO	Molecular formula for nitric oxide
NO_2	Molecular formula for nitrogen dioxide
NO_x	Molecular formula for oxides of nitrogen, (NO and NO_2)
NPI	National Pollutant Inventory
OEH	Office of Environment and Heritage, now part of the Department of Planning, Industry and Environment
$PM_{2.5}$	Particulate matter with equivalent aerodynamic diameters less than 2.5 microns
PM_{10}	Particulate matter with equivalent aerodynamic diameters less than 10 microns
ROM	Run-of-mine
SEARs	Secretary’s Environmental Assessment Requirements
SO_2	Sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance
TAPM	The Air Pollution Model – a meteorological and air dispersion model developed by CSIRO
TSP	Total Suspended Particulate matter
VLAMP	NSW Voluntary Land Acquisition and Mitigation Policy

Executive Summary

This report provides an assessment of the potential air quality impacts of the Glendell Continued Operations Project (the Project), a proposal for the continuation of mining at Glendell Mine into a new mining area to the immediate north of the existing operations. The purpose of this air quality impact assessment is to form part of an Environmental Impact Statement being prepared by Umwelt to accompany an application for development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project. The assessment has been undertaken in accordance with the *Secretary's Environmental Assessment Requirements* (SEARs) and the EPA's "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA 2016). This assessment has also been peer reviewed by ERM.

The potential air quality issues for the Project were identified as:

- Dust from the general mining activities;
- Fume from blasting; and
- Emissions of substances from machinery exhausts.

A detailed review of the existing environment was carried out. The following conclusions were made in relation to the existing air quality and meteorological conditions:

- Wind patterns in the vicinity of Glendell Mine are similar to other parts of the Hunter Valley, with the prevailing winds being from either the northwest or southeast.
- There are seasonal variations in particulate matter concentrations, with PM_{10} levels generally higher in spring and $PM_{2.5}$ levels generally higher in winter.
- There are daily variations in particulate matter concentrations, with levels typically highest in the morning and evening.
- In 2018 particle levels increased across the State due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH 2019).
- In terms of PM_{10} concentrations, most monitoring sites in the vicinity of Glendell Mine have experienced at least one day above the EPA's 24-hour criterion in the past seven years. The averages exceeded the EPA 24-hour criterion in 2017 and 2018 in some locations. These results were heavily influenced by the drought conditions occurring during this period.
- Measured TSP and NO_2 concentrations are below their relevant EPA criteria.
- Deposited dust levels have exceeded EPA criteria at two of the 13 monitoring locations, but not in 2017 or 2018.
- The two closest $PM_{2.5}$ monitoring stations, Camberwell and Singleton, have measured $PM_{2.5}$ concentrations which are close to or have exceeded the EPA criteria. A study by the OEH (2013b) found that wood smoke from domestic heating was one of the main factors that influenced $PM_{2.5}$ concentrations, especially in winter.
- Conditions in 2014 were representative of the longer-term air quality and meteorological conditions.

The computer-based dispersion model known as CALPUFF was used to predict the potential air quality impacts of the Project, including cumulative impacts. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used dust emission estimates to predict the off-site air quality impacts. The performance of the model was reviewed by comparing predictions to measured results for a representative year. It was found that, with the adopted approach for modelling and assessment, the model predictions for average concentrations were typically within 20 per cent of measured results. This result is well within the factor-of-two accuracy that has been recognised for these types of models (DEFRA, 2010).

The outcomes of the assessment in terms of compliance against assessment criteria can be summarised by the table below.

Summary of compliance outcomes

Air quality indicator	Averaging time	Criterion (note, application may differ under EPA and VLAMP assessments, see Section 4)	Summary of outcomes for private sensitive receptors not subject to acquisition rights
Particulate matter (PM_{10})	24-hour	50 µg/m^3	- Compliance with VLAMP - Potential for one or more days above EPA criteria at most locations (detailed in Appendix G). The frequency of days above EPA criteria has been quantified.
	Annual	25 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
	Annual	8 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
Particulate matter (TSP)	Annual	90 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
Deposited dust	Annual (maximum increase)	2 g/m^2/month	- Compliance with VLAMP - Compliance with EPA criteria
	Annual (maximum total)	4 g/m^2/month	- Compliance with VLAMP - Compliance with EPA criteria
Nitrogen dioxide (NO_2)	1-hour	246 µg/m^3	- Compliance with EPA criteria
	Annual	62 µg/m^3	- Compliance with EPA criteria
Odour	Nose-response	-	- Odour impacts can be managed with appropriate blasting procedures

The main conclusions of the assessment were also described as follows:

- There is potential for the combined contribution of the Project, other existing and approved mines, and background levels to influence compliance outcomes for 24-hour average PM_{10}. While this conclusion was based on a conservative approach to the assessment which assumes that, with the exception of the Mount Owen Complex, all existing, approved or expected to be approved mines will be concurrently operating at approved maximum limits, it is anticipated that PM_{10} concentrations will continue to be variable from day-to-day, due to existing conditions and sources as well as extreme events. Operations will need to continue to be managed in a way which minimises the contribution to off-site PM_{10} levels.
- There are no private sensitive locations not subject to acquisition rights which are predicted to experience exceedances of the annual average PM_{10}, maximum 24-hour average $PM_{2.5}$, annual average $PM_{2.5}$, annual average TSP or annual average dust deposition criteria at any stage of the Project.
- Post blast fume emissions are not expected to result in any adverse air quality impacts (as NO_2 or odour), based on model predictions which show compliance with air quality criteria and with consideration of blast management practices that are currently employed at the Mount Owen Complex.
- Emissions from diesel exhausts associated with off-road vehicles and equipment are not expected to result in any adverse air quality impacts.
- Construction impacts will be lower than those associated with operations however appropriate dust management will need to be implemented to make sure that impacts are minimised. Monitoring would continue to be carried out during the construction phase to assess compliance with EPA criteria.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to quantify the potential air quality impacts of the Glendell Continued Operations Project in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, Jacobs's Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

Jacobs Group (Australia) Pty Ltd (Jacobs) has been engaged by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Glendell Tenements Pty Ltd (the Proponent), a subsidiary of Glencore Coal Pty Limited (Glencore) to complete an air quality impact assessment for the Glendell Continued Operations Project (the Project). The Project involves the continuation of mining at Glendell Mine into a new mining area to the immediate north of the existing operations. The purpose of the assessment is to form part of an Environmental Impact Statement (EIS) being prepared by Umwelt to accompany an application for development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project. The Project will also require a modification of development consent SSD-5850 covering the Mount Owen operations (Mount Owen Consent) to facilitate the extension of the life of the coal processing facilities at the Mount Owen Complex. The Project does not affect mining operations approved under the Mount Owen Consent. **Figure 1** shows the regional location of Glendell Mine and the Mount Owen Complex.

The air quality impact assessment has been carried out in accordance with relevant guidelines published by the Environment Protection Authority (EPA), namely, the “Approved Methods for the Modelling and Assessment of Air Pollutants in NSW” (EPA 2016). This involved examining the Project and using a computer-based dispersion model to predict any potential impacts to air quality.

The main objectives of this assessment were to:

- Identify potential air quality issues;
- Quantify existing and potential air quality impacts; and
- Identify suitable air quality management measures, as appropriate, to minimise impacts.

The Secretary’s Environmental Assessment Requirements (SEARs) for the Project were issued by the Department of Planning, Industry and Environment (DPIE). The SEARs identify the specific requirements to be addressed by the EIS for the Project. This assessment has been prepared in accordance with the SEARs, as well as relevant governmental assessment requirements, guidelines and policies. **Table 1** lists the matters relevant to this assessment and where they are addressed in this report.

Table 1 Relevant matters raised in SEARs

Requirement	Section addressed
Air quality – including: - a detailed assessment of potential construction and operational air quality impacts, in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, and with a particular focus on dust emissions including $PM_{2.5}$ and PM_{10}, and having regard to the *Voluntary Land Acquisition and Mitigation Policy*; and - an assessment of the likely greenhouse gas emissions of the development	This report, in particular: - **Section 3** (identification of issues) - **Section 6** (estimated emissions) - **Section 9** and **10** (assessment of impacts) - **Section 12** (mitigation, monitoring and management) Greenhouse gas emissions have been assessed in a separate study for the EIS (Umwelt 2019).

The assessment was based on the use of an air dispersion model, CALPUFF, to predict concentrations of substances emitted to air due to the proposed mining activities. Model predictions have been compared with air quality criteria referred to by the EPA in order to assess the effect that the Project may have on the existing air quality environment.

In summary, the report provides information on the following:

- Proposed mining activities (**Section 2**);
- Potential air quality issues (**Section 3**);
- Relevant air quality criteria (**Section 4**);
- Existing meteorological and air quality conditions (**Section 5**);

- Emissions to air from proposed mining activities (**Section 6**);
- Methods used to predict air quality impacts (**Section 7**);
- Expected air quality impacts, as determined by a comparison of model results with air quality assessment criteria (**Section 9**); and
- Management measures to be implemented, and monitoring of potential impacts (**Section 12**).

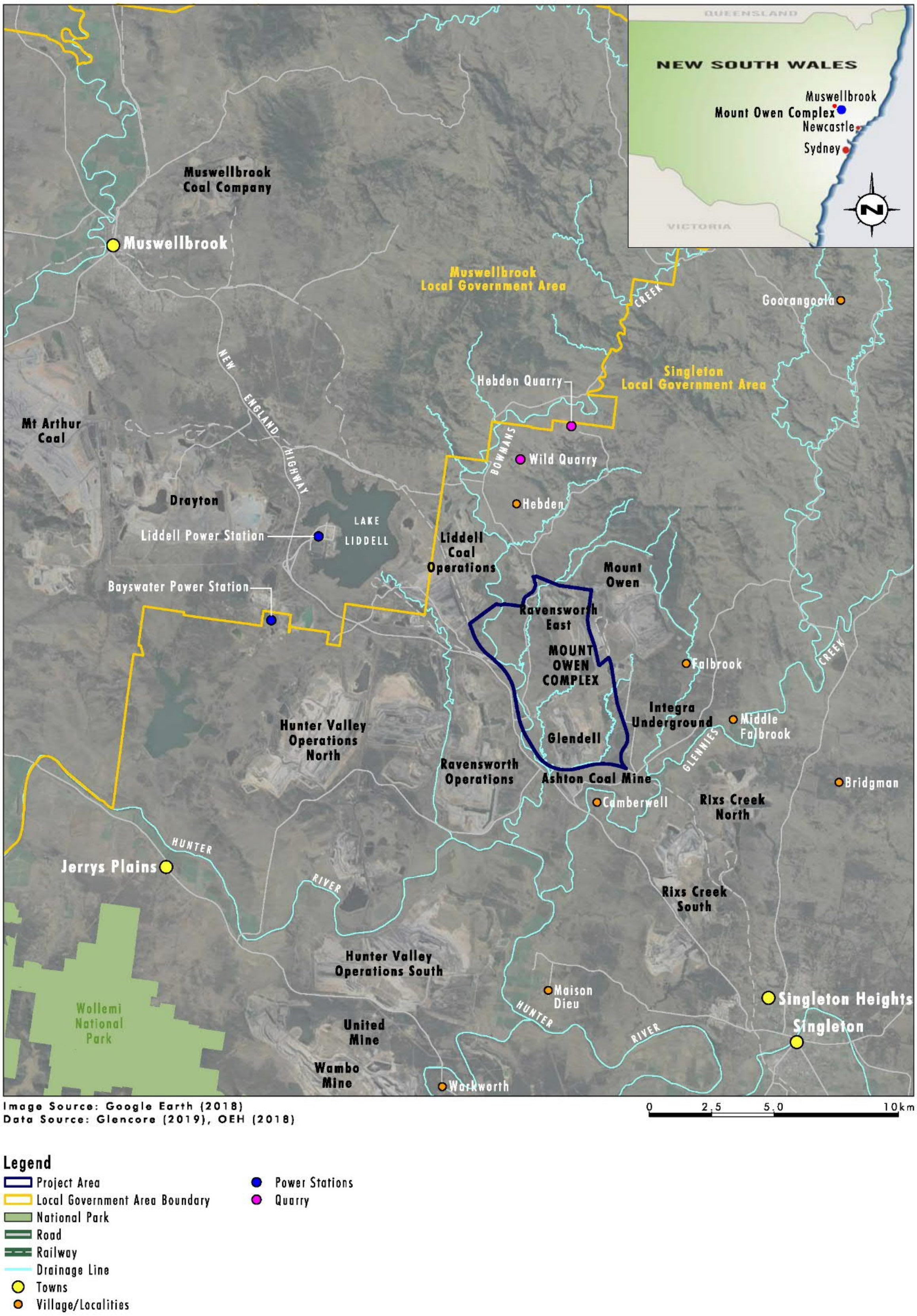


Figure 1 Regional locality plan

2. Project Description

The Glendell Mine forms part of the Mount Owen Complex located in the Hunter Coalfields in the Upper Hunter Valley of New South Wales (NSW), approximately 20 km northwest of Singleton in the Singleton Local Government Area (LGA). The Mount Owen Complex and is owned and operated by subsidiaries of Glencore Coal Pty Limited (Glencore) and also includes Mount Owen Mine, Ravensworth East Mine, a coal handling and preparation plant (CHPP) and coal transport infrastructure.

The Project is an extension of open cut mining operations immediately to the north of the existing Glendell Mine (refer to **Figure 2**). The Project would extend the life of the Glendell Mine to approximately 2044 and allow for the recovery of approximately 135 million tonnes (Mt) of run-of-mine (ROM) coal and provide ongoing employment opportunities for existing Glendell workforce.

The key features of the Project include:

- extension of open cut mining to the north of the existing Glendell Mine until 2044;
- extraction of approximately 135 million tonnes of run-off-mine (ROM) coal;
- continued integration of the mine with the wider Mount Owen Complex, including the use of the Mount Owen CHPP, rail loop and associated infrastructure for ROM coal processing and product coal transport to 2045;
- demolition of the existing Glendell Mine Infrastructure Area (MIA) and the construction of a new MIA;
- realignment of a section of Hebden Road;
- realignment of a section of Yorks Creek;
- relocation of Ravensworth Homestead;
- other ancillary infrastructure works such as the construction of a Heavy Vehicle Access Road; and
- progressive rehabilitation of the site.

Figure 2 illustrates the key features of the Project and **Figure 3** shows the location of nearest sensitive receptors.

This assessment supports both an application for a new development consent for the Project as well as the modification of the Mount Owen Consent.

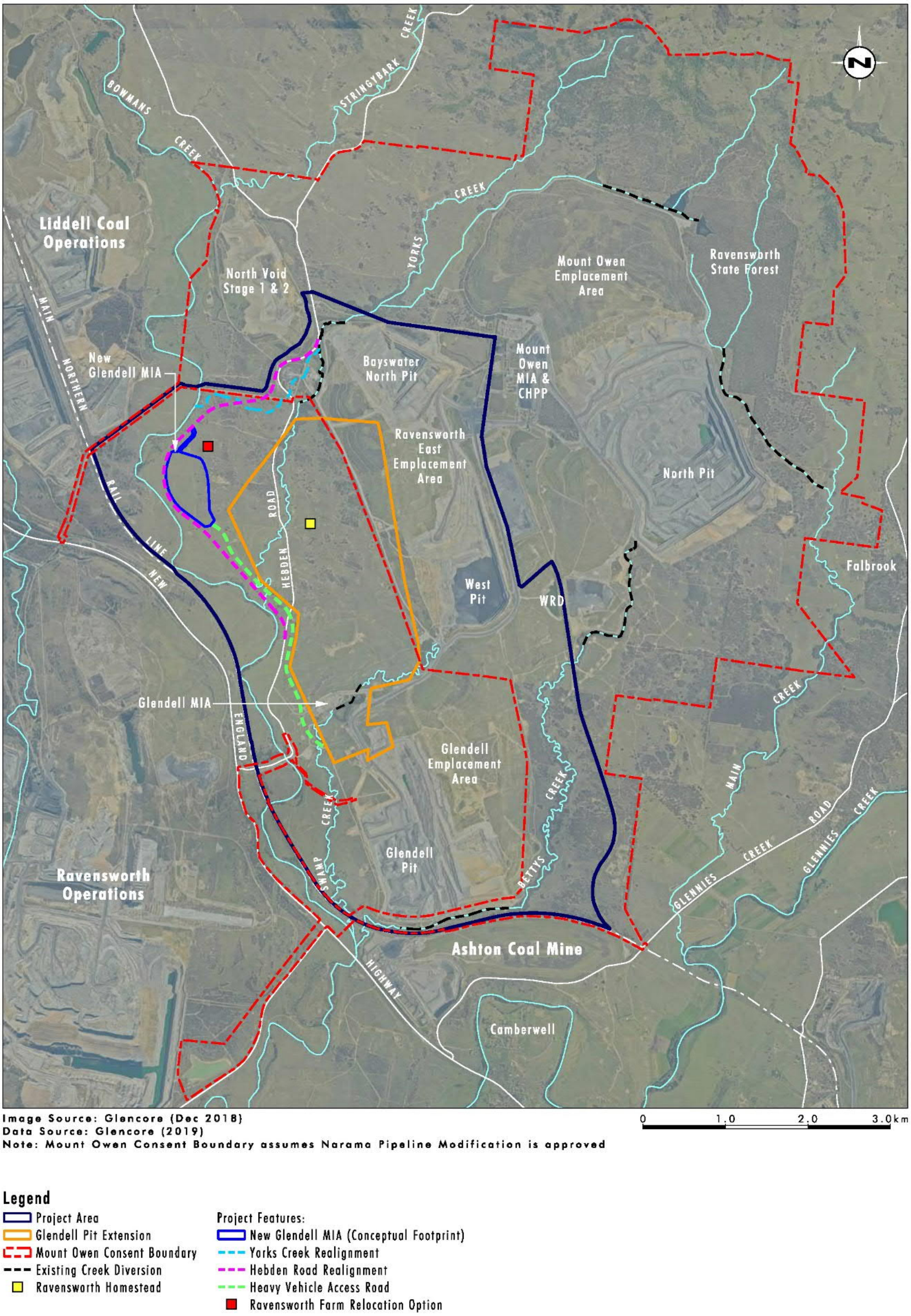


Figure 2 Glendell Continued Operations Project Key Features

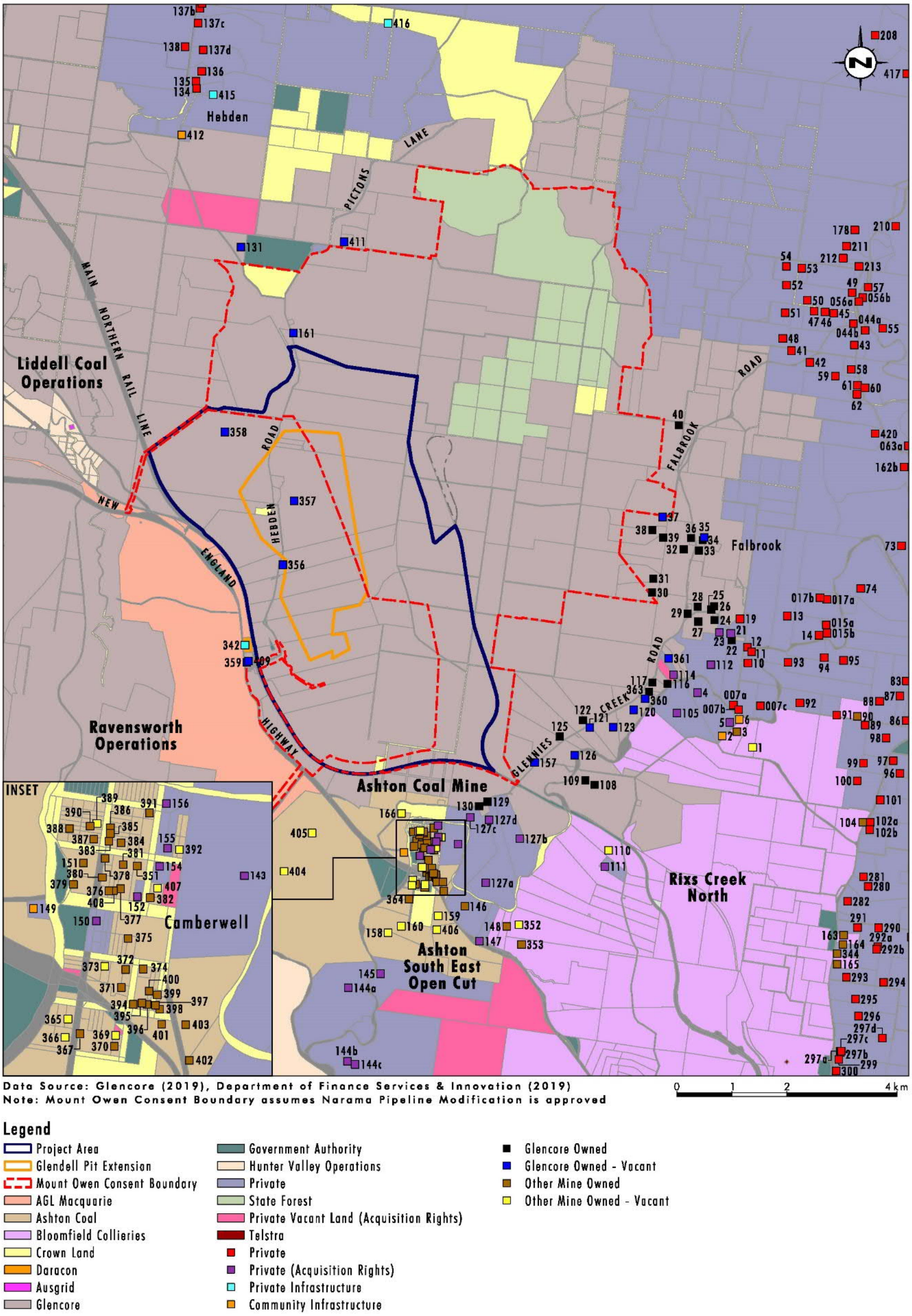


Figure 3 Location of nearest sensitive receptors and identification labels

3. Air Quality Issues

Air quality issues can arise when emissions from an industry or activity lead to deterioration in the ambient air quality. Potential air quality issues have been identified from a review of the Project and associated activities. This identification process has considered the types of emissions to air and proximity of these emission sources to sensitive receptors.

Emissions to air from the Project could occur from a variety of activities including material handling, material transport, processing, wind erosion, blasting and potentially, from the spontaneous combustion of coal. These emissions would mainly comprise of particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}) and particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). There would also be relatively minor emissions from machinery exhausts such as carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter, and to a lesser extent sulphur dioxide (SO_2), hydrogen sulphide (H_2S) and potentially odour and other substances from the spontaneous combustion of coal. However, spontaneous combustion of coal has historically not been an issue at Glendell Mine and is not anticipated to be an issue for the Project as the same coal seams are proposed to be mined.

The area around Glendell Mine also contains various emission sources that will contribute to local air quality, including mining. Cumulative impacts is an important issue to address, particularly in Camberwell, given that this area has historically been the focus of studies to further understand the factors that contribute to cumulative impacts (see for example, Department of Planning 2010).

In summary, the potential air quality issues associated with the existing and proposed mining activities have been identified as:

- Dust (that is, particulate matter in the form of TSP, deposited dust, PM_{10} or $PM_{2.5}$) from the general mining activities;
- Fume (that is, NO_x emissions) from blasting; and
- Emissions of substances from machinery exhausts, that is, diesel exhaust emissions such as NO_x, PM_{10} and $PM_{2.5}$.

The issues identified above are the focus of this assessment.

4. Air Quality Criteria

Typically, air quality is quantified by the concentrations of air pollutants in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the air pollutants most relevant to the Project are particulate matter due to emissions from blasting, excavation works and material handling, transport and processing activities (see **Section 3**).

There are various classifications of particulate matter and the EPA has developed assessment criteria for:

- TSP, to protect against nuisance amenity impacts;
- PM_{10}, to protect against health impacts;
- $PM_{2.5}$, to protect against health impacts; and
- Deposited dust, to protect against nuisance amenity impacts.

Most of the EPA criteria are drawn from national standards for air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPM). To measure compliance with ambient air quality criteria, the NSW Government has established a network of monitoring stations across the State and up-to-date records are published on the DPIE air quality monitoring network website.

Air quality impacts from the Project have been assessed against the air quality criteria set by the EPA as part of its “Approved Methods for the Modelling and Assessment of Air Pollutants in NSW” (EPA 2016). These criteria are outlined in **Table 2** and apply to existing and potentially sensitive receptors, where the “Approved Methods” defines a sensitive receptor as *“a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area”*. This has also been interpreted as places of near continuous occupation.

The impact assessment criteria from the development consent for Glendell Mine (DA 80/952) (Glendell Consent) as Mount Owen Consent are also included in **Table 2** for comparison. The criteria from the Glendell Consent are based on an earlier version of the “Approved Methods” (see DEC 2005) applicable at the time of approval, and the 2016 version of the Approved Methods introduced a revised, more stringent criterion for PM_{10} as well as new criteria for 24-hour and annual average $PM_{2.5}$.

Table 2 EPA air quality assessment criteria

Substance	Averaging time	Criterion	[d] Impact assessment criteria from Glendell Consent (DA 80/952)	[d] Impact assessment criteria from Mount Owen Consent (SSD-5850)
Particulate matter (PM_{10})	24-hour	[a] 50 µg/m³	[b] 50 µg/m³	[b] 50 µg/m³
	Annual	[a] 25 µg/m³	[a] 30 µg/m³	[a] 30 µg/m³
Particulate matter ($PM_{2.5}$)	24-hour	[a] 25 µg/m³	Nil	Nil
	Annual	[a] 8 µg/m³	Nil	Nil
Particulate matter (TSP)	Annual	[a] 90 µg/m³	[a] 90 µg/m³	[a] 90 µg/m³
[c] Deposited dust	Annual (maximum increase)	[a] 2 g/m²/month	[b] 2 g/m²/month	[b] 2 g/m²/month
	Annual (maximum total)	[a] 4 g/m²/month	[a] 4 g/m²/month	[a] 4 g/m²/month
Nitrogen dioxide (NO_2)	1-hour	[a] 246 µg/m³	Nil	Nil
	Annual	[a] 62 µg/m³	Nil	Nil

[a] *Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).*
[b] *Incremental impact (i.e. incremental increase in concentrations due to the development on its own).*

[c] *Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.*
[d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Secretary.*

The EPA air quality assessment criteria relate to the total concentration of air pollutant in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. Further discussion of background levels in the model domain is provided in **Section 5**.

In situations where background levels are elevated the proponent must "*demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical*" (EPA 2016). In the Glendell Consent the determination of impact, for the purposes of land acquisition, was based on either incremental or total concentrations, depending on the substance and averaging time and as can be seen in the footnotes of **Table 2**.

In December 2015 the Australian Government announced a National Clean Air Agreement (Agreement). This Agreement aims to reduce air pollution and improve air quality via the following main actions:

- The introduction of emission standards for new non-road spark ignition engines and equipment.
- Measures to reduce air pollution from wood heaters.
- Strengthened ambient air quality reporting standards for particle pollution.

The strengthening of ambient air quality reporting standards for particle pollution is relevant to the Project. Specifically, and at the time, the following was agreed:

> *"Taking into account the latest scientific evidence of health impacts, Ministers agreed to strengthen national ambient air quality reporting standards for airborne fine particles. Ministers agreed to adopt reporting standards for annual average and 24-hour $PM_{2.5}$ particles of 8 µg/m^3 and 25 µg/m^3 respectively, aiming to move to 7 µg/m^3 and 20 µg/m^3 respectively by 2025. Ministers also agreed to establish an annual average standard for PM_{10} particles of 25 µg/m^3. Victoria and the Australian Capital Territory will set, and South Australia will consider setting, a more stringent annual average PM_{10} standard of 20 µg/m^3 in the state, while ensuring nationally consistent monitoring and reporting against the agreed National Environment Protection Measure standards. The decision was also taken to review PM_{10} standards in 2018. The review will be co-led by the NSW and Victorian governments, in discussion with other jurisdictions."*

On 25 February 2016, an amendment to the NEPM entered into force and introduced the new national air quality standards for PM_{10} and $PM_{2.5}$, as noted above. The EPA subsequently revised its PM_{10} and $PM_{2.5}$ assessment criteria as part of an update to the "Approved Methods for the Modelling and Assessment of Air Pollutants NSW" (EPA 2016). These revised criteria are reflected in **Table 2** and took effect from January 2017 onwards. There is currently no State legislation regarding the aim to move to more stringent $PM_{2.5}$ criteria by 2025. Accordingly, the Project is assessed against the current criteria detailed in the Approved Methods (2016) as these criteria would be applied by the consent authority in accordance with the provisions of Clause 12AB of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) (2018 amendment).

The NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) (2018) includes the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments. VLAMP (2018) brings the air quality criteria in line with the NEPM standards and EPA criteria.

From this Policy, voluntary mitigation rights may apply where, even with best practice management, the development contributes to exceedances of the criteria in **Table 3** at any residence or workplace.

Table 3 VLAMP mitigation criteria for particulate matter

Substance	Averaging time	Mitigation criterion	Impact type
Particulate matter ($PM_{2.5}$)	Annual	8 µg/m^3*	Human health
	24-hour	25 µg/m^3**	Human health
Particulate matter (PM_{10})	Annual	25 µg/m^3*	Human health
	24-hour	50 µg/m^3**	Human health
Particulate matter (TSP)	Annual	90 µg/m^3*	Amenity
Deposited dust	Annual	2 g/m^2/month**	Amenity
	Annual	4 g/m^2/month*	Amenity

** Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).*

*** Incremental impact (i.e. increase in concentrations due to the development alone), with zero allowable exceedances of the criteria over the life of the development.*

Voluntary acquisition rights may apply where, even with best practice management, the development contributes to exceedances of the criteria in **Table 4** at any residence or workplace on privately owned land, or on more than 25% of any privately-owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

Table 4 VLAMP acquisition criteria for particulate matter

Substance	Averaging time	Acquisition criterion	Impact type
Particulate matter ($PM_{2.5}$)	Annual	8 µg/m^3*	Human health
	24-hour	25 µg/m^3**	Human health
Particulate matter (PM_{10})	Annual	25 µg/m^3*	Human health
	24-hour	50 µg/m^3**	Human health
Particulate matter (TSP)	Annual	90 µg/m^3*	Amenity
Deposited dust	Annual	2 g/m^2/month**	Amenity
	Annual	4 g/m^2/month*	Amenity

** Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).*

*** Incremental impact (i.e. increase in concentrations due to the development alone), with up to 5 allowable exceedances of the criteria over the life of the development.*

The particulate matter levels for comparison with the criteria in **Table 3** and **Table 4** must be calculated in accordance with the EPA's "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA 2016).

5. Existing Environment

This section provides a description of the environmental characteristics in the area, including a review of the local meteorological and ambient air quality conditions. The review considers data collected from the meteorological and air quality monitoring networks, the locations of which are shown in **Figure 4**. These locations were amended in the currently approved Mount Owen Complex Air Quality Management Plan however the data reviewed are based on the locations shown on **Figure 4**. One of the objectives for reviewing these data was to develop an understanding of existing air quality issues as well as the meteorological conditions which typically influence the local air quality conditions.

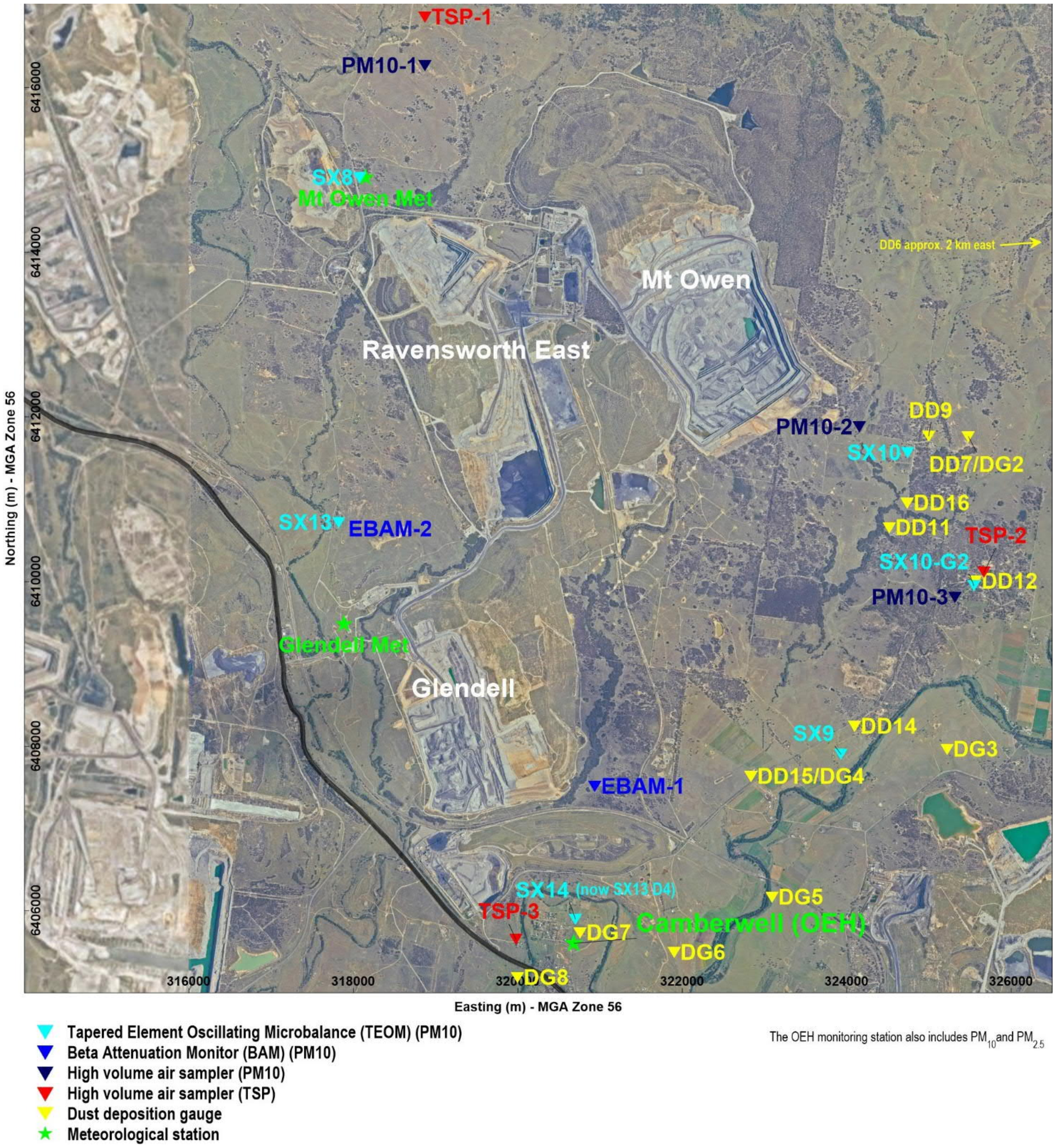


Figure 4 Location of air quality and meteorological monitoring sites

5.1 Meteorological Conditions

Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature, and atmospheric stability. For air quality assessments, a minimum one year of hourly data is usually required, which means that almost all possible meteorological conditions, including seasonal variations, are considered in the model simulations.

Three meteorological stations have been identified in a 20 km by 20 km domain around the Mount Owen Complex. These stations, shown in **Figure 4**, are referred to as:

- Glendell Met , operated by Mount Owen
- Mt Owen Met, operated by the Mount Owen
- Camberwell (OEH), operated by the DPIE

Meteorological data from seven recent years (2012 to 2018) have been analysed in order to identify a representative year for the modelling. Hourly records of wind speed and wind direction were examined. The procedure for identifying a representative meteorological year involved selecting a meteorological monitoring station and comparing wind patterns for each calendar year. Any of the three meteorological stations could have been chosen for identifying a representative year. For this exercise, data from the Glendell meteorological station (Glendell Met) were chosen since this station is closest to Glendell Mine.

Figure 5 shows the annual wind patterns for each year from 2012 to 2018. It can be seen from these wind-roses that the most common winds in the area are from the south-southeast, southeast and northwest and north-northwest. This pattern of winds is common for many parts of the Hunter Valley and reflects the northwest-southeast alignment of the valley.

It is also clear from **Figure 5** that wind patterns were similar in all seven years of data presented. This suggests that wind patterns do not vary significantly from year to year, and potentially the data from any of the years presented could be used as a representative year for modelling purposes.

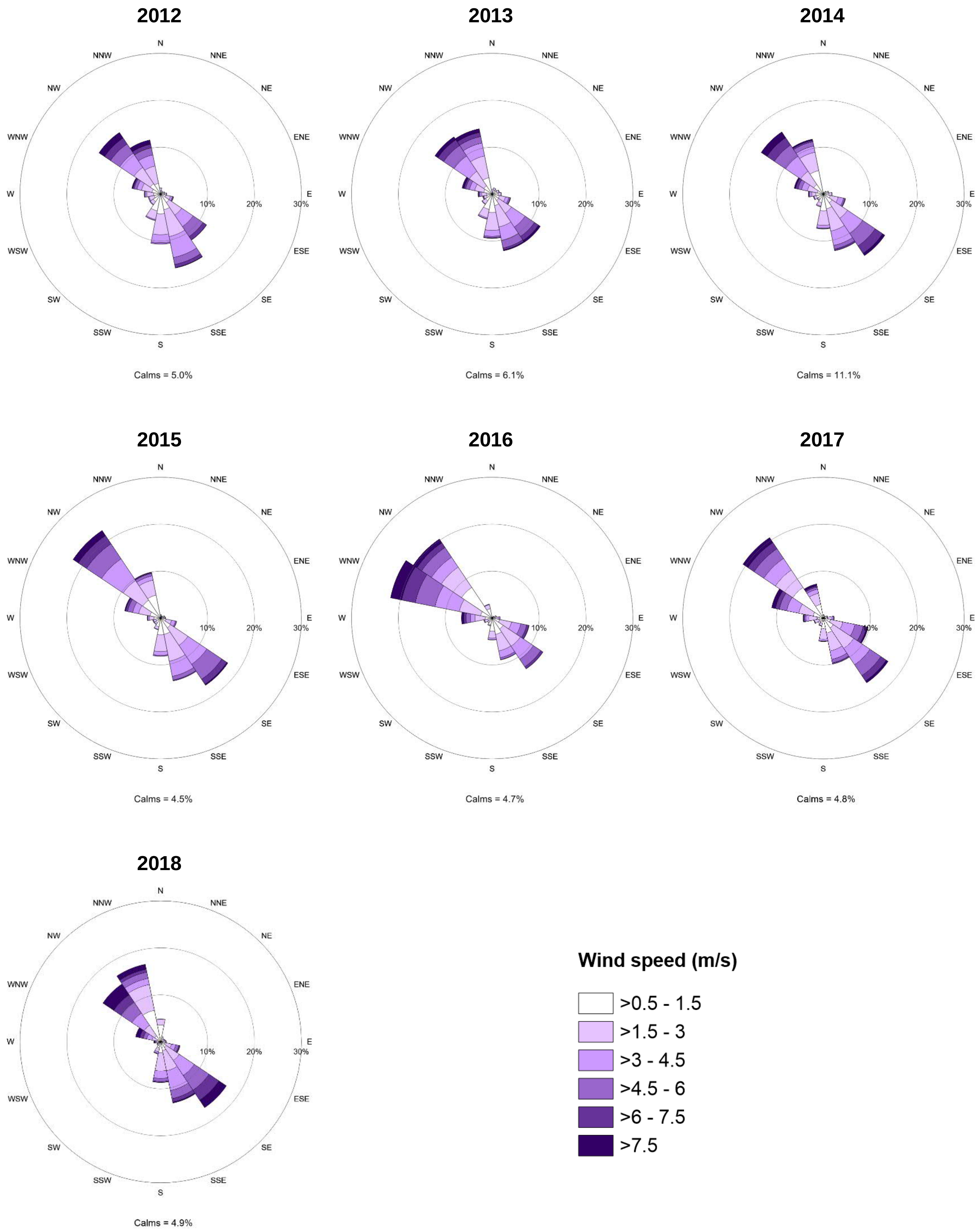


Figure 5 Annual wind-roses for data collected at Glendell Met meteorological station

Figure 6 shows the wind speed data from the Glendell Met meteorological station, as well as rainfall data from Singleton (station number 061397). In terms of wind conditions, the average and maximum wind speeds exhibited similar ranges across all seven years. Maximum wind speeds reached around 12 m/s (as an hourly average) and these winds typically occurred in spring.

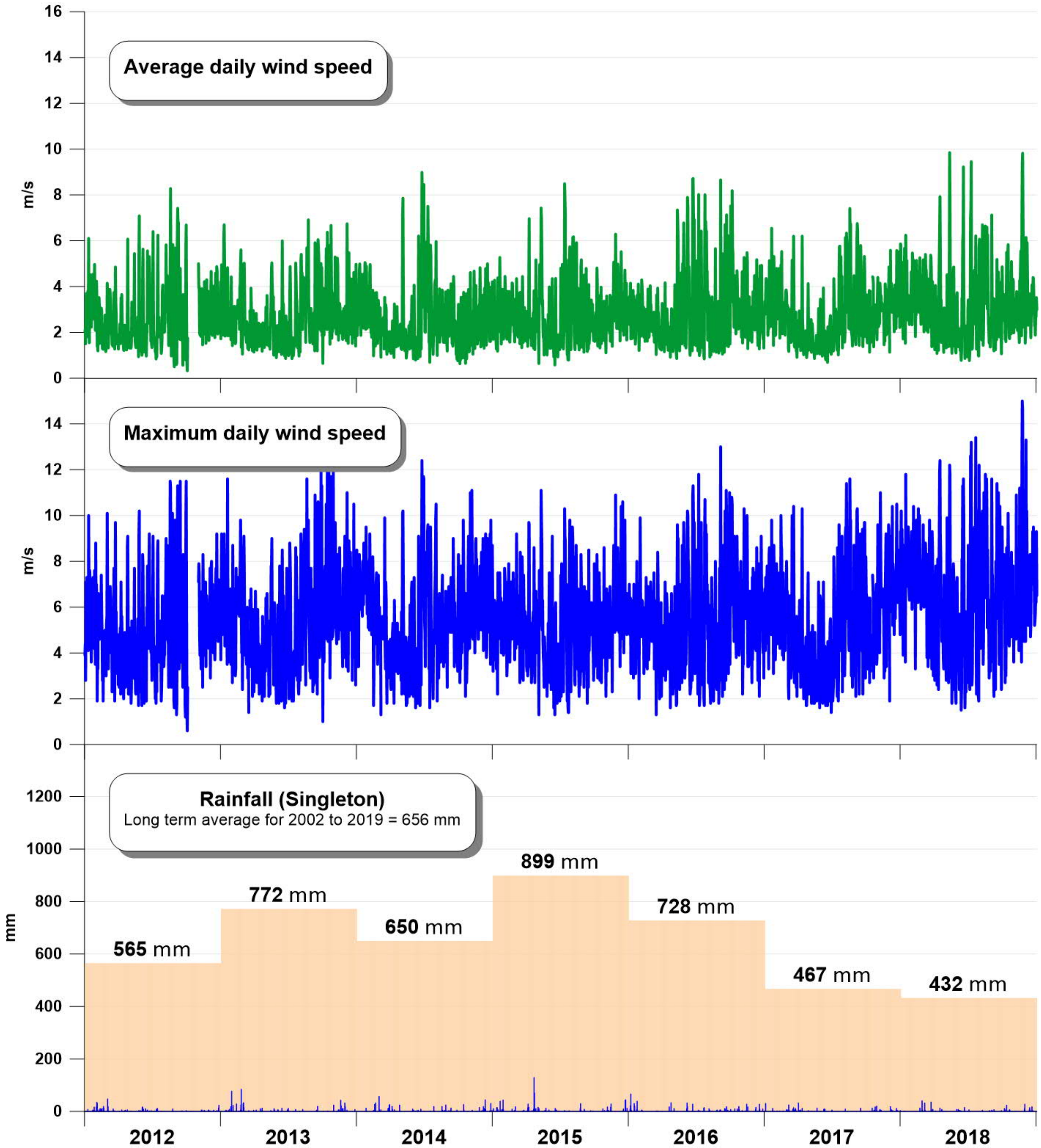


Figure 6 Wind speed and rainfall for data collected between 2012 and 2018

As can be seen from **Figure 6**, rainfall can occur at any time of the year and with varying intensity. Statistically, the annual rainfall (for 2012 to 2018) has ranged from 432 mm in 2018 to 899 mm in 2015. These annual values can be compared to the longer-term record which is as follows:

- Singleton STP (Bureau of Meteorology) 2002 to 2019 = 656 mm

Figure 6 also shows that rainfall in 2017 and 2018 was much lower than the long term average. This suggests that 2017 and 2018 were not typical meteorological years, in terms of rainfall.

Finally, the annual data statistics for the 2012 to 2018 years have been examined to assist with identifying a representative meteorological year. **Table 5** shows the statistics.

Table 5 Annual statistics from meteorological data collected between 2012 and 2018

Location	Statistic	2012	2013	2014	2015	2016	2017	2018
Glendell	Percent complete (%)	88	98	98	96	95	97	99
Glendell	Mean wind speed (m/s)	2.7	2.7	2.6	2.7	2.9	2.8	3.3
Glendell	99^{th} percentile wind speed (m/s)	8.9	8.9	8.8	8.5	9.3	9.0	10.9
Glendell	Percentage of calms (%)	5	6	11	5	5	5	5
Glendell	Percentage of winds >6 m/s (%)	7	7	8	6	10	9	14
Singleton	Rainfall (mm)	565	772	650	899	728	467	432

Over these seven years the mean annual wind speed has ranged from 2.6 to 2.9 m/s, and the percentage of calms has ranged from 5 to 11 per cent. None of these years appear to be significantly different to the other years and again, data from any of the years reviewed may be considered as representative for the purposes of modelling.

For this assessment the 2014 calendar year has been selected as the meteorological modelling year, based on:

- High data capture rate, meeting the EPA's requirement for a 90% complete dataset
- Similar wind patterns to other years
- Rainfall being slightly below the long-term average, and the preference was for a slightly drier than average year
- Air quality conditions which showed similarities to other years and not adversely influenced by bushfire activity or extreme conditions (as will be seen in **Section 5.2**)
- Consistency with other recent air quality impact assessments for the Mount Owen Complex which enables comparative analysis of predicted impacts (see for example, Jacobs [2016] and Jacobs [2018])

Methods used for incorporating the 2014 data into the meteorological modelling (CALMET) and air dispersion modelling (CALPUFF) are discussed in detail in **Section 7**. Annual and seasonal wind-roses from roses from all three meteorological stations used in the modelling are provided in **Appendix B**.

5.2 Air Quality Conditions

The EPA air quality criteria refer to levels of substances which generally include the project of interest and existing sources, not just the contribution from local mining activities. To fully assess predicted impacts against all the relevant air quality criteria (see **Section 4**) it is necessary to have information or estimates of the existing air quality conditions. This section provides a description of the existing air quality.

Air quality in the vicinity of the Mount Owen Complex is monitored by Mount Owen and by the DPIE. This monitoring includes the measurement of:

- Particulate matter (as PM_{10})
- Particulate matter (as $PM_{2.5}$)
- Particulate matter (as TSP)
- Dust deposition

Concentrations of NO_2 have not been measured in the vicinity of the Mount Owen Complex, however the DPIE measures this substance at other locations as part of its Upper Hunter Air Quality Monitoring Network. **Sections 5.2.1** to **5.2.5** describe the existing air quality conditions, based on a review of monitoring results for the substances listed above, as well as for NO_2.

It should be noted that the measurement data represent the contributions from all sources that have at some stage been upwind of each monitor. In the case of particulate matter (as PM_{10} and $PM_{2.5}$) for example, the background concentration may contain emissions from many sources such as from mining activities, construction works, bushfires and ‘burning off’, industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollens, moulds, domestic wood fires and so on.

5.2.1 Particulate Matter (as PM_{10})

Figure 4 shows the location of monitors which are used to measure PM_{10} concentrations. When assessing the data it is important to recognise the location of each monitor. For example, SX8 is located adjacent to active emplacement and mining operations and would not be representative of nearest sensitive receptors. The PM_{10} concentrations are measured by a variety of instruments including Tapered Element Oscillating Microbalance (TEOM), high volume air sampler (HVAS) and beta attenuation monitor (BAM). The data from the TEOMs have been used to characterise PM_{10} levels since these instruments provide records every day including at hourly resolution while, in contrast, the HVAS units only provide one record every six days. Data from the BAMs are available at hourly resolution however are not used for compliance purposes.

Figure 7 shows the measured 24-hour average PM_{10} concentrations from each TEOM monitoring site for data collected between 2012 and 2018. The EPA’s 24-hour air quality assessment criteria for PM_{10} (50 µg/m^3) has also been shown on these graphs. It can be seen from **Figure 7** that all sites recorded at least one day above the criterion in the past seven years. There is a seasonal variation in the air quality conditions, with most exceedances of the criterion occurring in spring. A dust storm was observed on 22 November 2018 and affected many parts of Eastern Australia including the Hunter Valley. This event adversely impacted on air quality around the Glendell Mine, resulting in 24-hour average PM_{10} concentrations in the order of 200 µg/m^3 at all monitors, as can be seen in **Figure 7**.

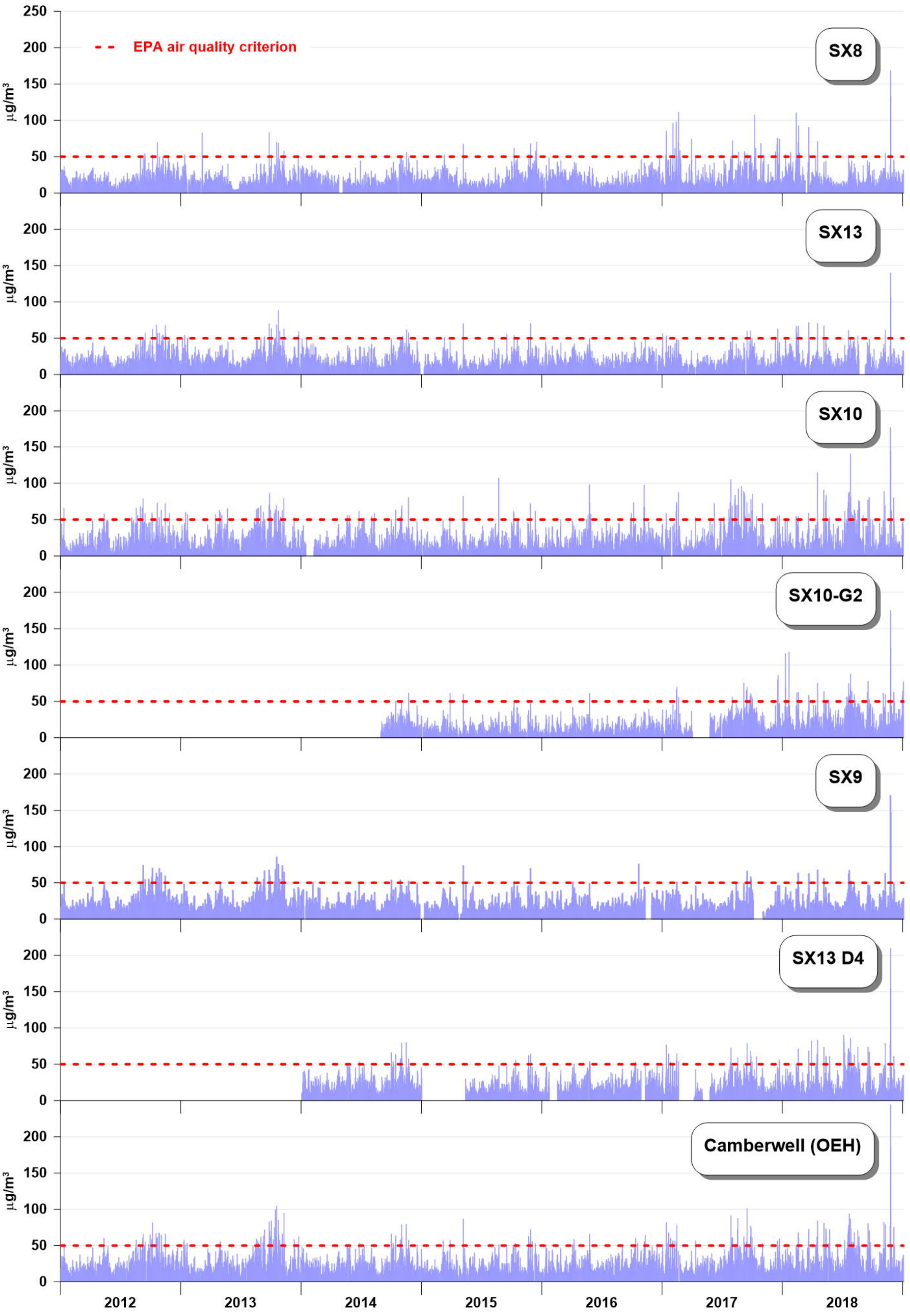


Figure 7 Measured 24-hour average PM_{10} concentrations

Table 6 summarises the measured PM_{10} concentration data for each site and for 24-hour and annual average periods, for comparison with the respective EPA criteria. As noted above, all sites have measured at least one day per year above the 24-hour criterion in the past seven years. Annual average PM_{10} concentrations did not exceed the 30 µg/m^3 criterion (applicable to the Glendell Consent) at any of the Glendell monitoring locations.

Data from the DPIE's monitoring sites at Camberwell, Singleton and Newcastle have also been presented in **Table 6** for comparison. The average PM_{10} concentrations in the vicinity of the Mount Owen Complex have been, on average, between 15% lower (SX10-G2) to 8% percent higher (SX13 D4) than PM_{10} concentrations measured at the DPIE Newcastle site. At Camberwell the concentrations have been, on average, 20% higher than PM_{10} concentrations in Newcastle.

Table 6 Summary of measured PM_{10} concentrations

Year	SX8	SX13	SX10	SX10-G2	SX9	SX13 D4	Camberwell (DPIE)	Singleton (DPIE)	Newcastle (DPIE)	EPA criterion
Maximum 24-hour average in µg/m^3										
2012	70	69	79	NA	74	NA	82	64	49	50
2013	83	88	86	NA	86	NA	105	63	69	
2014	56	62	80	61	54	80	80	55	54	
2015	70	71	107	61	74	64	87	85	70	
2016	51	56	98	61	76	54	66	61	89	
2017	111	63	105	86	66	79	102	57	55	
2018	168	140	177	175	170	210	244	198	146	
Number of days above 24-hour average criteria										
2012	4	10	20	NA	15	NA	23	7	0	-
2013	7	15	26	NA	15	NA	36	12	4	
2014	3	5	15	2	4	11	12	1	2	
2015	7	6	8	2	4	3	11	3	3	
2016	1	2	11	1	2	5	11	1	1	
2017	25	5	39	17	4	16	27	4	1	
2018	15	15	43	37	11	33	44	10	8	
Annual average in µg/m^3										
2012	21	23	24	-	22	22	27	22	21	30
2013	20	23	25	-	23	24	28	23	23	
2014	20	22	22	21	21	24	25	21	21	
2015	20	18	19	14	18	20	22	19	21	
2016	19	20	22	14	18	23	25	19	22	
2017	25	20	25	19	20	25	27	21	22	25
2018	23	23	29	26	22	29	31	24	24	

Note: shaded cells represent those results above EPA criteria

The spatial variation in PM_{10} concentrations has been examined by plotting the measurement data according to the geographical position of each monitor. **Figure 8** shows the maximum 24-hour average PM_{10} concentrations for the last seven years, and according to the position of each monitor. The data for Camberwell have been presented in a different colour to reflect the different operator of that monitor (that is, DPIE). This figure does not show any clear trend in maximum concentrations except for the higher results in 2018. In their “Annual Air Quality Statement 2018” the Office of Environment and Heritage (OEH, now DPIE) concluded that particle levels increased across the State due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH 2019). Air quality conditions in the Hunter Valley were clearly influenced by the drought conditions in 2017 and 2018 and lower than average rainfall as described in **Section 5.1**.

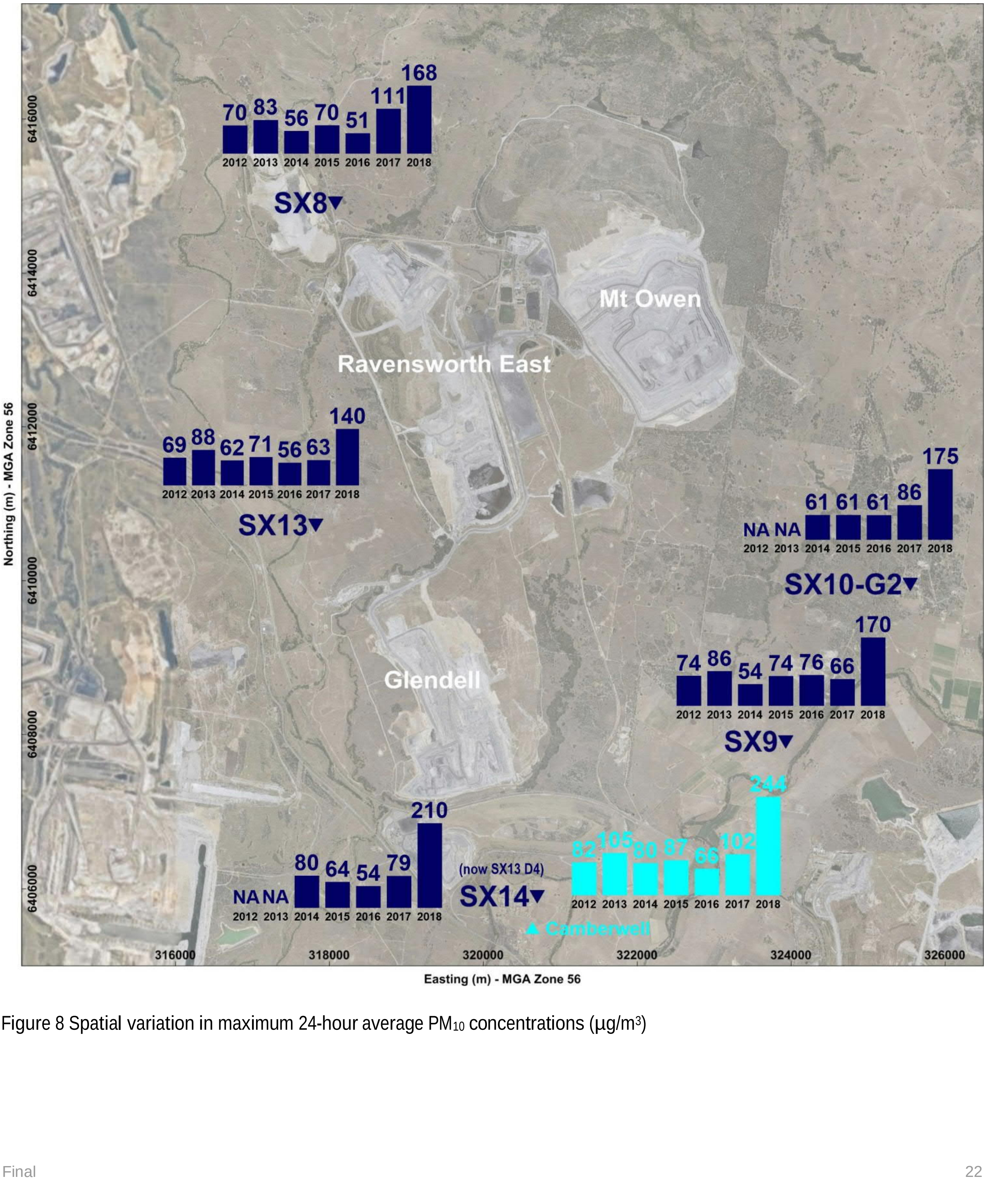


Figure 8 Spatial variation in maximum 24-hour average PM_{10} concentrations (µg/m³)

Figure 9 shows the number of days above the 24-hour PM_{10} criterion, for the last seven years. From these data, Camberwell has typically experienced more days above the criterion than the other locations, with 2012, 2013, 2017 and 2018 standing out as years with more events. Betts et al (2014) and the OEH (2013a) both reported that the higher number of days above the criterion in 2013 was due to significant bushfires in the region, mainly in September, October and November. The 2017 and 2018 conditions were, according to OEH (2019), influenced by intense drought and smoke from bushfires. Results for the 2014 calendar year appeared to be around the average for most locations.

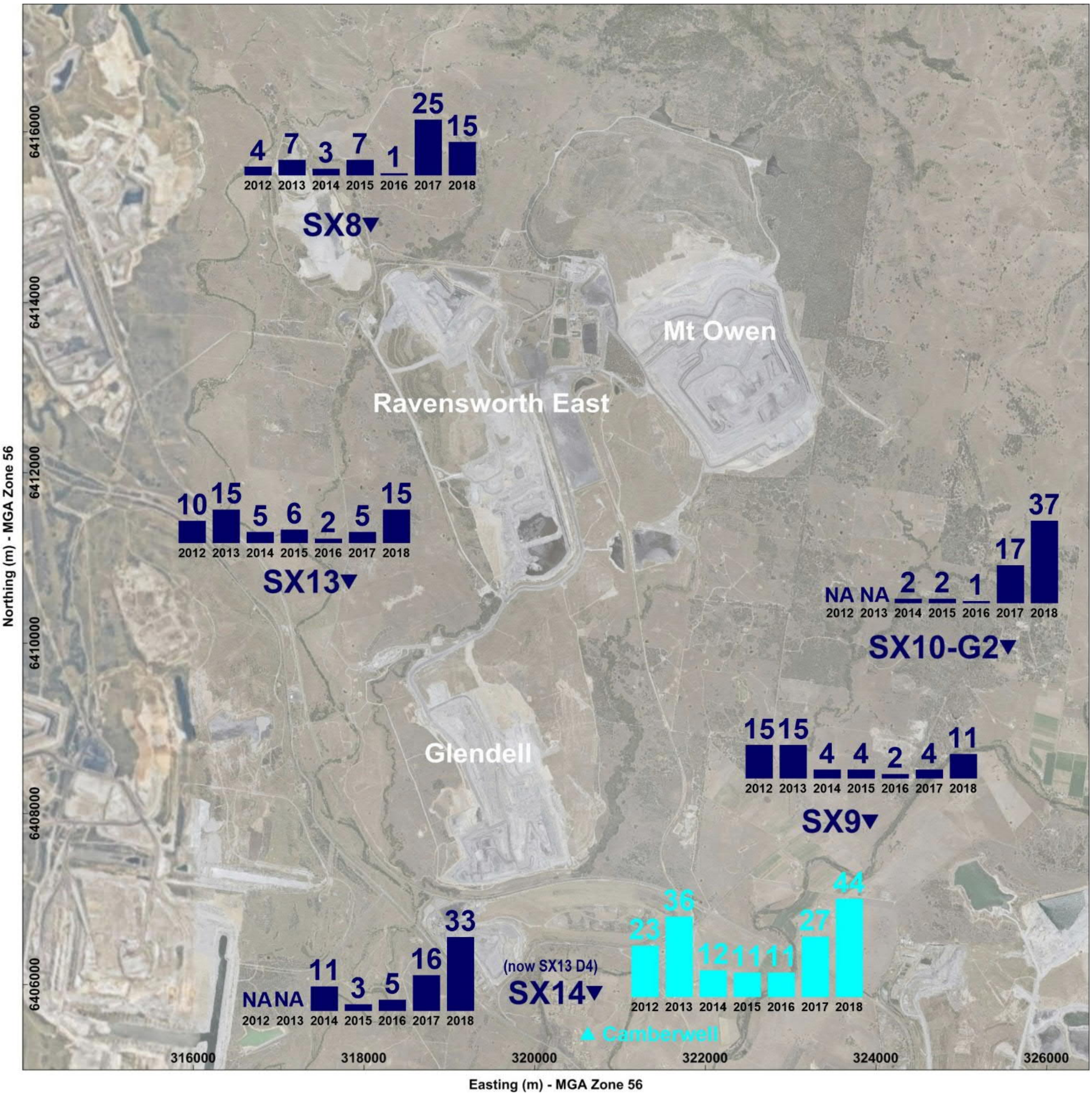


Figure 9 Spatial variation in the number of days per year above the 24-hour PM_{10} criterion (days)

Figure 10 shows the annual average PM_{10} concentrations for the last seven years and presented according to the position of each monitor. No exceedances of the EPA's previous annual average PM_{10} criterion (30 µg/m^3) were recorded at any of the Mount Owen Complex monitoring sites however the DPIE Camberwell monitoring site was above this criterion in 2018. The EPA criterion was revised to 25 µg/m^3 after 20 January 2017. Annual average PM_{10} concentrations did not exceed the 30 µg/m^3 criterion that was, and is currently, applicable to the Glendell Consent.

The highest annual average concentration was measured at the DPIE's monitor in Camberwell (31 µg/m^3 in 2018). Again, the results for the 2014 calendar year appear to be typical of the longer-term conditions experienced at each site which supports the earlier suggestion (**Section 5.1**) of 2014 being a typical or representative year.

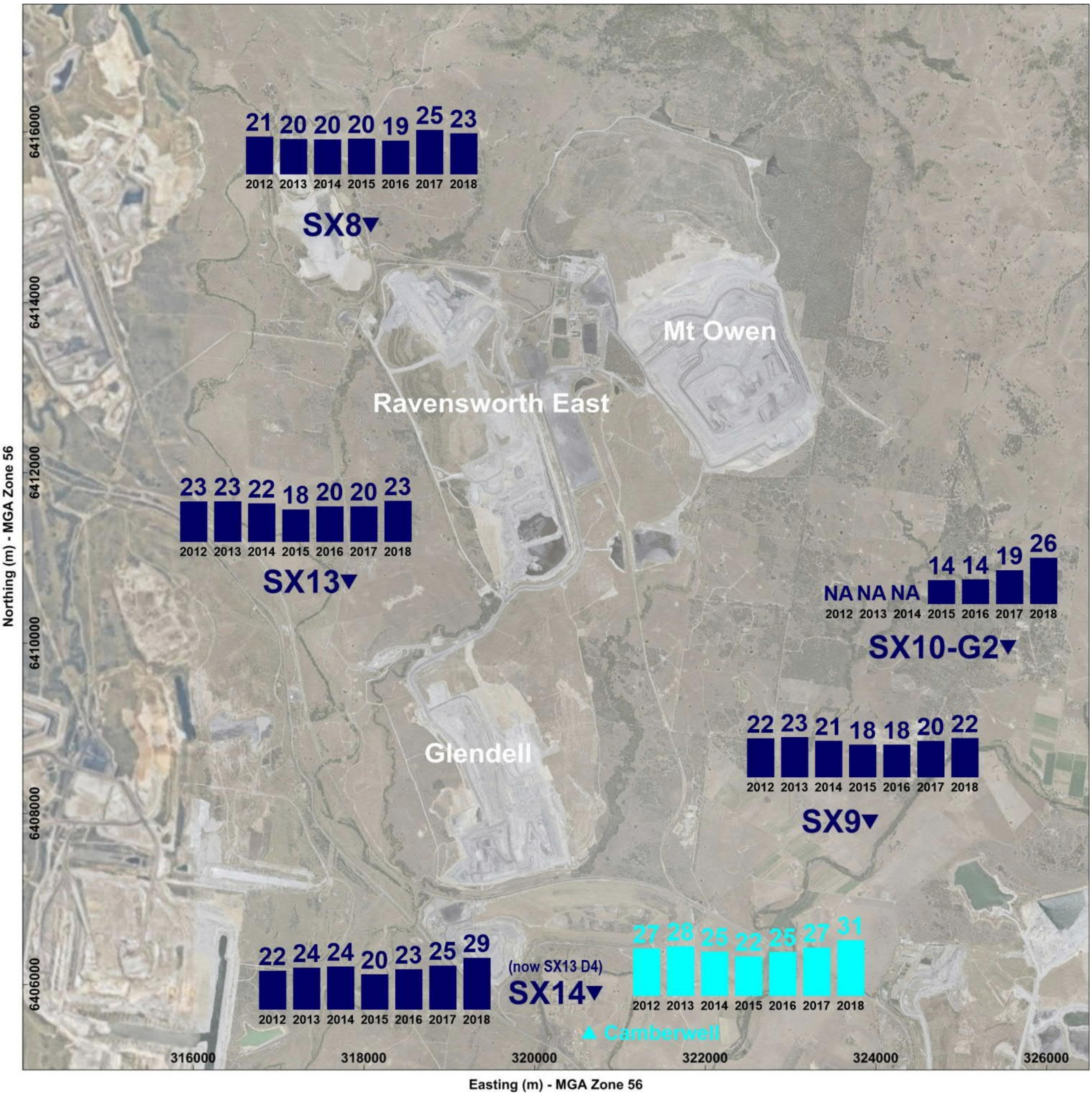


Figure 10 Spatial variation in annual average PM_{10} concentrations (µg/m^3)

The potential conditions which led to elevated PM_{10} concentrations at SX9, SX13 and Camberwell (three locations around Glendell Mine) for 2014 have been analysed by the preparation of the following graphs:

- Hourly PM_{10} concentrations by time of day and wind speed (**Figure 11**).
- Hourly PM_{10} concentrations by wind direction and wind speed (**Figure 12**).

The information from **Figure 11** shows that, for these monitoring sites in 2014, the highest short-term (1-hour average) PM_{10} concentrations could be at any time of day. However, on average, the PM_{10} concentrations are typically highest in the morning (around 9 am) and evening (around 7 pm). This pattern may be explained by poorer dispersion conditions in the morning and evening whereby any dust emissions disperse more slowly and allow higher concentrations to exist for extended periods of time. Also, the higher average concentrations in the morning and evening may be associated with increased anthropogenic (human) activity at these times, for example the use of wood heaters.

Figure 12 shows the measured hourly average PM_{10} concentrations by wind direction and wind speed, from 2014 data. It can be seen from these figures that at all sites the highest hourly average PM_{10} concentrations were typically associated with light to moderate winds from the northwest. The only deviation from this conclusion is a data point from SX9 where the highest concentration occurred during a strong (>6 m/s) wind from the southeast.

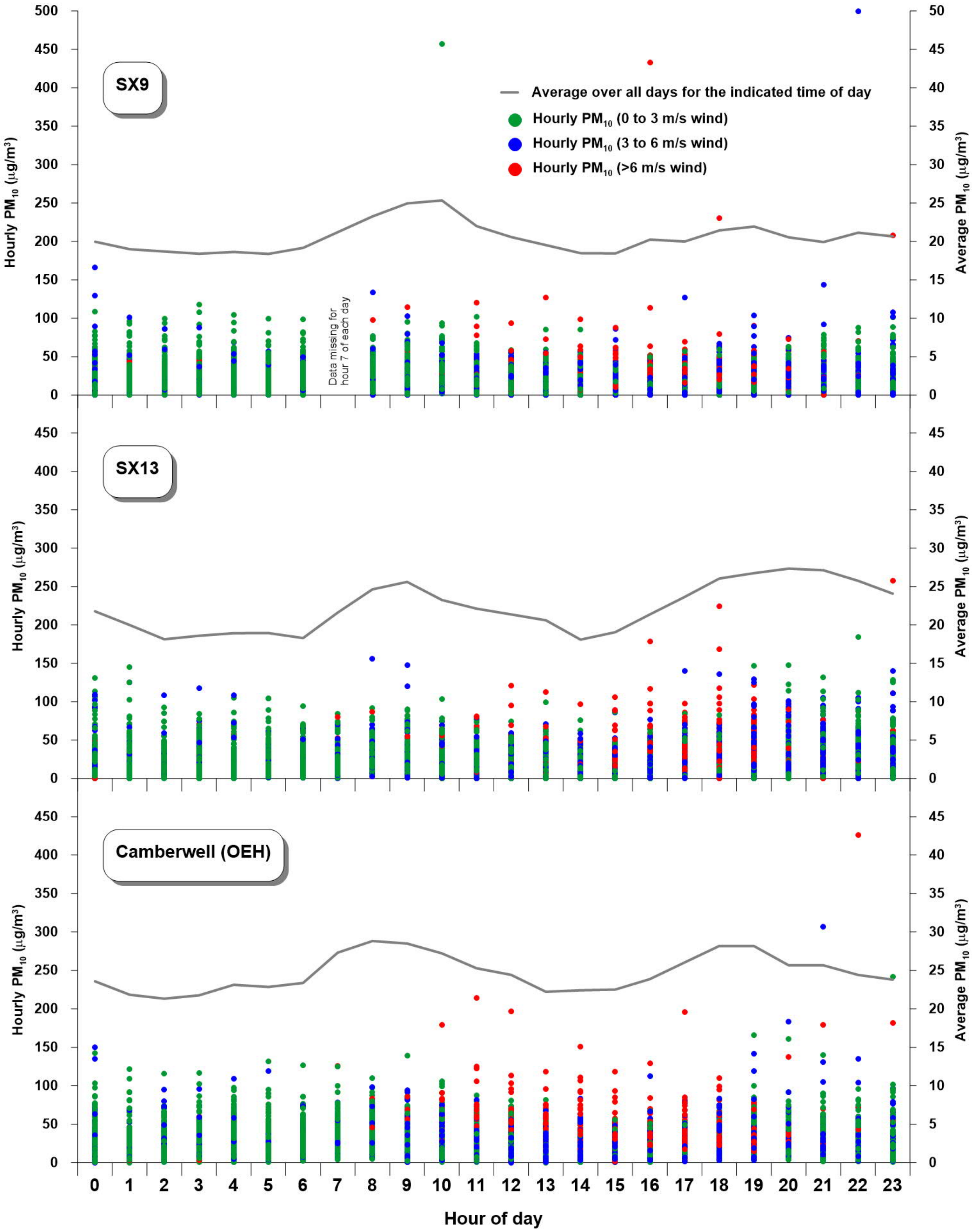


Figure 11 Measured PM_{10} concentrations by time of day and wind speed (2014 data)

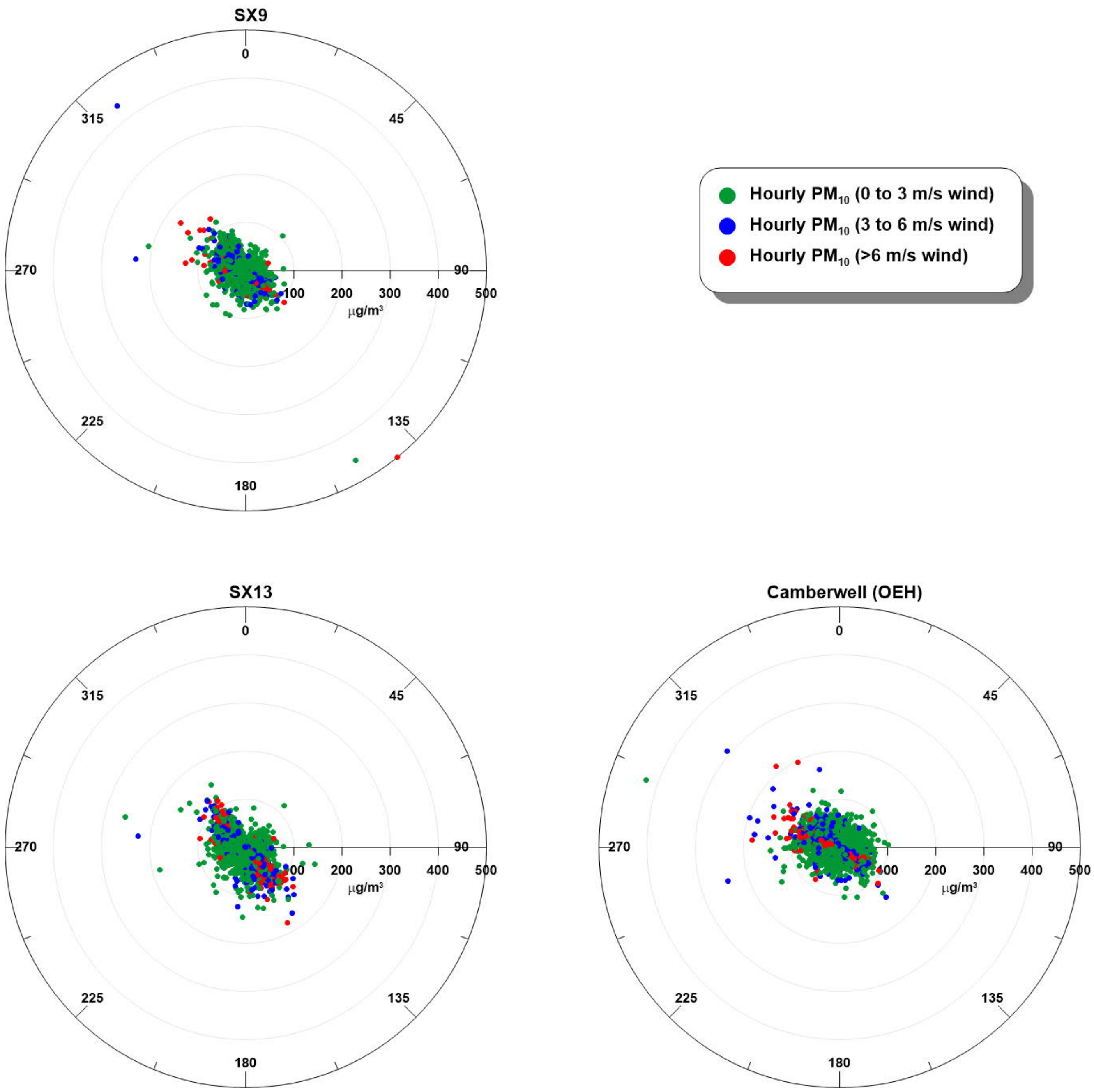


Figure 12 Measured PM_{10} concentrations by wind direction and wind speed (2014 data)

5.2.2 Particulate Matter (as $PM_{2.5}$)

The closest air quality monitoring stations which record concentrations of $PM_{2.5}$ with publicly available data are located at Singleton and Camberwell. These stations are operated by the DPIE and use Beta Attenuation Monitors (BAM) for the measurement of $PM_{2.5}$. Data from the DPIE's Newcastle monitoring site have also been reviewed, for comparison.

Figure 13 shows the measured 24-hour average $PM_{2.5}$ concentrations from the Camberwell monitoring site for data collected between 2012 and 2018. The EPA's current air quality assessment criterion for $PM_{2.5}$ (25 µg/m^3) has also been shown, but it should be noted that this assessment criterion came into effect from 20 January 2017 onwards. $PM_{2.5}$ concentrations have not exceeded the EPA criterion since it was introduced. A weak seasonal variation is also evident, with the higher concentrations tending to occur in spring.

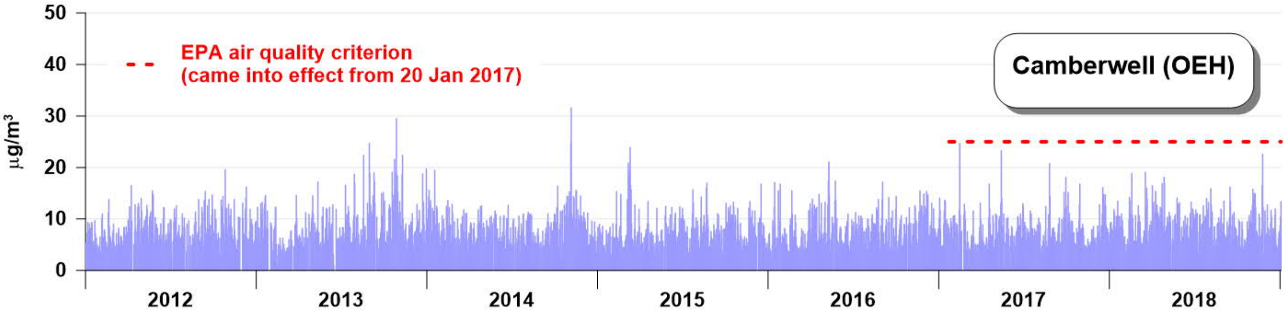


Figure 13 Measured 24-hour average $PM_{2.5}$ concentrations

Table 7 summarises the measured $PM_{2.5}$ results for data collected between 2012 and 2018. It can be seen from these data that the highest 24-hour average $PM_{2.5}$ concentrations exceeded the criterion on one occasion, that is, in Singleton in 2017. Annual averages are close to the criterion (8 µg/m^3), exceeding in some years by up to 0.4 µg/m^3 in Camberwell. Again, the annual average assessment criterion came into effect from 20 January 2017, prior to which it was referred to as an advisory reporting goal.

It is also useful to compare the Hunter Valley data with information from other locations. Annual average $PM_{2.5}$ concentrations in Newcastle were similar to those measured in the Hunter Valley. At Cape Grimm, a site in rural Tasmania that is used as a global "baseline" reference for unpolluted air entering Australia, the mean $PM_{2.5}$ concentration was 5.6 µg/m^3 for data collected between 1998 and 2008 (ANSTO 2008). Most of Cape Grimm's particulate matter mass is from sea salt.

The Upper Hunter Fine Particle Characterisation Study (OEH, 2013b) investigated the factors which contributed to elevated $PM_{2.5}$ concentrations in the Hunter Valley. This study identified a clear seasonal trend with higher $PM_{2.5}$ concentrations occurring in the cooler months, and predominantly due to wood smoke from domestic heating. Specifically, in Singleton, wood smoke accounted for an average of approximately 14% of the total $PM_{2.5}$, peaking at around 38% in winter.

Table 7 Summary of measured $PM_{2.5}$ concentrations

Year	Camberwell (OEH)	Singleton (OEH)	Newcastle (OEH)	EPA criterion
Maximum 24-hour average in µg/m³				
2012	20	20	-	-
2013	30	23	-	
2014	32	29	21	
2015	24	25	28	
2016	21	28	66	
2017	25	30	18	25
2018	23	19	20	
Number of days above 24-hour average criteria				
2012	0	0	-	-
2013	1	0	-	
2014	1	1	0	
2015	0	0	1	
2016	0	2	1	
2017	0	1	0	
2018	0	0	0	
Annual average in µg/m³				
2012	7.5	8.0	-	-
2013	8.2	7.9	-	
2014	7.8	7.8	8.1	
2015	7.2	7.6	7.8	
2016	7.5	7.9	7.8	
2017	7.4	8.2	7.3	8
2018	8.4	8.1	7.8	

Note: shaded cells represent those results above EPA criteria

5.2.3 Particulate Matter (as TSP)

TSP concentrations have been measured at three locations by high volume air sampler (HVAS). **Figure 4** shows the location of the monitoring sites and **Table 8** shows the annual average concentrations from data collected in the past seven years, for comparison with the EPA's 90 µg/m³ criterion. None of the monitoring sites have recorded annual average TSP concentrations above the criterion.

Table 8 Summary of measured TSP concentrations

Year	TSP-1	TSP-2	TSP-3	EPA criterion
Annual average in µg/m³				
2012	59	77	65	90
2013	47	85	73	
2014	58	76	70	
2015	55	61	57	
2016	53	76	62	
2017	60	73	68	
2018	59	78	80	

5.2.4 Deposited Dust

Table 9 shows the annual average deposited dust levels for each gauge from data collected in the past seven years, for locations representative of private properties. **Figure 4** shows the location of the monitoring sites. The results in **Table 9** can be compared with the EPA's 4 g/m²/month criterion. Contaminated monthly samples were excluded from the calculation of these annual averages.

Table 9 Summary of measured deposited dust levels

Year	DD6	DD7 / DG2	DD9	DD11	DD12	DD14	DD15 / DG4	DD16	DG3	DG5	DG6	DG7	DG8	EPA criterion
Annual average expressed as g/m²/month														
2012	1.0	2.6	3.1	4.4	3.3	2.3	3.2	2.5	1.8	3.3	5.3	2.9	2.9	4
2013	0.9	2.4	3.7	3.1	2.3	1.7	2.8	2.4	2.1	2.4	4.1	3.1	3.0	
2014	0.9	2.6	3.5	2.9	2.1	1.7	2.6	2.5	1.7	1.8	5.9	2.4	2.7	
2015	0.9	2.0	2.9	4.7	2.4	1.4	1.9	2.3	1.3	1.5	2.8	2.1	2.6	
2016	1.0	2.3	4.0	4.3	2.6	1.5	1.8	3.3	1.6	1.6	2.0	2.1	2.7	
2017	1.3	2.2	N/A	3.8	2.4	1.7	2.6	2.4	1.7	2.6	3.2	2.4	2.8	
2018	1.1	2.4	N/A	N/A	2.5	2.3	2.6	2.5	1.5	2.4	2.5	2.5	3.2	

Note: shaded cells represent those results above EPA criteria

It can be seen from **Table 9** that two locations (D11 and DG6) have experienced deposition levels above the EPA's 4 g/m²/month criterion, in one or more years. D11 is located on Glencore owned land. No monitors have recorded above 4 g/m²/month in the past two years, that is 2017 or 2018.

5.2.5 Nitrogen Dioxide (NO_2)

Table 10 provides a summary of the measured NO_2 concentrations from Singleton (the closest known air quality monitoring site which records this substance). These data show that the maximum NO_2 concentrations have been well below the EPA's 1-hour average criterion of 246 µg/m³. Annual averages have also been well below the EPA's annual average criterion of 62 µg/m³.

Table 10 Summary of measured NO_2 concentrations

Year	Singleton (OEH)	EPA criterion
Maximum 1-hour average in µg/m^3		
2012	82	246
2013	84	
2014	74	
2015	66	
2016	66	
2017	74	
2018	72	
Annual average in µg/m^3		
2012	18	62
2013	18	
2014	16	
2015	16	
2016	16	
2017	17	
2018	16	

5.3 Summary of the Existing Environment

The following conclusions have been made from the review of local meteorological and ambient air quality monitoring data:

- Wind patterns in the vicinity of Glendell Mine are similar to other parts of the Hunter Valley, with the prevailing winds being from either the northwest or southeast.
- There are seasonal variations in particulate matter concentrations, with PM_{10} levels generally higher in spring and $PM_{2.5}$ levels generally higher in winter.
- There are daily variations in particulate matter concentrations, with levels typically highest in the morning and evening.
- In 2018 particle levels increased across the State due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH 2019).
- In terms of PM_{10} concentrations, most monitoring sites in the vicinity of Glendell Mine have experienced at least one day above the EPA's 24-hour criterion in the past seven years. The averages exceeded the EPA 24-hour criterion in 2017 and 2018 in some locations. These results were heavily influenced by the drought conditions occurring during this period.
- Measured TSP and NO_2 concentrations are below their relevant EPA criteria.
- Deposited dust levels have exceeded EPA criteria at two of the 13 monitoring locations, but not in the recent two years.
- The two closest $PM_{2.5}$ monitoring stations, Camberwell and Singleton, have measured $PM_{2.5}$ concentrations which are close to or have exceeded the EPA criteria. A study by the OEH (2013b) found that wood smoke from domestic heating was one of the main factors that influenced $PM_{2.5}$ concentrations, especially in winter.
- Conditions in 2014 were representative of the longer-term air quality and meteorological conditions.

5.4 Assumed Background Levels

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to model predictions for the assessment of potential cumulative impacts, that is, mining contribution plus non-mining contribution. For this objective, the approach was to utilise the data collected from all real-time air quality monitors in the vicinity of Glendell Mine and, at the same time, minimise the potential for adding model predictions to measurements which may already contain contributions from those sources being modelled (i.e. to avoid double counting).

The adopted approach involved developing an hourly variable background dataset that was added to the model predictions. This dataset (for PM_{10}) was created by using the minimum measured non-zero hourly average concentration from SX8, SX9, SX10, SX10-G2, SX13 and SX13 D4 for each day in the 2014 calendar year. A key assumption to this approach was that the minimum hourly value from these sites reflected a location that was not being influenced by emissions from the sources / operation to be modelled. This approach aimed to minimise double counting of modelled contributions with background contributions.

Figure 14 shows a graphical representation of the assumed background PM_{10} and $PM_{2.5}$ concentrations that were used in this assessment and added to the model predictions of concentrations due to the Project. There is no standard, prescribed methodology for developing a background dataset in this manner, so an estimation approach had to be adopted and it is acknowledged that other approaches could also have been adopted. However, the statistics of the resultant datasets (included in **Table 11**) indicate that this approach, and its inherent assumption, produce estimated background levels which are similar to actual measurements in the region.

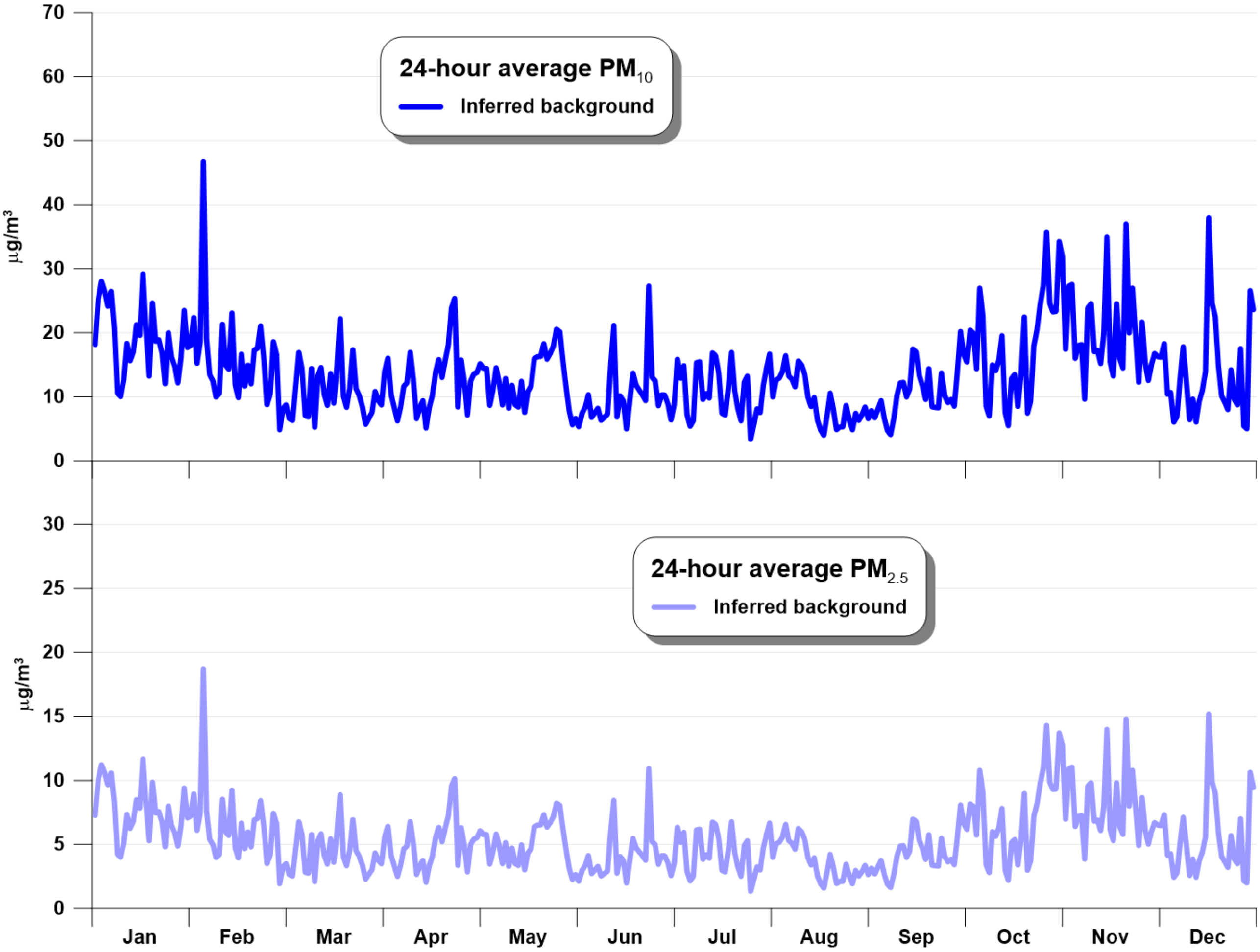


Figure 14 Assumed background PM_{10} and $PM_{2.5}$ concentrations as inferred from the measurement data

The estimated background levels that apply at sensitive receptors are shown below in **Table 11**. These levels (or approach adopted) have been added to model predictions to determine the potential cumulative impacts.

Table 11 Assumed non-modelled background levels that apply at sensitive receptors

Substance	Averaging time	Assumed background level that applies at sensitive receptors	Notes
Particulate matter (PM_{10})	24-hour and annual	Variable by hour of day	The adopted approach involved developing an hourly variable background dataset that was added to the model predictions. This dataset was created by using the minimum measured non-zero hourly average concentration from SX8, SX9, SX10, SX10-G2, SX13 and SX13 D4 for each hour in the 2014 calendar year. Statistics from the resultant dataset are as follows: - Maximum 24-hour average = 47 µg/m^3 - Annual average = 14 µg/m^3 The data derived above have been added to the predicted contributions of the Project for the assessment of potential cumulative impacts, in accordance with EPA guidelines.
Particulate matter ($PM_{2.5}$)	24-hour and annual	Variable by hour of day	Given that there is only one $PM_{2.5}$ monitor it was not possible to derive an hourly variable background dataset that did not include contributions from the sources being modelled, as was done for PM_{10}. The hourly $PM_{2.5}$ concentration was calculated from the hourly PM_{10} concentration on the assumption that 40% of the PM_{10} is $PM_{2.5}$. The DPIE data for Camberwell show that $PM_{2.5}$ is up to 33% of the PM_{10}, so 40% is a conservative estimate. Statistics from the resultant dataset are as follows: - Maximum 24-hour average = 19 µg/m^3 - Annual average = 5.4 µg/m^3 The data derived above have been added to the predicted contributions of the Project for the assessment of potential cumulative impacts, in accordance with EPA guidelines.
Particulate matter (TSP)	Annual	68 µg/m^3	Average of the three annual average concentrations measured from TSP-1, TSP-2 and TSP-3 in 2014.
Deposited dust	Annual	2 g/m^2/month	Estimate of background levels that may exist in the vicinity of nearest sensitive receptors without the contribution from modelled sources.
Nitrogen dioxide (NO_2)	1-hour	74 µg/m^3	Maximum 1-hour average from Singleton in 2014. Taking the maximum 1-hour average is a conservative approach.
	Annual	16 µg/m^3	Annual average from Singleton in 2014.

6. Emissions to Air

The most significant emission to air from the Project will be dust (particulate matter) due to material handling, material transport, processing, wind erosion, and blasting. Estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing the material handling schedule, equipment listing and mine plans and identifying the location and intensity of dust generating activities. Operations have been combined with emission factors developed both locally and by the US EPA.

The emission factors used for this assessment have been drawn largely from the following sources:

- *Emission Estimation Technique Manual for Mining* (NPI 2012); and
- AP 42 (US EPA 1985 and updates).

Dust emission inventories have been developed for each of the modelled scenarios, namely:

- Existing conditions. Monitoring and operational data from 2014 were used, in combination with the intensity and scheduling of operations approved and occurring at that time, for model performance evaluations and calibration.
- Project Years 1, 6, 13 and 18. These years have been selected as they represent proposed future conditions, and assuming maximum production. The Mount Owen emission inventories were updated to reflect the additional coal from Glendell Mine.

The "existing" scenario has been developed to evaluate the performance of the model. In this case the model predictions were compared to monitored results to determine the level of confidence that can be assumed for the future scenarios. The assessment focusses primarily on the performance of the model for predicting PM_{10} concentrations. This approach was driven by the outcome of the existing air quality review (see **Section 5.2**) which showed that PM_{10} is one of the key air quality issues due to a higher number of historical exceedances of the EPA air quality criteria than other substances. It was not possible to evaluate the performance of the model for predicting $PM_{2.5}$ or NO_2 as there are insufficient $PM_{2.5}$ or NO_x monitors in the model domain to allow for a comparison between measured and predicted levels.

The four future scenarios have been selected to represent various stages in the life of the mine, including at maximum production and for times when operations are close to sensitive receptors. There are no specific guidelines or procedures which define an adequate level of information to demonstrate that selected scenarios are representative of worst-case impacts. The selection of Project Year 1, 6, 13 and 18 was therefore based on a review of material handling quantities, haul distances, and location of activities for each year in the proposed mine life and selecting four years for assessment.

Figure 15 shows the estimated ROM coal and overburden movements over the life of the Project. Year 1 represents mining and operations in closest proximity to Camberwell. Year 1 is also representative of potential worst case cumulative impacts from other mining operations, particularly in the Camberwell area. Year 6 represents an increased level of production relative to existing operations and emplacement occurring at its most elevated position. Year 6 is also significant in terms of potential cumulative impacts due to contributions from other mining operations. Year 13 represents peak production from the Glendell Mine and is representative of potential worst case Project only impacts in terms of overall emissions. Year 18 has been selected as being representative of potential worst case impacts in the Hebden area. During Year 18, mining related disturbance from the Glendell Pit Extension is at its most northern extent and at higher production rates than subsequent years. These years are therefore considered to address the worst case operating scenarios in terms of both Project only impacts and cumulative impacts in the various areas around the Project.

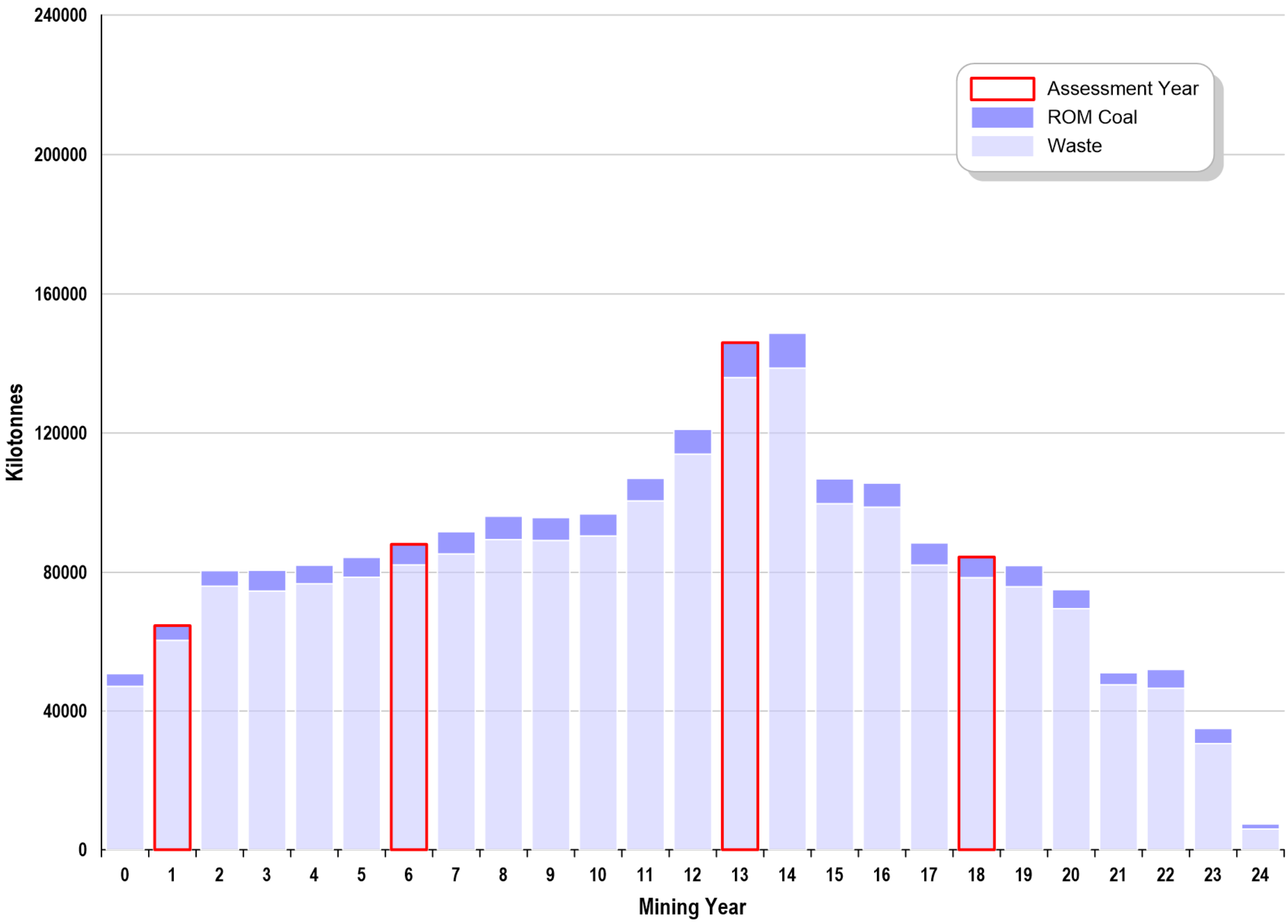


Figure 15 Estimated ROM coal and overburden movements over the life of the Project

In addition, the model includes predictions of contributions from surrounding existing operations, and in the case of future operating scenarios, approved mining operations to include the contribution of these mining sources to the total particulate matter levels in the surrounding area. **Table 12** shows the assumed ROM coal production data from each operation in the model domain. The data for 2014 were derived from the Annual Environmental Management Report (AEMR) produced by each mining operation and available on their respective websites. The AEMRs also included overburden handling quantities and plans showing the mining locations which are important for determining site dust emissions. For future mining scenarios, the production data and location of mining operations have been sourced from publicly available materials including relevant assessment documents (i.e. Environmental Assessments, EIS etc.) for the existing and approved operations. These have been included in the model for future mining scenarios reflective of their current approved life and maximum approved production limit in accordance with the development consent in place at the time of completing this assessment.

The approved Ashton South East Open Cut (SEOC) mining operation has been included in the future modelling scenarios despite the SEOC not being operational at the time of completing this assessment. The SEOC has been included as the existing development consent enables mining to occur during the life of the Project and has the potential to impact on air quality in the surrounding area. For the Rix's Creek South mining operation, it has been assumed that mining will occur in accordance with the approved Rix's Creek South Continuation Project (SSD 6300).

Estimated production quantities for the Project were provided by Glencore based on expected mine production schedules.

Table 12 Assumed ROM coal production from each operation located within the model domain

Operation	Notes / references	ROM coal production (Mtpa)				
		2014	Year 1 (2021)[1]	Year 6 (2026)[1]	Year 13 (2033)[1]	Year 18 (2038)[1]
Glendell	As per Project References: Mt Owen (2015) Consent(s): DA 80/952	4.4	4.2	5.9	10.0	5.9
Ashton (including SEOC)	Underground and current open cut approved to 2024. SEOC approved but not currently operating. SEOC consent lapses in 2020 if not commenced. Mining only approved for 12 years from commencement (i.e. ends 2032). Reference(s): Ashton (2015), PAE Holmes (2009) Consent(s): MP 08_0182, DA 309-11-2001-i	2.8	8.6 (cap for SEOC and underground)	8.6 (cap for SEOC and underground)	3.6 (underground only)	-
HVO North and South[2]	HVO North: Approved until July 2025. HVO South coal processed to 2030. HVO South: Approved until 2030, assume 16 Mtpa transferred to HVO North CHPP for washing. Future years as per maximum approved in development consents. Reference(s): Rio Tinto (2015), Todoroski (2017) Consent(s): DA 450-10-2003, 06_0261	18	HVO North: 22 (production), processing up to 26. HVO South: 20	HVO North: 16 processing only. HVO South: 20	-	-
Integra Underground	Operation in care and maintenance (that is, no mining) from Apr 2014 to Feb 2017. Approved to 2035. Reference(s): Vale (2015) Consent(s): 08_0101	0.8	4.5	4.5	4.5	-
Liddell Coal Operations	2023 is the last planned mining year. Future years as per maximum approved in development consent. Reference(s): Liddell Coal (2015). Consent(s): DA 305-11-01	6.7	8	-	-	-
Mount Owen	As per Mount Owen Modification 2. Reference(s): Mt Owen (2015), Jacobs (2018) Consent(s): SSD-5850	10	9.9	7.2	3.2	0[3]
Ravensworth Operations	Open cut approved to 2039 at up to 16 Mtpa. Complex approved to process 21 Mtpa. Underground approved to 2024 but not currently operating or proposed to operate. Future years as per maximum approved in development consent. Reference(s): Ravensworth (2015) Consent(s): 09_0176	10.9	16	16	16	16
Rix's Creek South	As per the Rix's Creek South Continuation Project. Reference(s): Rix's Creek (2015), Todoroski (2015) Consent(s): DA 49/94, SSD 6300	2.8	4.5	4.5	4.5	4.5
Rix's Creek North	Operation in care and maintenance (that is, no mining) in 2014. Recommenced operations in 2016. Approved to 2035. Future years as per maximum approved in development consent. Reference(s): Vale (2015) Consent(s): 08_0102	0	6 (1.5 North and 4.5 West)	6 (1.5 North and 4.5 West)	6 (1.5 North and 4.5 West)	-

[1] Calendar years are indicative only and are to provide guidance for the duration of other mining operations relative to the Project.

[2] The component of HVO which is in the model domain.

[3] CHPP operation only

Table 13, **Table 14** and **Table 15** summarise the estimated annual TSP, PM_{10} and $PM_{2.5}$ emissions, respectively, due to the Project as well as all other operating, or assumed to be operating, mines in the model domain. Estimates for 2014 were based on production and material handling quantities contained in the respective AEMRs. Estimates for future years, that is, Project Year 1 onwards, were based on the maximum approved production rates as per the relevant development consents with the exception of the Mount Owen contributions which were modelled according to the production schedules assessed in the Mount Owen Continued Operations Project Modification 2 Assessment and the increased coal throughput at the CHPP associated with the Project. As noted above, the assessment has also been carried out on the assumption that the Ashton SEOC will be operating in the future. These assumptions mean that the model predictions will likely over-state actual impacts as the mines are not likely to operate at their maximum approved production rate in each year.

It should be noted that the main intent of the inventories is to capture the most significant emission sources that may affect off-site air quality. Not every source will be captured. However, the contribution of emissions from sources not identified will be captured in the air quality monitoring data and these data have been added to the predicted project contributions. **Appendix C** provides details of the dust emission calculations, including assumptions, emission controls and allocation of emissions to modelled locations.

Emissions from other mining operations are also important for quantifying the potential cumulative impacts. Two approaches were considered for estimating emissions from other mining operations. These approaches included:

- Deriving emission estimates from previously published EIS data, and
- Recalculating emissions from other mines in the model domain specifically for this assessment.

The approach of recalculating emissions from other mining operations in the model domain has been chosen for this assessment, with the exception of the Mount Owen mine where emissions were based on the Mount Owen Continued Operations Project Modification 2 Assessment as per Jacobs (2018). This approach has been favoured because it maintains consistency in the emission calculation methods for all mining operations. It also has the following advantages over recent EIS data:

- TSP, PM_{10} and $PM_{2.5}$ can be separated for each activity for each mining operations. To date, most EIS air quality assessments have only calculated TSP emissions, with PM_{10} and $PM_{2.5}$ emissions derived from regional ratios such as those published by the SPCC (1986).
- The proportions of wind sensitive, wind insensitive and wind erosion activities can be more accurately defined. Historical assessments have often applied fixed ratios of these three activity types, usually based on information from the Mt Arthur Mine EIS (URS 2000).
- Pit retention can be modelled and the adjusted emissions can be made specific to each activity and the hourly wind speed.
- Triggered control factors can be modelled. For example, the effect of rainfall for suppressing dust from exposed areas can be simulated for relevant hours in the year.

There are also disadvantages to the approach of recalculating emissions from other mines. The main disadvantages are potential inconsistencies between the emission estimates and other published EIS emissions data, and the inability to precisely match source locations to future mine plans. However, it will be seen in **Section 8**, that the emission estimation approach combined with model setup assumptions has produced results which do not underestimate average concentrations at the key sensitive receptor locations, for the existing scenario.

Table 13 Estimated TSP emissions due to the Project and other operations

Operation (see Table 12 for Consent references)	Annual TSP emissions (kg/y)				
	2014	Year 1 (2021) [1]	Year 6 (2026) [1]	Year 13 (2033) [1]	Year 18 (2038) [1]
Glendell	2,411,539	2,241,625	3,274,887	5,017,124	2,992,017
Ashton (including SEOC)	114,780	1,379,698	1,379,698	114,937	
HVO (component in model domain)	9,923,425	13,547,344	13,547,344		
Integra Underground	114,683	115,112	115,112	115,112	
Liddell Coal Operations	3,688,178	4,089,481			
Mount Owen	4,682,946	5,800,071	4,308,575	2,548,710	727,669
Ravensworth Operations	5,941,622	7,440,069	7,440,069	7,440,069	7,440,069
Rix's Creek South	2,199,466	2,635,613	2,635,613	2,635,613	2,635,613
Rix's Creek North	210,391	2,163,828	2,163,828	2,163,828	

[1] Calendar years are indicative only and are to provide guidance for the duration of other mining operations relative to the Project.

Table 14 Estimated PM_{10} emissions due to the Project and other operations

Operation (see Table 12 for Consent references)	Annual PM_{10} emissions (kg/y)				
	2014	Year 1 (2021) [1]	Year 6 (2026) [1]	Year 13 (2033) [1]	Year 18 (2038) [1]
Glendell	721,190	681,177	1,037,423	1,522,894	936,928
Ashton (including SEOC)	37,909	413,100	413,100	37,983	
HVO (component in model domain)	2,780,851	3,704,001	3,704,001		
Integra Underground	37,863	38,066	38,066	38,066	
Liddell Coal Operations	1,147,692	1,268,767			
Mount Owen	1,428,982	1,847,572	1,357,871	828,889	252,176
Ravensworth Operations	1,940,467	2,414,566	2,414,566	2,414,566	2,414,566
Rix's Creek South	682,901	811,805	811,805	811,805	811,805
Rix's Creek North	108,449	691,822	691,822	691,822	

[1] Calendar years are indicative only and are to provide guidance for the duration of other mining operations relative to the Project.

Table 15 Estimated $PM_{2.5}$ emissions due to the Project and other operations

Operation (see Table 12 for Consent references)	Annual $PM_{2.5}$ emissions (kg/y)				
	2014	Year 1 (2021)[1]	Year 6 (2026)[1]	Year 13 (2033)[1]	Year 18 (2038)[1]
Glendell	130,163	128,378	191,639	287,474	173,953
Ashton (including SEOC)	3,530	72,044	72,044	3,542	
HVO (component in model domain)	519,120	709,570	709,570		
Integra Underground	3,523	3,554	3,554	3,554	
Liddell Coal Operations	180,926	194,906			
Mount Owen	219,856	291,783	207,023	134,223	62,853
Ravensworth Operations	290,083	345,834	345,834	345,834	345,834
Rix's Creek South	118,692	133,542	133,542	133,542	133,542
Rix's Creek North	15,779	111,572	111,572	111,572	

[1] Calendar years are indicative only and are to provide guidance for the duration of other mining operations relative to the Project.

Finally, there will be operational controls in place at Glendell Mine which will also have a direct effect on emissions to air. Specifically, Glencore is committed to the continued implementation of operational controls during adverse weather conditions in order to minimise impacts. The operational controls will result in reduced levels of activity at Glendell Mine relative to the capacity considered as part of the current air quality modelling. In practice these operational controls, which will vary on a daily basis, will lead to lower emissions to air than for unconstrained activities. Consequently the estimated emissions in **Table 13**, **Table 14** and **Table 15** should represent conservative estimates, as these further detailed operational controls are not included, and it follows that the predicted impacts of the Project will also be conservative. That is, the predicted impacts are likely to over-state actual impacts to some extent.

7. Approach to Assessment

7.1 Overview

This assessment has followed the EPA's "Approved Methods of the Modelling and Assessment of Air Pollutants in New South Wales" (EPA 2016), which specifies how assessments based on the use of air dispersion models should be undertaken. The "Approved Methods" include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of dispersion model predictions.

The CALPUFF computer-based air dispersion model has been used to predict ground-level concentrations and deposition levels due to the identified emission sources, and the model predictions have been compared with relevant air quality criteria. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and potential for stagnation conditions characterised by calm or very low wind speeds with variable wind directions.

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model. The model comprises meteorological modelling as well as dispersion modelling, both of which are described below.

This Air Quality Impact Assessment has been subject to independent peer review, by ERM, in order to test all assumptions. Review comments have been addressed in this assessment and the peer review has been included as **Appendix D**. In summary, the peer review concluded that this assessment *"is consistent with the requirements of the NSW EPA Approved Methods for a Project of this nature. The methodology is sound and includes an acceptable level of conservatism. The assessment conclusions are consistent with what would be expected for a Project such as this"*.

7.2 Meteorological Modelling

The air dispersion model used for this assessment, CALPUFF, requires information on the meteorological conditions in the modelled region. This information is typically generated by the meteorological pre-processor, CALMET, using surface observation data from local weather stations and upper air data from radio-sondes or numerical models, such as the CSIRO's prognostic model known as TAPM (The Air Pollution Model). CALMET also requires information on the local land-use and terrain. The result of a CALMET simulation is a year-long, three-dimensional output of meteorological conditions that can be used as input to the CALPUFF air dispersion model.

There are no known meteorological stations in the Upper Hunter region that collect suitable upper air data for CALMET. The closest station with suitable data is operated by the Bureau of Meteorology at Williamtown, approximately 80 km to the east-southeast of Glendell Mine. The necessary upper air data were therefore generated by TAPM, using influence from the surface observations at the Glendell Met meteorological station. CALMET was then set up with three surface observations stations (Glendell Met, Mt Owen Met and Camberwell (OEH) meteorological stations) and one upper air station (based on TAPM output for the Glendell Met meteorological station). The meteorological modelling followed the guidance of TRC (2011) and adopted the "observations" mode. A "hybrid" mode was also tested but found to produce unrealistic wind-fields because of too much weighting towards the prognostic data.

Key model settings for TAPM are shown below in **Table 16**.

Table 16 Model settings and inputs for TAPM

Parameter	Value(s)
Model version	4.0.5
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	35 x 35 x 25
Year(s) of analysis	2014, with one “spin-up” day.
Centre of analysis	Glendell Mine (32º24.5’ S, 151º5.5’ E)
Terrain data source	30 m Shuttle Research Topography Mission (SRTM)
Land use data source	Default
Meteorological data assimilation	Glendell Met meteorological station. Radius of influence = 15 km. Number of vertical levels for assimilation = 4

Table 17 lists the model settings and input data for CALMET. This information has been provided so that the user can reproduce the results if required.

Table 17 Model settings and inputs for CALMET

Parameter	Value(s)
Model version	6.334
Terrain data source(s)	30 m SRTM
Land-use data source(s)	Digitized from aerial imagery
Meteorological grid domain	20 km x 20 km
Meteorological grid resolution	0.2 km
Meteorological grid dimensions	100 x 100 x 9
Meteorological grid origin	310000 mE, 6400000 mN. MGA Zone 56
Surface meteorological stations	Glendell Met (Observations of wind speed and wind direction. TAPM for ceiling height, cloud cover and air pressure) Mount Owen Met (Observations of wind speed and wind direction) Camberwell (OEH) (Observations of wind speed, wind direction, temperature and humidity)
Upper air meteorological stations	Upper air data file for the location of Glendell Met station derived by TAPM Biased towards surface observations (-1, -0.8, -0.6, -0.4, -0.2, 0, 0, 0, 0)
Simulation length	8760 hours (1 Jan 2014 to 31 Dec 2014)
R1, R2	0.5, 1
RMAX1, RMAX2	5, 20
TERRAD	5

Terrain information was extracted from the NASA Shuttle Research Topography Mission database which has global coverage at approximately 30 metre resolution (in addition to the Project Digital Elevation Model). Higher resolution topographical data are not necessary in order to develop wind fields that reflect the influence of terrain and effects that are important for dispersion of emissions from the Project to the sensitive receptor areas. Land use data were extracted from aerial imagery. **Figure 16** shows the model grid, land-use and terrain information, as used by CALMET. It is noted that the extent of some land-uses will change over time, such as mining areas, however the model sensitivity has been tested and changes from grassland to barren land (i.e. mining areas) were found to have very little influence on the dispersion modelling results.

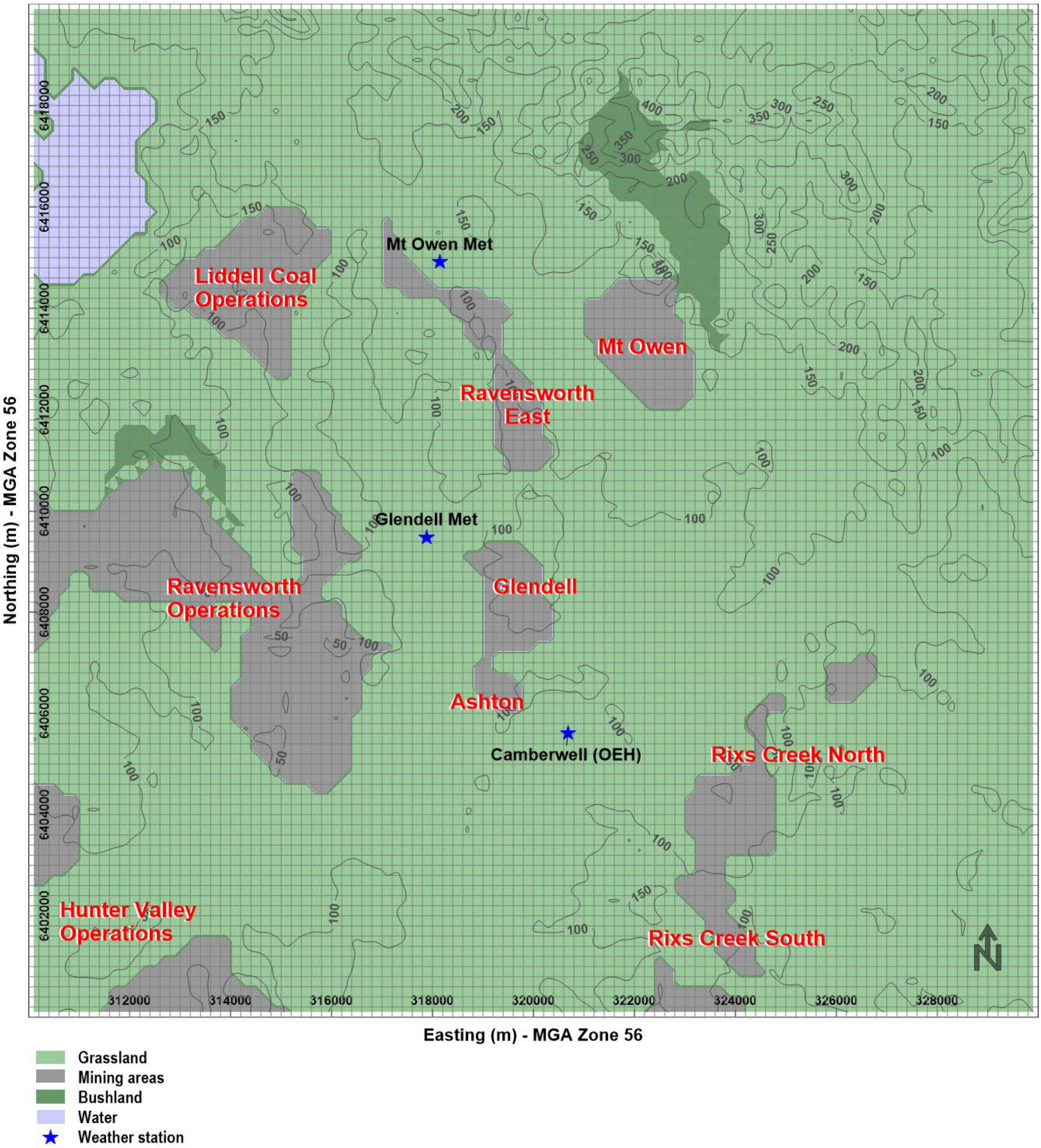


Figure 16 Model domain, grid, land-use and terrain information

Figure 17 shows a snapshot of winds at 10 metres above ground-level as simulated by the CALMET model under stable conditions. This plot shows the effect of the topography on local winds (for this particular hour), and highlights the non-uniform wind patterns in the area, which further supports the use of a non-steady-state model such as CALPUFF.

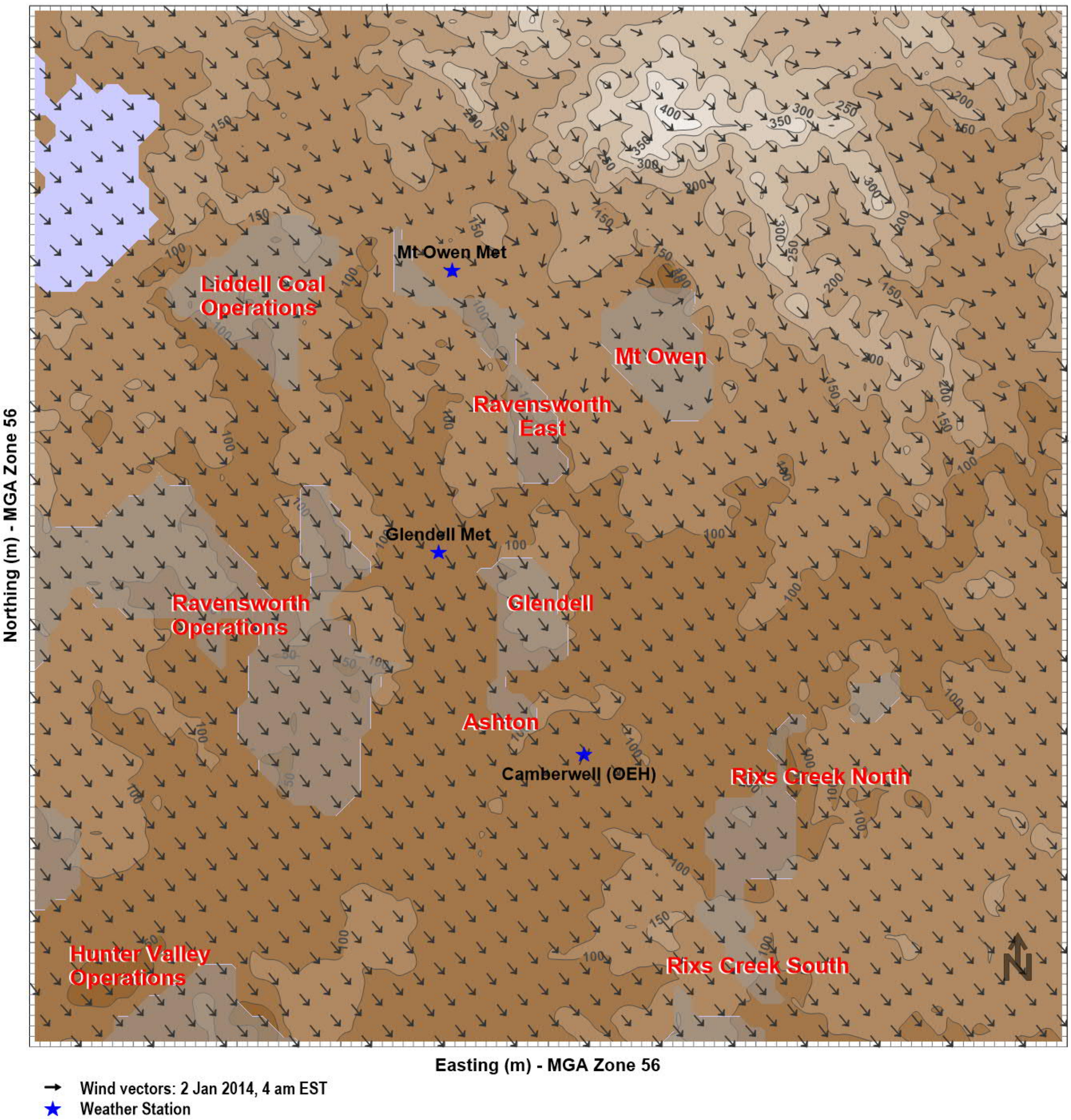


Figure 17 Example of CALMET simulated ground-level wind flows

7.3 Dispersion Modelling

Ground-level concentration and deposition levels due to the emission sources have been predicted using the air dispersion model known as CALPUFF (Version 6.42). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME and ISCST3) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long-range transport and near calm conditions. CALPUFF has the ability to model the effect of emissions entrained into the thermal internal boundary layer that forms over land, both through fumigation and plume trapping. CALPUFF is an air dispersion model which has been approved by the EPA for these types of assessments (EPA 2016).

The modelling was performed using the emission estimates from **Section 6** and the meteorological information provided by the CALMET model, described in **Section 7.2**. Predictions were made at 1,003 discrete receptors (including sensitive receptors and monitoring locations) to allow for contouring of results. The locations of the model receptors are shown in **Appendix E**.

Mining operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. **Figure 18** to **Figure 22** show the location of the modelled sources for 2014 and future Project years, where the emissions from the dust generating activities summarised in **Table 13** to **Table 15** were assigned to one or more of these source locations (refer to **Appendix C** for details of the allocations).

Dust emissions for all modelled mine-related sources have been considered to fit in one of three categories, as follows:

- Wind insensitive sources, where emissions are relatively insensitive to wind speed (for example, dozers).
- Wind sensitive sources, where emissions vary with the hourly wind speed, raised to the power of 1.3, a generic relationship published by the US EPA (1987). This relationship has been applied to sources such as loading and unloading of waste to/from trucks and results in increased emissions with increased wind speed.
- Wind sensitive sources, where emissions also vary with the hourly wind speed, but raised to the power of 3, a generic relationship published by Skidmore (1998). This relationship has been applied to sources including wind erosion from stockpiles, overburden dumps or active pits, and results in increased emissions with increased wind speed.

Emissions from each volume source were developed on an hourly time step, taking into account the level of activity at that location and, in some cases, the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

Blasting activities and associated emissions were assumed to take place only during daylight hours (9 am to 5 pm for the purposes of the modelling) while all other activities have been modelled for 24 hours per day.

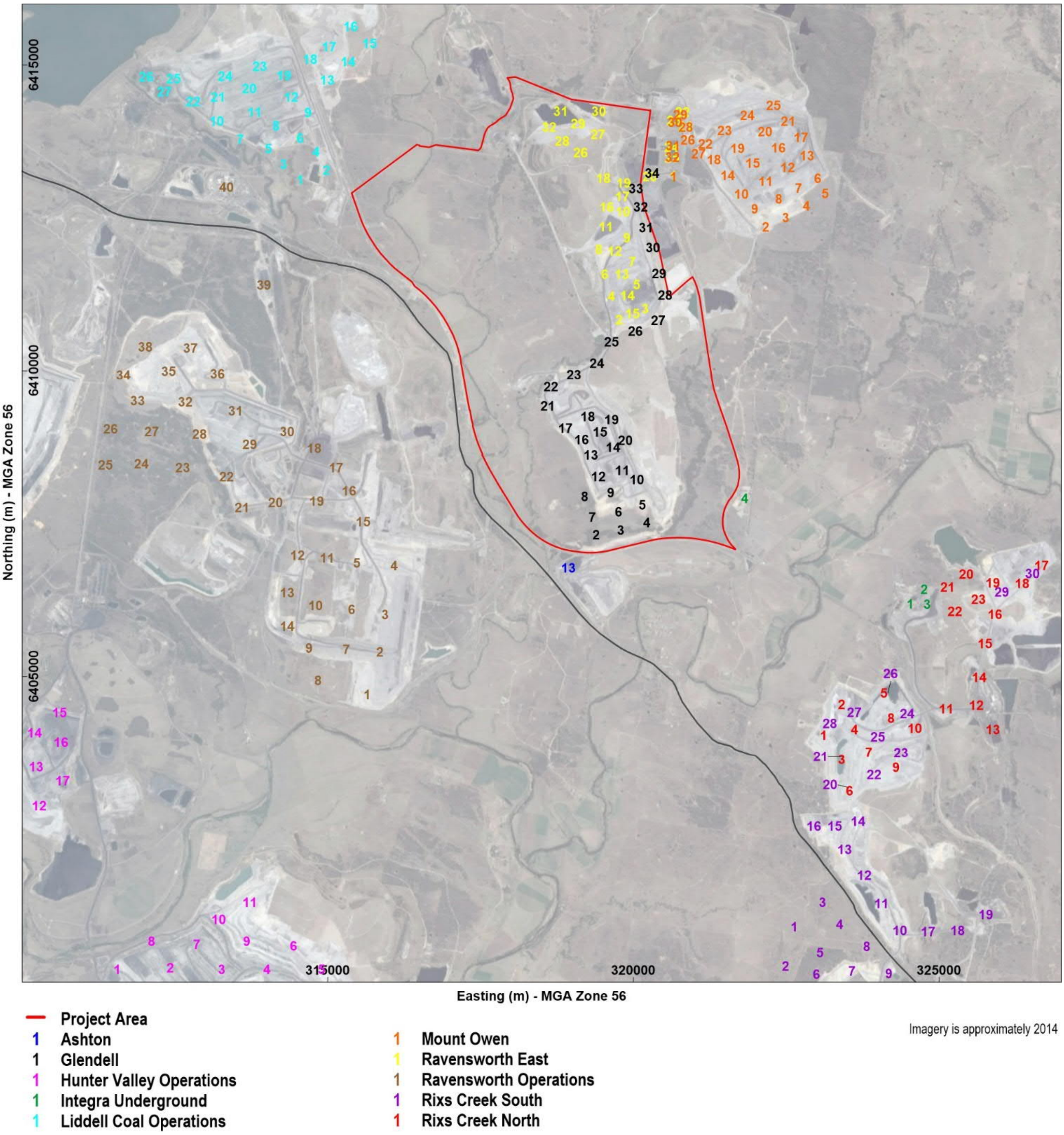


Figure 18 Location of modelled sources in 2014 (Existing Conditions)

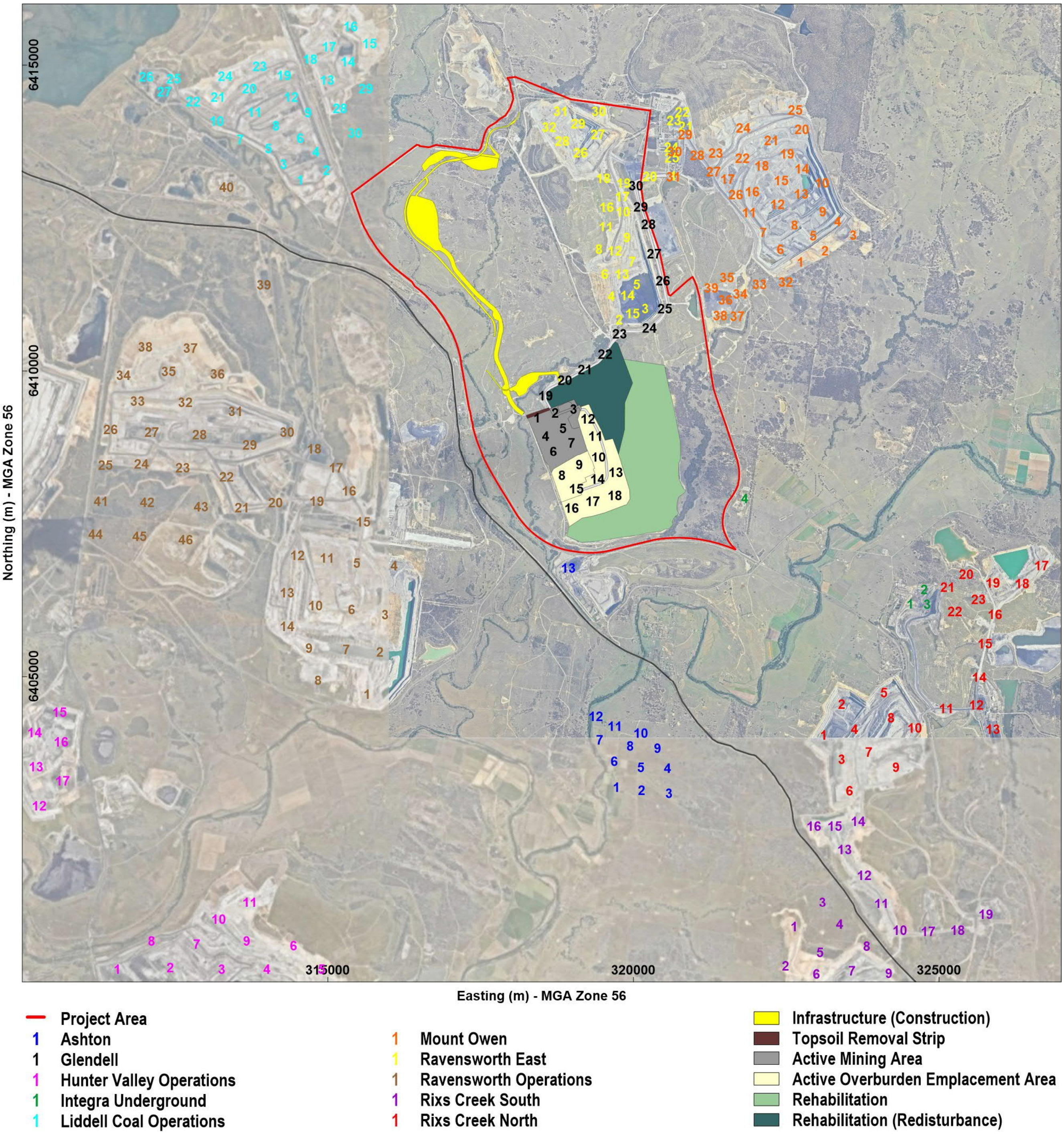


Figure 19 Location of modelled sources in Project Year 1

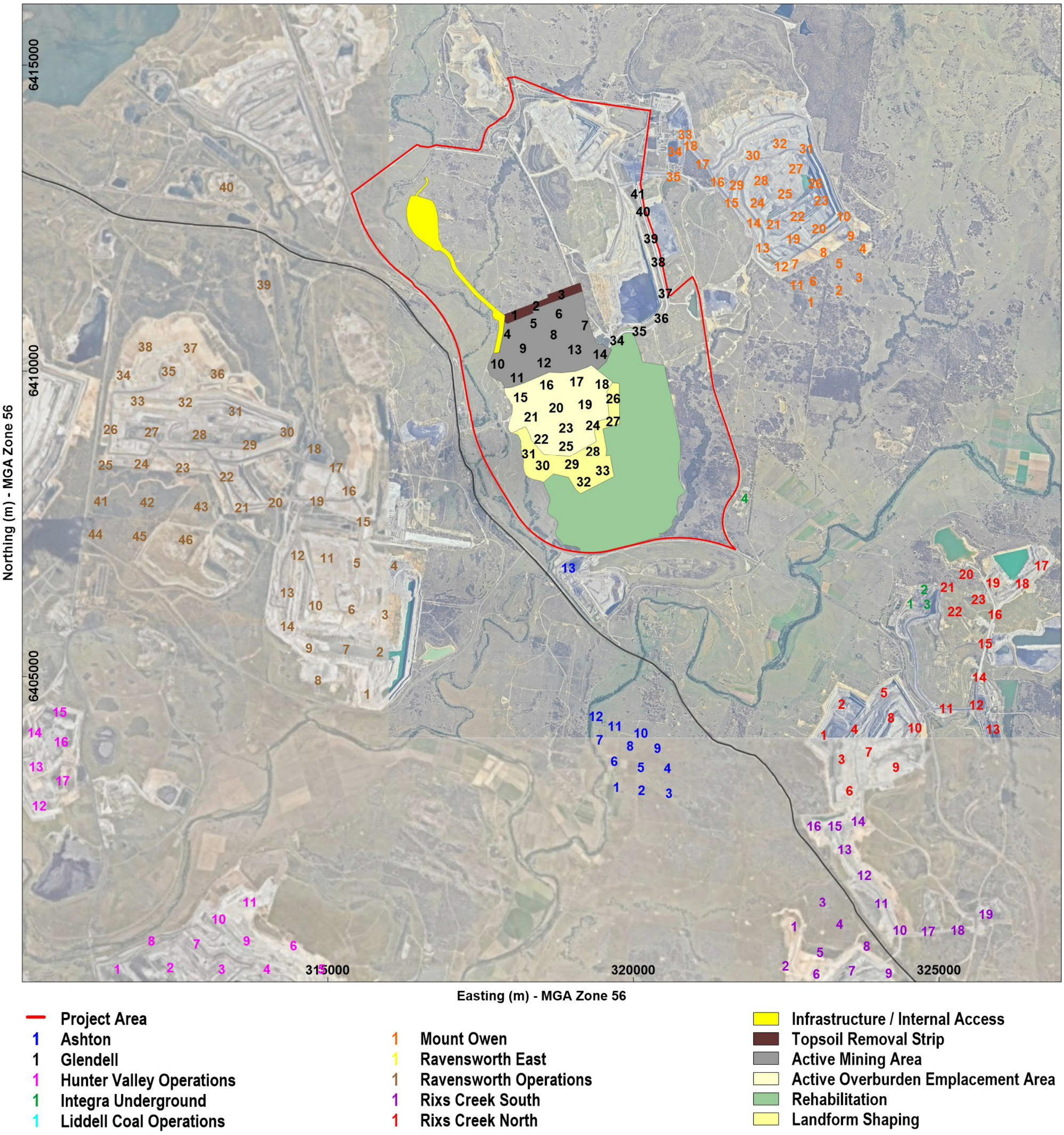


Figure 20 Location of modelled sources in Project Year 6

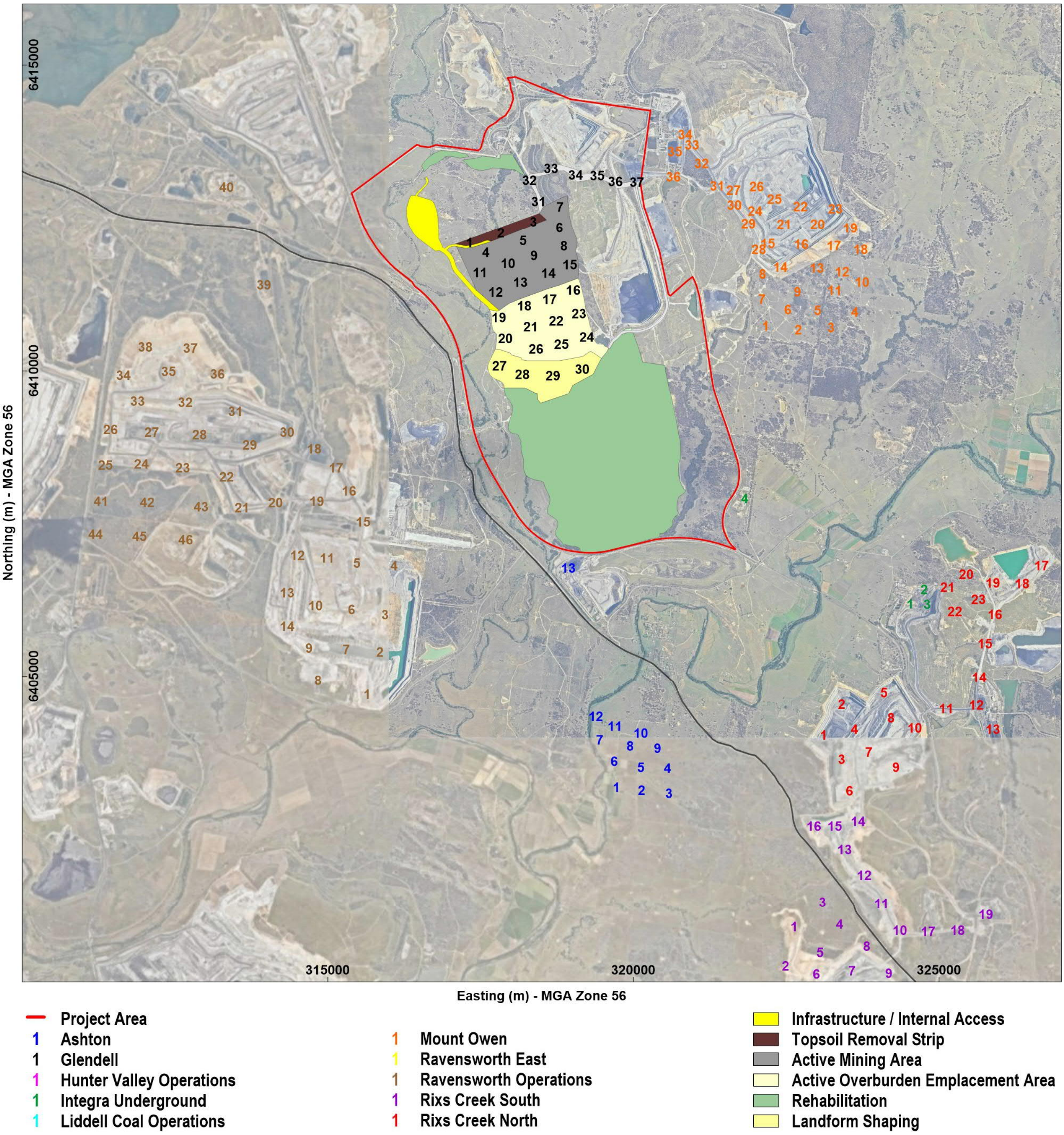


Figure 21 Location of modelled sources in Project Year 13

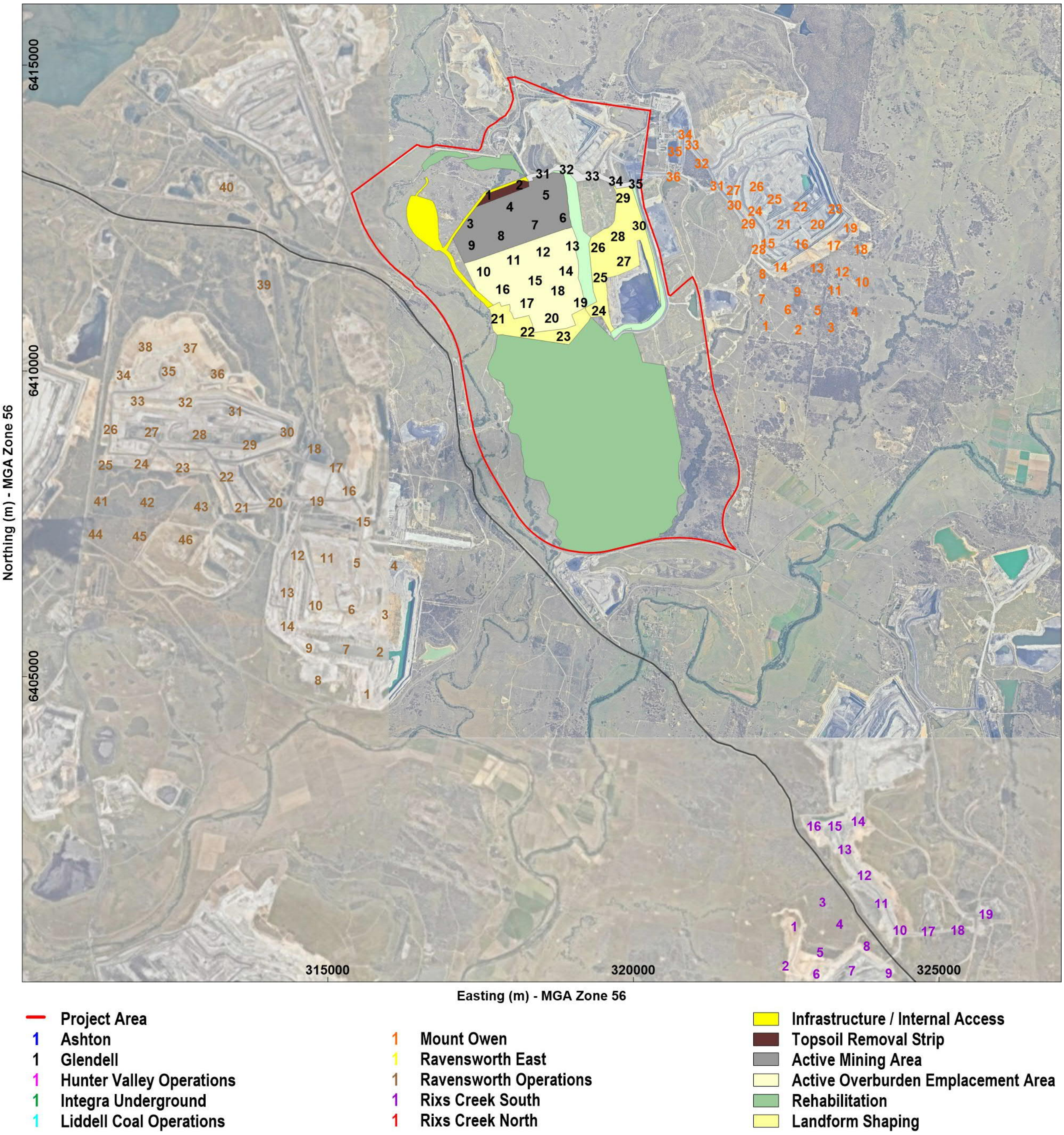


Figure 22 Location of modelled sources in Project Year 18

Pit retention (that is, retention of dust particles within the open pits) has been included in the model simulations. The pit retention calculation determines the fraction of dust emitted in the pit that may escape the pit. The "escaped fraction" is a function of the gravitational settling velocity of the particles and the wind speed and is shown by the following relationship (US EPA, 1995).

Equation 1:

$$\varepsilon = \frac{1}{\left(1 + \frac{v_g}{(\alpha U_r)}\right)}$$

where:

ε = escaped fraction for the particle size category
V_g = gravitational settling velocity (m/s)
U_r = approach wind speed at 10 m (m/s)
α = proportionality constant in the relationship between flux from the pit and the product of U_r and concentration in the pit (0.029)

To model the effect of pit retention, the emissions from mining sources within the open pits have been reduced, as per the calculation above. This approach means that much of the coarser dust would remain trapped in the pits. Typically, five per cent of the PM_{10} emissions are trapped in the pit using this calculation.

The effect of rainfall for suppressing dust from exposed areas has also been simulated. For each hour of rainfall above 0.254 mm (i.e. 0.1 inch) a 50% control on emissions has been applied to wind erosion from active pits and active dumps. Inclusion of rainfall in this manner has minimal (i.e. less than 1%) effect on the model results.

Key model settings and inputs for CALPUFF are provided in **Table 18**.

Table 18 Model settings and inputs for CALPUFF

Parameter	Value(s)
Model version	6.42
Computational grid domain	100 x 100
Chemical transformation	None
Dry deposition	Yes
Wind speed profile	ISC rural
Puff element	Puff
Dispersion option	Turbulence from micrometeorology
Time step	3600 seconds (1 hour)
Terrain adjustment	Partial plume path
Number of volume sources	See Appendix C. Height = 5 m, SY = 20 m, SZ = 10 m. Elevations from Project Digital Elevation Model (DEM)
Number of discrete receptors	1003. See Appendix E.

Finally, the model predictions at identified sensitive receptors were then compared with the EPA air quality criteria, previously discussed in **Section 4**. Contour plots have also been created to show the spatial distribution of model predictions. The results for each substance and averaging time were presented as a series of figures showing:

- Model predictions for future operational scenarios, as Project only contributions.
- Model predictions for future operational scenarios, due to the Project and other sources.

8. Model Performance

The performance of the model for predicting air quality conditions has been evaluated. This involved comparing predictions with measurements for a recent year (2014), using information on meteorological and operating conditions at the time, in order to establish the likely confidence in the model predictions for future operations.

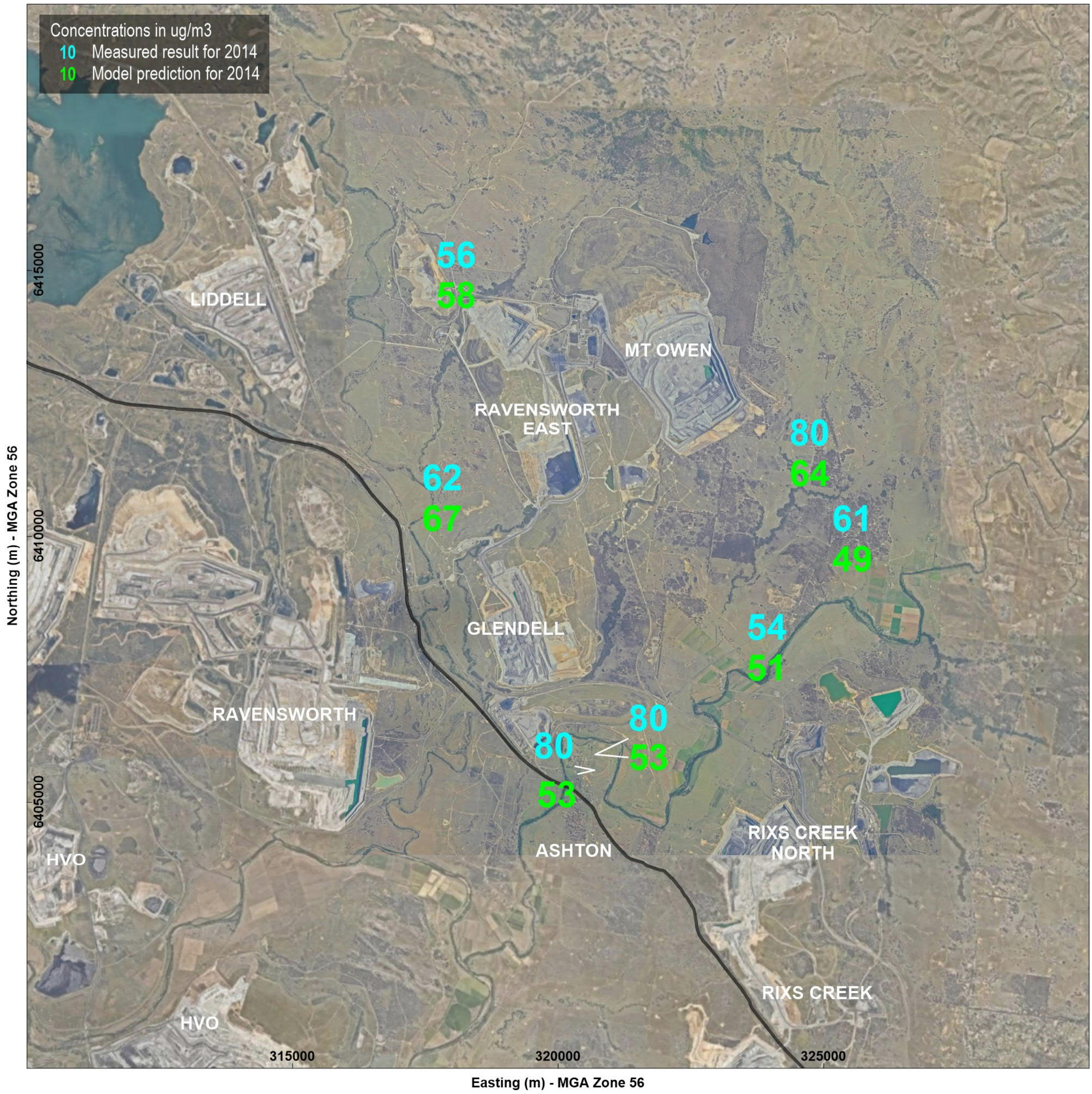
The model performance has been evaluated for:

- Maximum 24-hour average PM_{10} concentrations;
- Annual average PM_{10} concentrations;
- Annual average TSP concentrations; and
- Annual average dust deposition.

Model performance was not evaluated for $PM_{2.5}$ as there are insufficient $PM_{2.5}$ monitors in the model domain (only one) to allow for a comparison between measured and predicted levels.

Figure 23 shows the model performance for predicting maximum 24-hour average PM_{10} concentrations, based on conditions in 2014. As noted above, this comparison is useful for determining the confidence in the model predictions for future operations. It should be noted that only one data point is shown for each location (that is, the highest value) and more detailed comparisons between measured and predicted results for all percentiles is provided in **Appendix F.**

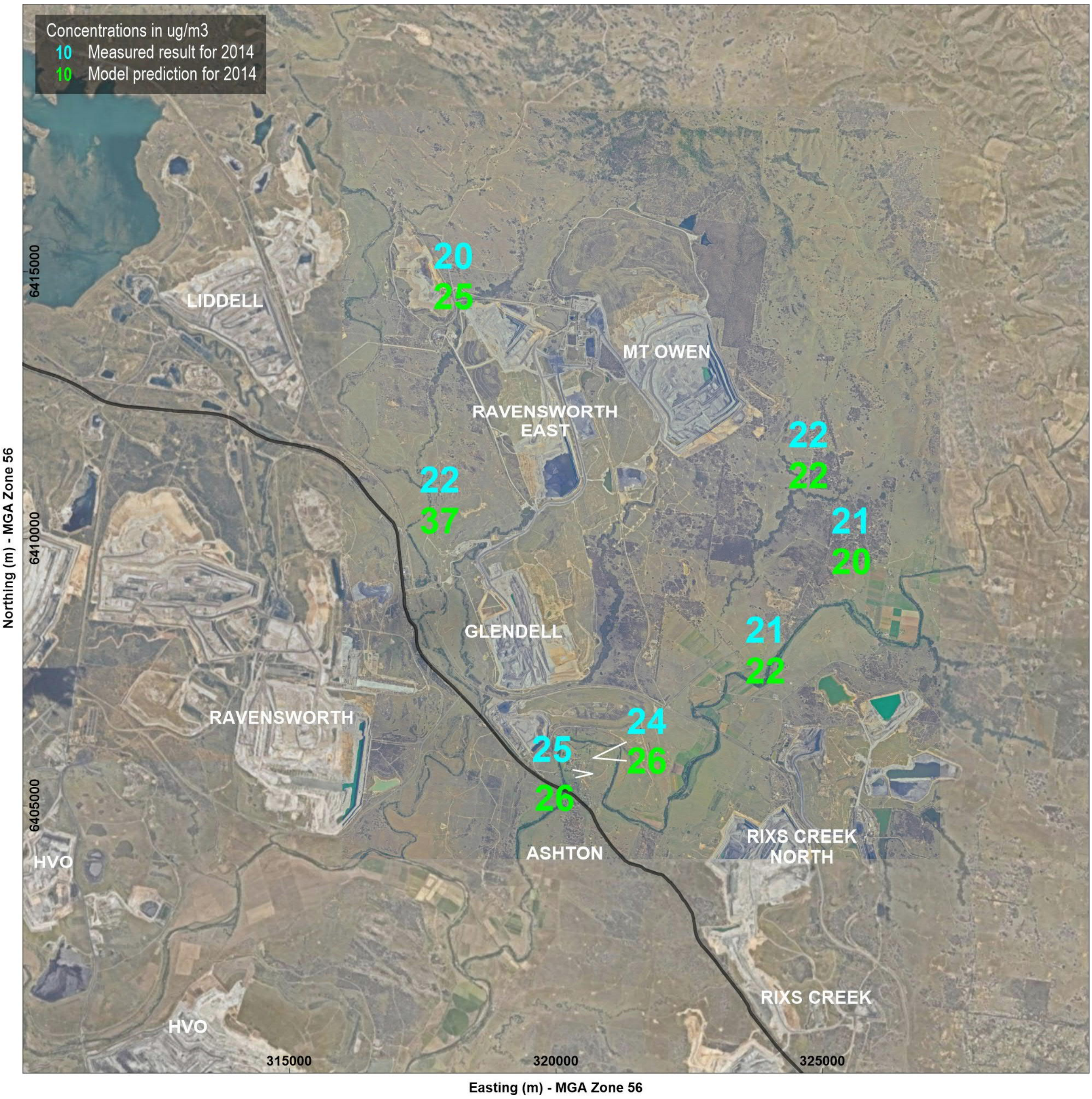
Figure 23 shows that the model predictions for 24-hour averages are in the range of 30 per cent lower to 10 per cent higher than the measured result, depending on the location. These results highlight the difficultly in predicting short-term (24-hour average) concentrations and the highly variable nature of daily PM_{10} concentrations but they are however well within a factor of two for all percentiles. **Appendix F** provides this detail.



EPA criterion is 50 µg/m³.

Figure 23 Model performance for predicting maximum 24-hour average PM_{10} concentrations

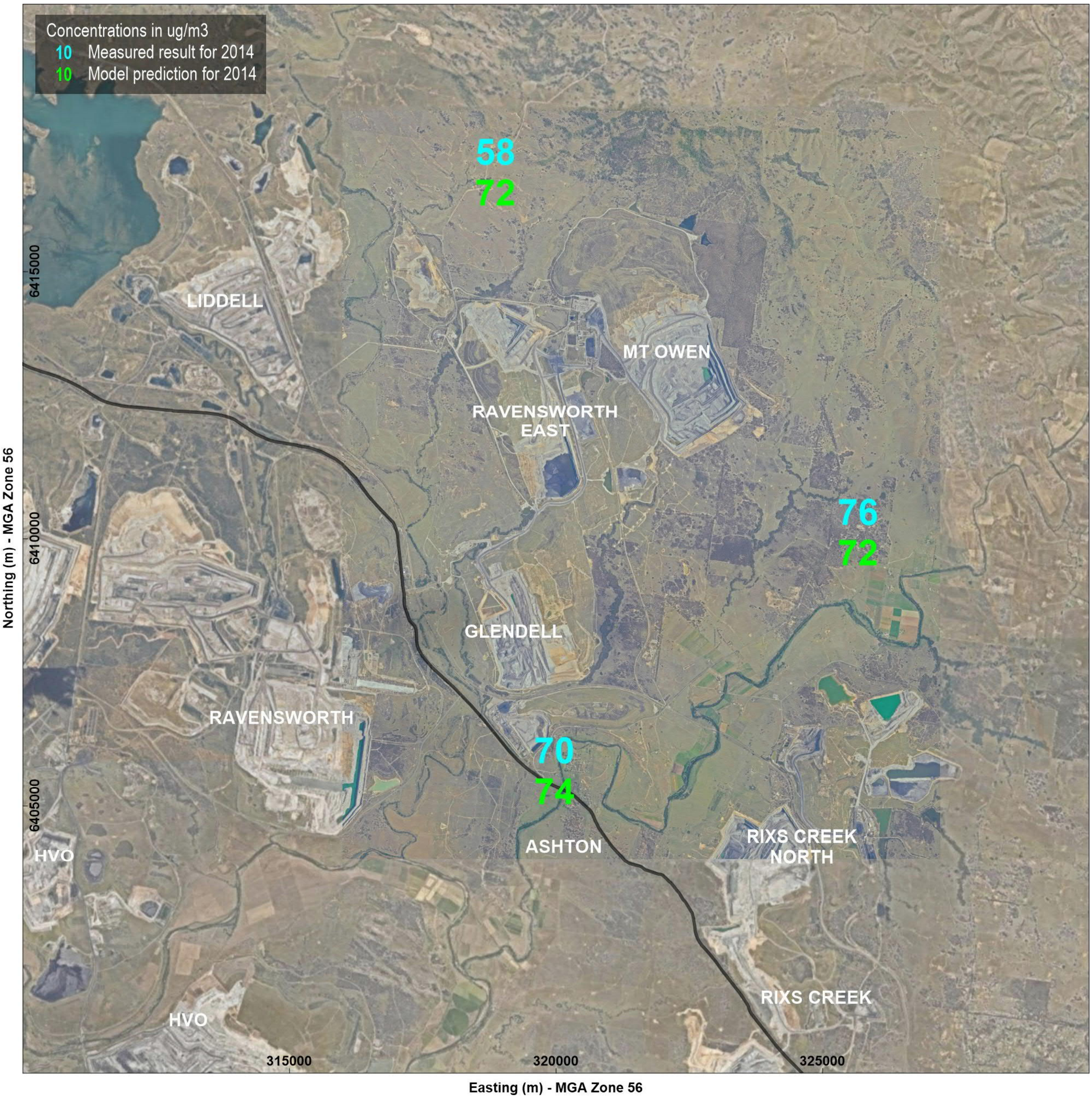
Figure 24 shows the measured and predicted annual average PM_{10} concentrations for 2014. These results show that, for locations around Glendell Mine, the model predictions range from 4 per cent lower to 27 per cent higher than measured results. In absolute numbers, these results show that the model predictions at sensitive receptor locations in the Middle Falbrook and Camberwell areas are within 1 to 2 µg/m^3 of the measurements. There is a tendency for over-prediction to the northwest of Mount Owen Complex, however it is noted that the closest sensitive receptors are located to the southeast of the Project. Accordingly, the over prediction to the northwest is acceptable for determining the impacts of the Project. Similar performance may therefore be expected for the predictions of future conditions.



EPA criterion is 25 µg/m^3.

Figure 24 Model performance for predicting annual average PM_{10} concentrations

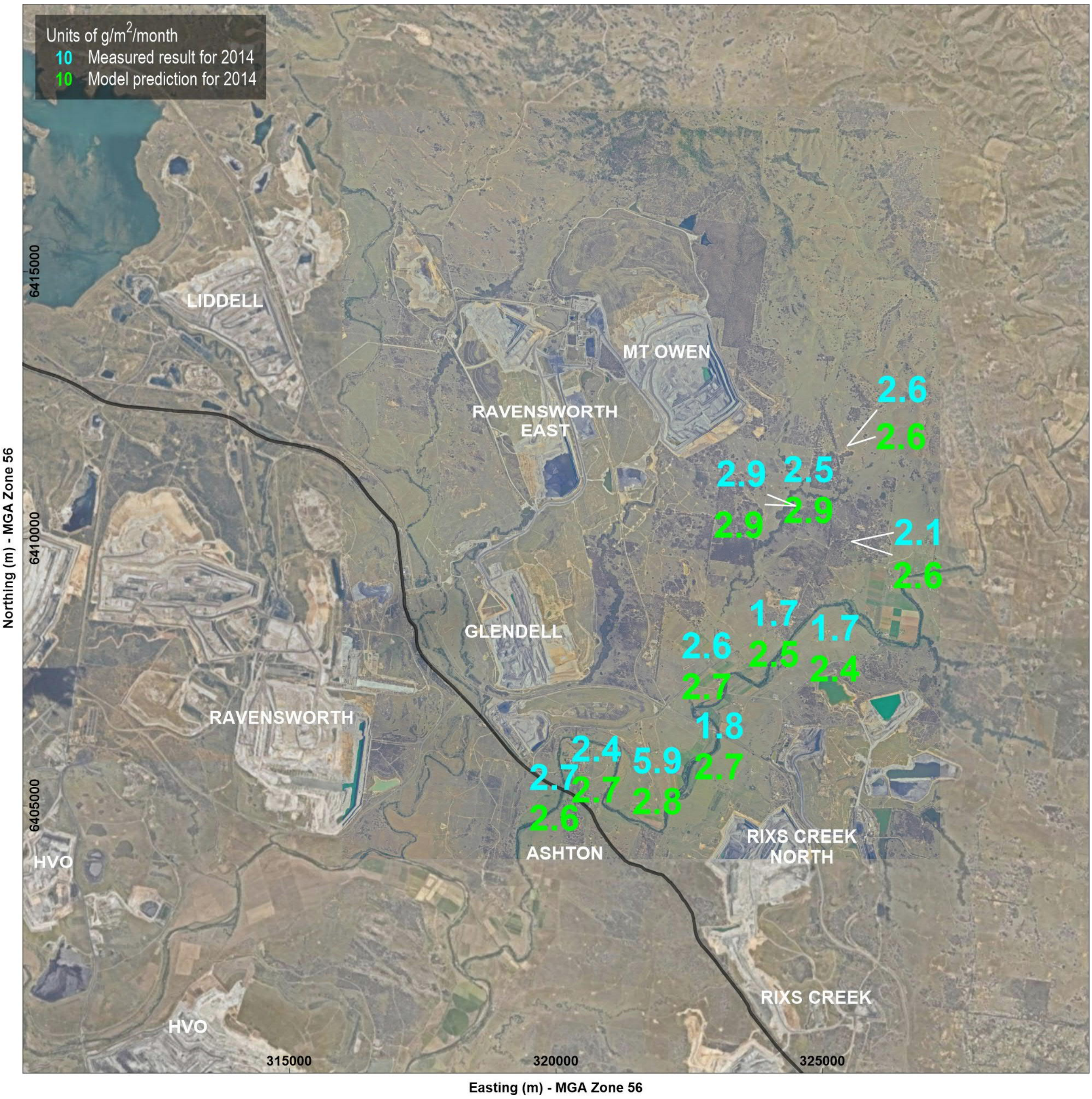
Figure 25 shows the annual average TSP concentrations for existing conditions (2014). This figure shows that the model predictions for this statistic are within five per cent of the measured result in the Camberwell and Middle Falbrook areas. There is a tendency for over-prediction to the northwest of Mount Owen Complex, however it is noted that the closest sensitive receptors are located to the southeast of the Project. Accordingly, it is considered that the over prediction to the northwest is acceptable.



EPA criterion is 90 µg/m³.

Figure 25 Model performance for predicting annual average TSP concentrations

Figure 26 shows the annual average dust deposition levels for existing conditions (2014). The model predictions are higher than the measured results at all but two locations and typically within 0.5 g/m^2/month of the measured result. Similar performance may therefore be expected for the predictions of future conditions.



EPA criterion is 4 g/m^2/month.

Figure 26 Model performance for predicting annual average deposited dust

9. Assessment of Impacts

This section provides an assessment of the key air quality issues associated with the Project primarily based on comparisons of model predictions to EPA air quality criteria. Assessment against the VLAMP criteria has been provided separately in **Section 10**. Outcomes of this assessment have been determined for all locations but with a focus on private sensitive receptors not already subject to acquisition rights. In this context a sensitive receptor is defined by the EPA as "*a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area"* and interpreted as places of near continuous occupation (e.g. with likely daily occupation). Two receptors have been excluded from consideration as private sensitive receptors for the purposes of the assessment:

- Receptor ID342, owned by Daracon Mining Pty Limited. This is an industrial workplace located adjacent to the New England Highway to the West of the Project Area; and
- Receptor ID2, The Glennies Creek Hall. This is a community based facility located on private land which is only occupied periodically for short periods.

One objective of this study was to predict the extent of air quality impacts due to the Project, and to identify potential changes in air quality over existing levels, recognising that the Glendell Mine is currently operational and the Project represents the progression of mining into a new area. For these objectives it is useful to understand the performance of the model (as per **Section 8**) as well as the expected change in impacts.

The complete list of tabulated results is provided in **Appendix G**. Contour plots have also been prepared and are discussed below. Additional information on the model performance is provided in **Appendix F**.

9.1 Particulate Matter (as PM_{10})

Figure 27 and **Figure 28** show the predicted maximum 24-hour average PM_{10} concentrations for the Project only and cumulative scenarios respectively.

Figure 27 shows that the contribution of the Project to maximum 24-hour average PM_{10} concentrations will not exceed 50 µg/m^3 at any private (non-mine owned) sensitive receptors at any stage of the Project..

To fully assess the Project against the EPA's 24-hour average criterion for PM_{10} it is necessary to consider potential cumulative impacts since the criterion (50 µg/m^3) relates to the total concentration in the air and not just the contribution from the project of interest. **Figure 28** shows that most areas of the model domain will experience at least one day each year when PM_{10} concentrations will exceed the 24-hour criterion due to the contributions of mining operations and other sources (with the exception of bushfires, dust storms and other extreme events). The analysis of existing air quality conditions (**Section 5.2.1**) also showed that this region, as well as other parts of NSW such as Newcastle, have historically experienced one or more days above the 24-hour criterion each year so the model results are indicating that air quality outcomes will not change in terms of maximum PM_{10} concentrations.

As noted in **Section 4**, in situations where background levels are elevated the proponent must "*demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical*" (EPA 2016). Additional investigation of the predictions has therefore been carried out, in particular for property 156 located in Camberwell; one of the nearest private sensitive receptors to the Project. This property is subject to existing acquisition rights.

Table 19 shows the predicted number of days above the EPA's 24-hour average criterion for PM_{10} at property 156 over the course of a year, for each assessment year, including the contributions from the Project, other mines and background levels. An increase in the number of days above 50 µg/m^3 is predicted at this location with the Project. Of the 17 potential exceedance days in Year 1, when mining operations will be at their closest to Camberwell, the contribution of the Project to this location is predicted to range from 2 to 24 µg/m^3 with an average of 12 µg/m^3.

Table 19 Predicted number of days above 24-hour average PM_{10} criteria at Camberwell (property ID 156)

ID	Due to background and other mines without Glendell					Due to background and other mines with Glendell (including Project)				
	2014	Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18
156	1	3	1	1	0	7	17	6	1	1

The air quality monitoring data (see **Section 5.2**) have shown that Camberwell has experienced between 11 and 44 days above 50 µg/m^3 in each of the past seven years and the predictions of future conditions represent a similar range of impacts. These impacts will be due to the combined contributions of all sources of dust that influence the region. With this information it can be anticipated that 24-hour average PM_{10} concentrations will continue to be variable from day-to-day, due to existing conditions and sources as well as extreme events, and that operations will need to continue to be managed in a way which minimises the contribution to off-site PM_{10} levels.

Figure 29 shows the predicted annual average PM_{10} concentrations due to the Project only and **Figure 30** shows the predicted cumulative concentrations. The cumulative predictions (**Figure 30**) can be compared to the EPA criteria, which is 25 µg/m^3. Annual average PM_{10} concentrations are predicted to comply with the criterion at all private sensitive receptors not already subject to acquisition rights.

As noted from **Section 5.2**, the air quality monitoring data showed that annual average PM_{10} concentrations have exceeded 25 µg/m^3 at Camberwell in four of the past seven years, and at two other locations in 2018 due in part to drought conditions. The modelling suggests that exceedances of the annual average criterion at Camberwell are likely for much of the life of the Project with levels declining in the later years of the Project as mining at Glendell moves away from Camberwell and other mining operations cease operations. It is noted however that the modelling indicates that this criterion is likely to be exceeded irrespective of the contribution from the Project.

The Daracon facility (ID 342), located near the New England Highway on the west side of the Project, to the northwest of Camberwell is predicted to experience an exceedance of the criteria for maximum 24-hour average PM_{10} concentrations (Project only) and cumulative annual average PM_{10}. The exceedance of the 24-hour Project only criterion is anticipated to occur in the Year 6 model year with three predicted exceedance days in the modelling year. The annual average PM_{10} criterion is predicted to be exceeded at this location in all modelling years however, as noted above, this facility is not considered to be a private sensitive receiver for the purposes of the assessment against the EPA or VLAMP criteria.

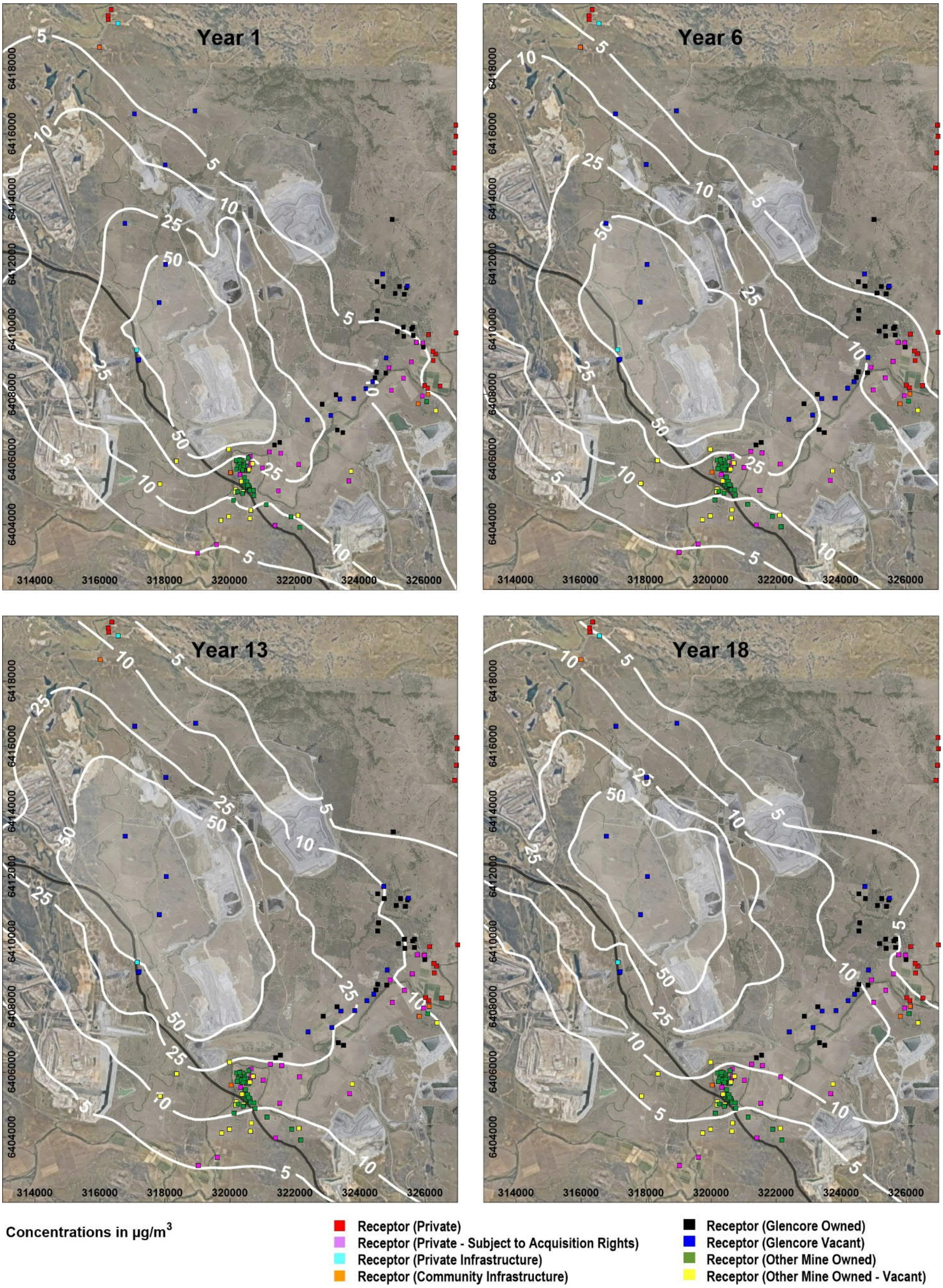


Figure 27 Predicted maximum 24-hour average PM_{10} concentrations due to the Project only

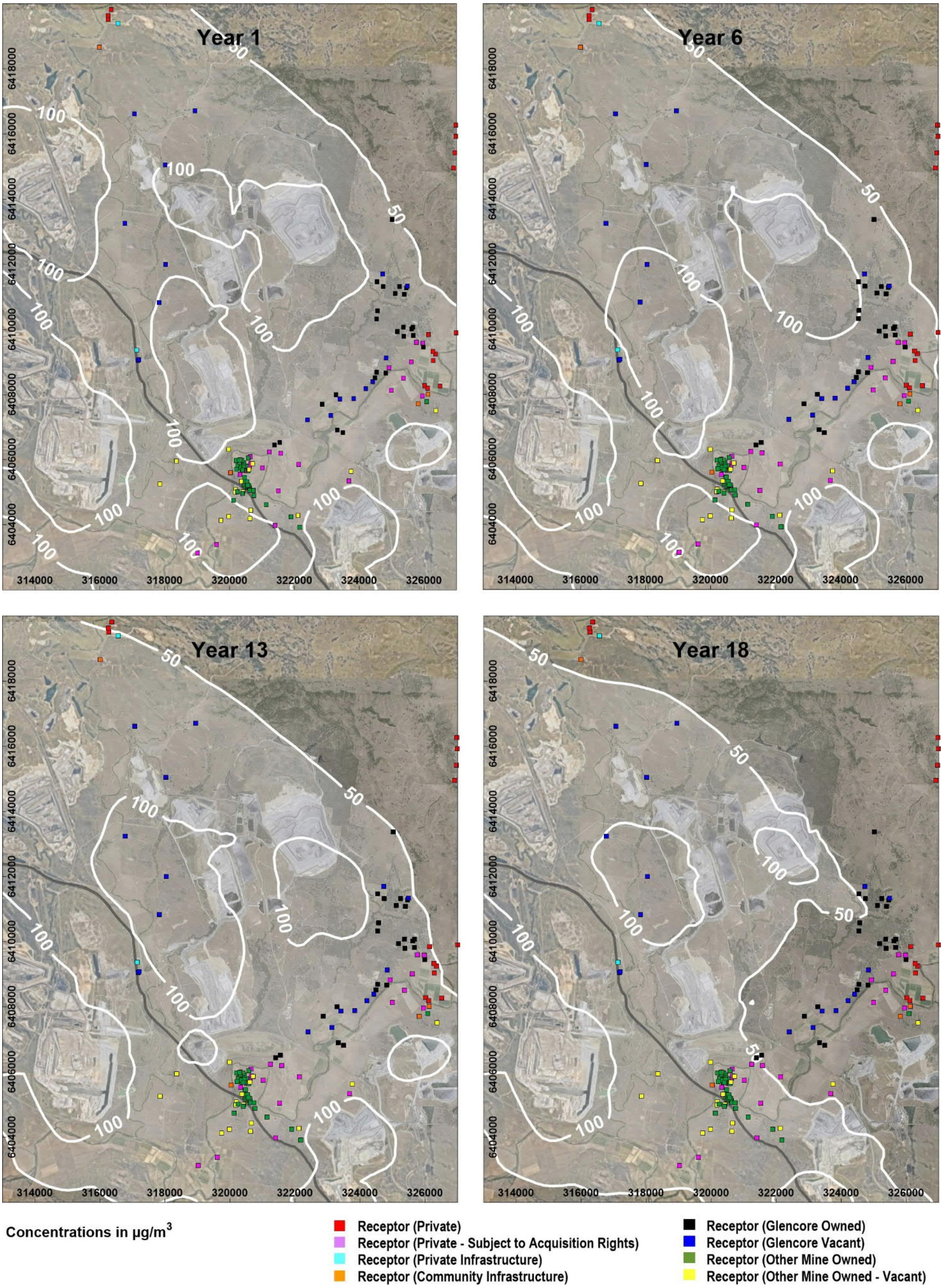


Figure 28 Predicted maximum 24-hour average PM_{10} concentrations due all sources (cumulative)

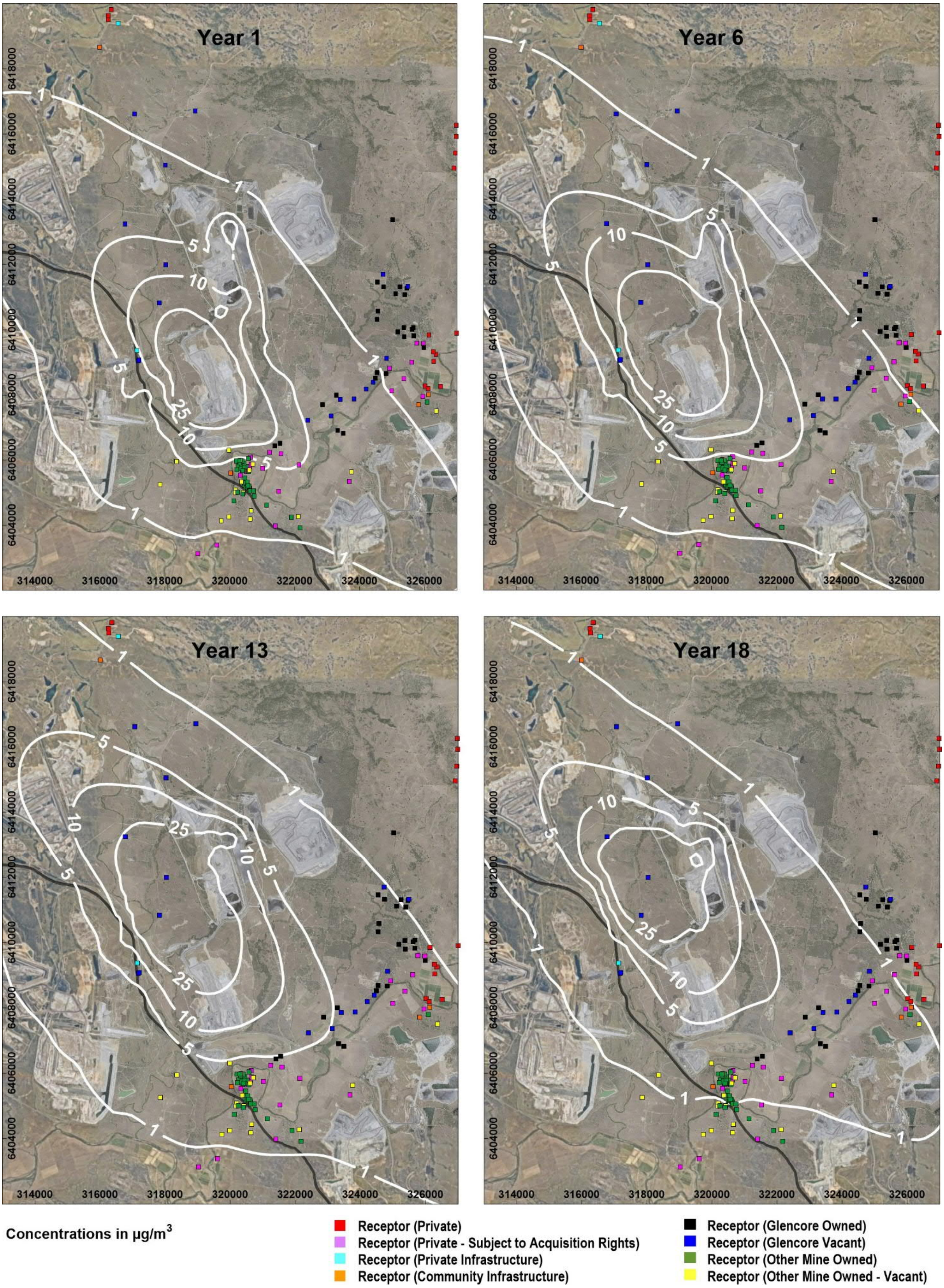


Figure 29 Predicted annual average PM_{10} concentrations due to the Project only

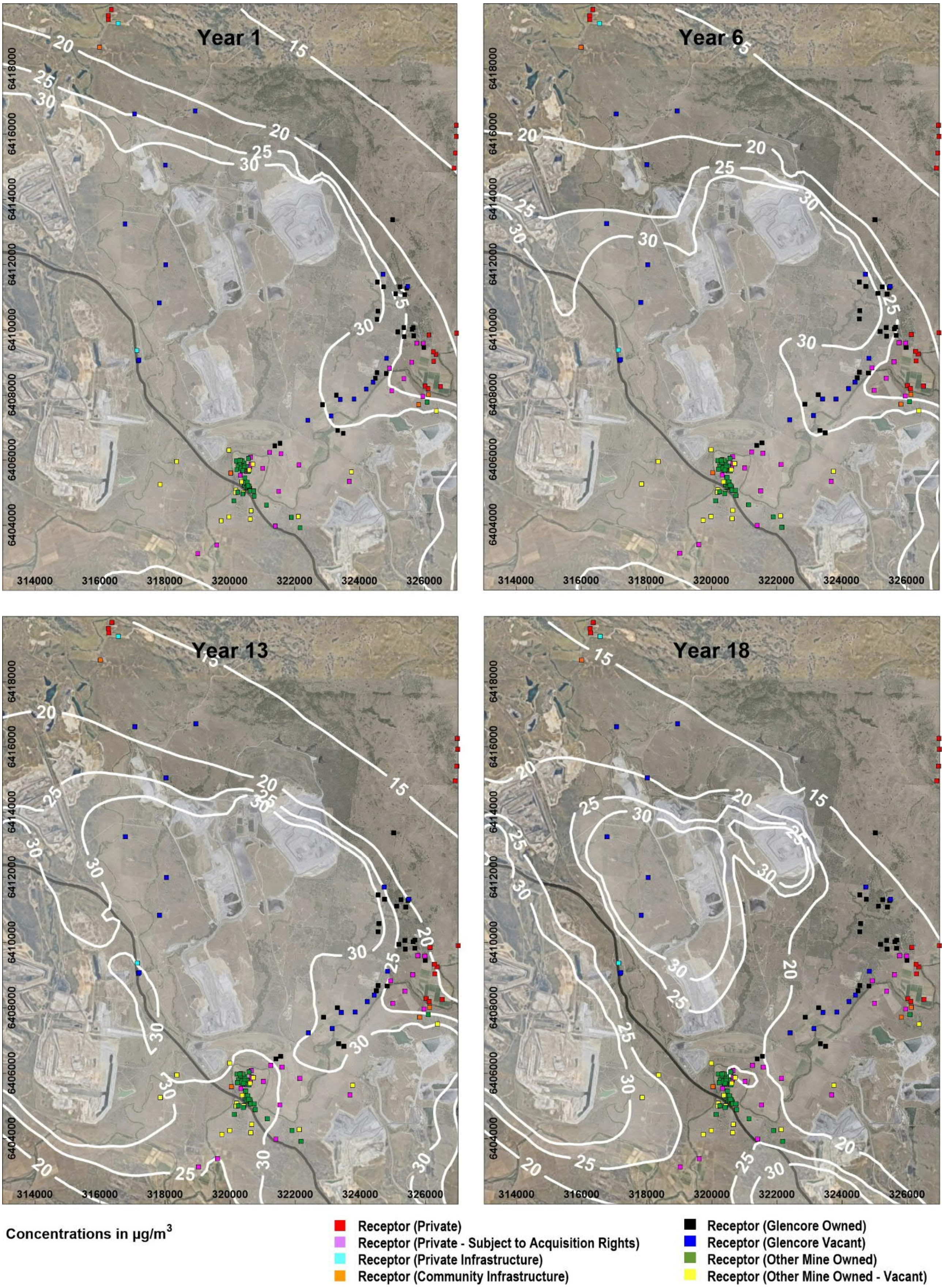


Figure 30 Predicted annual average PM_{10} concentrations due to all sources (cumulative)

9.2 Particulate Matter (as $PM_{2.5}$)

The results for $PM_{2.5}$ are shown in **Figure 31** to **Figure 34**, including the Project only and cumulative scenarios, for maximum 24-hour and annual averages. **Appendix G** provides all $PM_{2.5}$ model results for each receptor in tabular form.

Figure 31 shows that the contribution of the Project will not exceed 25 µg/m^3 at any private (non-mine owned) sensitive receptor at any stage of the Project. To fully assess the Project against the EPA's 24-hour average criterion for $PM_{2.5}$ it is necessary to consider potential cumulative impacts since the criterion (25 µg/m^3) relates to the total concentration in the air and not just the contribution from the project of interest. **Figure 32** shows the predicted maximum 24-hour average $PM_{2.5}$ concentrations due to all sources, that is, cumulative for the purposes of assessing against EPA criteria. Compliance with the EPA criteria for 24-hour average $PM_{2.5}$ (25 µg/m^3) is demonstrated at all private sensitive receptors not subject to acquisition rights.

Figure 33 and **Figure 34** show the predicted annual average $PM_{2.5}$ concentrations due to the Project only and all sources scenarios respectively. Compliance with the EPA criteria for annual average $PM_{2.5}$ (8 µg/m^3) is demonstrated at all private sensitive receptors not already subject to acquisition rights.

The Daracon facility (ID 342) is predicted to experience exceedances of the cumulative maximum 24-hour average and annual average $PM_{2.5}$ criteria. The exceedance of the 24-hour cumulative criterion is anticipated to occur in the Year 6 and Year 13 modelling years. The annual average $PM_{2.5}$ criterion is predicted to be exceeded at this location in the Year 1, 6 and 13 modelling years.

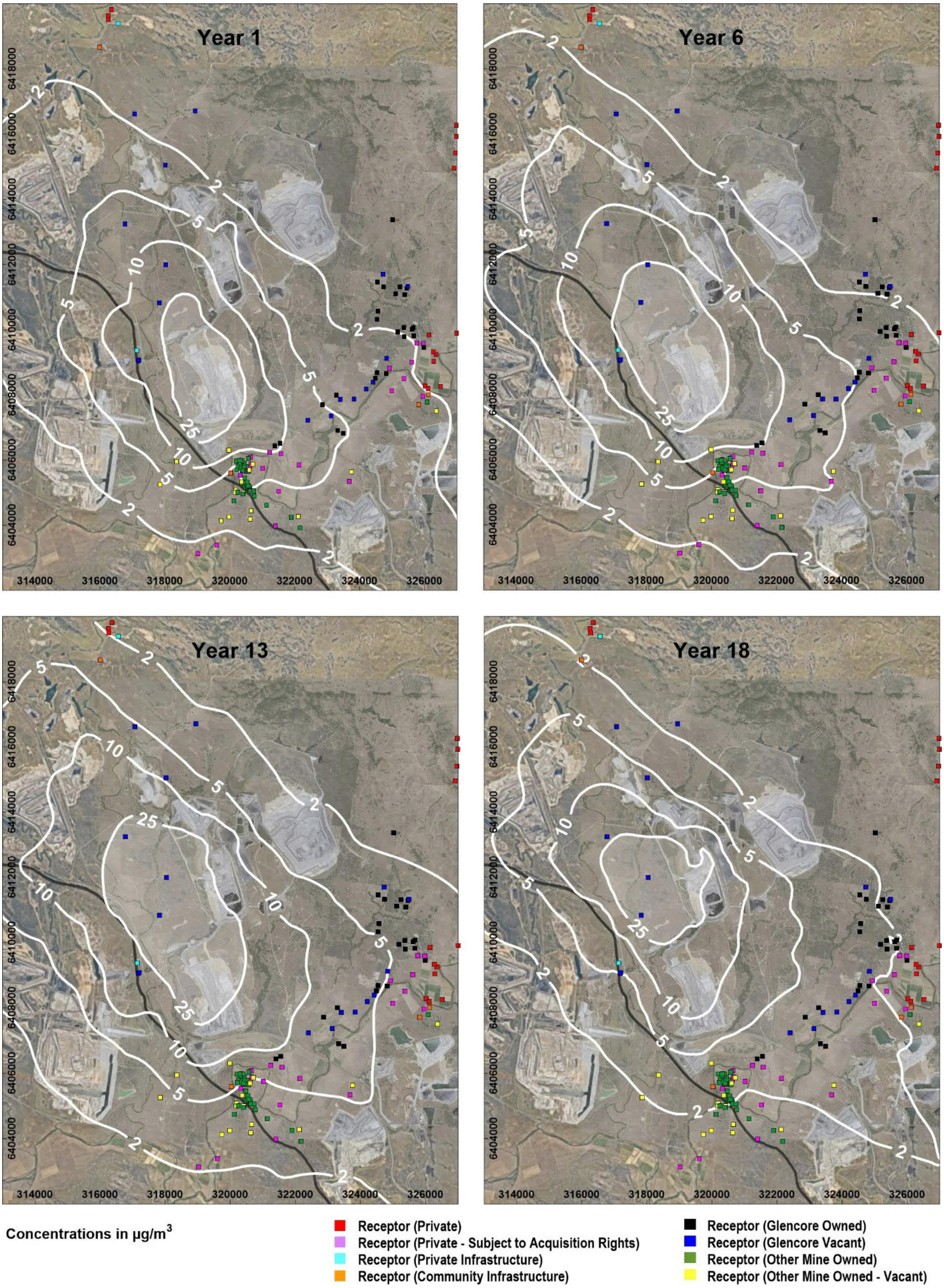


Figure 31 Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to the Project only

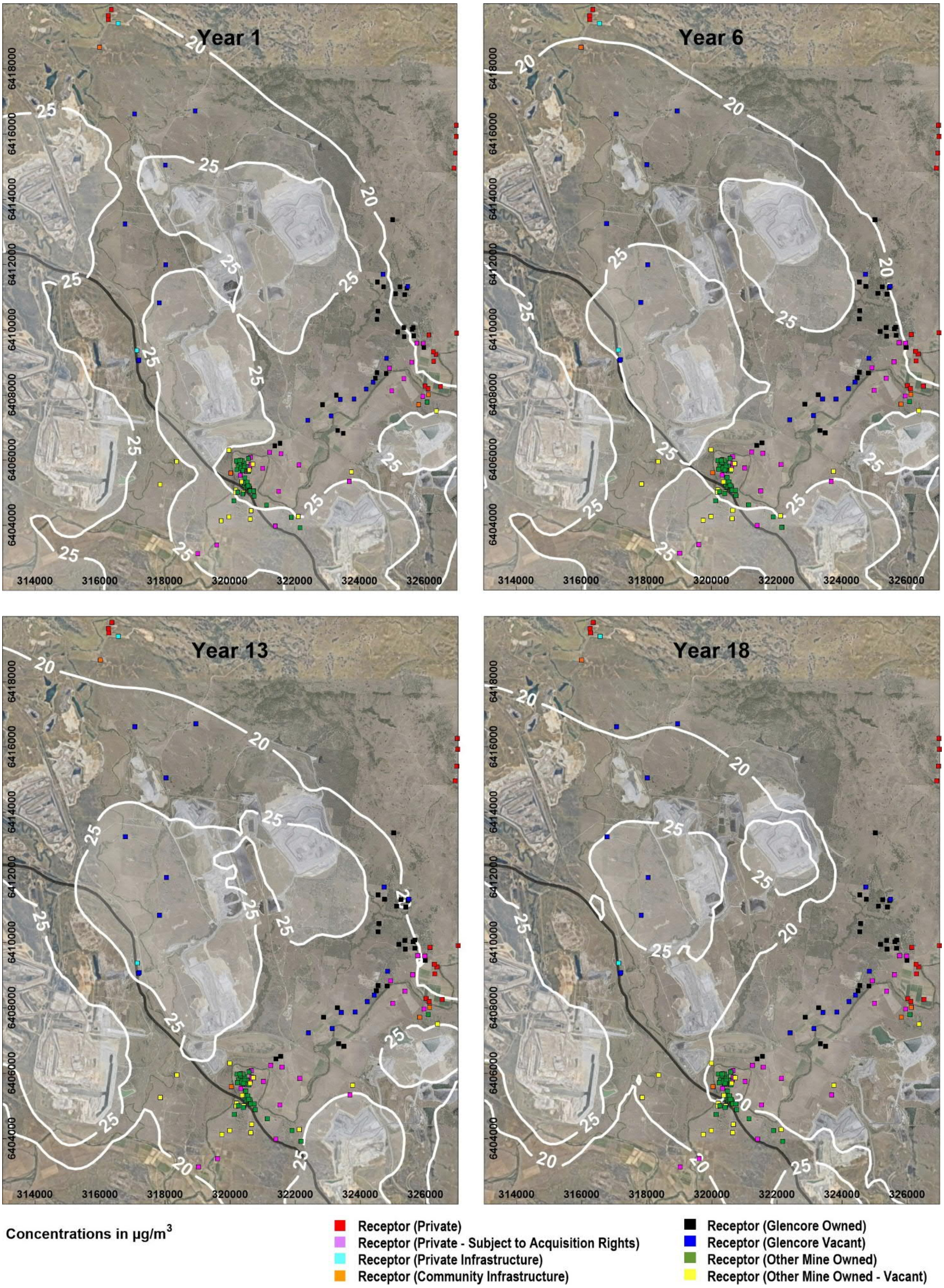


Figure 32 Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to all sources (cumulative)

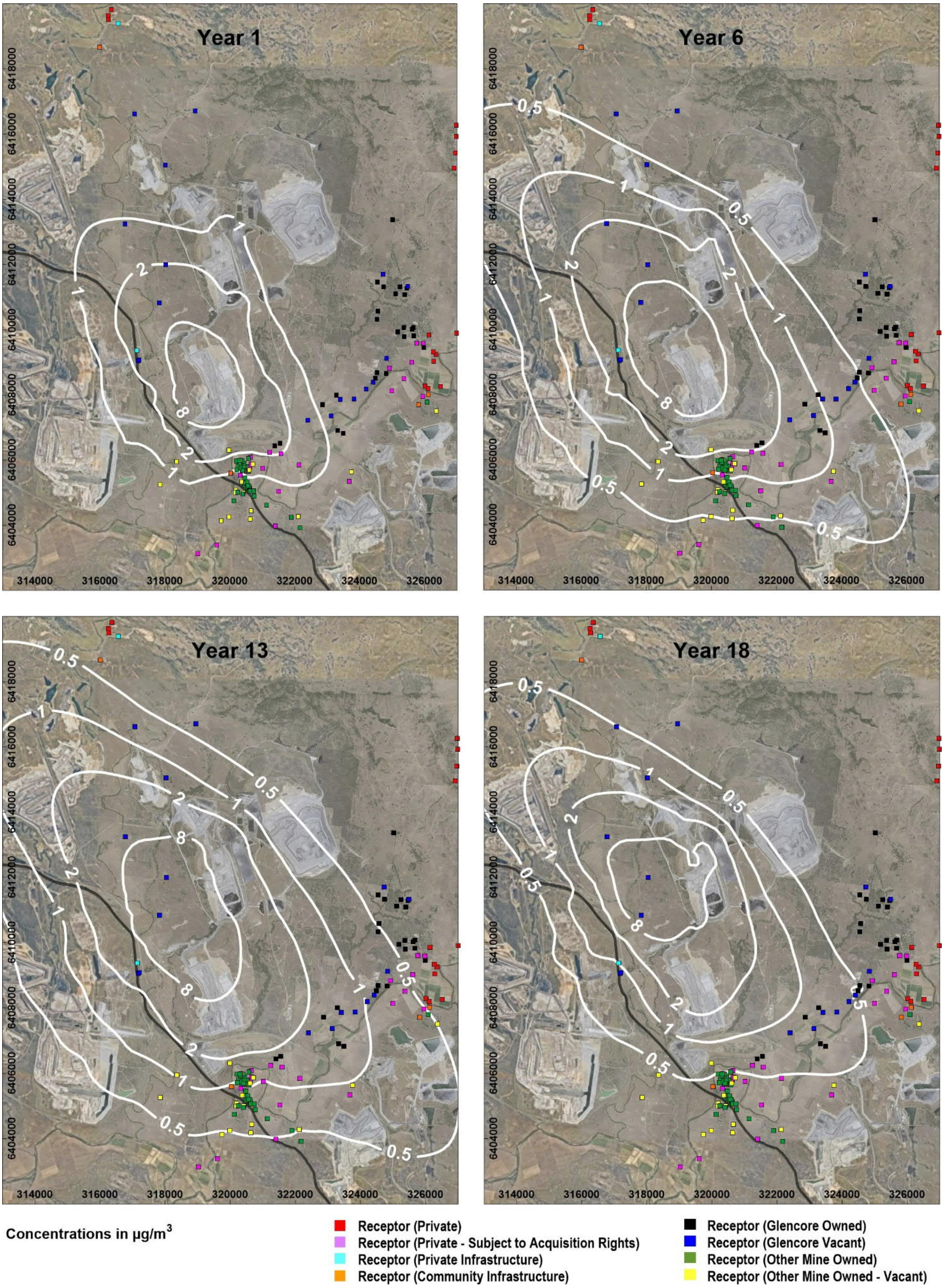


Figure 33 Predicted annual average $PM_{2.5}$ concentrations due to the Project only

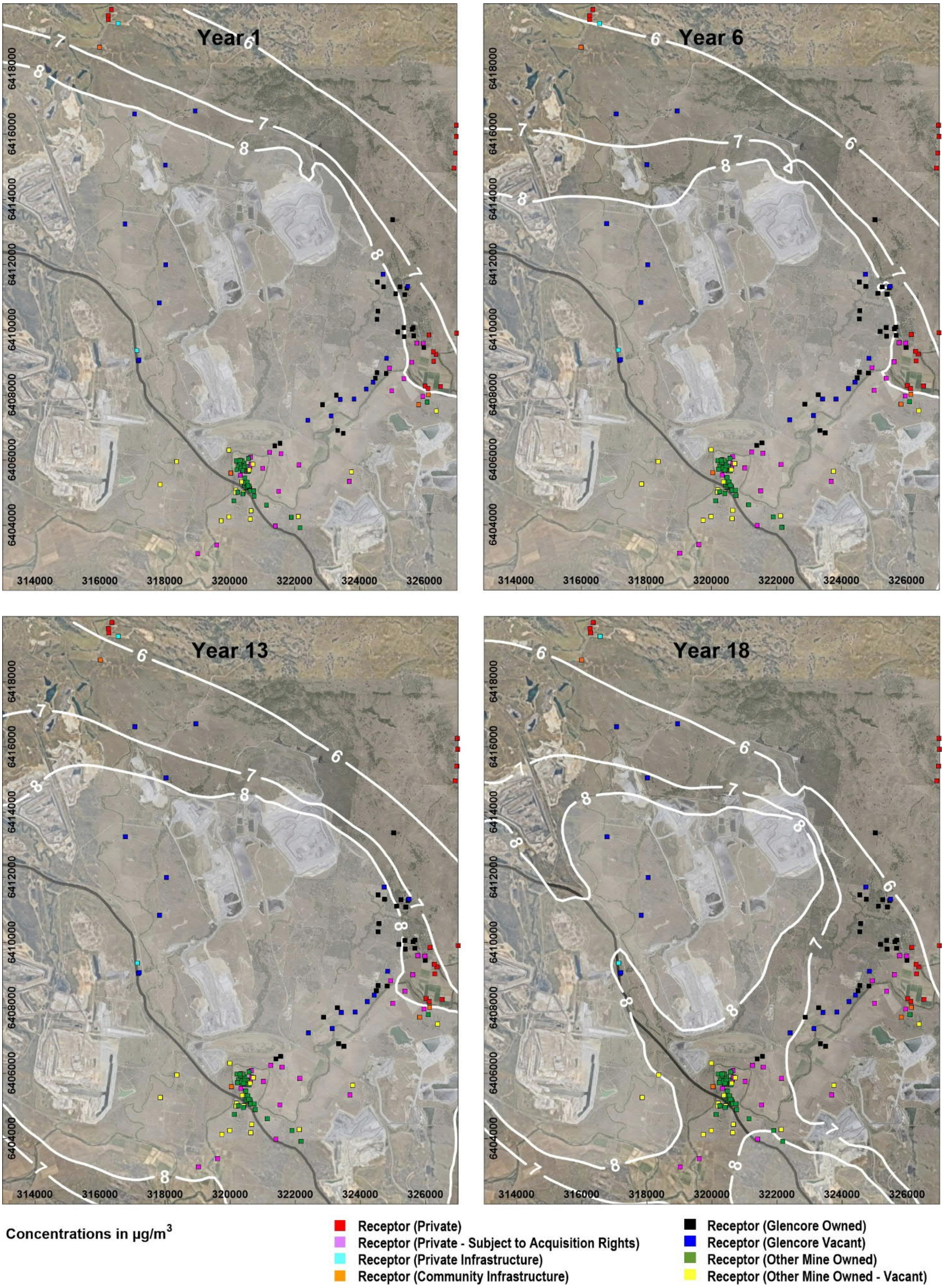


Figure 34 Predicted annual average $PM_{2.5}$ concentrations due to all sources (cumulative)

9.3 Particulate Matter (as TSP)

Figure 35 and **Figure 36** show the predicted annual average TSP concentrations in future years for the Project only and cumulative scenarios respectively. Compliance with the EPA criteria for annual average TSP (90 µg/m^3) is demonstrated at all private sensitive receptors not already subject to acquisition rights.

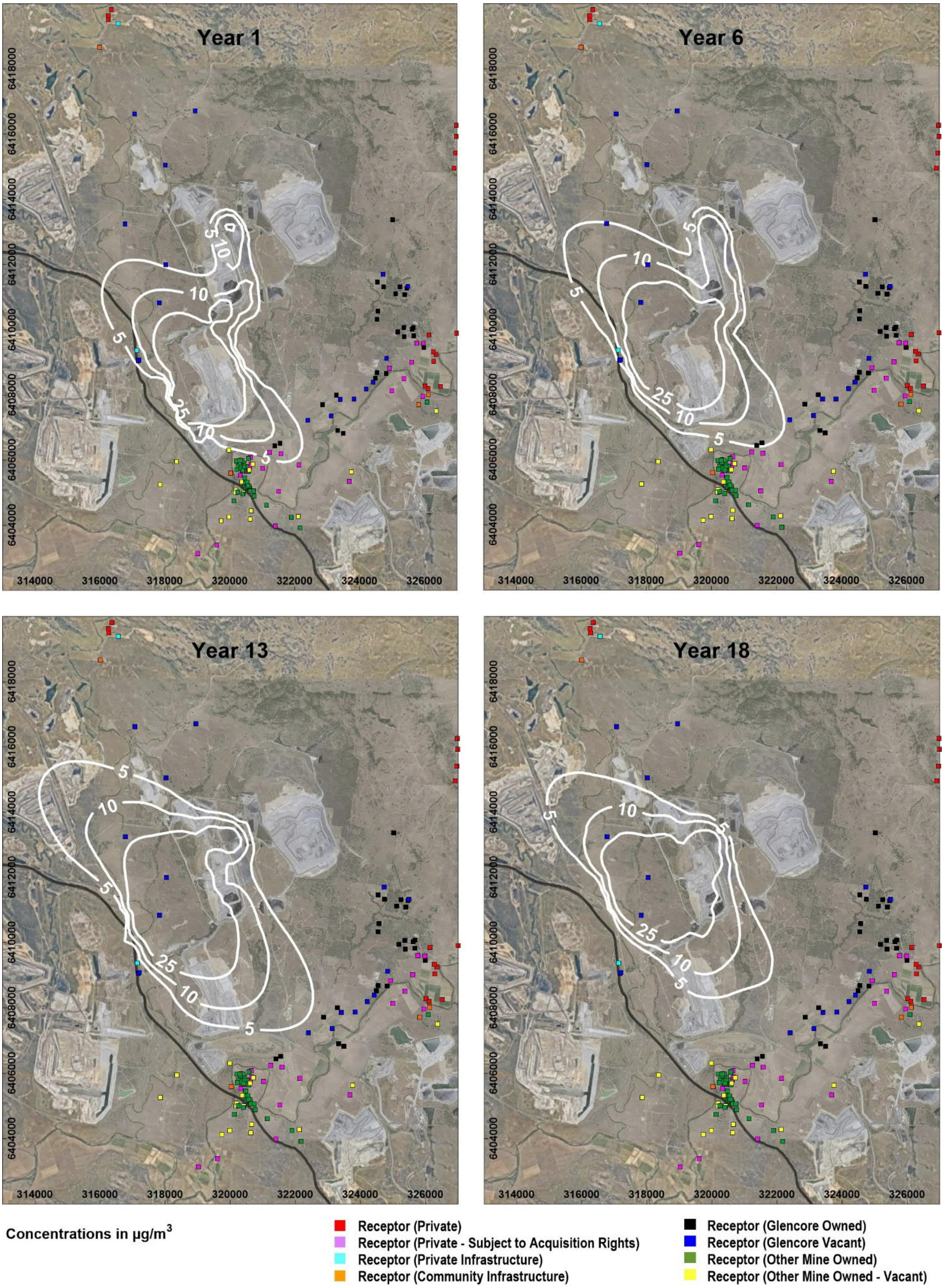


Figure 35 Predicted annual average TSP concentrations due to the Project only

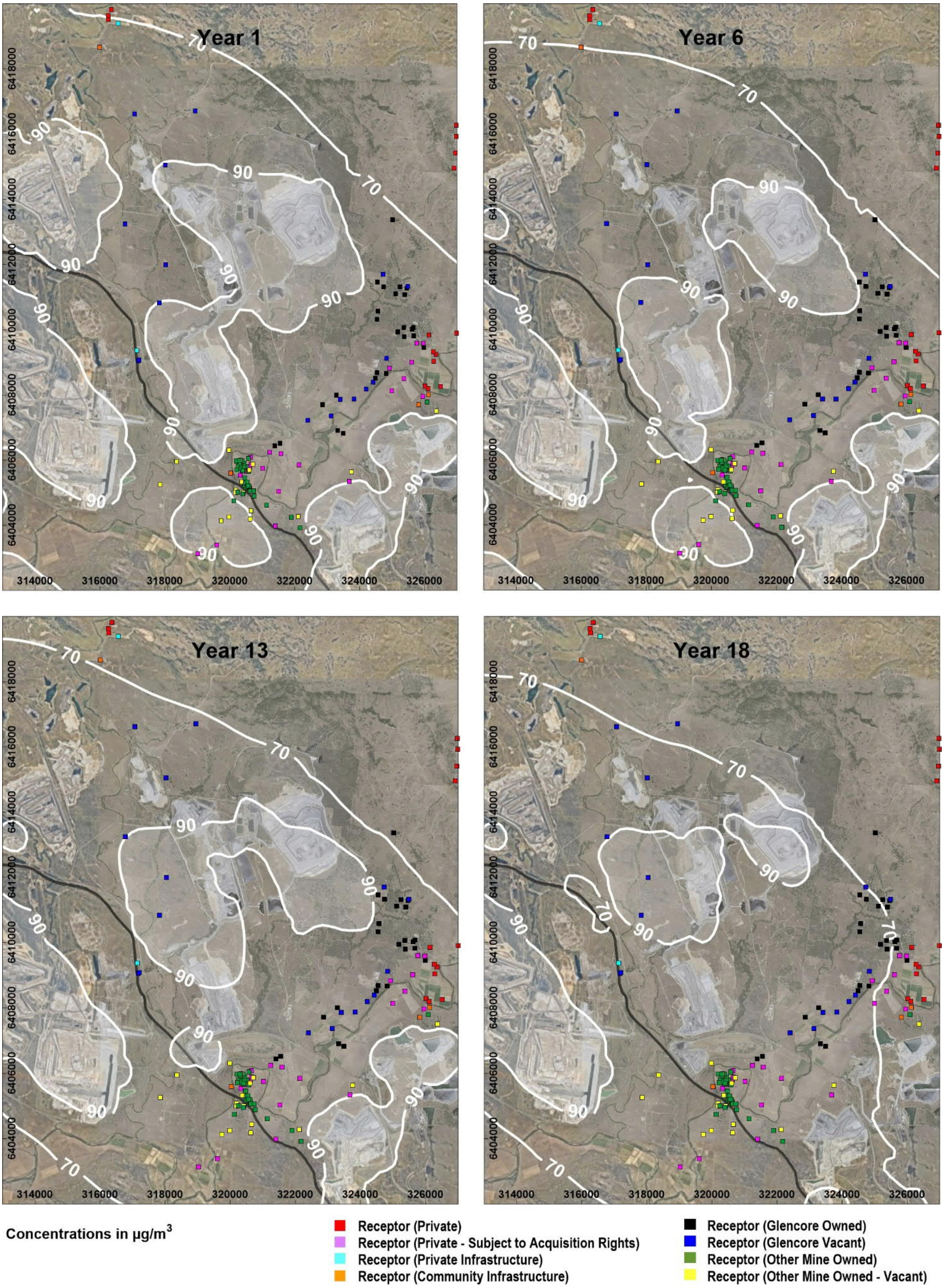


Figure 36 Predicted annual average TSP concentrations due to all sources (cumulative)

9.4 Deposited Dust

Figure 37 and **Figure 38** show the predicted annual average dust deposition levels in future years for the Project only and cumulative scenarios respectively. Compliance with the EPA criteria for annual average dust deposition (4 g/m^2/month) is demonstrated at all private sensitive receptors not already subject to acquisition rights.

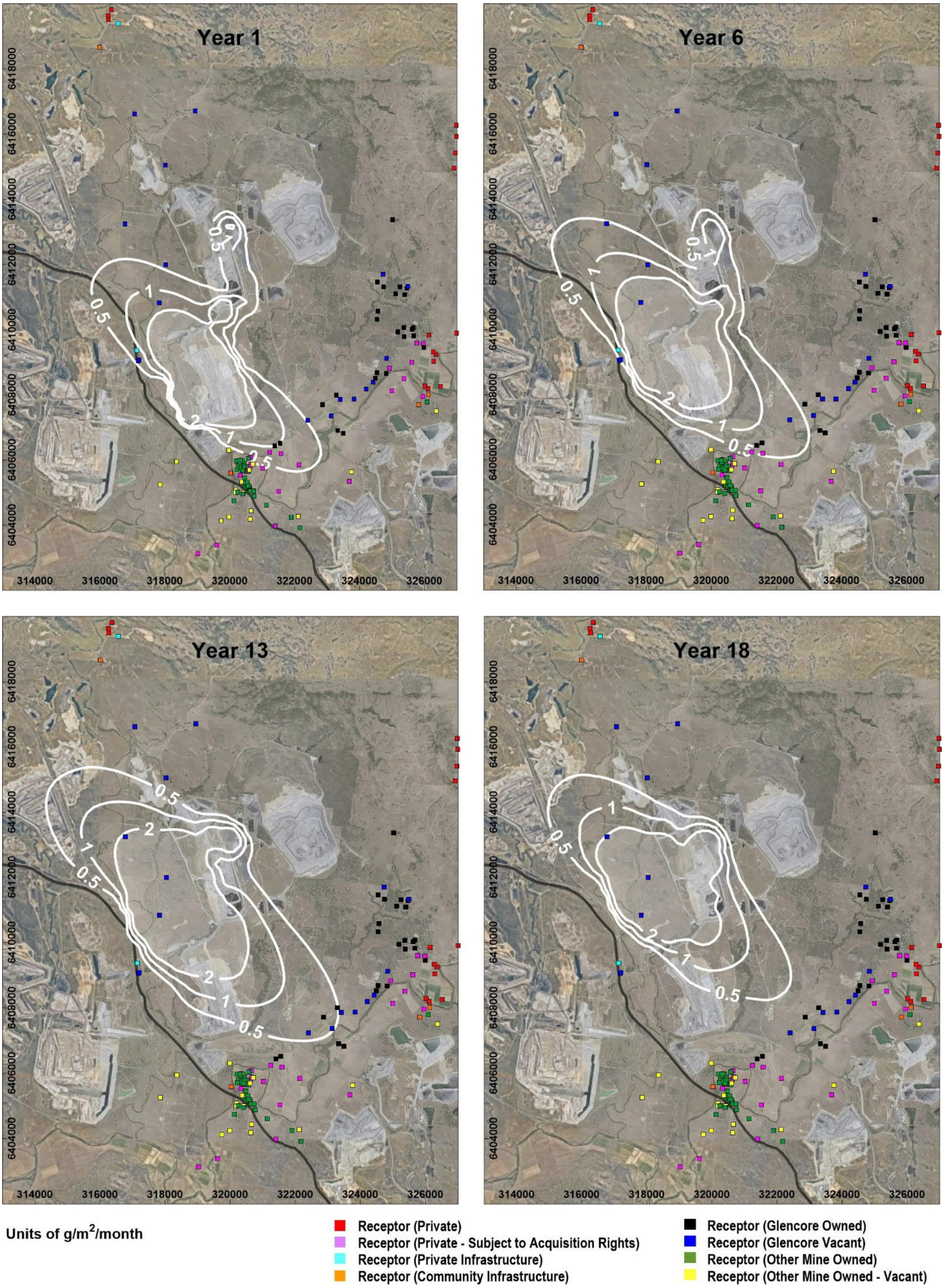


Figure 37 Predicted annual average deposited dust levels due to the Project only

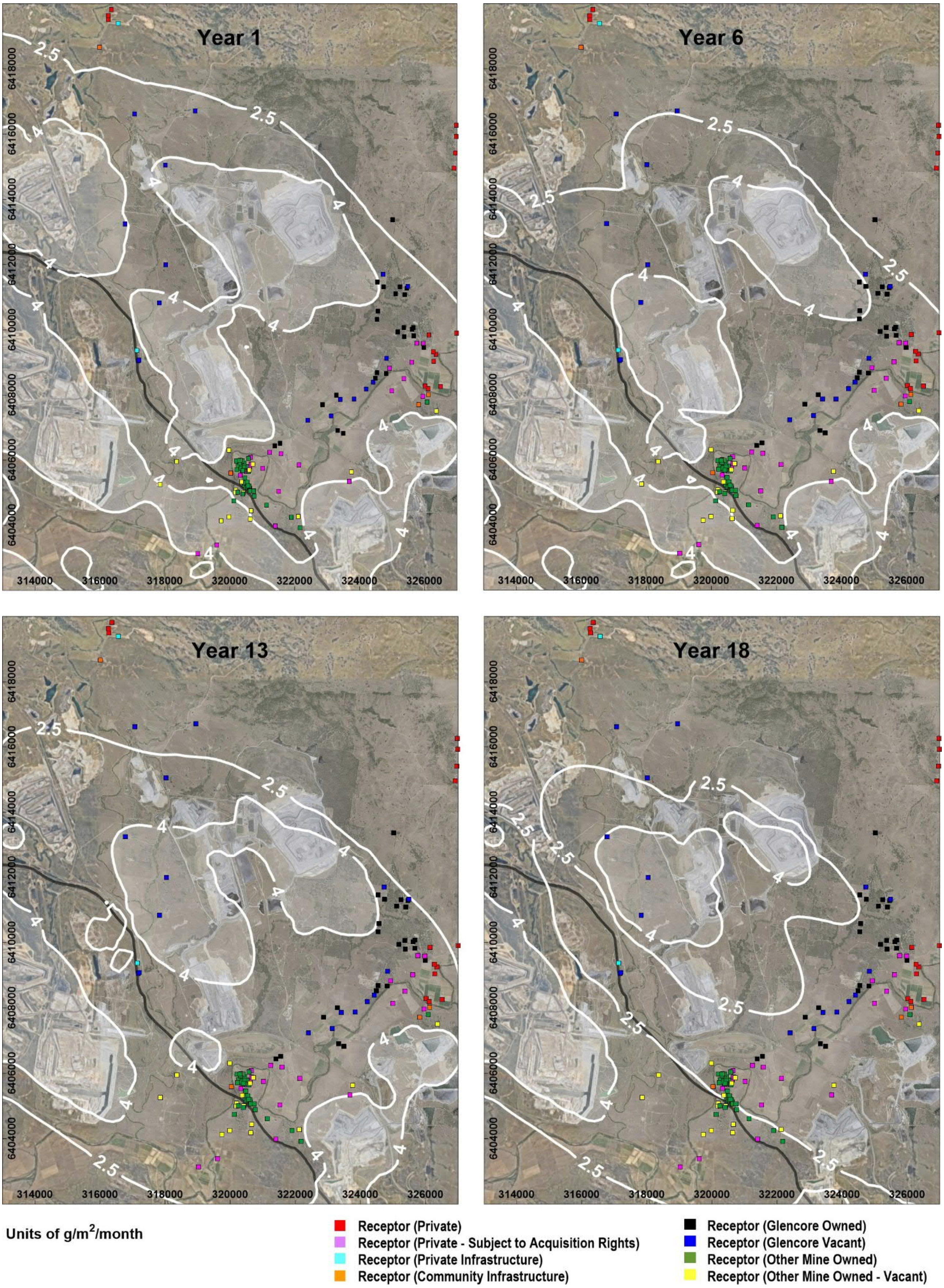


Figure 38 Predicted annual average deposited dust levels due to all sources (cumulative)

9.5 Post-Blast Fume (NO_2)

Blasting activities have the potential to result in fume and particulate matter emissions. Particulate matter emissions from blasting are included in the dispersion modelling results presented in **Sections 9.1** to **9.4**. Post-blast fume can be produced in non-ideal explosive conditions of the ammonium nitrate/fuel oil (ANFO) and is visible as an orange / brown plume.

Post-blast fumes comprise of oxides of nitrogen (NO_x) including nitric oxide (NO) and nitrogen dioxide (NO_2). In general, at the point of emission, NO will comprise the greatest proportion of the total NO_x emission. Typically, this is 90% by volume of the NO_x. The remaining 10% will comprise mostly NO_2. It is the NO_2 which has been linked to adverse health effects.

Ultimately however, much of the NO emitted into the atmosphere is oxidised to NO_2. The rate at which this oxidisation takes place depends on prevailing atmospheric conditions including temperature, humidity and the presence of other substances in the atmosphere such as ozone. It can vary from a few minutes to many hours. The rate of conversion is important because from the point of emission to the point of maximum ground-level concentration there will be an interval of time during which some oxidation will take place. If the dispersion is sufficient to have diluted the plume to the point where the concentration is very low, then the level of oxidation is unimportant. However, if the oxidation is rapid and the dispersion is slow then high concentrations of NO_2 can occur.

In NO_x monitoring data near significant emission sources (for example, power stations and motorways) the percentage of NO_2 in the NO_x is (as a rule) inversely proportional to the total NO_x concentration, and when NO_x concentrations are high, the percentage of NO_2 in the NO_x is typically of the order of 20%. This is demonstrated by **Figure 39** which shows that, for high NO_x concentrations, the NO_2 to NO_x ratio reduces to less than 20%.

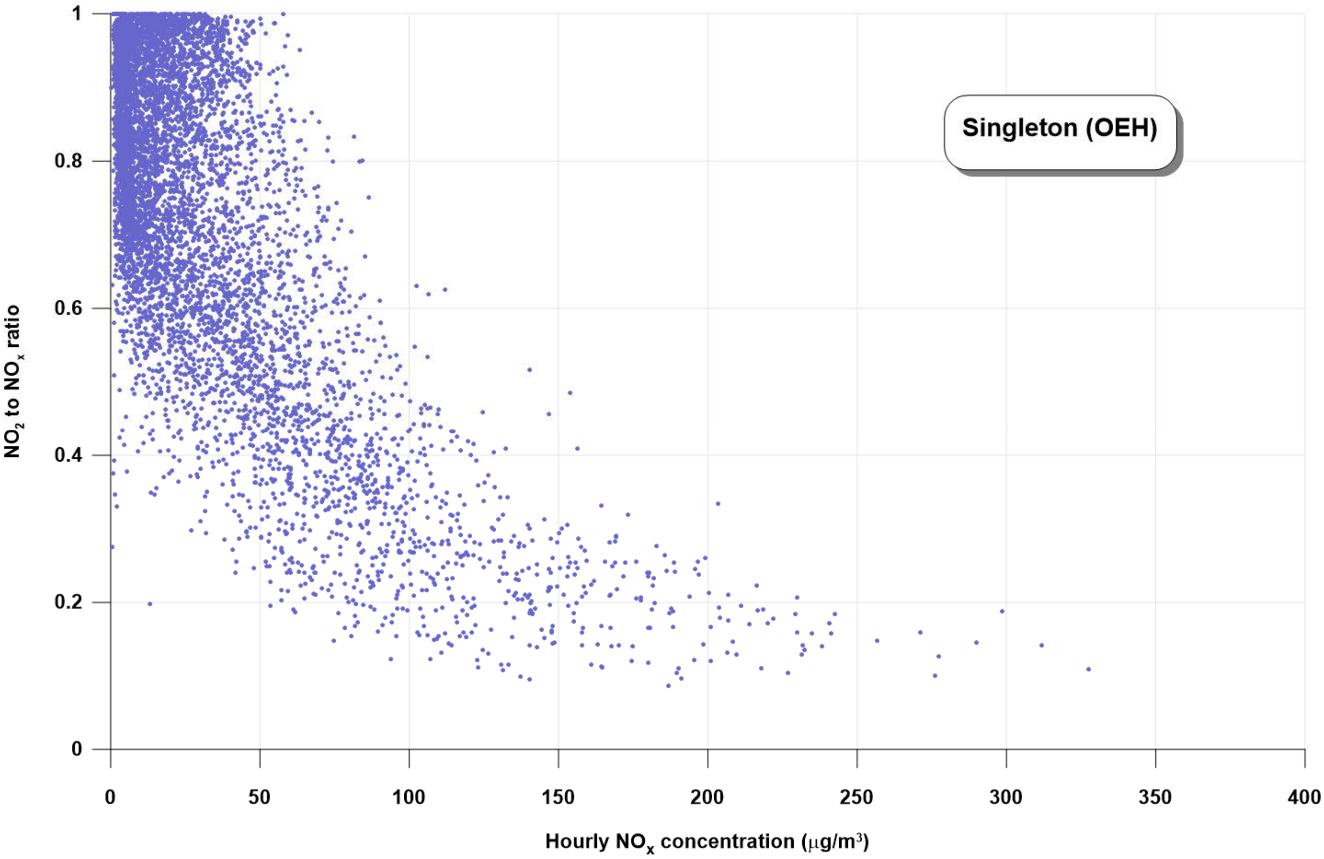


Figure 39 Measured NO_2 to NO_x ratios from hourly average data collected at Singleton by the OEH in 2014

For assessment of post-blast fume the applicable EPA air quality criterion for NO_2 is 246 µg/m^3 as a 1-hour average.

The CALPUFF dispersion model has been used to quantify potential NO_2 concentrations due to blasting. The methodology was as follows:

- Blast modelled as single volume source in a location indicative of the centre of the proposed operations over the life of the Project.
- Release heights of 20 m, effective plume heights of 40 m, initial horizontal spread (sigma y) of 25 m and initial vertical spread (sigma z) of 10 m. These are conservative estimates based on the data presented by Attalla *et al*. (2008). No plume rise due to buoyancy was modelled, which is again a conservative assumption.
- Emissions assumed to occur every hour between 9 am and 5 pm. However, it has been assumed that blasting would not occur if a temperature inversion was present, as identified in the existing Mount Owen Complex pre-blast meteorological assessment. In the meteorological datasets used for this assessment, temperature inversions may be present in the afternoon, from around 4 pm onwards, for approximately 2% of the time during daytime (9 am to 5 pm) hours. From January 2017 to March 2019 most blasts (around 80%) occurred between 11 and 1 pm and only one of the 280 blasts was between 4 and 5 pm.
- Blasting could be on any day of the week (a conservative assumption as, in accordance with the current Glendell Consent, blasting cannot occur on Sundays or public holidays unless written approval is obtained from the administering authority).
- NO_x emissions based on data presented in the Queensland *Guidance Note for the management of oxides in open cut blasting* (DEEDI, 2011). It was conservatively assumed that the initial NO_2 concentration in the plume would be 17 ppm (34.9 mg/m^3) based on the Rating 3 Fume Category in the Queensland Guidance Note. Of the 280 blasts that occurred between January 2017 to March 2019, 61% were rated category 0, 26% were rated category 1, 9% were rated category 2 and 3% were rated category 3. The assumption of a fume rating 3 blast every hour is therefore very conservative.
- The initial NO_2 concentration in the plume was converted to a total NO_x emission rate based on a detailed measurement program of NO_x in blast plumes in the Hunter Valley made by Attalla *et al*. (2008) which found that the NO:NO_2 ratio was typically 27:1, giving a NO_x:NO_2 ratio of approximately 18.6 g NO_x/g NO_2.
- Calculated emission of 866 g/s of NO_x per blast and an emission release time of 5 minutes.
- 20% of the NO_x is NO_2 at the points of maximum 1-hour average concentrations and at sensitive receptors.

Figure 40 shows the predicted maximum 1-hour average NO_2 concentrations due to post-blast fume, based on the methodology outlined above. These results show that, under worst-case meteorological conditions with a rated 3 fume, blasting every day between 9 am and 5 pm and maximum background NO_2 concentrations from Singleton, the maximum 1-hour average NO_2 concentrations will not exceed EPA's criterion of 246 µg/m^3 at any off-site sensitive receptor location. While worst-case assumptions have been made with respect to time-of-day, fume rating and background levels, the modelling has been based on a blast positioned broadly in the middle of the proposed disturbance footprint. It is acknowledged that moving the blast location, for example further to the northwest, would lead to a corresponding shift in the contours, potentially changing the predicted extent of impacts. However, this potential will be managed through the design process for each individual blast which will be designed to comply with relevant criteria. The potential for post-blast fume impacts will be identified prior to all blasts, taking into account the specific parameters of each blast, to avoid worst-case conditions and to minimise fume emissions from blasting, in accordance with contemporary conditions of approval.

Glencore has developed a pre-blasting procedure which covers fume management. A site-specific blast management plan will be implemented during operations, including key fume management actions, such as defining the potential risk zone based upon weather patterns and obtaining permissions to fire based on an assessment of real-time weather conditions.

Based on the dispersion modelling (with predominantly worst-case assumptions) and proposed implementation of site-specific pre-blast procedures it has therefore been concluded that the Project will not lead to any adverse air quality impacts with respect to post blast fume.

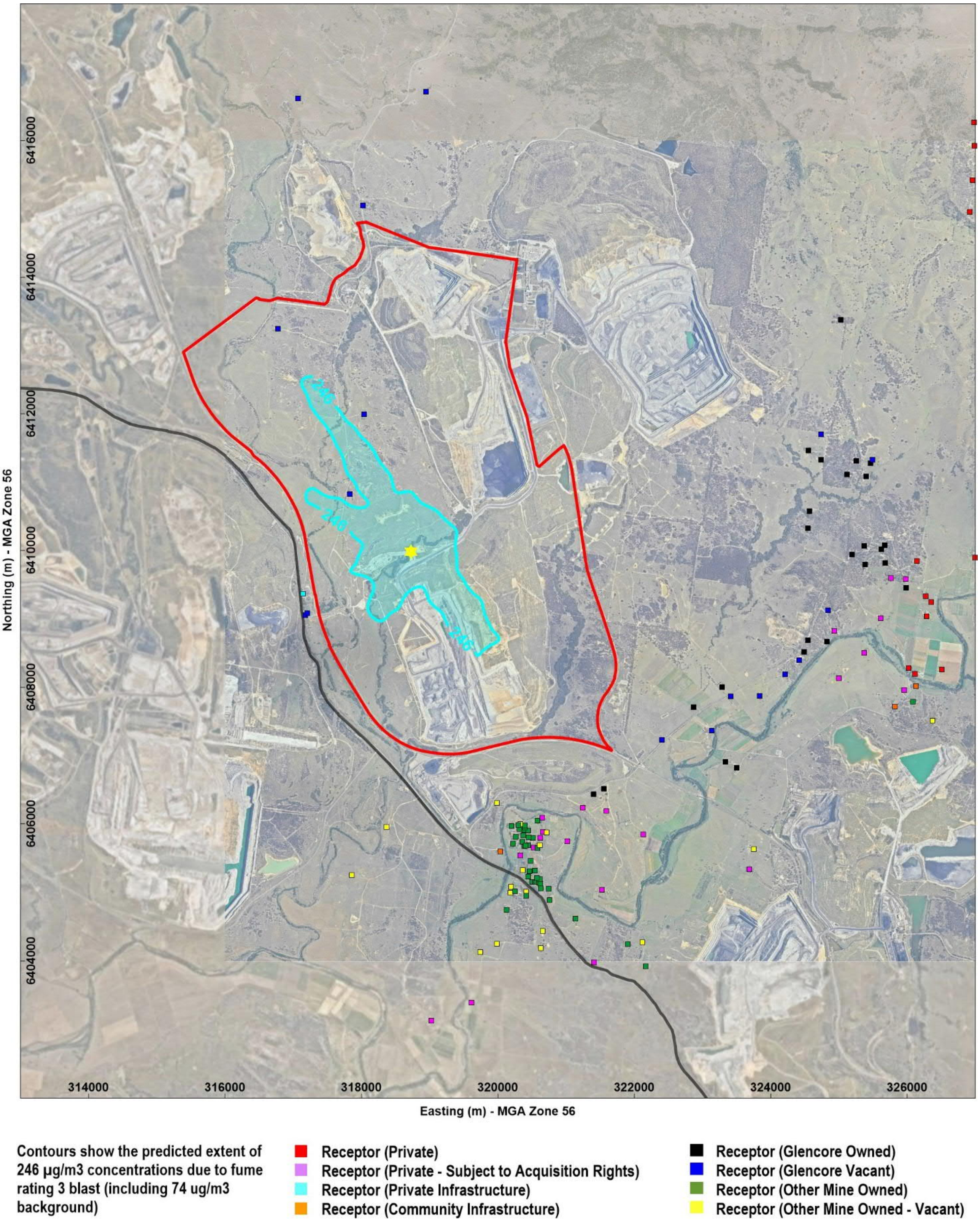


Figure 40 Predicted maximum 1-hour average NO_2 concentrations due to blasting

The potential for odour impacts due to blasting has also been considered. This has been done by comparing the odour threshold (concentration) for NO_2 with the current predictions of NO_2 concentrations due to blasting. The odour threshold for NO_2 has been reported by the World Health Organisation (WHO) to range between 100 µg/m^3 and 410 µg/m^3 (WHO 2000). **Figure 41** shows the predicted 99th percentile nose-response time average NO_2 concentrations, due to blasting. The results have been presented in this form as the EPA criteria for odour assessment criteria are frequency based and relate to 99th percentiles. A peak-to-mean ratio of 2.3 was used to convert the model's 1-hour average predictions to nose-response times.

The model predictions of NO_2 at the nearest sensitive receptors are between 30 and 50 µg/m^3. These predictions are below the odour threshold range reported by the WHO which suggests that the odour impacts can be managed with appropriate blasting procedures.

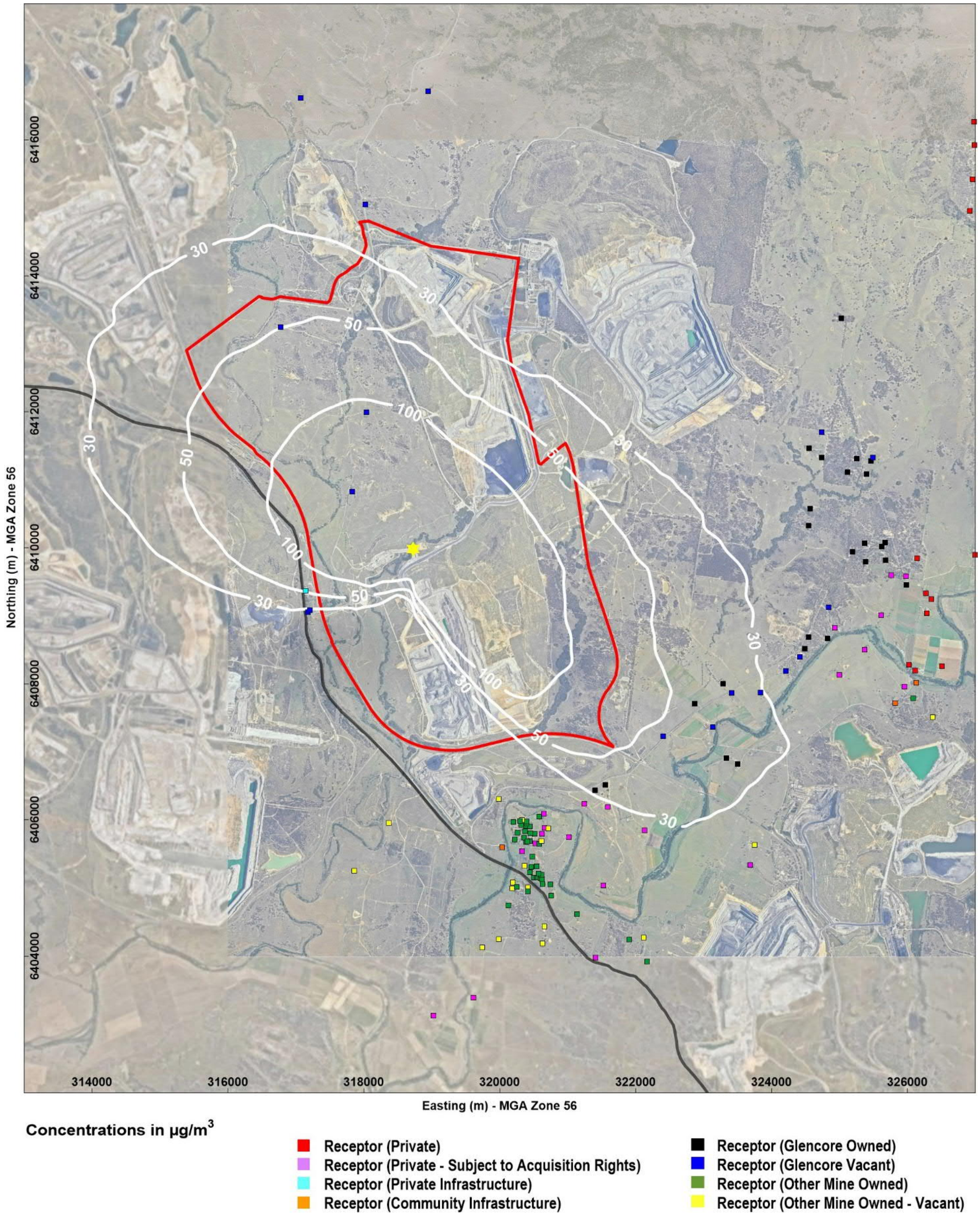


Figure 41 Predicted 99th percentile nose-response time average NO_2 concentrations due to blasting

9.6 Diesel Exhaust Emissions

Emissions from diesel exhausts associated with off-road vehicles and equipment at mine sites are often deemed a lower air quality impact risk than dust emissions from the material handling activities. This is because of the relatively few emission sources involved, for example when compared to a busy motorway, and the large distances between the sources and sensitive receptors. Nevertheless, a review of the potential impacts has been carried out.

The most significant emissions from diesel exhausts are products of combustion including carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter (PM_{10} and including $PM_{2.5}$). It is the NO_x, or more specifically NO_2, and PM_{10} (including $PM_{2.5}$) which have been reviewed in this section. DPIE monitoring data have shown that CO concentrations have not exceeded relevant air quality criteria at rural or urban monitoring stations in NSW, indicating that this substance represents a much lower air quality risk.

9.6.1 Particulate Matter (as PM_{10} and $PM_{2.5}$)

The emission factors, presented in **Section 6** and **Appendix C**, represent the contribution from both wheel generated particulates and the exhaust particulates. These emission factors, including with control factors, are based on measured emissions which include diesel particulates in the form of both PM_{10} and $PM_{2.5}$. The emission factors are also likely to include more diesel exhaust particulate than from a modern truck as the factors were developed on the basis of emissions from trucks measured in the 1980s (that is, older trucks). Todoroski Air Sciences has also reported (TAS 2016) that several studies, reported to the EPA, confirmed that a control factor of 85% can be maintained, representing all components of the truck haulage emission.

Based on the information collated above, the potential impacts of diesel exhaust emissions (as PM_{10} and $PM_{2.5}$) are represented in the preceding results, in **Sections 9.1** to **9.4**.

Table 20 provides the explicit estimates of PM_{10} and $PM_{2.5}$ emissions due only to diesel plant and equipment exhausts. Emission factors for "Industrial off-road vehicles and equipment" from the EPA's 2008 Air Emissions Inventory (EPA 2012) were used for the calculations. These factors relate to diesel exhaust and evaporative emissions.

Table 20 Estimate of PM_{10} and $PM_{2.5}$ emissions from diesel engines

Parameter	Year 1	Year 6	Year 13	Year 18
Estimated fuel used (L) (source: Glencore)	31,851,781	43,459,386	72,080,908	41,791,469
PM_{10} calculations				
Diesel exhaust emission factor (kg/kL)	2.84	2.84	2.84	2.84
Diesel exhaust emissions - all equipment (kg/y)	90,459	123,425	204,710	118,688
$PM_{2.5}$ calculations				
Diesel exhaust emission factor (kg/kL)	2.75	2.75	2.75	2.75
Diesel exhaust emissions - all equipment (kg/y)	87,745	119,722	198,568	115,127

Glencore has considered the practicalities of exhaust after-treatment technologies for in service non-road diesel engines. Consideration has been given to the emission reductions, capital costs, maintenance costs and operational costs. The proposed mitigation measures to manage diesel combustion emissions aim to address the equipment maintenance and engine replacement strategies from the *NSW Coal Mining Benchmarking Study: Best practice measures for reducing non-road diesel exhaust emissions"* (EPA 2014).

The emission control measures proposed by Glencore include:

- Servicing all machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance.

- Targeting the maintenance to ensure, as far as reasonably practical, equipment remains fit for purpose over its whole life cycle.
- Defining failure modes, effects and criticality which helps to minimise potential equipment failure.

9.6.2 Nitrogen Dioxide (NO_2)

Emissions of NO_x from diesel exhausts have been estimated using fuel consumption data, provided by Glencore, and an emission factor from the EPA's Air Emissions Inventory for 2008 (EPA 2012). **Table 21** shows the calculations.

Table 21 Estimated NO_X emissions from diesel exhausts

Parameter	Year 1	Year 6	Year 13	Year 18
Estimated fuel used (L) (source: Glencore)	31,851,781	43,459,386	72,080,908	41,791,469
NO_x calculations				
Diesel exhaust emission factor (kg/kL)	40.77	40.77	40.77	40.77
Diesel exhaust emissions - all equipment (kg/y)	1,298,597	1,771,839	2,938,739	1,703,838

The NO_x emission estimate from **Table 21** has been modelled using the same source locations as Year 13 (a potential worst case year based on above) to provide an indication of the off-site NO_2 concentrations due to diesel exhaust emissions. The predicted maximum 1-hour average NO_2 concentrations are shown in **Figure 42**, which assumes that 20% of the NO_x is NO_2 at the locations of maximum ground-level concentrations.

At the nearest sensitive receptors, the predicted maximum 1-hour average NO_2 concentrations are in the order of 50 µg/m^3. With the addition of maximum background levels (74 µg/m^3 from **Table 10**) the results demonstrate compliance with the EPA's 246 µg/m^3 criterion. The 172 µg/m^3 contour represents the EPA criterion assuming a background level of 74 µg/m^3.

Figure 43 shows the predicted annual average NO_2 concentrations. These predictions assume that 78% of the NO_x is NO_2 based on the annual average NO_x to NO_2 percentage in the data collected from Singleton in 2014. At nearest sensitive receptors the predicted average NO_2 concentrations are in the order of 10 µg/m^3 or less. With the addition of background levels (16 µg/m^3 from **Table 10**) the results show compliance with the EPA's 62 µg/m^3 criterion. The 46 µg/m^3 contour in **Figure 43** represents the EPA criterion assuming a background level of 16 µg/m^3.

Figure 42 Predicted maximum 1-hour average NO_2 concentrations due to diesel exhausts

Figure 43 Predicted annual average NO_2 concentrations due to diesel exhausts

10. Assessment Against VLAMP

The relevant VLAMP criteria are set out in **Table 3** and **Table 4**. These criteria apply to both existing and potential sensitive receptor locations. The criteria are based on project only contributions to impacts as well as potential cumulative impacts.

Where the VLAMP criteria are based on cumulative impacts, all private receptors have been assessed however consideration in **Table 22** and **Table 23** below has only been given to impacts on residences and properties located between the Mount Owen Complex and surrounding mining operations. Properties located beyond these other operations would be primarily impacted by activities at those closer mining operations. The contribution from the Mount Owen Complex (including Glendell Mine) to cumulative impacts at locations beyond these other operations is not considered to be significantly material to justify the Mount Owen Complex consents providing these properties with voluntary mitigation or acquisition rights.

10.1 Predicted Impacts

10.1.1 Project Only Impacts

As discussed in **Section 9** the impacts from the Project alone for maximum 24-hour average PM_{10} and $PM_{2.5}$ are not predicted to exceed the relevant VLAMP criteria at any private residences. The Project is similarly not anticipated to exceed the annual average depositional dust VLAMP criteria at any private residences.

10.1.2 Cumulative Impacts

As discussed in **Section 9** the Project is not predicted to result in any exceedance of the applicable annual average PM_{10} or $PM_{2.5}$ criteria at any private residences that do not currently have acquisition rights under existing development consents.

Table 22 contains a list of private residences with acquisition rights (noise and/or air quality) under existing development consents which the AQIA has identified as likely to experience an exceedance of the VLAMP voluntary mitigation and acquisition annual average PM_{10} (25 $\mu g/m^3$) and $PM_{2.5}$ (8 $\mu g/m^3$) criteria during the life of the Project.

Table 22 Residences with predicted exceedance of VLAMP criteria

ID	Impact type (annual average)	Associated lots in land-holding	Project contribution ($\mu g/m^3$)				Existing mitigation and/or acquisition rights[7]
			Y1	Y6	Y13	Y18	
114	PM_{10}	5//851867	-	1.2	-	-	Mount Owen Consent
127a	PM_{10}	1//741653	2.4	2.2	1.9	-	Glendell Consent Rix's Creek North (08_0102) Rix's Creek South (SSD 6300) [M] Ashton SEOC (noise trigger) (08_0182)
	$PM_{2.5}$		0.8	0.8	0.7	-	
127b	PM_{10}	1//745211	5.0	4.5	3.2	-	Glendell Consent Rix's Creek North (08_0102) Ashton SEOC (noise trigger) (08_0182) Rix's Creek South (SSD 6300)[M] Integra Underground [M]
	$PM_{2.5}$		1.4	1.4	1.1	-	
127c[6]	PM_{10}	10//1169092	7.7	6.1	4.1	-	Rix's Creek North (08_0102)
	$PM_{2.5}$		2.2	1.9	1.5	-	
127d[6]	PM_{10}	11//1169092	7.2	5.9	4.1	-	Rix's Creek North (08_0102)
	$PM_{2.5}$		2.0	1.8	1.4	-	

ID	Impact type (annual average)	Associated lots in land-holding	Project contribution ($\mu g/m^3$)				Existing mitigation and/or acquisition rights[7]
			Y1	Y6	Y13	Y18	
143	PM_{10}	3//1088108	3.8	3.3	2.6	-	Ashton SEOC (noise trigger) 08_0182 Rix's Creek South (SSD 6300) [5] Mount Owen Consent [1] Glendell Consent [M]
	$PM_{2.5}$		1.1	1.1	1.0	-	
147	PM_{10}	30//1018512	1.3	1.2	1.2	-	Ashton SEOC (08_0182) Rix's Creek North (08_0102) Rix's Creek South (SSD 6300) [M] Ashton Underground (DA309-11-2001)
	$PM_{2.5}$		0.4	0.5	0.5	-	
150	PM_{10}	1//248748 2/9/758214 3/9/758214 4/9/758214 5/9/758214 6/9/758214 7/9/758214 8/9/758214 9/9/758214	2.9	2.8	2.4	-	Ashton SEOC (08_0182) Rix's Creek South (SSD 6300) [3] Mount Owen Consent [1]
	$PM_{2.5}$		0.9	1.0	0.9	-	
152	PM_{10}	1/8/758214 2/8/758214	3.4	3.1	2.6	-	Ashton SEOC (noise trigger) (08_0182) Rix's Creek South (SSD 6300) [2] Mount Owen Consent [1] Glendell Consent [M] Rix's Creek North (08_0102) [M]
	$PM_{2.5}$		1.1	1.1	1.0	-	
154	PM_{10}	105//855187	3.8	3.5	2.8	-	Ashton SEOC (08_0182) Rix's Creek South (SSD 6300) [3] Mount Owen Consent [1] Glendell Consent [M]
	$PM_{2.5}$		1.2	1.2	1.1	-	
155	PM_{10}	102//852484	4.1	3.7	2.9	-	Ashton SEOC (08_0182) Rix's Creek South (SSD 6300) [4] Mount Owen Consent [1] Glendell Consent [M] Rix's Creek North (08_0102) [M]
	$PM_{2.5}$		1.2	1.2	1.1	-	
156	PM_{10}	103//852484 104//852484	5.0	4.3	3.2	-	Ashton SEOC (08_0182) Rix's Creek South (SSD 6300) [4] Mount Owen Consent [1]
	$PM_{2.5}$		1.5	1.4	1.2	-	

Notes:

1 - As per Mount Owen Consent, the Applicant is only required to acquire the identified land if acquisition is not reasonably achievable under the development consents for the Ashton SEOC Project (MP 08_0182), the Glendell Open Cut Coal Mine (DA 80/952), Ravensworth Operations Project (MP 09_0176), Rix's Creek South Continuation of Mining Project (SSD 6300) or the Rix's Creek North Open Cut Project (MP 08_0102).

2 - As per the Rix's Creek South Consent, the Applicant is only required to acquire these properties if acquisition is not reasonably achievable under the approval for Rix's Creek North Mine.

3 - As per the Rix's Creek South Consent, the Applicant is only required to acquire these properties if acquisition is not reasonably achievable under the approval for Rix's Creek North Mine or Ashton SEOC.

4 - As per the Rix's Creek South Consent, the Applicant is only required to acquire these properties if acquisition is not reasonably achievable under the approval for Rix's Creek North Mine, Ashton SEOC or Glendell Mine.

5 - As per the Rix's Creek South Consent, the Applicant is only required to acquire these properties if acquisition is not reasonably achievable under the approval for Rix's Creek North Mine or Glendell Mine.

6 - Dwelling constructed following approval of Glendell Mine (DA80/952). Lots have acquisition rights due to being contiguous landholding to 127a and 127b.
7 - Current acquisition/mitigation status under Glendell and Mount Owen Consents will continue to apply should the Project be approved.
- VLAMP criterion not exceeded in this modelled year.
M – Mitigation only

Annual average TSP and dust deposition criteria are not predicted to exceed VLAMP criteria at any private residences.

10.2 Land Holding Assessment

An assessment of privately owned land where at least 25% of the lot is likely to experience an exceedance of relevant VLAMP criteria was also undertaken. **Table 23** contains a summary of the assessment of private land (including vacant land) where exceedances of VLAMP criteria are predicted but which do not have predicted exceedances at a residence located on that land.

Table 23 Private land with predicted exceedance of VLAMP criteria

Lot	ID	Impact Type	Percentage of land affected (%)				Existing mitigation and acquisition rights[2]
			Y1	Y6	Y13	Y18	
1//600327	4[1]	PM_{10}	26	18	13	0	Mount Owen (SSD-5850) Rix's Creek North (08_0102)[M]
		$PM_{2.5}$	84	67	45	0	
4//851867	115	PM_{10}	100	100	77	0	Mount Owen (SSD-5850)
		$PM_{2.5}$	100	100	100	0	
8//851867	112[1]	PM_{10}	11	28	1.5	0	Mount Owen (SSD-5850) Rix's Creek North (08_0102)[M]
		$PM_{2.5}$	37	44	18	0	
4//1166047	NA	PM_{10}	100	100	100	0	Ashton SEOC (noise trigger) (08_0182) Rix's Creek South (SSD 6300)[4] Mount Owen (SSD-5850)[3]
		$PM_{2.5}$	100	100	100	0	
5//1166047	NA	PM_{10}	100	100	100	0	Ashton SEOC (noise trigger) (08_0182) Rix's Creek South (SSD 6300)[4] Mount Owen (SSD-5850)[3]
		$PM_{2.5}$	100	100	100	0	
175//1002770	NA	PM_{10}	100	100	100	0	Ashton SEOC (noise trigger) (08_0182) Mount Owen (SSD-5850)[3]
		$PM_{2.5}$	100	100	100	0	
106//855187	NA	PM_{10}	100	100	100	0	Ashton SEOC (noise trigger) (08_0182) Rix's Creek South (SSD 6300)[5] Mount Owen (SSD-5850)[3]
		$PM_{2.5}$	100	100	100	0	

Notes:
1 - Predicted cumulative annual average PM2.5 impacts at the dwelling in Years 1, 6 and 13 are at criteria.
2 - Current acquisition/mitigation status under Glendell and Mount Owen Consents will continue to apply should the Project be approved.
3 - As per Mount Owen Consent, the Applicant is only required to acquire the identified land if acquisition is not reasonably achievable under the development consents for the Ashton SEOC Project (MP 08_0182), the Glendell Open Cut Coal Mine (DA 80/952), Ravensworth Operations Project (MP 09_0176), Rix's Creek South Continuation of Mining Project (SSD 6300) or the Rix's Creek North Open Cut Project (MP 08_0102).
4 - As per the Rix's Creek South Consent, the Applicant is only required to acquire these properties if acquisition is not reasonably achievable under the approval for Rix's Creek North Mine.
5 - As per the Rix's Creek South Consent, the Applicant is only required to acquire these properties if acquisition is not reasonably achievable under the approval for Rix's Creek North Mine, Ashton SEOC or Glendell Mine.

Lot 11//1100029 is privately owned land however this contains the Glennies Creek Hall, used by the local community, and has been assessed as being community infrastructure (ID 2). The lot does not form part of a contiguous landholding and is approximately 0.2 ha, which does not meet the minimum lot size requirement in the RU1 – Primary Production zone under the Singleton LEP (>40 ha). As a dwelling could not be built on this land under existing planning controls and it does not form part of a larger contiguous landholding, the lot does not trigger either mitigation or acquisition rights under the VLAMP. It is also noted that this building is only used periodically and for relatively short periods (several hours). The application of the annual average PM_{10} and

$PM_{2.5}$ criteria to this land is not considered appropriate as a trigger for mitigation or acquisition rights given the intermittent use of the land.

No additional properties (i.e. properties that do not already have acquisition rights under existing development consents) are identified as having acquisition rights due to predicted impacts on at least 25% of the property as a result of the Project.

Annual average TSP and dust deposition criteria are not exceeded at any residences or privately owned land.

11. Construction

Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts using dispersion modelling. To do so would require knowledge of weather conditions for the period in which work will be taking place in each location on the site.

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the site construction works. Specifically, these works will primarily include the demolition of the existing Glendell MIA and construction of a new MIA, realignment of a section of Hebden Road and associated electricity and communication infrastructure, realignment of part of Yorks Creek, relocation of Ravensworth Homestead, and other ancillary infrastructure works such as the construction of a Heavy Vehicle Access Road. The total amount of dust generated would depend on the quantities of material handled, silt and moisture content of the soil, the types of operations being carried out, exposed areas, frequency of water spraying and speed of machinery. The detailed approach to construction will depend on decisions that will be made by Glencore in conjunction with the contractor(s) and changes to the construction methods and sequences that are expected to take place during the construction phase.

Given the uncertainties related to weather conditions, methods, sequences and material handling quantities, the modelling (**Sections 6** to **10**) has not explicitly included contributions from construction related activities. However, an assessment of the potential cumulative effects between construction activities and mining operations has been undertaken based on preliminary estimates of equipment inventories and material handling quantities as well as assumptions on how the construction activities may occur.

Table 24 shows preliminary estimates of material handling quantities for all key construction works in Year 1. It is anticipated that most of the construction works will occur in Year 1-2. The estimates in **Table 24** will include doubling counting with mine waste but have, nevertheless, been used to develop a construction dust (TSP, PM_{10} and $PM_{2.5}$) emissions inventory for comparison with the Year 1 mine operation emission inventories, and for modelling of indicative impacts.

Table 24 Preliminary estimates of Year 1 construction material handling quantities

Construction works	Volume of earthworks moved (bank cubic metres)
New Mine Infrastructure Area	719,700
Heavy Vehicle Access Road	707,928
Hebden Road Realignment	259,361
Yorks Creek Realignment	167,467
Total	**1,854,456**

Construction activities will generally be undertaken within standard construction hours (7.00 am to 6.00 pm Monday to Friday, 8.00 am to 1.00 pm Saturday). Construction of the new MIA and ancillary works may be undertaken 24 hours per day, 7 days per week as required. Blasting associated with construction activities will only be undertaken 9.00 am to 5.00 pm, Monday to Friday and 9.00 am to 1.00 pm Saturday.

The material handling quantities from **Table 24** have been used to develop a construction dust emissions inventory based on the following assumptions:

- All construction works will occur concurrently;
- The combined total exposed areas of all work sites (approximately 93 ha) will be susceptible to wind erosion;
- Dust generating activities for construction works will include:
  - 2 dozers working
  - 3 excavators loading

- 3 trucks hauling and dumping (190 t capacity)
- 3 concrete trucks operating, and
- continuous wind erosion from exposed areas

- Trucks will transport the estimated material volumes over unsealed routes for approximately one kilometre each way. Water carts will be used for dust suppression;
- Dozers will work continuously for 11 hours per day, every day of the year;
- Blasting an area of approximately 5,000 m^2 will occur once per week.

Table 25 shows the calculated annual emissions due to construction works including the emission estimates for the mines operational activities (Year 1) for comparison. A conservative approach was taken for all assumptions listed above meaning that the resultant construction emission estimates in **Table 25** will represent maximum upper limits. **Table 25** shows that construction emissions have the potential to increase annual operational emissions in Year 1 by a maximum of 10% for TSP, 13% for PM_{10} and 13% for $PM_{2.5}$.

Table 25 Estimated emissions due to construction works for the Project

Particulate matter classification	Annual emissions in Year 1 (kg/y)		Construction as a percentage of operation
	Construction	Mining Operation	
TSP	220,195	2,241,625	10%
PM_{10}	88,608	681,177	13%
$PM_{2.5}$	17,089	128,378	13%

The emissions data from **Table 25** and information above on the location and intensity of activities have been used to create a model of construction activities. Outputs of the model have then been added to the Year 1 mining operations model to identify the potential cumulative effects of construction activities with mining operations. **Appendix H** provides details on the construction model inputs including emission breakdown by activities and source locations.

Figure 44 shows the predicted cumulative air quality impacts in Year 1 comparing “Operations” and “Operations including construction” scenarios. This figure includes annual average predictions of PM_{10}, $PM_{2.5}$, TSP and deposition, each showing the extent of potential impact based on the respective air quality assessment criteria. These results clearly show that, with the conservative assumptions for emission estimation, the contribution of maximum emissions from the proposed concurrent construction and mining operations will not change air quality outcomes for all private sensitive receptors. Consequently this analysis demonstrates that outcomes derived from **Sections 9** and **10** will not change with consideration of concurrent construction activities in the early stages of the Project.

However, as for mining operations, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. Dust management will require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme unfavourable weather conditions, such as dry wind conditions. Monitoring would also continue to be carried out during the construction phase to assess compliance with EPA criteria.

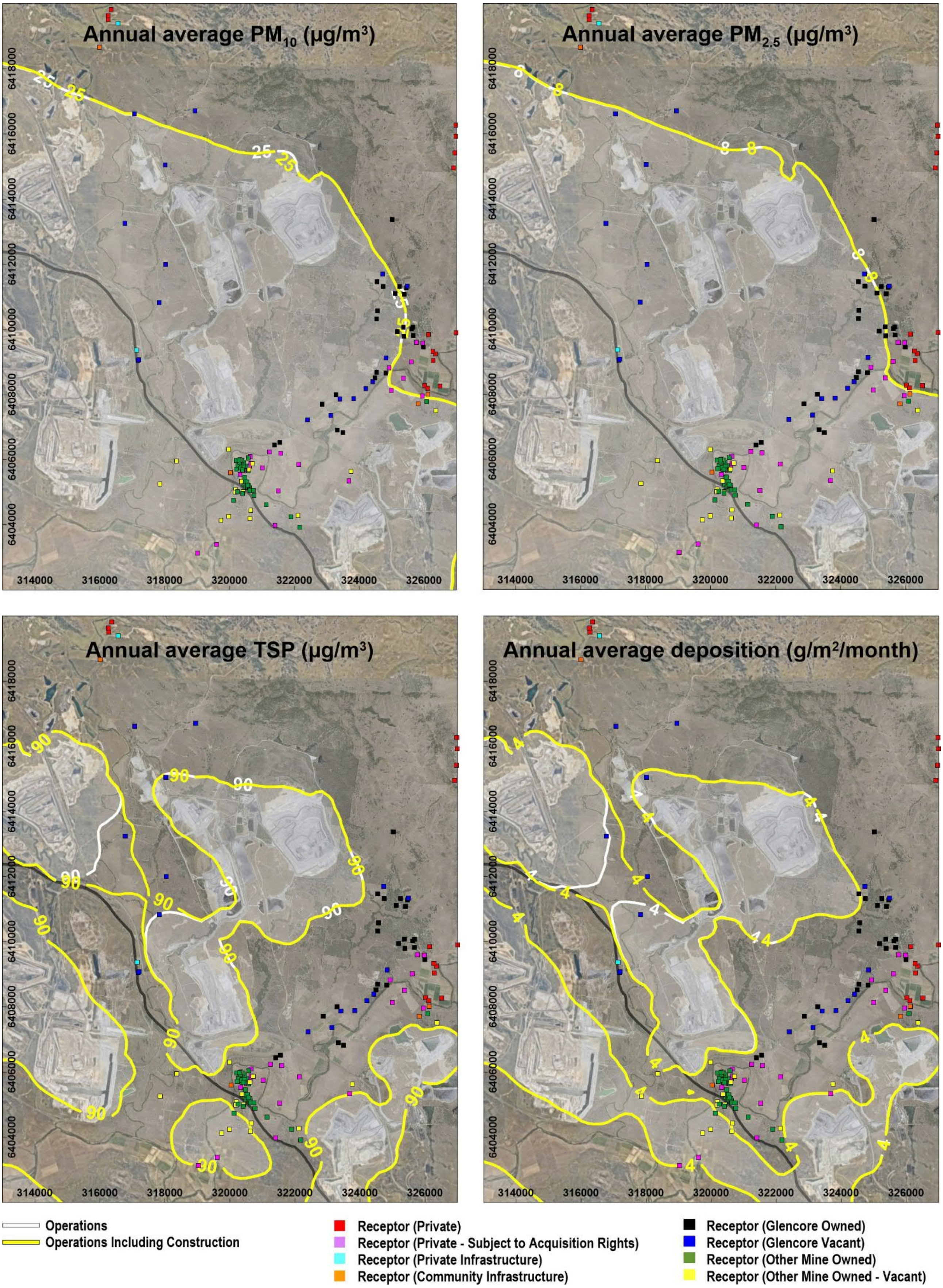


Figure 44 Predicted cumulative air quality impacts in Year 1 with construction

12. Management and Monitoring

Table 26 summarises the standard emission management measures, currently implemented as part of the existing Mount Owen Complex Air Quality Management Plan, that will continue to be adopted as part of the Project.

Table 26 Emission management measures

Activity	Emission management measures	Assumed emission control (%) (NPI 2012, Donnelly et el 2011)	Measures identified from Donnelly et al (2011)	Consistent with best practice
Stripping topsoil by scraper	Watering of haul routes Restricting vehicle speeds	50	Control measures for this activity are not specifically identified but can be inferred from the bulldozer information below.	Y
Drilling overburden	Water injection and application of water to drill cuttings upon removal Dust curtains Ceasing operations when visible dust is generated	70	*"Best practice control measures include air extraction to a bag filter. No mines were found to use this practice."*	N
Blasting overburden	Pre-blast checks including review of meteorological conditions	0	*"Best practice control measures include delaying shot to avoid unfavourable weather conditions and minimising the area blasted"*	Y
Hauling overburden and coal on unsealed roads	Watering of haul routes Gravel compaction and maintenance of haul routes Restricting vehicle speeds Clearly marked haul routes Fleet optimisation to reduce vehicle kilometres travelled Prompt clean-up of any material spillage	85	*"Control measures include watering, grading, well-defined haul routes, speed limits to 40 km/h and/or the use of suppressants."*	Y
Loading and unloading of overburden	Minimisation of fall distances during unloading and loading Planning of dump locations based on weather conditions Ceasing operations during adverse dust conditions	0	*"Current practices adopted to control emissions from loading and dumping overburden were found to be water application, minimisation of drop heights and suspension or modification of activities during adverse weather conditions. Best practice control measures were identified as minimising drop heights and / or the application of water".*	Y
Unloading coal to ROM hopper	Water sprays and partial enclosure	70	*"Best practice control measures for minimising emissions from the ROM hopper is enclosure with air extraction to a fabric filter or other control device. No mines in the GMR adopt this approach."*	N
Coal processing	Enclosure	70	Control measures for this process are not specifically identified.	N/A

Activity	Emission management measures	Assumed emission control (%) (NPI 2012, Donnelly et el 2011)	Measures identified from Donnelly et al (2011)	Consistent with best practice
Dozers or loaders on ROM and product coal stockpiles	Watering of travel routes Minimisation during dusty conditions Reduced travel speed during dusty conditions	50	*"Best practice control measures include minimising the travel speed and distance travelled by bulldozers and the application of water to keep travel routes moist"*	Y
Conveyors to stockpiles	Covered / enclosure Belt cleaning	70	*"The use of wind shielding on conveyor sides, water sprays at conveyor transfers, enclosure of transfer points, and, soft-loading chutes."*	Y (except for water sprays and soft-loading chutes)
Wind erosion from partially rehabilitated dumps	Partial rehabilitation / stabilisation	30	*"Control measures include watering exposed areas, minimising areas of disturbance, progressive rehabilitation and use of suppressants"*	Y
Wind erosion from ROM and product coal stockpiles	Water sprays, triggered by wind conditions Minimisation of FEL drop heights when loading	50	*"Control measures include watering exposed areas, minimising areas of disturbance, progressive rehabilitation and use of suppressants"*	Y
Grading roads	Watering of haul routes Restricting vehicle speeds Clearly marked routes	50	Control measures for this activity are not specifically identified. This activity forms part of the control measures for haul roads.	N/A
Machinery exhausts and plant and equipment	Servicing all machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance. Targeting the maintenance to ensure, as far as reasonably practical, equipment remains fit for purpose over its whole life cycle. Defining failure modes, effects and criticality.	0	Control measures for this activity are not specifically identified.	N/A

In addition to the measures listed above Glencore is committed to effectively managing the air quality impacts associated with the Project and will implement a range of dust management measures for the key dust generating activities. These measures are currently implemented as part of the existing Air Quality Management Plan for the Glendell Mine and will continue to be improved and implemented as part of the Project.

The key measures that will continue to be implemented and that have been incorporated into the modelling of the dust impacts of the Project include:

- minimising the area of disturbed land at any one time, in line with the approved Mining Operations Plan
- continued implementation of timely progressive rehabilitation

- adopting controls for haul road dust emissions
- review of meteorological conditions prior to blasting
- consideration of meteorological conditions in planning the loading and unloading of overburden
- applying water and using dust curtains when drilling overburden
- minimising fall distance during loading and unloading of overburden
- utilising water sprays and water carts on ROM coal stockpile area
- maintaining the existing covered conveyors and belt cleaning
- maintaining and servicing machinery, exhaust systems and plant equipment in accordance with contemporary maintenance practices
- using cameras to monitor dust
- continued implementation of the Trigger Action Response Plan (TARP) process and investigating dust levels when the TARP process is enacted to identify likely sources of dust from any complaints or potential compliance issues
- using temporary rehabilitation and stabilisation measures on disturbed land.

In addition to the measures listed above, both proactive and reactive dust control strategies informed by real-time dust and meteorological monitoring systems are currently implemented at Glendell Mine. Reactive air quality management will continue to assess the need to modify the activities in response to the following triggers:

- visual conditions, such as excessive visible dust
- meteorological conditions, such as dry, strong wind conditions
- ambient air quality conditions (that is, elevated short-term PM_{10} concentrations).

Proactive air quality management involve the discussion and planning of activities in advance of potentially adverse conditions. Specifically, the pro-active air quality management approach includes:

- a system that provides personnel with a daily forecast of expected dust conditions in the vicinity of the operation
- discussion of the dust forecast at daily operational meetings
- modifying the planned mining activities, as appropriate, to minimise or avoid the potential dust impacts.

The dust management measures proposed for the Project have been compared to the measures outlined in the "*NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*" (Donnelly et al, 2011). This comparison, as per **Table 26**, shows that the proposed measures are consistent with best practice dust mitigation measures. In some instances Donnelly et al (2011) identified control measures that were not common practice, or reasonable and/or feasible to apply at any mine in NSW. For example, air extraction to bag filters for drilling operations.

As part of the implementation of the Project the existing Air Quality Management Plan will be reviewed and updated. The Air Quality Management Plan will be revised to detail the implementation of monitoring and management controls to manage air quality impacts associated with the Project to maintain compliance with air quality criterion as required.

A review of the existing air quality monitoring locations will be undertaken prior to the commencement of the Project to make sure that the monitoring network provides adequate coverage of the Project Area. In addition there may need to be necessary changes to the monitoring network to suit the progression of mining, for example, relocation of the Glendell Mt weather station. Any changes to the monitoring network will also be included in the revised Air Quality Management Plan.

Table 27 provides details of the proposed air quality emission control measures, as requested by the SEARs.

Table 27 Project approach to air quality emission control measures

Requested SEARs information	Approach for the Project
Explicit linkage of proposed emission controls to the site specific best practice determination assessment	As per **Table 26**
Timeframe for implementation of all identified emission controls	From commencement of the Project
Key performance indicators for emission controls	Compliance with development consent criteria
Monitoring methods (location, frequency, duration)	The monitoring methods will be as per the current approved Mount Owen Complex Air Quality Management Plan. Should the Project be approved, the monitoring methods (location, frequency, duration) will be reviewed as part of the revised management plan and will reflect the expected areas of potential impact. The revised monitoring network will be developed to allow for evaluation of compliance at private landowners in accordance with conditions of consent.
Response mechanisms	Response mechanisms will be outlined in the dust Trigger Action Response Plan and revised Air Quality Management Plan.
Responsibilities for demonstrating and reporting achievement of KPIs	Responsibilities will be outlined the dust Trigger Action Response Plan and revised Air Quality Management Plan.
Record keeping and complaints response register	Details of records keeping and complaints response register are outlined in the currently approved Air Quality Management Plan. These will be reviewed and confirmed prior to the commencement of the Project.
Compliance reporting	Compliance reporting information is outlined in the currently approved Air Quality Management Plan. These will be reviewed and confirmed prior to the commencement of the Project.

It is anticipated that the existing Environment Protection Licence (EPL) will be revised under the *Protection of the Environment (Operations) Act 1997* (POEO Act). Relevant to air quality, the EPL includes requirements to minimise dust emissions and to monitor air quality. Also relevant is the *Protection of the Environment Operations (Clean Air) Regulation 2010* which prescribes requirements for domestic solid fuel heaters, control of burning, motor vehicle emissions and industrial emissions (such as Volatile Organic Compounds). Motor vehicle emissions would be addressed by regular maintenance of all vehicles associated with the Project.

13. Conclusions

This report has assessed the potential air quality impacts of the Glendell Continued Operations Project. In summary the assessment has involved identifying the key air quality issues, characterising the existing air quality and meteorological environment, quantifying Project emissions and using an air dispersion model to predict the impact of Project emissions on local air quality.

The potential air quality issues were identified as:

- Dust (that is, particulate matter in the form of TSP, PM_{10} or $PM_{2.5}$) from the general mining activities;
- Fume (that is, NO_x emissions) from blasting; and
- Emissions of substances from machinery exhausts, that is, diesel emissions.

A detailed review of the existing environment was carried out. The following conclusions were made in relation to the existing air quality and meteorological conditions:

- Wind patterns in the vicinity of Glendell Mine are similar to other parts of the Hunter Valley, with the prevailing winds being from either the northwest or southeast.
- There are seasonal variations in particulate matter concentrations, with PM_{10} levels generally higher in spring and $PM_{2.5}$ levels generally higher in winter.
- There are daily variations in particulate matter concentrations, with levels typically highest in the morning and evening.
- In 2018 particle levels increased across the State due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH 2019).
- In terms of PM_{10} concentrations, most monitoring sites in the vicinity of Glendell Mine have experienced at least one day above the EPA's 24-hour criterion in the past seven years. The averages exceeded the EPA 24-hour criterion in 2017 and 2018 in some locations. These results were heavily influenced by the drought conditions occurring during this period.
- Measured TSP and NO_2 concentrations are below their relevant EPA criteria.
- Deposited dust levels have exceeded EPA criteria at two of the 13 monitoring locations, but not in 2017 or 2018.
- The two closest $PM_{2.5}$ monitoring stations, Camberwell and Singleton, have measured $PM_{2.5}$ concentrations which are close to or have exceeded the EPA criteria. A study by the OEH (2013b) found that wood smoke from domestic heating was one of the main factors that influenced $PM_{2.5}$ concentrations, especially in winter.
- Conditions in 2014 were representative of the longer-term air quality and meteorological conditions.

The computer-based dispersion model known as CALPUFF was used to predict the potential air quality impacts of the Project, including cumulative impacts. The dispersion modelling accounted for meteorological conditions, land use and terrain information and used dust emission estimates to predict the off-site air quality impacts. The performance of the model was reviewed by comparing predictions to measured results for a representative year. It was found that, with the adopted approach for modelling and assessment, the model predictions for average concentrations were typically within 20 per cent of measured results. This result is well within the factor-of-two accuracy that has been recognised for these types of models (US EPA, 2005).

The outcomes of the assessment in terms of compliance against assessment criteria can be summarised by **Table 28** below.

Table 28 Summary of compliance outcomes

Air quality indicator	Averaging time	Criterion (note, application may differ under EPA and VLAMP assessments , see Section 4)	Summary of outcomes for private sensitive receptors not subject to acquisition rights
Particulate matter (PM_{10})	24-hour	50 µg/m^3	- Compliance with VLAMP - Potential for one or more days above EPA criteria at most locations (detailed in Appendix G). The frequency of days above EPA criteria has been quantified.
	Annual	25 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
	Annual	8 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
Particulate matter (TSP)	Annual	90 µg/m^3	- Compliance with VLAMP - Compliance with EPA criteria
Deposited dust	Annual (maximum increase)	2 g/m^2/month	- Compliance with VLAMP - Compliance with EPA criteria
	Annual (maximum total)	4 g/m^2/month	- Compliance with VLAMP - Compliance with EPA criteria
Nitrogen dioxide (NO_2)	1-hour	246 µg/m^3	- Compliance with EPA criteria
	Annual	62 µg/m^3	- Compliance with EPA criteria
Odour	Nose-response	-	- Odour impacts can be managed with appropriate blasting procedures

The main conclusions of the assessment can also be described as follows:

- There is potential for the combined contribution of the Project, other existing and approved mines, and background levels to influence compliance outcomes for 24-hour average PM_{10}. While this conclusion was based on a conservative approach to the assessment which assumes that, with the exception of the Mount Owen Complex, all existing, approved or expected to be approved mines will be concurrently operating at approved maximum limits, it is anticipated that PM_{10} concentrations will continue to be variable from day-to-day, due to existing conditions and sources as well as extreme events. Operations will need to continue to be managed in a way which minimises the contribution to off-site PM_{10} levels.
- There are no private sensitive locations not subject to acquisition rights which are predicted to experience exceedances of the annual average PM_{10}, maximum 24-hour average $PM_{2.5}$, annual average $PM_{2.5}$, annual average TSP or annual average dust deposition criteria at any stage of the Project.
- Post blast fume emissions are not expected to result in any adverse air quality impacts (as NO_2 or odour), based on model predictions which show compliance with air quality criteria and with consideration of blast management practices that are currently employed at the Mount Owen Complex.
- Emissions from diesel exhausts associated with off-road vehicles and equipment are not expected to result in any adverse air quality impacts.
- Construction impacts will be lower than those associated with operations however appropriate dust management will need to be implemented to make sure that impacts are minimised. Monitoring would continue to be carried out during the construction phase to assess compliance with EPA criteria.

14. References

ACARP (2015) "Development of Australia-specific PM_{10} emission factors for coal mines". Published by the Australian Coal Association Research Program (ACARP), 21/9/2015.

ANSTO (2008) Fine particle aerosol sampling newsletter. Number 38, July 2008.

Ashton Coal (2015) "Annual Environmental Management Report 2014". 24/3/2015.

Attalla M I, Day S J, Lange T, Lilley W and Morgan S (2008) "NOx emissions from blasting operations in open-cut coal mining" published in Atmospheric Environment, 42, (2008), 7874-7883. CSIRO Energy Technology, PO Box 330, Newcastle, NSW 2300.

Betts A, Dutt U, Jiang N, Warren L and Watt S (2014) "Observations of particulate matter concentrations from the Upper Hunter Air Quality Monitoring Network, NSW". Published in "Air Quality and Climate Change" journal from the Clean Air Society of Australia and New Zealand, Volume 48, No. 4, November 2014.

BoM (2019) Climatic Averages Australia, Bureau of Meteorology website, accessed July 2019. http://www.bom.gov.au/climate/averages/

DEC (2005) "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW". Published by the Department of Environment and Conservation, now EPA. August 2005.

DEEDI (2011) "Management of oxides of nitrogen in open cut blasting". Queensland Guidance Note QGN 20 v3. Department of Employment, Economic Development and Innovation.

DEFRA (2010) "Evaluating the Performance of Air Quality Models". Issue 3 / June 2010.

DoE (2016) *National Environment Protection (Ambient Air Quality) Measure – as amended*, Federal Register of Legislative Instruments F2016C00215, Department of the Environment, Canberra.

Department of Planning (2010) "Independent Review of Cumulative Impacts on Camberwell (noise, dust, emissions)".

Donnelly S-J, Balch A, Wiebe A, Shaw N, Welchman S, Schloss A, Castillo E, Henville K, Vernon A and Planner J (2011) "NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and / or Minimise Emissions of Particulate Matter from Coal Mining". Prepared by Katestone Environmental Pty Ltd for NSW Office of Environment and Heritage, December 2010.

EPA (2012) "Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, 2008 Calendar Year, Off-Road Mobile Emissions". Technical Report No. 6. Prepared by the Environment Protection Authority. EPA 2012/0050. August 2012.

EPA (2016) "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW".

Jacobs (2016) United Wambo Open Cut Coal Mine Project – Air Quality Impact Assessment. Report dated 13 July 2016.

Jacobs (2018) "Mount Owen Continued Operations Modification 2 - Air Quality Impact Assessment". Report dated 20 June 2018.

Liddell Coal (2015) "2014 Annual Environmental Management Report". Final, version 0.1, effective 30/03/2015.

Mt Owen Pty Ltd (2015) "Mt Owen Complex Annual Review 2014".

National Pollutant Inventory (2012) "Emission Estimation Technique Manual for Mining". Version 3.1, January 2012.

NEPC (1998) “Ambient Air – National Environment Protection Measure for Ambient Air Quality”, National Environment Protection Council, Canberra.

NERDDC (1988) “Air Pollution from Surface Coal Mining: Measurement, Modelling and Community Perception”, Project No. 921, National Energy Research Development and Demonstration Council, Canberra.

NHMRC (1996) “Ambient Air Quality Goals Recommended by the National Health and Medical Research Council, National Health and Medical Research Council”, Canberra.

NSW Government (2018) “Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments”. September 2018.

OEH (2013a) New South Wales Air Quality Statement 2013. http://www.environment.nsw.gov.au/aqms/140057nswairqual13.htm

OEH (2013b) “Upper Hunter Fine Particle Characterisation Study”. Final report, dated 17 September 2013. CSIRO.

OEH (2019) Air quality monitoring data from the Office of Environment and Heritage website http://www.environment.nsw.gov.au/AQMS/search.htm. Accessed August 2019.

OEH (2019) “Annual Air Quality Statement 2018”.

PAEHolmes (2009) “Air Quality Impact Assessment – Ashton South East Open Cut Mine”. Report dated 23 October 2009.

Pacific Environment Limited (2013) “Air Quality and Greenhouse Gas Assessment – Liddell Coal Operations Modification 5”. Job no. 5347. Report dated 20 February 2013.

Pacific Environment Limited (2014) “Air Quality Impact Assessment - Mount Owen Continued Operations”. Dated 29 October 2014.

Pacific Environment Limited (2016) “Mount Owen Continued Operations – Refined Project”. Dated 26 May 2016.

PAEHolmes (2009) “Air Quality Impact Assessment – Ashton South East Open Cut Mine”. Job no. 2886, 23 October 2009.

Ravensworth Operations Pty Ltd (2015) “The Ravensworth Complex Annual Review for the period of 1 January 2014 to 31 December 2014”. Dated March 2015.

Rio Tinto (2015) “2014 Hunter Valley Operations Annual Environmental Review”. March 2015.

Rix’s Creek Ltd (2015) “Annual Review 2015”. Rix’s Creek Mine. Dated 19/4/2016.

Skidmore, E.L. (1998) “Wind Erosion Processes”. USDA-ARS Wind Erosion Research Unit, Kansas State University. Wind Erosion in Africa and West Asia: Problems and Control Strategies. Proceedings of the expert group meeting 22-25 April 1997, Cairo, Egypt.

SPCC (1986) “Particle size distributions in dust from open cut coal mines in the Hunter Valley”. Report number 10636-002-71. Prepared for the State Pollution Control Commission of NSW (now EPA) by Dames and Moore.

Todoroski (2015) “Air Quality and Greenhouse Gas Assessment – Rix’s Creek Continuation of Mining Project”. Prepared by Todoroski Air Sciences, job number 13080222, report dated 26 August 2015.

Todoroski (2016) “Review – Air Quality Impact Assessment – Mt Owen Continued Operations Project”. Prepared by Todoroski Air Sciences for the NSW Department of Planning and Environment. Job number 15090470, report dated 29 April 2016.

Todoroski (2017) “Air Quality and Greenhouse Gas Assessment – HVO South Modification 5”. Prepared by Todoroski Air Sciences, job number 15010400, report dated 25 January 2017.

TRC (2007) CALPUFF model web-site (http://www.src.com/calpuff/regstat.htm).

TRC (2011) “Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the ‘Approved Methods for the Modelling and Assessments of Air Pollutants in NSW’”. Prepared for the Office of Environment and Heritage by TRC, March 2011.

URS (2000) “Mount Arthur North Coal Project”. EIS produced for Coal Australia Pty Ltd by URS Australia Pty Ltd.

Umwelt (2019) “Glendell Continued Operations Project - Greenhouse gas assessment”. Prepared by Umwelt (Australia) Pty Ltd.

US EPA (1985 and updates) “Compilation of Air Pollutant Emission Factors”, AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711. Now a web-based document.

US EPA (1987) Update of fugitive dust emission factors in AP-42 Section 11.2, EPA Contract No. 68-02-3891, Midwest Research Institute, Kansas City, MO, July 1987.

US EPA (1995) “User’s Guide for the Industrial Source Complex (ISC3) Dispersion Models – Volume 1 User’s Instructions” and “Volume 2 Description of Model Algorithms” US Environmental Protection Agency, Office of Air Quality Planning and Standards Emissions, Monitoring and Analysis Division, Research Triangle Park, North Carolina 27711.

US EPA (2005) “Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule”. Environmental Protection Agency.

Vale (2015) “Annual Review – Integra Coal Operations”. Report dated March 2015.

WHO (2000) “Air Quality Guidelines for Europe – Second Edition”. WHO Regional Publications, European Series, No. 91. World Health Organisation.

Appendix A. EPA Assessment Requirements

4 Air Issues

4.1 Air quality

The EIS must include an air quality impact assessment (AQIA) in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, including, as a minimum the following components:

Assessment Objective

1. Demonstrate the proposed project will incorporate and apply best management practice emission controls; and
2. Demonstrate that the project will not cause violation of the project adopted air quality impact assessment criteria at any residential dwelling or other sensitive receptor.

Assessment Criteria

- Define applicable assessment criteria for the proposed development referencing the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, including appendices and updates
- Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations* (POEO) *Act* (1997) and the POEO (Clean Air) Regulation (2010).

Existing Environment

- Provide a detailed description of the existing environment within the assessment domain, including:
  - geophysical form and land-uses;
  - location of all sensitive receptors;
  - existing air quality; and
  - local and regional prevailing meteorology.
- Justify all data used in the assessment, specifically including analysis of inter-annual trends (preferably five consecutive years of data), availability of monitoring data, and local topographical features.
- Meteorological modelling must be verified against monitored data. Verification should involve comparative analysis of wind speed, wind direction and temperature, at a minimum.
- A review of all existing, recently approved and planned developments likely to contribute to cumulative air quality impacts must be completed.

Emissions Inventory

- Provide a detailed description of the project and identify the key stages with regards to the potential for air emissions and impacts on the surrounding environment.
- Identify all sources of air emissions, including mechanically generated, combustion and transport related emissions likely to be associated with the proposed development.
- Estimate emissions of TSP, PM_{10}, $PM_{2.5}$, NO_x, (tonnes per year), at a minimum, for all identified sources during each key development stage. The emissions inventory should:
  - utilise USEPA (1995) (and updates) emission estimation techniques, direct measurement or other method approved in writing by EPA;
  - calculate uncontrolled emissions (with no particulate matter controls in place); and
  - calculate controlled emissions (with proposed particulate matter controls in place).

- The emissions inventory must be explicitly coupled with the project description.
- Provide a detailed summary and justification of all parameters adopted within all emission estimation calculations, including site specific measurements, proponent recommended values or published literature.
- Document, including quantification and justification, all air quality emission control techniques/practices proposed for implementation during the project. As a minimum, consideration must be given to source control techniques, emission control through mine planning and reactive/predictive management techniques.
- Blasting emission estimation should provide specific details on likely activities, including the frequency of blasts, area per blast, amount and type of explosives used and blasting hours.

Best Practice Determination

- Based on the TSP, PM_{10} and $PM_{2.5}$ emissions inventories calculated for the proposed development, undertake a site-specific best practice determination, in accordance with the document Coal Mine Particulate Matter Control Best Practice – Site specific determination guideline.
- Demonstrate that the proposed control techniques/practices are consistent with best management practice.
- Detail all sources possible sources of air pollution and activities/processes with the potential to cause air pollutants, including odours and fugitive dust emissions and odours; and
- Describe in detail the measures proposed to mitigate the impacts and quantify the extent to which the mitigation measures are likely to be effective in achieving the relevant environmental outcomes.

Dispersion Modelling and Interpretation of Results

- Atmospheric dispersion modelling should be undertaken in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, including appendices and updates.
- Modelling must implement fit for purpose modelling techniques that:
    - have regard for the most up to date and scientifically accepted dispersion modelling techniques;
    - contextualise all assumptions based on current scientific understanding and available data; and
    - include a thorough validation of adopted methods and model performance.
- Use an appropriate atmospheric dispersion model to predict, at a minimum, incremental ground level concentrations/levels of the following:
    - 24-hour and annual average PM_{10} concentrations;
    - 24-hour and annual average $PM_{2.5}$ concentrations; and
    - 1-hour and annual average NO_2 concentrations. NO_2 concentrations should be assessed using a well justified approach for the transformation of NOx to NO_2.
- Ground level concentrations of pollutants should be presented for surrounding privately-owned properties, mine-owned properties and other sensitive receptors (as applicable).
- Undertake a cumulative assessment of predicted impacts. The contribution of all identified existing and recently approved developments should be accounted for in the cumulative assessment.
- Cumulative 24-hour PM_{10} and $PM_{2.5}$ concentrations must be assessed in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, including appendices and updates, and/or a suitably justified probabilistic methodology.

- Cumulative annual average PM_{10}, $PM_{2.5}$, and NO_2 should be assessed using a sufficiently justified background concentration(s);
- Results of dispersion modelling should be presented as follows:
  - isopleth plots showing the geographic extent of maximum pollutant concentrations (incremental and cumulative);
  - tables presenting the maximum predicted pollutant concentrations (increment and cumulative) and the frequency of any predicted exceedances at each surrounding privately-owned properties, mine-owned properties and other sensitive receptors (as applicable); and
  - time series and frequency distribution plots of pollutant concentrations at each private receptor location at which an exceedance is predicted to occur. Where no exceedances are predicted, the analysis must be performed for the most impacted off site sensitive receptor.

<u>Air Quality Emission Control Measures</u>

- Provide a detailed discussion of all proposed air quality emission control measures, including details of a reactive/predictive management system. The information provided must include:
  - explicit linkage of proposed emission controls to the site specific best practice determination assessment
  - timeframe for implementation of all identified emission controls;
  - key performance indicators for emission controls;
  - monitoring methods (location, frequency, duration);
  - response mechanisms;
  - responsibilities for demonstrating and reporting achievement of KPIs;
  - record keeping and complaints response register; and
  - compliance reporting.

<u>Air Quality Impact Assessment (Blasting)</u>

- The AQIA must also be undertaken to determine the potential impacts of blasting activities. This must include assessment and modelling to determine the level of potential impacts (dust, gases and offensive odour) and how these potential impacts would be mitigated.

Appendix B. Wind-roses for all meteorological stations

Figure B1 Annual and seasonal wind-roses for Glendell Met 2014

Figure B2 Annual and seasonal wind-roses for Mt Owen Met 2014

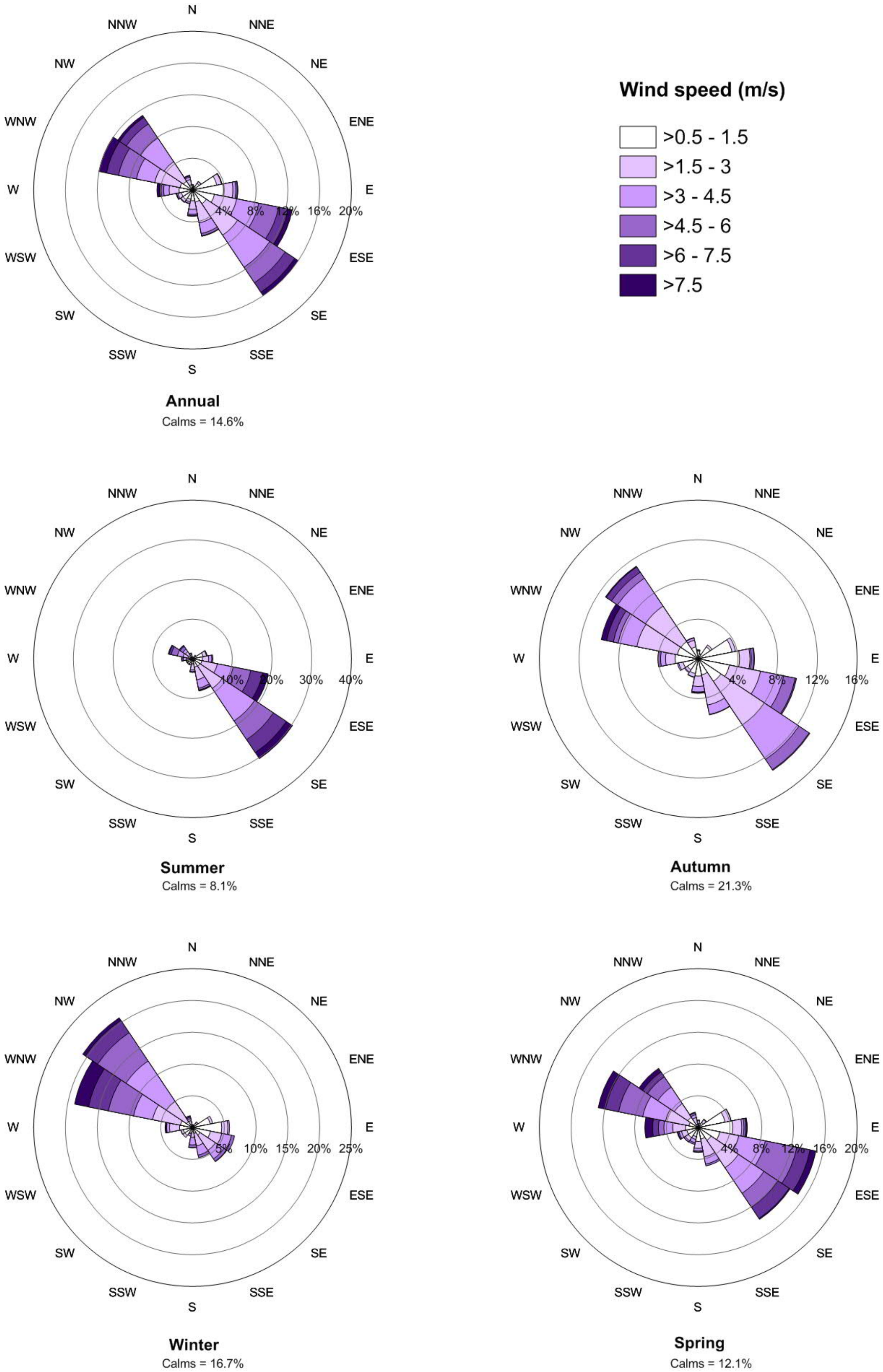


Figure B3 Annual and seasonal wind-roses for Camberwell (OEH) 2014

Figure B4 shows the wind data as determined by CALMET for the location of the Glendell Met meteorological station. This demonstrates that the data used by the model accurately reflects the measurement data, based on the similarities to **Figure B1**.

Figure B4 Annual and seasonal wind-roses for Glendell Met 2014 as determined by CALMET

Appendix C. Emissions Calculations

Emission factors

Activity	Emission factor			Units	Source
	TSP	PM_{10}	$PM_{2.5}$		
Stripping topsoil by scraper	$E_{TSP} = 0.029$	$E_{PM10} = 0.0073 \times E_{TSP}$	$E_{PM2.5} = 0.05 \times E_{TSP}$	kg/t	US EPA / NPI
Drilling	$E_{TSP} = 0.59$	$E_{PM10} = 0.52 \times E_{TSP}$	$E_{PM2.5} = 0.03 \times E_{TSP}$	kg/hole	US EPA / NPI
Blasting	$E_{TSP} = 0.00022 \times A^{1.5}$	$E_{PM10} = 0.52 \times E_{TSP}$	$E_{PM2.5} = 0.03 \times E_{TSP}$	kg/blast	US EPA / NPI
Loading material / dumping overburden	$E_{TSP} = 0.74 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	$E_{PM10} = 0.35 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	$E_{PM2.5} = 0.053 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	kg/t	US EPA / NPI
Hauling on unsealed roads	$E_{TSP} = 4$	$E_{PM10} = 0.3 \times E_{TSP}$	$E_{PM2.5} = 0.03 \times E_{TSP}$	kg/VKT	SPCC
Dozers shaping overburden	$E_{TSP} = 2.6 \times (S^{1.2}/M^{1.3})$	$E_{PM10} = 0.3375 \times (S^{1.5}/M^{1.4})$	$E_{PM2.5} = 0.105 \times E_{TSP}$	kg/hour	US EPA / NPI
Dozers working on coal	$E_{TSP} = 35.6 \times (S^{1.2}/M^{1.3})$	$E_{PM10} = 6.33 \times (S^{1.5}/M^{1.4})$	$E_{PM2.5} = 0.022 \times E_{TSP}$	kg/hour	US EPA / NPI
Loading coal	$E_{TSP} = 0.58 / M^{1.2}$	$E_{PM10} = 0.0447 / M^{0.9}$	$E_{PM2.5} = 0.019 \times E_{TSP}$	kg/t	US EPA / NPI
Unloading coal	$E_{TSP} = 0.01$	$E_{PM10} = 0.0042$	$E_{PM2.5} = 0.019 \times E_{TSP}$	kg/t	NPI
Miscellaneous transfer	$E_{TSP} = 0.74 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	$E_{PM10} = 0.35 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	$E_{PM2.5} = 0.053 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	kg/t	US EPA / NPI
Loading product coal to trains	$E_{TSP} = 0.0004$	$E_{PM10} = 0.00017$	$E_{PM2.5} = 0.05 \times E_{TSP}$	kg/t	NPI
Wind erosion from exposed areas	$E_{TSP} = 0.1$	$E_{PM10} = 0.5 \times E_{TSP}$	$E_{PM2.5} = 0.075 \times E_{TSP}$	kg/ha/h	US EPA
Grading roads	$E_{TSP} = 0.0034 \times s^{2.5}$	$E_{PM10} = 0.00336 \times s^{2}$	$E_{PM2.5} = 0.0001054 \times s^{2.5}$	kg/VKT	US EPA / NPI
Dragline working on overburden	$E_{TSP} = 0.0046*(D^{1.1}/M^{0.3})$	$E_{TSP} = 0.0022*(D^{0.7}/M^{0.3})$	$E_{PM2.5} = 0.05 \times E_{TSP}$	kg/bcm	US EPA / NPI

A = blast area (m^2)
U = wind speed (m/s)
M = moisture content (%)
S = silt content (%)
s = speed (km/h)
D = drop distance (m)

Emission inventory
Glendell Mine 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	653	164	33	50	45000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	16001	8320	480	70	90400	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	70315	36564	2109	0	113	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	65412	30938	4685	0	40161366	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	442143	130657	13264	85	40161366	t/y	0.07339	kg/t	0.02169	kg/t	0.002	kg/t	-	-	-	-	4	218	4	-	-
Unloading overburden to dump	65412	30938	4685	0	40161366	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	439805	106281	46179	0	26280	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	219902	53141	23090	0	13140	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	209027	30061	3972	0	4370000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	331200	97872	9936	85	4370000	t/y	0.50526	kg/t	0.14931	kg/t	0.015	kg/t	-	-	-	-	4	133	16.8	-	-
Unloading ROM coal to ROM pad	13110	5506	249	70	4370000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	21850	9177	415	0	2185000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	511	242	37	50	4370000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	1540	728	22	70	4390000	t/y	0.00117	kg/t	0.00055	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	217	103	16	50	2899122	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	1153	490	58	0	2882479	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	76326	39343	5724	0	90	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	104028	53623	7802	0	122	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	9232	3226	286	50	30000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	2411539	721190	130163																		

Notes: based on data from Mt Owen (2015)

Emission inventory
Glendell Continued Operations Project Year 1

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	2480	624	124	50	171000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	6834	3554	205	70	38610	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	54361	28268	1631	0	99	blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	98323	46504	7042	0	60367739	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	664599	196394	19938	85	60367739	t/y	0.07339	kg/t	0.02169	kg/t	0.002	kg/t	-	-	-	-	4	218	4	-	-
Unloading overburden to dump	98323	46504	7042	0	60367739	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	481375	116327	50544	0	28764	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	160458	38776	16848	0	9588	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Dozers working on coal	73954	19149	1627	0	3002	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	201809	29023	3834	0	4219106	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	209369	61870	6281	85	4219106	t/y	0.33083	kg/t	0.09776	kg/t	0.010	kg/t	-	-	-	-	4	133	11	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	57812	29800	4336	0	68	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	109198	56288	8190	0	129	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	21110	7376	654	50	68600	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Gravel crushing in-pit	1620	720	81	70	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	2241625	681177	128378																		

Notes: production data supplied by Mt Owen

Emission inventory
Glendell Continued Operations Project Year 6

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	2349	591	117	50	162000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	11183	5815	335	70	63180	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	88954	46256	2669	0	162	blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	133859	63312	9587	0	82185900	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	904799	267376	27144	85	82185900	t/y	0.07339	kg/t	0.02169	kg/t	0.002	kg/t	-	-	-	-	4	218	4	-	-
Unloading overburden to dump	133859	63312	9587	0	82185900	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	671995	162392	70559	0	40154	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	223998	54131	23520	0	13385	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Dozers working on coal	111818	28952	2460	0	4539	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	280249	40304	5325	0	5859000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	253743	74983	7612	85	5859000	t/y	0.28872	kg/t	0.08532	kg/t	0.009	kg/t	-	-	-	-	4	133	9.6	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	155499	80154	11662	0	183	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	152950	78840	11471	0	180	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped dumps	111823	57641	8387	30	188	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	36189	12644	1122	50	117600	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Gravel crushing in-pit	1620	720	81	70	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	3274887	1037423	191639																		

Notes: production data supplied by Mt Owen

Emission inventory
Glendell Continued Operations Project Year 13

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	2610	657	131	50	180000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	18224	9476	547	70	102960	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	144962	75380	4349	0	264	blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	221357	104696	15854	0	135907000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	1496224	442147	44887	85	135907000	t/y	0.07339	kg/t	0.02169	kg/t	0.002	kg/t	-	-	-	-	4	218	4	-	-
Unloading overburden to dump	221357	104696	15854	0	135907000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	1089294	263234	114376	0	65090	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	363098	87745	38125	0	21697	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70		holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0		blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	212057	54907	4665	0	8608	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	478322	68790	9088	0	10000000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	342857	101317	10286	85	10000000	t/y	0.22857	kg/t	0.06754	kg/t	0.007	kg/t	-	-	-	-	4	133	7.6	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	168807	87014	12661	0	199	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	142487	73447	10687	0	168	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped dumps	53532	27594	4015	30	90	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	60316	21074	1870	50	196000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Gravel crushing in-pit	1620	720	81	70	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	5017124	1522894	287474																		

Notes: production data supplied by Mt Owen

Emission inventory
Glendell Continued Operations Project Year 18

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	1436	361	72	50	99000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	10907	5672	327	70	61620	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	86757	45114	2603	0	158	blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	127881	60484	9159	0	78515100	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	864386	255433	25932	85	78515100	t/y	0.07339	kg/t	0.02169	kg/t	0.002	kg/t	-	-	-	-	4	218	4	-	-
Unloading overburden to dump	127881	60484	9159	0	78515100	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	620948	150056	65200	0	37104	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	206983	50019	21733	0	12368	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70		holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0		blasts/y	549.1	kg/blast	285.5	kg/blast	16.5	kg/blast	18400	-	-	-	-	-	-	-	-
Dozers working on coal	120859	31293	2659	0	4906	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	282592	40641	5369	0	5908000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	165246	48832	4957	85	5908000	t/y	0.18647	kg/t	0.0551	kg/t	0.006	kg/t	-	-	-	-	4	133	6.2	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	136448	70334	10234	0	161	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	177899	91701	13342	0	209	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped dumps	28662	14774	2150	30	48	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	31512	11010	977	50	102400	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Gravel crushing in-pit	1620	720	81	70	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	2992017	936928	173953																		

Notes: production data supplied by Mt Owen

Source allocations
Glendell Mine 2014

```
--------------------------------       22-May-2019 15:27
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Output emissions file  :
C:\Users\slakmaker\Projects\IA160700_Glendell\calpuff\2014\Glendell
\emiss.vol
 Meteorological file    : NA
 Number of dust sources : 39
 Number of activities   : 28

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Stripping topsoil by scraper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 653 kg/y TSP  164 kg/y PM10  33 kg/y PM2.5
 FROM SOURCES  : 2
7 8
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 16001 kg/y TSP  8320 kg/y PM10  480 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 70315 kg/y TSP  36564 kg/y PM10  2109 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 65412 kg/y TSP  30938 kg/y PM10  4685 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 442143 kg/y TSP  130657 kg/y PM10  13264 kg/y
PM2.5
 FROM SOURCES  : 15
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 65412 kg/y TSP  30938 kg/y PM10  4685 kg/y PM2.5
 FROM SOURCES  : 6
11 12 13 14 15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 439805 kg/y TSP  106281 kg/y PM10  46179 kg/y
PM2.5
 FROM SOURCES  : 6
11 12 13 14 15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 219902 kg/y TSP  53141 kg/y PM10  23090 kg/y PM2.5
 FROM SOURCES  : 4
17 18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 323702 kg/y TSP  83815 kg/y PM10  7121 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 209027 kg/y TSP  30061 kg/y PM10  3972 kg/y PM2.5
 FROM SOURCES  : 6
2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 331200 kg/y TSP  97872 kg/y PM10  9936 kg/y PM2.5
 FROM SOURCES  : 27
2 3 4 5 6 7 12 13 16 17 21 22 23 24 25 26 27 28 29 30 31 32 33 34
35 36 37
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 13110 kg/y TSP  5506 kg/y PM10  249 kg/y PM2.5
 FROM SOURCES  : 3
35 36 37
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 21850 kg/y TSP  9177 kg/y PM10  415 kg/y PM2.5
 FROM SOURCES  : 3
35 36 37
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 511 kg/y TSP  242 kg/y PM10  37 kg/y PM2.5
 FROM SOURCES  : 3
35 36 37
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1540 kg/y TSP  728 kg/y PM10  22 kg/y PM2.5
 FROM SOURCES  : 1
37
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 3
35 36 37
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
38 39
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 217 kg/y TSP  103 kg/y PM10  16 kg/y PM2.5
 FROM SOURCES  : 2
38 39
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1153 kg/y TSP  490 kg/y PM10  58 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 76326 kg/y TSP  39343 kg/y PM10  5724 kg/y PM2.5
 FROM SOURCES  : 8
2 3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 104028 kg/y TSP  53623 kg/y PM10  7802 kg/y PM2.5
 FROM SOURCES  : 11
10 11 12 13 14 15 16 17 18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from partially rehabilitated dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 3
18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 3
35 36 37
 HOURS OF DAY  :
```

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

ACTIVITY NAME : Wind erosion from product coal stockpile
ACTIVITY TYPE : Wind erosion
DUST EMISSION : 0 kg/y TSP 0 kg/y PM10 0 kg/y PM2.5
FROM SOURCES : 2
38 39
HOURS OF DAY :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

ACTIVITY NAME : Grading roads
ACTIVITY TYPE : Wind insensitive
DUST EMISSION : 9232 kg/y TSP 3226 kg/y PM10 286 kg/y PM2.5
FROM SOURCES : 33
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34
HOURS OF DAY :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

ACTIVITY NAME : Dragline working on overburden
ACTIVITY TYPE : Wind sensitive
DUST EMISSION : 0 kg/y TSP 0 kg/y PM10 0 kg/y PM2.5
FROM SOURCES : 1
1
HOURS OF DAY :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Pit retention sources:
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Source allocations
Glendell Continued Operations Project Year 1

```
--------------------------------      03-Jul-2019 20:30
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Number of dust sources : 39
 Number of activities   : 29

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Stripping topsoil by scraper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2480 kg/y TSP  624 kg/y PM10  124 kg/y PM2.5
 FROM SOURCES  : 2
1 2
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 6834 kg/y TSP  3554 kg/y PM10  205 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 54361 kg/y TSP  28268 kg/y PM10  1631 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 98323 kg/y TSP  46504 kg/y PM10  7042 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 664599 kg/y TSP  196394 kg/y PM10  19938 kg/y
PM2.5
 FROM SOURCES  : 17
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 98323 kg/y TSP  46504 kg/y PM10  7042 kg/y PM2.5
 FROM SOURCES  : 10
8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 481375 kg/y TSP  116327 kg/y PM10  50544 kg/y
PM2.5
 FROM SOURCES  : 10
8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 160458 kg/y TSP  38776 kg/y PM10  16848 kg/y PM2.5
 FROM SOURCES  : 6
12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 73954 kg/y TSP  19149 kg/y PM10  1627 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 201809 kg/y TSP  29023 kg/y PM10  3834 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 209369 kg/y TSP  61870 kg/y PM10  6281 kg/y PM2.5
 FROM SOURCES  : 20
1 2 3 4 5 6 7 19 20 21 22 23 24 25 26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 57812 kg/y TSP  29800 kg/y PM10  4336 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 109198 kg/y TSP  56288 kg/y PM10  8190 kg/y PM2.5
 FROM SOURCES  : 11
8 9 10 11 12 13 14 15 16 17 18
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from shaped dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 11
8 9 10 11 12 13 14 15 16 17 18
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
```

```
 FROM SOURCES  : 2
32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 21110 kg/y TSP  7376 kg/y PM10  654 kg/y PM2.5
 FROM SOURCES  : 39
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dragline working on overburden
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Gravel crushing in-pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
4 5 6 7
```

Source allocations
Glendell Continued Operations Project Year 6

```
--------------------------------      24-May-2019 14:20
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Number of dust sources : 50
 Number of activities   : 29

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Stripping topsoil by scraper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2349 kg/y TSP  591 kg/y PM10  117 kg/y PM2.5
 FROM SOURCES  : 3
1 2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 11183 kg/y TSP  5815 kg/y PM10  335 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 88954 kg/y TSP  46256 kg/y PM10  2669 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 133859 kg/y TSP  63312 kg/y PM10  9587 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 904799 kg/y TSP  267376 kg/y PM10  27144 kg/y
PM2.5
 FROM SOURCES  : 22
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 133859 kg/y TSP  63312 kg/y PM10  9587 kg/y PM2.5
 FROM SOURCES  : 11
15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 671995 kg/y TSP  162392 kg/y PM10  70559 kg/y
PM2.5
 FROM SOURCES  : 11
15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 223998 kg/y TSP  54131 kg/y PM10  23520 kg/y PM2.5
 FROM SOURCES  : 8
26 27 28 29 30 31 32 33
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 111818 kg/y TSP  28952 kg/y PM10  2460 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 280249 kg/y TSP  40304 kg/y PM10  5325 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 253743 kg/y TSP  74983 kg/y PM10  7612 kg/y PM2.5
 FROM SOURCES  : 20
4 5 6 7 8 9 10 11 12 13 14 34 35 36 37 38 39 40 41 42
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
42
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
42
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
42
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
45
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 155499 kg/y TSP  80154 kg/y PM10  11662 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 152950 kg/y TSP  78840 kg/y PM10  11471 kg/y PM2.5
 FROM SOURCES  : 11
15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from shaped dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 111823 kg/y TSP  57641 kg/y PM10  8387 kg/y PM2.5
 FROM SOURCES  : 6
26 27 28 29 30 31
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
42
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
```

```
 FROM SOURCES  : 2
43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 36189 kg/y TSP  12644 kg/y PM10  1122 kg/y PM2.5
 FROM SOURCES  : 50
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dragline working on overburden
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Gravel crushing in-pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 11
4 5 6 7 8 9 10 11 12 13 14
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
4 5 6 7 8 9 10 11 12 13 14
```

Source allocations
Glendell Continued Operations Project Year 13

```
--------------------------------     24-May-2019 14:25
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Number of dust sources : 47
 Number of activities   : 29

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Stripping topsoil by scraper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2610 kg/y TSP  657 kg/y PM10  131 kg/y PM2.5
 FROM SOURCES  : 3
1 2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 18224 kg/y TSP  9476 kg/y PM10  547 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 144962 kg/y TSP  75380 kg/y PM10  4349 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 221357 kg/y TSP  104696 kg/y PM10  15854 kg/y
PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1496224 kg/y TSP  442147 kg/y PM10  44887 kg/y
PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 221357 kg/y TSP  104696 kg/y PM10  15854 kg/y
PM2.5
 FROM SOURCES  : 11
16 17 18 19 20 21 22 23 24 25 26
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1089294 kg/y TSP  263234 kg/y PM10  114376 kg/y
PM2.5
 FROM SOURCES  : 11
16 17 18 19 20 21 22 23 24 25 26
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 363098 kg/y TSP  87745 kg/y PM10  38125 kg/y PM2.5
 FROM SOURCES  : 4
27 28 29 30
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 212057 kg/y TSP  54907 kg/y PM10  4665 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 478322 kg/y TSP  68790 kg/y PM10  9088 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 342857 kg/y TSP  101317 kg/y PM10  10286 kg/y
PM2.5
 FROM SOURCES  : 20
4 5 6 7 8 9 10 11 12 13 14 15 31 32 33 34 35 36 37 41
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
41
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
41
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
41
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
42
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 168807 kg/y TSP  87014 kg/y PM10  12661 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 142487 kg/y TSP  73447 kg/y PM10  10687 kg/y PM2.5
 FROM SOURCES  : 11
16 17 18 19 20 21 22 23 24 25 26
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from shaped dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 53532 kg/y TSP  27594 kg/y PM10  4015 kg/y PM2.5
 FROM SOURCES  : 4
27 28 29 30
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
41
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 60316 kg/y TSP  21074 kg/y PM10  1870 kg/y PM2.5
 FROM SOURCES  : 47
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dragline working on overburden
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Gravel crushing in-pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 12
4 5 6 7 8 9 10 11 12 13 14 15
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
4 5 6 7 8 9 10 11 12 13 14
```

Source allocations
Glendell Continued Operations Project Year 18

```
--------------------------------      24-May-2019 14:23
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Number of dust sources : 39
 Number of activities   : 29

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Stripping topsoil by scraper
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1436 kg/y TSP  361 kg/y PM10  72 kg/y PM2.5
 FROM SOURCES  : 2
1 2
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 10907 kg/y TSP  5672 kg/y PM10  327 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden (including through seam)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 86757 kg/y TSP  45114 kg/y PM10  2603 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 127881 kg/y TSP  60484 kg/y PM10  9159 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 864386 kg/y TSP  255433 kg/y PM10  25932 kg/y
PM2.5
 FROM SOURCES  : 18
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 127881 kg/y TSP  60484 kg/y PM10  9159 kg/y PM2.5
 FROM SOURCES  : 11
10 11 12 13 14 15 16 17 18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 620948 kg/y TSP  150056 kg/y PM10  65200 kg/y
PM2.5
 FROM SOURCES  : 11
10 11 12 13 14 15 16 17 18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 206983 kg/y TSP  50019 kg/y PM10  21733 kg/y PM2.5
 FROM SOURCES  : 10
21 22 23 24 25 26 27 28 29 30
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 120859 kg/y TSP  31293 kg/y PM10  2659 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 282592 kg/y TSP  40641 kg/y PM10  5369 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 165246 kg/y TSP  48832 kg/y PM10  4957 kg/y PM2.5
 FROM SOURCES  : 13
3 4 5 6 7 8 9 31 32 33 34 35 36
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
36
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
36
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
37 38
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
37 38
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
36
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
37 38
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 2
37 38
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
39
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 136448 kg/y TSP  70334 kg/y PM10  10234 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 177899 kg/y TSP  91701 kg/y PM10  13342 kg/y PM2.5
 FROM SOURCES  : 11
10 11 12 13 14 15 16 17 18 19 20
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from shaped dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 28662 kg/y TSP  14774 kg/y PM10  2150 kg/y PM2.5
 FROM SOURCES  : 10
21 22 23 24 25 26 27 28 29 30
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
36
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
```

```
 FROM SOURCES  : 2
37 38
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 31512 kg/y TSP  11010 kg/y PM10  977 kg/y PM2.5
 FROM SOURCES  : 39
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dragline working on overburden
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Gravel crushing in-pit
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 7
3 4 5 6 7 8 9
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
3 4 5 6 7 8 9
```

Emission inventory
Ashton (including SEOC) 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	0	0	0	50	0	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	0	0	0	0	0	blasts/y	157.4	kg/blast	81.9	kg/blast	4.7	kg/blast	8000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	0	0	0	85	0	t/y	0.03200	kg/t	0.00946	kg/t	0.001	kg/t	-	-	-	-	4	250	2	-	-
Unloading overburden to dump	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	0	0	0	0	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	0	0	0	0	0	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	0	0	0	85	0	t/y	0.07111	kg/t	0.02101	kg/t	0.002	kg/t	-	-	-	-	4	180	3.2	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	0	0	0	0	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	0	0	0	0	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	0	0	0	50	0	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
UG - ROM coal by conveyor to ROM stockpile	194	92	14	70	2771218	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
UG - Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
UG Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
UG Ventilation outlet(s)	31536	15768	1577	0	1.577E+10	m3/y	2E-06	kg/m3	1E-06	kg/m3	0.0000	kg/m3	-	-	-	-	-	-	-	-	-
	114780	37909	3530																		

Notes: based on data from Ashton (2015), PAE Holmes 2009, and MP 08_0182

Emission inventory
Ashton (including SEOC) 2021 and 2026

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	261	66	13	50	18000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	8496	4418	255	70	48000	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	23613	12279	708	0	150	blasts/y	157.4	kg/blast	81.9	kg/blast	4.7	kg/blast	8000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	50426	23850	3612	0	30960000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	148608	43915	4458	85	30960000	t/y	0.03200	kg/t	0.00946	kg/t	0.001	kg/t	-	-	-	-	4	250	2	-	-
Unloading overburden to dump	50426	23850	3612	0	30960000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	219902	53141	23090	0	13140	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	109951	26570	11545	0	6570	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	161851	41907	3561	0	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	172196	24764	3272	0	3600000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	38400	11348	1152	85	3600000	t/y	0.07111	kg/t	0.02101	kg/t	0.002	kg/t	-	-	-	-	4	180	3.2	-	-
Unloading ROM coal to ROM pad	10800	4536	205	70	3600000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	3600	1512	68	0	360000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	421	199	30	50	3600000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	1263	597	90	70	3600000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	35722	8099	786	50	6570	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	111	52	8	50	1481578	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	593	252	30	0	1481578	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	61180	31536	4588	0	72	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	61180	31536	4588	0	72	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
UG - ROM coal by conveyor to ROM stockpile	351	166	25	70	5000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
UG - Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
UG Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
UG Ventilation outlet(s)	31536	15768	1577	0	1.577E+10	m3/y	2E-06	kg/m3	1E-06	kg/m3	0.0000	kg/m3	-	-	-	-	-	-	-	-	-
	1379698	413100	72044																		

Notes: based on data from Ashton (2015), PAE Holmes 2009, and MP 08_0182

Emission inventory
Ashton (including SEOC) 2033

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	0	0	0	50	0	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	0	0	0	0	0	blasts/y	157.4	kg/blast	81.9	kg/blast	4.7	kg/blast	8000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	0	0	0	85	0	t/y	0.03200	kg/t	0.00946	kg/t	0.001	kg/t	-	-	-	-	4	250	2	-	-
Unloading overburden to dump	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	0	0	0	0	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	0	0	0	0	0	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	0	0	0	85	0	t/y	0.07111	kg/t	0.02101	kg/t	0.002	kg/t	-	-	-	-	4	180	3.2	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	0	0	0	0	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	0	0	0	0	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	0	0	0	50	0	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
UG - ROM coal by conveyor to ROM stockpile	351	166	25	70	5000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
UG - Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
UG Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
UG Ventilation outlet(s)	31536	15768	1577	0	1.577E+10	m3/y	2E-06	kg/m3	1E-06	kg/m3	0.0000	kg/m3	-	-	-	-	-	-	-	-	-
	114937	37983	3542																		

Notes: based on data from Ashton (2015), PAE Holmes 2009, and MP 08_0182

Emission inventory
HVO North and South 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	1450	365	73	50	100000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	14921	7759	448	70	84300	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	65570	34096	1967	0	105	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	136912	64756	9806	0	84060000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	611537	180714	18346	85	84060000	t/y	0.04850	kg/t	0.01433	kg/t	0.001	kg/t	-	-	-	-	4	240	3	-	-
Unloading overburden to dump	136912	64756	9806	0	84060000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	1649267	398555	173173	0	98550	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	549756	132852	57724	0	32850	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	7461	3879	224	70	42150	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	23183	12055	695	0	105	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	1618512	419073	35607	0	65700	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	860979	123822	16359	0	18000000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	882189	260694	26466	85	18000000	t/y	0.32674	kg/t	0.09655	kg/t	0.010	kg/t	-	-	-	-	4	190	16	-	-
Unloading ROM coal to ROM pad	54000	22680	1026	70	18000000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	18000	7560	342	0	1800000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	2105	996	151	50	18000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	6314	2987	452	70	18000000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	647405	167629	14243	50	52560	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	142889	32397	3144	50	26280	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	574	272	41	50	7669286	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	3068	1304	153	0	7669286	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	491958	253587	36897	0	579	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	491958	253587	36897	0	579	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	1483794	325836	74190	0	46700000	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	9923425	2780851	519120																		

Notes: based on data from Rio Tinto (2015), Todoroski (2017), DA 450-10-2003, 06_0261

Emission inventory
HVO North and South 2021 and 2026

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	1450	365	73	50	100000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	21553	11207	647	70	121767	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	94712	49250	2841	0	152	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	197761	93536	14164	0	121420000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	883331	261031	26500	85	121420000	t/y	0.04850	kg/t	0.01433	kg/t	0.001	kg/t	-	-	-	-	4	240	3	-	-
Unloading overburden to dump	197761	93536	14164	0	121420000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	2382275	575691	250139	0	142350	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	794092	191897	83380	0	47450	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	10776	5604	323	70	60883	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	33486	17413	1005	0	152	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	2337851	605328	51433	0	94900	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	1243636	178855	23629	0	26000000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	1274274	376558	38228	85	26000000	t/y	0.32674	kg/t	0.09655	kg/t	0.010	kg/t	-	-	-	-	4	190	16	-	-
Unloading ROM coal to ROM pad	78000	32760	1482	70	26000000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	26000	10920	494	0	2600000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	3040	1438	218	50	26000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	9121	4314	653	70	26000000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	647405	167629	14243	50	52560	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	142889	32397	3144	50	26280	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	2845	1346	204	50	38000000	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	15200	6460	760	0	38000000	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	491958	253587	36897	0	579	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	491958	253587	36897	0	579	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	2143258	470652	107163	0	67455556	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	13547344	3704001	709570																		

Notes: based on data from Rio Tinto (2015), Todoroski (2017), DA 450-10-2003, 06_0261

Emission inventory
Integra Underground 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
ROM coal by conveyor to ROM stockpile	97	46	7	50	828813	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Ventilation outlet(s)	31536	15768	1577	0	1.577E+10	m3/y	2E-06	kg/m3	1E-06	kg/m3	0.0000	kg/m3									
	114683	37863	3523																		

Notes: based on data from Vale (2015), 08_0101

Emission inventory
Integra Underground 2021, 2026 and 2033

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
ROM coal by conveyor to ROM stockpile	526	249	38	50	4500000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Wind erosion from ROM coal stockpiles	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Ventilation outlet(s)	31536	15768	1577	0	1.577E+10	m3/y	2E-06	kg/m3	1E-06	kg/m3	0.0000	kg/m3									
	115112	38066	3554																		

Notes: based on data from Vale (2015) , 08_0101

Emission inventory
Liddell Coal Operations 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	600	151	30	50	41400	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	21806	11339	654	70	123200	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	95827	49830	2875	0	154	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	158582	75005	11358	0	97365146	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	1168382	345266	35051	85	97365146	t/y	0.08000	kg/t	0.02364	kg/t	0.002	kg/t	-	-	-	-	4	300	6	-	-
Unloading overburden to dump	158582	75005	11358	0	97365146	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	318385	45789	6049	0	6656285	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	150876	44585	4526	85	6656285	t/y	0.15111	kg/t	0.04465	kg/t	0.005	kg/t	-	-	-	-	4	180	6.8	-	-
Unloading ROM coal to ROM pad	19969	8387	379	70	6656285	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	6656	2796	126	0	665629	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	778	368	56	50	6656285	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	2335	1104	167	70	6656285	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	161851	41907	3561	50	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	71445	16198	1572	50	13140	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	492	233	35	50	6567836	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	2627	1117	131	0	6567836	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	103666	53436	7775	0	122	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	177591	91542	13319	0	209	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	59480	30660	4461	30	100	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	3688178	1147692	180926																		

Notes: based on data from Liddell Coal (2015), DA 305-11-01

Emission inventory
Liddell Coal Operations 2021

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	600	151	30	50	41400	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	21806	11339	654	70	123200	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	95827	49830	2875	0	154	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	190596	90147	13651	0	117020406	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	1404245	414966	42127	85	117020406	t/y	0.08000	kg/t	0.02364	kg/t	0.002	kg/t	-	-	-	-	4	300	6	-	-
Unloading overburden to dump	190596	90147	13651	0	117020406	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	382657	55032	7270	0	8000000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	181333	53586	5440	85	8000000	t/y	0.15111	kg/t	0.04465	kg/t	0.005	kg/t	-	-	-	-	4	180	6.8	-	-
Unloading ROM coal to ROM pad	24000	10080	456	70	8000000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	8000	3360	152	0	800000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	935	442	67	50	8000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	2806	1327	201	70	8000000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	161851	41907	3561	50	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	71445	16198	1572	50	13140	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	599	283	43	50	8000000	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	3200	1360	160	0	8000000	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	103666	53436	7775	0	122	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	177591	91542	13319	0	209	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	59480	30660	4461	30	100	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	4089481	1268767	194906																		

Notes: based on data from Liddell Coal (2015), DA 305-11-01

Emission inventory
Mount Owen 2014

Mt Owen 2014

Activity	Annual emissions (kg/y) TSP	PM10	PM2.5	Control (%)	Intensity	Units	TSP Factor	Units	PM10 Factor	Units	PM2.5 Factor	Units
Stripping topsoil by scraper	1305	329	65	50	90000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t
Drilling overburden	13594	7069	408	70	76800	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole
Blasting overburden	59736	31063	1792	0	96	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast
Excavators loading overburden to trucks	140058	66244	10031	0	85992000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t
Hauling overburden from pit to dump	1183376	349697	35501	85	85992000	t/y	0.09174	kg/t	0.02711	kg/t	0.003	kg/t
Unloading overburden to dump	140058	66244	10031	0	85992000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t
Dozers shaping overburden	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h
Dozers working on overburden for rehabilitation	109951	26570	11545	0	6570	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h
Loading ROM coal to trucks	393180	56546	7470	0	8220000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t
Hauling ROM coal from pit to hopper / ROM pad	229913	67941	6897	85	8220000	t/y	0.18647	kg/t	0.0551	kg/t	0.006	kg/t
Unloading ROM coal to ROM pad	24660	10357	469	70	8220000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t
ROM coal rehandle to hopper	41100	17262	781	0	4110000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t
Transferring ROM coal by conveyor to CHPP	961	455	69	50	8220000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t
Handling coal at CHPP	2898	1370	208	70	8260000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t
Dozers on ROM coal stockpiles	14781	3827	325	50	1200	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h
Dozers on product coal stockpiles	58722	13314	1292	50	10800	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h
Conveyer to product stockpiles	347	164	25	50	4630000	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t
Loading product coal to trains	1841	783	92	0	4603421	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t
Wind erosion from active pits	88651	45696	6649	0	104	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y
Wind erosion from active dumps	185650	95696	13924	0	218	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y
Wind erosion from ROM coal stockpiles	4881	2516	366	50	11	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y
Wind erosion from product coal stockpile	2549	1314	191	50	6	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm
Machinery exhausts	0	0	0	100	45441	kL/y	2.84	kg/kL	2.84	kg/kL	2.75	kg/kL
	3370232	1034433	150460									

Activity	Variables: Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	-	-	-	-	-	-	-	-	-
Drilling overburden	-	-	-	-	-	-	-	-	-
Blasting overburden	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	-	-	-	-	4	218	5	-	-
Unloading overburden to dump	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	-	-	2	-	-	-	-	10	-
Drilling coal	-	-	-	-	-	-	-	-	-
Blasting coal	10000	-	-	-	-	-	-	-	-
Dozers working on coal	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	-	-	-	-	4	133	6.2	-	-
Unloading ROM coal to ROM pad	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	-	-	-	-	-	-	-	-	-
Grading roads	-	-	-	-	-	-	-	-	8
Dragline working on overburden	-	-	2	7	-	-	-	-	-
Machinery exhausts	-	-	-	-	-	-	-	-	-

Ravensworth East 2014																					
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	653	164	33	50	45000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	3823	1988	115	70	21600	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	16801	8736	504	0	27	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	26644	12602	1908	0	16358634	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	270143	79829	8104	85	16358634	t/y	0.11009	kg/t	0.03253	kg/t	0.003	kg/t	-	-	-	-	4	218	6	-	-
Unloading overburden to dump	26644	12602	1908	0	16358634	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	219902	53141	23090	0	13140	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	109951	26570	11545	0	6570	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	85141	12245	1618	0	1780000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	56211	16611	1686	85	1780000	t/y	0.21053	kg/t	0.06221	kg/t	0.006	kg/t	-	-	-	-	4	133	7	-	-
Unloading ROM coal to ROM pad	5340	2243	101	70	1780000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	8900	3738	169	0	890000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	208	98	15	50	1780000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	772	365	55	70	2200000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	88	42	6	50	1180878	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	470	200	23	0	1174099	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	58224	30013	4367	0	69	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	89865	46322	6740	0	106	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	9232	3226	286	50	30000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	1312714	394549	69396																		

Notes: based on data from Mt Owen (2015), Jacobs (2018), SSD-5850

Emission inventory
Mount Owen 2021

Mt Owen 2021																					
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	2114	532	106	50	145800	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	12949	6734	388	70	73160	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	141751	73711	4253	0	124	blasts/y	1143.2	kg/blast	594.4	kg/blast	34.3	kg/blast	30000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	152630	72190	10932	0	93710777	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	1702269	503035	51068	85	93710777	t/y	0.12110	kg/t	0.03579	kg/t	0.004	kg/t	-	-	-	-	4	218	6.6	-	-
Unloading overburden to dump	152630	72190	10932	0	93710777	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	559395	135181	58736	0	33426	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	186465	45060	19579	0	11142	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	138103	35758	3038	0	5606	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	392596	56462	7459	0	8207785	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	429520	126927	12886	85	8207785	t/y	0.34887	kg/t	0.10309	kg/t	0.010	kg/t	-	-	-	-	4	133	11.6	-	-
Unloading ROM coal to ROM pad, inc Glendell	34450	14469	655	70	11483388	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	57417	24115	1091	0	5741694	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal to CHPP	665	315	48	70	9483388	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	3327	1573	238	70	9483388	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	10716	2775	236	50	870	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	42573	9653	937	50	7830	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	373	177	27	70	8308860	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	3324	1413	166	0	8308860	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits, inc topsoil stockpiles	232823	120012	17462	0	274	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	252367	130086	18928	0	297	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped or partially rehabilitated dumps	25492	13140	1912	0	30	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	5821	3000	437	50	14	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	5268	2716	395	50	12	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	32598	11389	1011	50	105928	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	6	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Machinery exhausts	0	0	0	100	51372	kL/y	2.84	kg/kL	2.84	kg/kL	2.75	kg/kL	-	-	-	-	-	-	-	-	-
Gravel crushing in-pit	810	360	41	85	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	4578447	1462971	222957																		

Ravensworth East 2021 (BNP only)

Activity	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	352	89	18	50	24282	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	1971	1025	59	70	11134	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	64714	33651	1941	0	104	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	44432	21015	3182	0	27280080	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	450497	133126	13515	85	27280080	t/y	0.11009	kg/t	0.03253	kg/t	0.003	kg/t	-	-	-	-	4	218	6	-	-
Unloading overburden to dump	44432	21015	3182	0	27280080	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	223132	53921	23429	0	13333	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	109951	26570	11545	0	6570	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	29808	7718	656	0	1210	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	82218	11824	1562	0	1718882	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	48077	14207	1442	85	1718882	t/y	0.18647	kg/t	0.0551	kg/t	0.006	kg/t	-	-	-	-	4	133	6.2	-	-
Unloading ROM coal to ROM pad	5157	2166	98	70	1718882	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	1719	722	33	0	171888	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	201	95	14	50	1718882	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	603	285	43	70	1718882	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	75	35	5	50	996952	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	399	169	20	0	996952	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	58631	30222	4397	0	69	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	45035	23214	3378	0	53	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	0	0	0	50	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	10720	3746	332	50	34837	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	1222124	384816	68852																		

Notes: based on data from Mt Owen (2015), Jacobs (2018), SSD-5850

Emission inventory
Mount Owen 2026

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	914	230	46	50	63000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	12427	6462	373	70	70210	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	136035	70738	4081	0	119	blasts/y	1143.2	kg/blast	594.4	kg/blast	34.3	kg/blast	30000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	147546	69785	10567	0	90588946	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	1595695	471541	47871	85	90588946	t/y	0.11743	kg/t	0.0347	kg/t	0.004	kg/t	-	-	-	-	4	218	6.4	-	-
Unloading overburden to dump	147546	69785	10567	0	90588946	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	547881	132399	57528	0	32738	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	182633	44134	19176	0	10913	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	119479	30936	2629	0	4850	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	342281	49225	6503	0	7155874	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	503601	148818	15108	85	7155874	t/y	0.46917	kg/t	0.13864	kg/t	0.014	kg/t	-	-	-	-	4	133	15.6	-	-
Unloading ROM coal to ROM pad, inc Glendell	39045	16399	742	70	13014874	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	65074	27331	1236	0	6507437	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal to CHPP	1522	720	109	50	13014874	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	4566	2159	327	70	13014874	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	9977	2583	219	50	810	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	39637	8987	872	50	7290	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	582	275	42	50	7775725	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	3110	1322	156	0	7775725	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits, inc topsoil stockpiles	185239	95484	13893	0	218	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	170794	88038	12810	0	201	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped or partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	6373	3285	478	50	15	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	5268	2716	395	50	12	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	40621	14193	1259	50	132000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	6	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Machinery exhausts	0	0	0	100	51064	kL/y	2.84	kg/kL	2.84	kg/kL	2.75	kg/kL	-	-	-	-	-	-	-	-	-
Gravel crushing in-pit	810	360	41	85	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	4308656	1357907	207027																		

Notes: based on data from Mt Owen (2015), Jacobs (2018), SSD-5850

Emission inventory
Mount Owen 2033

Activity	Annual emissions (kg/y) TSP	PM10	PM2.5	Control (%)	Intensity	Units	TSP Factor	Units	PM10 Factor	Units	PM2.5 Factor	Units	Variables: Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	1436	361	72	50	99000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	5744	2987	172	70	32450	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	62873	32694	1886	0	55	blasts/y	1143.2	kg/blast	594.4	kg/blast	34.3	kg/blast	30000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	68144	32230	4881	0	41838670	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	829097	245005	24873	85	41838670	t/y	0.13211	kg/t	0.03904	kg/t	0.004	kg/t	-	-	-	-	4	218	7.2	-	-
Unloading overburden to dump	68144	32230	4881	0	41838670	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	396025	95702	41583	0	23664	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	132008	31901	13861	0	7888	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	86370	22363	1900	0	3506	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	152423	21921	2896	0	3186632	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	207011	61174	6210	85	3186632	t/y	0.43308	kg/t	0.12798	kg/t	0.013	kg/t	-	-	-	-	4	133	14.4	-	-
Unloading ROM coal to ROM pad, inc Glendell	39560	16615	752	70	13186632	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	65933	27692	1253	0	6593316	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal to CHPP	1542	729	110	50	13186632	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	4626	2188	331	70	13186632	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	10100	2615	222	50	820	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	40126	9098	883	50	7380	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	609	288	44	50	8138340	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	3255	1384	163	0	8138340	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits, inc topsoil stockpiles	175042	90228	13128	0	206	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	169094	87162	12682	0	199	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped or partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	6373	3285	478	50	15	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	5268	2716	395	50	12	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	17233	6021	534	50	56000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	6	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Machinery exhausts	0	0	0	100	28846	kL/y	2.84	kg/kL	2.84	kg/kL	2.75	kg/kL	-	-	-	-	-	-	-	-	-
Gravel crushing in-pit	810	360	41	85	2000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	2548849	828949	134230																		

Notes: based on data from Mt Owen (2015), Jacobs (2018), SSD-5850

Emission inventory
Mount Owen 2038

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	0	0	0	50	0	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden (including through seam)	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden (including through seam)	0	0	0	0	0	blasts/y	1143.2	kg/blast	594.4	kg/blast	34.3	kg/blast	30000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	0	0	0	85	0	t/y	0.13211	kg/t	0.03904	kg/t	0.004	kg/t	-	-	-	-	4	218	7.2	-	-
Unloading overburden to dump	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	407807	98549	42820	0	24368	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	0	0	0	0	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	0	0	0	0	0	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	0	0	0	85	0	t/y	0.43308	kg/t	0.12798	kg/t	0.013	kg/t	-	-	-	-	4	133	14.4	-	-
Unloading ROM coal to ROM pad, inc Glendell	17724	7444	337	70	5908000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	29540	12407	561	0	2954000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal to CHPP	691	327	49	50	5908000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	2073	980	148	70	5908000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	4188	1084	92	50	340	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	16638	3772	366	50	3060	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	290	137	21	50	3869198	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	1548	658	77	0	3869198	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits, inc topsoil stockpiles	0	0	0	0	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	0	0	0	0	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from shaped or partially rehabilitated dumps	234353	120800	17576	30	394	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4036	2081	303	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	5268	2716	395	50	12	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	3594	1256	111	50	11680	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	6	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
Machinery exhausts	0	0	0	100	4333	kL/y	2.84	kg/kL	2.84	kg/kL	2.75	kg/kL	-	-	-	-	-	-	-	-	-
Gravel crushing in-pit	0	0	0	85	0	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-	-	-
	727749	252210	62858																		

Notes: based on data from Mt Owen (2015), Jacobs (2018), SSD-5850

Emission inventory
Ravensworth Operations 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	783	197	39	50	54000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	58198	30263	1746	70	328800	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	255746	132988	7672	0	411	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	237493	112328	17010	0	168528000	t/y	0.00141	kg/t	0.00067	kg/t	0.0001	kg/t	-	1.19	2	-	-	-	-	-	-
Hauling overburden from pit to dump	1685280	498014	50558	85	168528000	t/y	0.06667	kg/t	0.0197	kg/t	0.002	kg/t	-	-	-	-	4	300	5	-	-
Unloading overburden to dump	237493	112328	17010	0	168528000	t/y	0.00141	kg/t	0.00067	kg/t	0.0001	kg/t	-	1.19	2	-	-	-	-	-	-
Dozers shaping overburden	439805	106281	46179	0	26280	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	439805	106281	46179	0	26280	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	647405	167629	14243	0	26280	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	523323	75262	9943	0	10940825	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	218817	64662	6564	85	10940825	t/y	0.13333	kg/t	0.0394	kg/t	0.004	kg/t	-	-	-	-	4	180	6	-	-
Unloading ROM coal to ROM pad	32822	13785	624	70	10940825	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	10941	4595	208	0	1094083	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	1107	524	79	50	10940825	t/y	0.00020	kg/t	0.00010	kg/t	0.0000	kg/t	-	1.19	8	-	-	-	-	-	-
Handling coal at CHPP	4118	1948	295	70	13566539	t/y	0.00101	kg/t	0.00048	kg/t	0.0001	kg/t	-	1.19	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	161851	41907	3561	50	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	71445	16198	1572	50	13140	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	879	416	63	50	13566539	t/y	0.00013	kg/t	0.00006	kg/t	0.0000	kg/t	-	1.19	11	-	-	-	-	-	-
Loading product coal to trains	5427	2306	271	0	13566539	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	357668	184365	26825	0	421	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	357668	184365	26825	0	421	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	125184	64528	9389	30	210	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	43529	9559	2176	0	1370000	bcm/y	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	5941622	1940467	290083																		

Notes: based on data from Ravensworth (2015), 09_0176

Emission inventory
Ravensworth Operations 2021, 2026, 2033, 2038

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	783	197	39	50	54000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	58198	30263	1746	70	328800	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	255746	132988	7672	0	411	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	409246	193562	29311	0	251265763	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	2512658	742511	75380	85	251265763	t/y	0.06667	kg/t	0.0197	kg/t	0.002	kg/t	-	-	-	-	4	300	5	-	-
Unloading overburden to dump	409246	193562	29311	0	251265763	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	439805	106281	46179	0	26280	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	439805	106281	46179	0	26280	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	647405	167629	14243	0	26280	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	765315	110064	14541	0	16000000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	320000	94563	9600	85	16000000	t/y	0.13333	kg/t	0.0394	kg/t	0.004	kg/t	-	-	-	-	4	180	6	-	-
Unloading ROM coal to ROM pad	48000	20160	912	70	16000000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	16000	6720	304	0	1600000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	1871	885	134	50	16000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	7367	3484	528	70	21000000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	161851	41907	3561	50	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	71445	16198	1572	50	13140	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	1572	744	113	50	21000000	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	8400	3570	420	0	21000000	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	357668	184365	26825	0	421	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	357668	184365	26825	0	421	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	125184	64528	9389	30	210	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	bcm/y	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	7440069	2414566	345834																		

Notes: based on data from Ravensworth (2015), 09_0176

Emission inventory
Rixs Creek South 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	869	219	43	50	59958	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	16709	8689	501	70	94400	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	73426	38182	2203	0	118	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	51732	24468	3705	0	31761804	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	381142	112631	11434	85	31761804	t/y	0.08000	kg/t	0.02364	kg/t	0.002	kg/t	-	-	-	-	4	300	6	-	-
Unloading overburden to dump	51732	24468	3705	0	31761804	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	219902	53141	23090	0	13140	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	132050	18991	2509	0	2760693	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	62576	18492	1877	85	2760693	t/y	0.15111	kg/t	0.04465	kg/t	0.005	kg/t	-	-	-	-	4	180	6.8	-	-
Unloading ROM coal to ROM pad	8282	3478	157	70	2760693	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	2761	1159	52	0	276069	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	323	153	23	50	2760693	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	968	458	69	70	2760693	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	161851	41907	3561	50	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	71445	16198	1572	50	13140	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	111	52	8	50	1481578	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	593	252	30	0	1481578	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	142302	73351	10673	0	167	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	142302	73351	10673	0	167	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	2199466	682901	118692																		

Notes: based on data from Rix's Creek (2015), Todoroski (2015), DA 49/94

Emission inventory
Rixs Creek South 2021, 2026, 2033, 2038

Activity	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	869	219	43	50	59958	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	16709	8689	501	70	94400	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	73426	38182	2203	0	118	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	84324	39883	6039	0	51772551	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	621271	183591	18638	85	51772551	t/y	0.08000	kg/t	0.02364	kg/t	0.002	kg/t	-	-	-	-	4	300	6	-	-
Unloading overburden to dump	84324	39883	6039	0	51772551	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	219902	53141	23090	0	13140	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	215245	30956	4090	0	4500000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	102000	30142	3060	85	4500000	t/y	0.15111	kg/t	0.04465	kg/t	0.005	kg/t	-	-	-	-	4	180	6.8	-	-
Unloading ROM coal to ROM pad	13500	5670	257	70	4500000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	4500	1890	86	0	450000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	526	249	38	50	4500000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	1579	747	113	70	4500000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	161851	41907	3561	50	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	71445	16198	1572	50	13140	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	181	86	13	50	2415010	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	966	411	48	0	2415010	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	142302	73351	10673	0	167	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	142302	73351	10673	0	167	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	2635613	811805	133542																		

Notes: based on data from Rix's Creek (2015), Todoroski (2015), DA 49/94

Emission inventory
Rixs Creek North 2014

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	0	0	0	50	0	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	0	0	0	0	0	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	0	0	0	85	0	t/y	0.02667	kg/t	0.00788	kg/t	0.001	kg/t	-	-	-	-	4	300	2	-	-
Unloading overburden to dump	0	0	0	0	0	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	0	0	0	0	0	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	0	0	0	0	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	0	0	0	0	0	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	0	0	0	85	0	t/y	0.12444	kg/t	0.03677	kg/t	0.004	kg/t	-	-	-	-	4	180	5.6	-	-
Unloading ROM coal to ROM pad	0	0	0	70	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	0	0	0	0	0	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	0	0	0	50	0	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	0	0	0	70	0	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	0	0	0	50	0	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	0	0	0	50	0	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	0	0	0	50	0	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	0	0	0	0	0	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	102009	52582	7651	30	172	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	102009	52582	7651	30	172	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	0	0	0	50	0	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	210391	108449	15779																		

Notes: based on data from Vale (2015), 08_0102

Emission inventory
Rixs Creek North 2021, 2026, 2033

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables								
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	Drop distance (m)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Stripping topsoil by scraper	783	197	39	50	54000	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-	-	-
Drilling overburden	30302	15757	909	70	171200	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting overburden	133162	69244	3995	0	214	blasts/y	622.3	kg/blast	323.6	kg/blast	18.7	kg/blast	20000	-	-	-	-	-	-	-	-
Excavators loading overburden to trucks	84043	39750	6019	0	51600000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Hauling overburden from pit to dump	206400	60993	6192	85	51600000	t/y	0.02667	kg/t	0.00788	kg/t	0.001	kg/t	-	-	-	-	4	300	2	-	-
Unloading overburden to dump	84043	39750	6019	0	51600000	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-	-	-
Dozers shaping overburden	329853	79711	34635	0	19710	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Dozers working on overburden for rehabilitation	109951	26570	11545	0	6570	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	-	10	-
Drilling coal	0	0	0	70	0	holes/y	0.59	kg/hole	0.31	kg/hole	0.018	kg/hole	-	-	-	-	-	-	-	-	-
Blasting coal	0	0	0	0	0	blasts/y	220.0	kg/blast	114.4	kg/blast	6.6	kg/blast	10000	-	-	-	-	-	-	-	-
Dozers working on coal	323702	83815	7121	0	13140	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Loading ROM coal to trucks	286993	41274	5453	0	6000000	t/y	0.04783	kg/t	0.00688	kg/t	0.001	kg/t	-	-	8	-	-	-	-	-	-
Hauling ROM coal from pit to hopper / ROM pad	112000	33097	3360	85	6000000	t/y	0.12444	kg/t	0.03677	kg/t	0.004	kg/t	-	-	-	-	4	180	5.6	-	-
Unloading ROM coal to ROM pad	18000	7560	342	70	6000000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
ROM coal rehandle to hopper	6000	2520	114	0	600000	t/y	0.01	kg/t	0.0042	kg/t	0.000	kg/t	-	-	-	-	-	-	-	-	-
Transferring ROM coal by conveyor to CHPP	702	332	50	50	6000000	t/y	0.00023	kg/t	0.00011	kg/t	0.0000	kg/t	-	1.38	8	-	-	-	-	-	-
Handling coal at CHPP	2105	996	151	70	6000000	t/y	0.00117	kg/t	0.00055	kg/t	0.0001	kg/t	-	1.38	8	-	-	-	-	-	-
Dozers on ROM coal stockpiles	80926	20954	1780	50	6570	h/y	24.6	kg/h	6.4	kg/h	0.542	kg/h	-	-	8	-	-	-	-	7	-
Dozers on product coal stockpiles	35722	8099	786	50	6570	h/y	10.9	kg/h	2.5	kg/h	0.239	kg/h	-	-	11	-	-	-	-	5	-
Conveyer to product stockpiles	449	212	32	50	6000000	t/y	0.00015	kg/t	0.00007	kg/t	0.0000	kg/t	-	1.38	11	-	-	-	-	-	-
Loading product coal to trains	2400	1020	120	0	6000000	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-	-	-
Wind erosion from active pits	145727	75117	10930	0	172	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from active dumps	145727	75117	10930	0	172	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from partially rehabilitated dumps	0	0	0	30	0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from ROM coal stockpiles	4249	2190	319	50	10	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Wind erosion from product coal stockpile	2124	1095	159	50	5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-	-	-
Grading roads	18464	6451	572	50	60000	km	0.61547	kg/VKT	0.21504	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	-	-	8
Dragline working on overburden	0	0	0	0	0	t/bcm	0.03	kg/bcm	0.01	kg/bcm	0.002	kg/bcm	-	-	2	7	-	-	-	-	-
	2163828	691822	111572																		

Notes: based on data from Vale (2015), 08_0102

Appendix D. Peer Review Outcomes

ERM

Level 15
309 Kent Street
Sydney NSW 2000

Telephone: +61 2 8584 8888

www.erm.com

David Holmes
Principal Environmental Consultant
Umwelt
75 York Street
Teralba, NSW 2284

ERM

12 November 2019

Reference: 0518191

Dear David

Subject: **Glendell Continued Operations Project – Peer Review of Air Quality Assessment**

1 Introduction

Judith Cox has over 20 years' experience in air quality assessment, dispersion modelling, emissions estimation and meteorology. She has extensive experience in the assessment of coal mines in the Hunter Valley and it is in this context that she completed a review of the above mentioned project.

The air quality assessment for the Glendell Continued Operations Project (the Project) was completed by Jacobs Group (Australia) Pty Limited (Jacobs).

As detailed in the following sections, Judith has reviewed the input and output data applied in the dispersion modelling completed for the air quality assessment, together with the draft version of the report dated 18 September (Jacobs, 2019).

The purpose of this review is to ensure all the essential recommendations have incorporated, the methodology is sound and that the requirements of the Secretary's Environmental Assessment Requirements (SEARs) have been met.

2 Background

The Glendell Mine forms part of the Mount Owen Complex in the Hunter Region of New South Wales (NSW) and is owned and operated by subsidiaries of Glencore Coal Pty Limited (Glencore). The site is part of the Hunter Valley Coalfields and is located approximately 20 km northwest of Singleton in the Singleton Local Government Area (LGA). The Mount Owen Complex also includes Mount Owen Mine, Ravensworth East Mine, a coal handling and preparation plant (CHPP), and coal transport infrastructure.

The Project is an extension of open cut mining operations immediately to the north of the existing Glendell Mine. The Project would extend the life of the Glendell Mine to approximately 2044 and allow for the recovery of approximately 135 million tonnes (Mt) of run-of-mine (ROM) coal.

The Jacobs assessment was based on dispersion modelling to predict ground level concentrations of particulate matter and other pollutants emitted to air as a result of mining activities. The report referred to procedures outlined by the EPA in their *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2016) (Approved Methods) and considered four operational years of the life of the mine (Year 1, 6, 13 and 18).

The potential air quality issues assessed by Jacobs were:

Registered office
ERM Australia Pacific Pty Ltd
Level 15, 309 Kent Street
Sydney NSW 2000

ABN: 86 127 101 642
Offices worldwide

A member of the
ERM Group

- Dust (that is, particulate matter in the form of TSP, PM_{10} or $PM_{2.5}$) from the general mining activities;
- Fume (that is, NO_x emissions) from blasting; and
- Emissions of substances from machinery exhausts, that is, diesel emissions.

This review has considered the adequacy of the air quality assessment with respect to the methodology used and its consistency with the SEARs and EPA's Approved Methods.

3 Selection of representative modelling year

Meteorological and monitoring data were reviewed for the seven-year period 2012 to 2018.

With respect to wind patterns, and average and maximum wind speeds, these do not vary significantly from year-to-year. However, when considering rainfall, the annual rainfall has ranged from 432 mm in 2018 to 899 mm in 2015, with 2017 and 2018 having much lower rainfall.

Air quality monitoring data collected by Mount Owen in the vicinity of the Mount Owen Complex, and at sites operated by NSW Department of Planning, Industry & Environment (DPIE) were also reviewed for the period 2012 to 2018.

It is agreed that that calendar year 2014 selected as the meteorological modelling year is representative of longer-term conditions, based on:

- Similar wind patterns to other years.
- Rainfall being slightly below the long-term average.
- Consistency with other recent air quality impact assessments for the Mount Owen Complex which enables comparative analysis of predicted impacts.
- Air quality conditions which showed similarities to other years and not adversely influenced by bushfire activity or extreme conditions.

4 Determination of background levels

- PM_{10} and $PM_{2.5}$,
  - hourly variable background dataset was created to add to the model predictions
- TSP
  - Average of the 2014 annual average concentrations measured at three gauges operated by Mount Owen.
- Deposited dust
  - The assumption of 2 g/m^2/month is considered a reasonable estimate of levels that would exist in the absence of the mining activities.
- Nitrogen dioxide (NO_2)
  - 1-hour average
    - A conservative assumption was made using the maximum 1-hour average measured at Singleton in 2014 (matching the selected meteorological year).
  - Annual average
    - 2014 annual average from Singleton was assumed (matching the selected meteorological year).

5 Selection of modelling years

The assessment years for the Project (Project Year 1, 6, 13 and 18) were selected based on a review of material handling quantities, haul distances, and location of activities for each year in the proposed mine life and the potential for cumulative impacts from other mining operations.

In addition, an existing scenario was assessed to evaluate the performance of the dispersion model based on the determined representative year 2014.

6 Best Practice Review

Dust control measures have been benchmarked against the recommendations of the *NSW Coal Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Donnelly et al, 2011) and are deemed adequate.

7 Dust emissions

7.1 The Project

The emission factors and related assumptions used for this assessment have been drawn largely from the Emission Estimation Technique Manual for Mining (NPI, 2012) and US EPA AP42 (US EPA, 1985 and updates).

A thorough review of all emission factors and assumptions applied was completed. A number of questions were asked in relation to these, as detailed below:

7.1.1 Overburden silt and moisture assumptions

The values stated in the Emission Estimation Technique Manual for Mining (EETMM) of 10% for overburden (silt =10% and moisture = 2%) have been applied.

It has been previously confirmed with EPA (pers. comm. Nick Agapides) that it is not known where the silt and moisture assumptions in the EETMM originated from, other than they used to be the default values for air quality assessments in the Hunter Valley before it was more common practice to collect site-specific data.

It was therefore suggested that the data collected as part of the ACARP emission factor project be applied (Pacific Environment, 2015). The average values for uncontrolled active overburden derived from the ACARP study were silt = 4% and moisture = 4.1%.

Jacobs explained they would prefer to retain the EETMM data because of the variability that is reported from site-to-site and from day-to-day, and use of these in the dispersion modelling of the existing scenario has produced annual average PM_{10} results within a few micrograms of measurements.

They are also consistent with values used in previous modelling for site which allows for easier comparison between the studies.

Given the explanation provided by Jacobs, and the fact the application of the EETMM values result in higher emissions estimates than the application of the ACARP values, the predicted results are likely to be conservative. It was therefore considered appropriate for the EETMM values to be applied.

7.1.2 Haul road emission factor

The emission factor applied to calculate TSP emissions from hauling on unsealed roads is 4 kg per vehicle-km travelled (km/VKT). PM_{10} and $PM_{2.5}$ emission factors were derived from the TSP emission factor by applying the PM_{10}:TSP and $PM_{2.5}$:TSP ratios that are derived from the US EPA AP-42 equation for wheel-generated dust.

This TSP emission factor of 4 kg/VKT is sourced from the SPCC document *Air Pollution from Coal Mining and Related Developments* (SPCC, 1983).

It was queried why the US EPA AP-42 equation for wheel-generated dust had not been applied to calculate TSP, PM_{10} and $PM_{2.5}$ emissions as most air quality assessment completed by ERM (formerly Pacific Environment and PAEHolmes) for extractive operations have applied these equations for at least five years.

Jacobs completed some sensitivity tests for the haul road emission factor, being either from SPCC or from the AP-42 equation approaches. The calculation using the AP-42 equation assumed an average 4% silt content (based on the ACARP study) (Pacific Environment 2015).

Table 1 summarises the differences based on the Glendell Continued Operations Project Year 6 inventory.

Table 1: Comparison of total emissions using the AP-42 and SPCC haul road emission factor

Glendell Continued Operations Project Year 6	Annual emission (kg/y)		
	TSP	PM_{10}	$PM_{2.5}$
Total emission with haul road emission factor as per AP-42 equation	3,542,289	1,045,471	191,924
Total emission with haul road emission factor as per SPCC factor	3,274,887	1,037,423	191,639
Difference as a percentage (%)	+8%	+1%	0%

On the basis of these small differences in emissions, experience has shown there would be no change in the predicted concentrations, and as such it was considered valid for the SPCC emission factor to be applied.

7.2 Other Mines

Emissions from other mines in the vicinity were calculated based on the maximum approved production limits at the time the assessment was completed. This included the assumption that the Ashton South East Open Cut project will be operating in the future.

This is considered to be a conservative approach as it is unlikely that all the approved mines would be operating at the maximum approved production limit at all times, but it does provide an assessment of the potential cumulative air quality concentrations that could occur.

Rather than use published emissions for each mine (such as those presented in previous EISs), Jacobs recalculated the emissions which retained consistency in the calculation methods for all mining operations.

7.3 Summary

Based upon the above, ERM is satisfied that the emissions factors have been used in an appropriate manner and the total values calculated for both the Project and other mining operations are reasonable.

8 Meteorological and dispersion modelling

The CALPUFF suite of models was selected and is considered to be an appropriate tool for the assessment.

As discussed in Section 3, the meteorology in 2014 was determined to be representative of the Project area and is considered suitable for use in the assessment. Meteorological model settings used for TAPM and CALMET were provided and are confirmed as appropriate for the chosen model.

Gridded receptors were not used for the CALPUFF dispersion modelling but the discrete receptors used provide sufficient coverage of the modelling domain and sensitive receptors to generate the contours.

9 Post-blast fume

A conservative assessment of post-blast fumes was completed assuming emissions would occur every hour between 9am and 5pm, assuming that all blasts would be a Rating 3 Fume Category as defined in the Queensland *Guidance Note for the management of oxides of nitrogen in open cut blasting* (DEEDI, 2011).

Of the 280 blasts that occurred between January 2017 to March 2019, 61% were rated category 0, 26% were rated category 1, 9% were rated category 2 and 3% were rated category 3. The assumption of a category 3 fume rating blast every hour is therefore very conservative.

Even taking into account the conservative assumptions applied, the maximum 1-hour average NO_2 concentrations are not predicted to exceed EPA's criterion of 246 µg/m^3 at any off-site sensitive receptor location.

10 Diesel exhaust emissions

The dispersion modelling for PM_{10} and $PM_{2.5}$ included emissions from diesel engines and the assessment of NOx emissions showed no predicted exceedances of the criteria at any sensitive receptor.

11 Model performance

In order to determining the confidence in the model, the dispersion modelling was completed for a recent year of operations (2014) and the predicted concentrations compared against measured concentrations.

- 24-hour averages were in the range of 30 per cent lower to 10 per cent higher than the measured result, depending on the location. These results highlight the difficultly in predicting short-term (24-hour average) concentrations and the highly variable nature of daily PM_{10} concentrations but they are however well within a factor of two for all percentiles.
- Annual average PM_{10} concentrations for 2014 ranged from 4 per cent lower to 27 per cent higher than measured results. In absolute numbers, these results show that the model predictions at sensitive receptor locations in the Middle Falbrook and Camberwell areas are within 1 to 2 µg/m^3 of the measurements.

- Annual average TSP concentrations were within five per cent of the measured result in the Camberwell and Middle Falbrook areas.

Whilst there is a tendency for over-prediction of annual average to the northwest of Mount Owen Complex, the closest sensitive receptors are located to the southeast of the Project. Accordingly, it is considered that the over prediction to the northwest is acceptable.

On the basis of these results it is considered that model is performance is acceptable.

12 Assessment results

In terms of predicted air quality impacts, the main conclusions are summarised as follows:

- No private sensitive receptors are predicted to exceed the 24-hour average PM_{10} criterion of 50 $\mu g/m^3$ due to the Project-alone.
- Cumulative 24-hour average PM_{10} concentrations shows that most areas of the model domain will experience at least one day each year when PM_{10} concentrations will exceed the 24-hour criterion due to the contributions of mining operations and other sources (with the exception of bushfires, dust storms and other extreme events). Detail on the number of days above the cumulative criterion of 50 $\mu g/m^3$ is only presented for one receptor located in Camberwell (ID 156) but has demonstrated that the predicted number of days above the criterion are similar to current.
- Annual average PM_{10} concentrations are predicted to comply with the criterion of 25 $\mu g/m^3$ due to the Project-alone and cumulatively at all private sensitive receptors that are not already subject to acquisition rights.
- No private sensitive receptors (not already subject to acquisition rights) are predicted to exceed the 24-hour average $PM_{2.5}$ criterion of 25 $\mu g/m^3$ due to the Project-alone or cumulatively.
- Annual average $PM_{2.5}$ concentrations are predicted to comply with the criterion of 8 $\mu g/m^3$ due to the Project-alone and cumulatively at all private sensitive receptors that are not already subject to acquisition rights.
- Annual average TSP concentrations are predicted to comply with the criterion of 90 $\mu g/m^3$ due to the Project-alone and cumulatively at all private sensitive receptors that are not already subject to acquisition rights.
- Annual average dust deposition levels are predicted to comply with the cumulative criterion of 4 g/m^2/month at all private sensitive receptors that are not already subject to acquisition rights.
- Post-blast fume and emissions from vehicle exhausts are not expected to result in any adverse air quality impacts.

13 Review conclusions

It is ERM's professional opinion that the air quality impact assessment carried out by Jacobs is consistent with the requirements of the NSW EPA Approved Methods for a Project of this nature. The methodology is sound and includes an acceptable level of conservatism. The assessment conclusions are consistent with what would be expected for a Project such as this.

I confirm that the above reflects the detailed peer review of Judith Cox. I have reviewed Judith's opinions and concur with her findings.

Yours sincerely

Damon Roddis
Partner – Air Quality and Greenhouse
ERM

14 References

Donnelly S-J, Balch A, Wiebe A, Shaw N, Welchman S, Schloss A, Castillo E, Henville K, Vernon A and Planner J (2011). NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and / or Minimise Emissions of Particulate Matter from Coal Mining. Prepared by Katestone Environmental Pty Ltd for NSW Office of Environment and Heritage, December 2010.

EPA (2016). Approved Methods for the Modelling and Assessment of Air Pollutants in NSW. December 2016

Jacobs (2019). Glendell Continued Operations Project Air Quality Impact Assessment. Mt Owen Pty Ltd, Draft 3 Revision 0, Umwelt 4166, dated 18 September 2019.

Pacific Environment (2015). Development of Australia-specific PM_{10} emission factors for coal mines. Published by the Australian Coal Association Research Program (ACARP), 21 September 2015. ACARP Project C22027.

NPI (2012), “National Pollutant Inventory Emission Estimation Technique Manual for Mining, Version 3.1”, January 2012.

SPCC (1986). Particle size distributions in dust from open cut coal mines in the Hunter Valley. Report number 10636-002-71. Prepared for the State Pollution Control Commission of NSW (now EPA) by Dames and Moore.

US EPA (1985 and updates). Compilation of Air Pollutant Emission Factors, AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711. This is now a web-based document.

Appendix E. Model Receptors

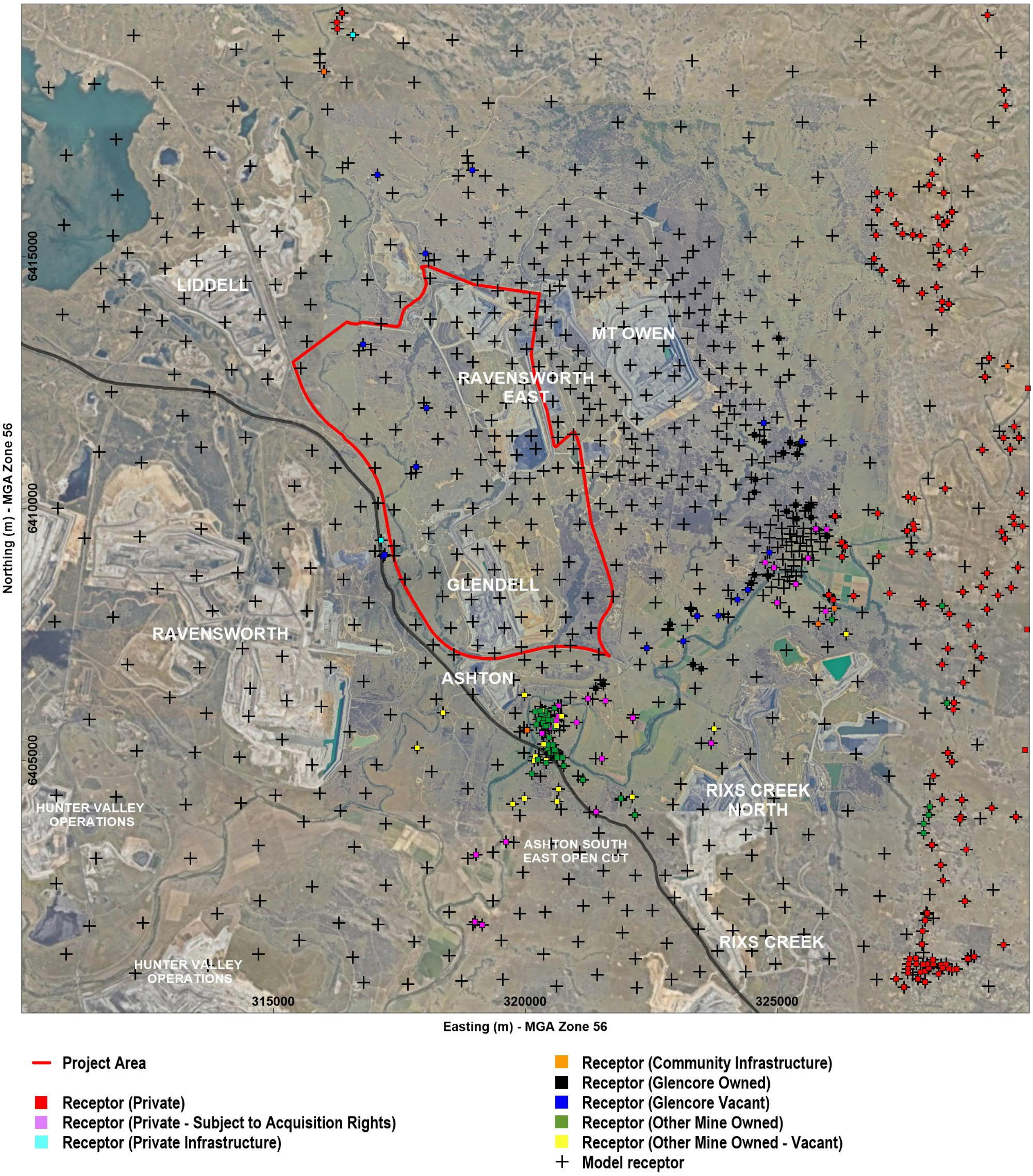


Figure E1 Location of model receptors

Appendix F. Additional Model Performance Evaluations

This section provides information on the performance of the model for predicting measured PM_{10} concentrations. The performance evaluation has been carried out by predicting PM_{10} concentrations for the 2014 calendar year (based on mining and activities rates in 2014) and comparing these results to measurement data.

Figure F1 shows quantile-quantile plots of measured and predicted 24-hour average PM_{10} concentrations at Camberwell, SX9 and SX10. These plots show the measured data and predictions paired by highest to lowest, and not matched in time. Dispersion models often encounter difficulties when trying to reproduce monitoring results for a single point, especially for the extreme statistics such as the maximum 24-hour average. The most significant factor is the limitation of using computers to model large, complex systems (this would be the case even if all the physics were perfectly correct). The quantile-quantile plots **Figure F1** do however show that the model predictions are well within a factor of two for all percentiles.

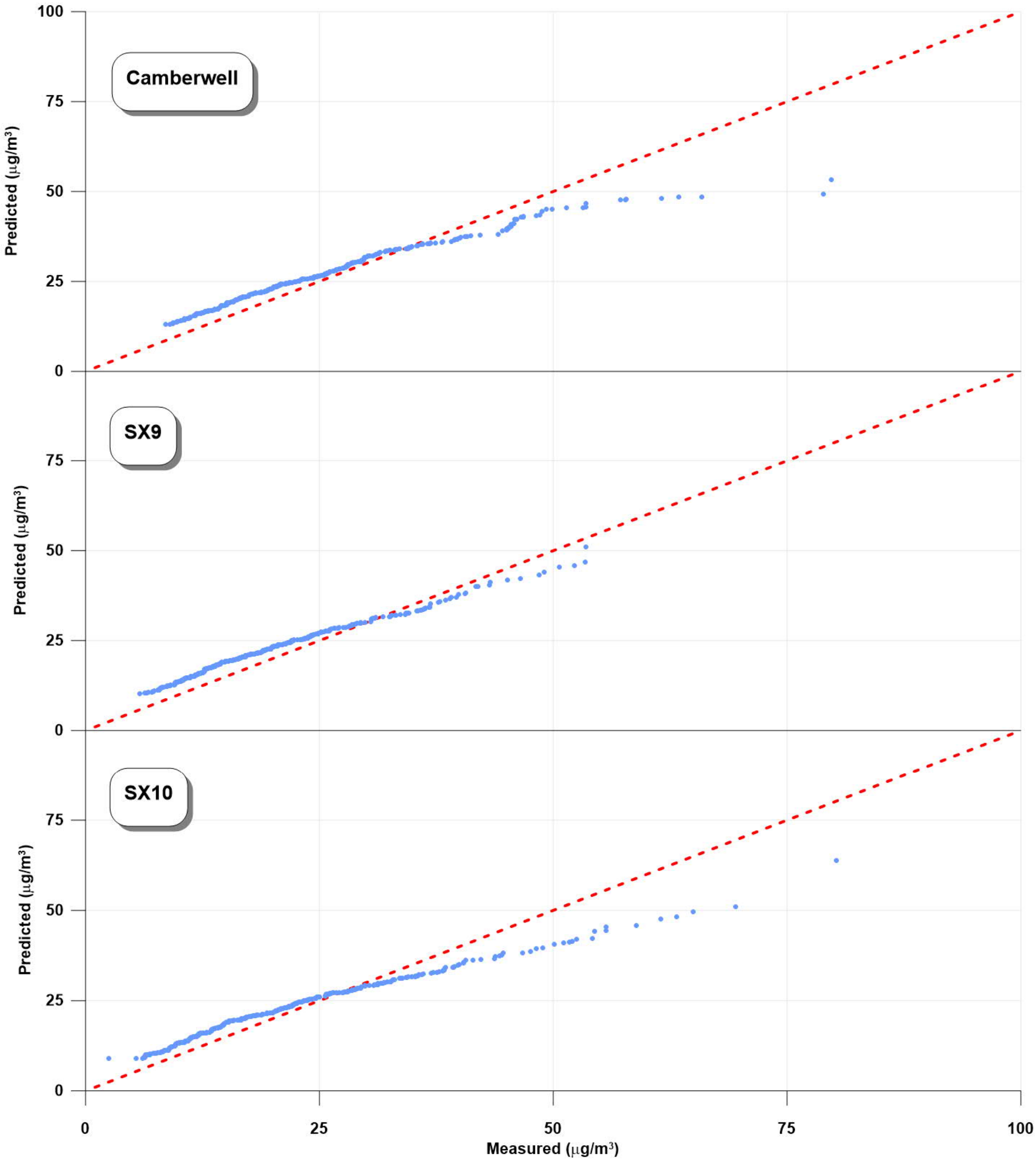


Figure F1 Quantile-quantile plots of measured and predicted 24-hour average PM_{10} concentrations

Appendix G. Tabulated Model Results

Model predictions at properties

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
Maximum 24-hour average PM10 (ug/m3)											
001	Other Mine Owned - Vacant	6	7	10	8	49	63	63	63	48	50
002	Community Infrastructure	7	8	12	9	50	60	60	60	48	50
003	Other Mine Owned	6	7	10	8	49	58	58	58	48	50
004	Private - Subject to Acq. Rights	6	7	10	7	49	53	54	53	48	50
005	Private - Subject to Acq. Rights	6	7	10	7	49	55	55	55	48	50
006	Community Infrastructure	5	6	9	6	49	53	53	53	48	50
007a	Private	5	6	9	6	48	52	52	52	48	50
007b	Private	5	6	9	6	48	52	52	52	48	50
007c	Private	4	5	8	5	48	51	51	51	48	50
010	Private	5	6	7	4	48	53	54	51	48	50
011	Private	5	6	7	4	48	52	54	50	48	50
012	Private	5	6	7	4	48	53	55	50	48	50
013	Private	4	4	5	3	48	55	49	49	47	50
014	Private	3	4	5	3	48	52	49	49	47	50
015a	Private	3	4	4	2	48	50	49	49	47	50
015b	Private	3	4	4	2	48	51	49	48	47	50
017a	Private	3	4	4	3	48	48	49	48	47	50
017b	Private	3	4	5	3	48	49	49	49	47	50
019	Private	4	6	7	4	48	61	59	50	48	50
021	Private - Subject to Acq. Rights	5	6	8	5	48	56	59	51	48	50
022	Glencore Owned	5	6	8	4	48	55	58	51	48	50
023	Private - Subject to Acq. Rights	5	7	9	5	48	56	61	51	48	50
024	Glencore Owned	5	7	9	5	49	59	64	53	48	50
025	Glencore Owned	5	6	9	5	49	63	65	54	48	50
026	Glencore Owned	5	6	9	5	49	65	64	53	48	50
027	Glencore Owned	5	7	10	6	49	59	67	56	48	50
028	Glencore Owned	5	7	10	6	50	63	69	57	48	50
029	Glencore Owned	5	7	11	6	50	61	71	59	48	50
030	Glencore Owned	5	8	12	7	51	67	100	73	48	50
031	Glencore Owned	4	7	10	6	53	69	101	71	48	50
032	Glencore Owned	3	5	9	6	61	76	73	59	48	50
033	Glencore Owned	3	5	9	6	57	67	61	53	48	50
034	Glencore Owned	3	4	9	6	54	57	55	51	48	50
035	Glencore Owned - Vacant	2	4	8	6	52	54	54	51	48	50
036	Glencore Owned	3	4	9	6	57	63	59	54	48	50
037	Glencore Owned - Vacant	2	4	10	8	62	67	85	64	48	50
038	Glencore Owned	2	4	10	7	68	91	99	64	48	50
039	Glencore Owned	2	4	10	7	65	84	84	61	48	50
040	Glencore Owned	1	1	4	4	49	51	51	50	48	50
041	Private	1	1	2	1	48	48	48	48	47	50
042	Private	0	1	2	1	48	48	48	48	47	50
043	Private	0	1	2	1	47	48	48	47	47	50
044a	Private	0	1	1	1	47	48	48	47	47	50
044b	Private	0	1	1	1	47	48	48	47	47	50
045	Private	0	1	1	1	47	48	48	47	47	50
046	Private	0	1	1	1	47	48	48	47	47	50
047	Private	0	1	1	1	47	48	48	48	47	50

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
048	Private	1	1	2	1	48	48	48	48	47	50
049	Private	0	0	1	1	47	48	48	47	47	50
050	Private	0	1	1	1	47	48	48	48	47	50
051	Private	0	1	2	1	48	48	48	48	47	50
052	Private	0	1	1	1	48	48	48	48	47	50
053	Private	0	1	1	1	47	48	48	47	47	50
054	Private	0	1	1	1	47	48	48	47	47	50
055	Private	0	1	1	1	47	47	47	47	47	50
056a	Private	0	0	1	1	47	48	48	47	47	50
056b	Private	0	0	1	1	47	48	47	47	47	50
057	Private	0	0	1	1	47	47	47	47	47	50
058	Private	0	1	2	1	47	48	48	48	47	50
059	Private	1	1	2	2	47	48	48	48	47	50
060	Private	1	1	2	2	47	48	48	47	47	50
061	Private	1	1	2	2	47	48	48	48	47	50
062	Private	1	1	2	2	47	48	48	48	47	50
063a	Private	1	1	3	2	47	48	48	47	47	50
068	Private	1	1	2	2	47	48	48	47	47	50
069a	Private	1	2	3	2	47	48	48	47	47	50
069b	Private	1	2	2	2	47	48	48	47	47	50
071	Private	1	2	3	2	47	48	48	47	47	50
072	Private	2	2	3	1	47	48	48	47	47	50
073	Private	1	2	3	2	47	48	48	48	47	50
074	Private	2	3	4	2	47	48	48	48	47	50
075	Private	2	2	3	1	47	48	48	48	47	50
076	Private	2	2	3	1	47	48	48	48	47	50
077	Private	2	2	3	1	47	48	48	48	47	50
082	Private	2	2	3	2	47	48	48	48	47	50
083	Private	2	3	4	2	47	48	48	48	47	50
084a	Private	2	2	3	2	47	48	48	48	47	50
085	Private	2	3	3	2	47	48	48	48	47	50
086	Private	2	3	4	3	47	48	48	48	47	50
087	Private	2	3	4	2	47	48	48	48	47	50
088	Private	3	3	4	3	47	49	48	48	47	50
089	Private	3	3	5	3	47	49	49	48	47	50
090	Other Mine Owned	3	3	5	3	47	49	49	49	47	50
091	Private	3	4	6	4	48	49	49	49	47	50
092	Private	4	4	7	4	48	50	50	50	47	50
093	Private	4	4	5	3	48	52	50	49	47	50
094	Private	3	4	5	3	48	53	49	49	47	50
095	Private	3	4	5	3	48	52	49	49	47	50
096	Private	3	4	5	3	47	48	48	48	47	50
097	Private	2	4	5	3	47	48	48	48	47	50
098	Private	3	3	5	3	47	48	48	48	47	50
099	Private	3	4	6	4	47	49	49	49	47	50
100	Private	4	5	6	5	48	50	49	49	47	50
101	Private	3	5	6	5	47	48	48	48	47	50
102a	Private	4	6	7	7	47	48	49	48	47	50
102b	Private	4	6	8	7	47	49	49	48	47	50
104	Other Mine Owned	4	6	8	7	47	49	49	48	47	50
105	Private - Subject to Acq. Rights	7	8	15	10	50	55	56	55	48	50
108	Glencore Owned	21	23	23	14	51	58	58	57	49	50
109	Glencore Owned	22	24	24	14	52	57	57	56	49	50

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
110	Other Mine Owned - Vacant	18	19	22	13	54	67	67	66	49	50
111	Private - Subject to Acq. Rights	17	21	21	12	56	84	84	84	50	50
112	Private - Subject to Acq. Rights	6	7	8	5	49	52	53	51	48	50
114	Private - Subject to Acq. Rights	7	9	11	7	50	54	54	54	48	50
115	Private - Subject to Acq. Rights	8	10	12	8	50	54	59	54	48	50
116	Glencore Owned	8	9	12	9	50	54	55	54	48	50
117	Glencore Owned	10	11	15	10	50	55	56	55	48	50
120	Glencore Owned - Vacant	11	13	22	14	51	57	57	57	48	50
121	Glencore Owned - Vacant	13	23	28	15	51	56	57	56	49	50
122	Glencore Owned	14	23	29	16	51	56	57	56	49	50
123	Glencore Owned - Vacant	12	18	25	14	51	57	57	57	49	50
125	Glencore Owned	19	30	27	16	52	56	56	56	49	50
126	Glencore Owned - Vacant	22	27	25	15	53	56	56	56	49	50
127a	Private - Subject to Acq. Rights	16	13	11	6	53	62	62	60	51	50
127b	Private - Subject to Acq. Rights	31	27	22	10	55	63	63	62	50	50
127c	Private - Subject to Acq. Rights	42	35	24	11	75	73	61	59	50	50
127d	Private - Subject to Acq. Rights	41	33	23	11	72	71	62	60	50	50
129	Glencore Owned	42	38	28	13	79	73	61	60	50	50
130	Glencore Owned	46	38	26	13	83	77	63	60	50	50
131	Glencore Owned - Vacant	6	9	21	14	58	65	56	54	51	50
134	Private	2	4	8	5	52	54	52	50	49	50
135	Private	2	4	7	5	52	53	51	50	49	50
136	Private	2	3	6	4	51	53	51	50	49	50
143	Private - Subject to Acq. Rights	23	18	15	7	53	60	60	57	50	50
144a	Private - Subject to Acq. Rights	5	5	5	3	64	107	104	53	53	50
144b	Private - Subject to Acq. Rights	3	3	3	2	52	54	54	50	49	50
144c	Private - Subject to Acq. Rights	3	3	3	2	51	54	54	50	49	50
145	Private - Subject to Acq. Rights	5	5	6	3	56	220	217	54	54	50
146	Other Mine Owned	9	9	9	4	53	69	69	57	52	50
147	Private - Subject to Acq. Rights	8	8	7	4	55	101	100	64	55	50
148	Other Mine Owned	10	9	8	4	54	79	79	78	54	50
149	Community Infrastructure	15	15	15	8	53	63	63	55	51	50
150	Private - Subject to Acq. Rights	16	14	14	7	53	62	62	56	51	50
151	Other Mine Owned	17	16	16	8	53	61	61	56	51	50
152	Private - Subject to Acq. Rights	19	16	14	7	53	61	61	57	51	50
154	Private - Subject to Acq. Rights	19	18	15	7	53	61	60	57	51	50
155	Private - Subject to Acq. Rights	20	19	16	8	53	60	60	57	51	50
156	Private - Subject to Acq. Rights	26	22	18	8	56	60	60	57	50	50
157	Glencore Owned - Vacant	31	32	30	16	65	62	58	56	49	50
158	Other Mine Owned - Vacant	7	7	8	4	56	440	440	55	54	50
159	Other Mine Owned - Vacant	10	9	8	4	54	90	90	57	53	50
160	Other Mine Owned - Vacant	7	8	8	4	54	238	237	55	53	50
161	Glencore Owned - Vacant	9	15	38	25	58	99	56	59	54	50
162b	Private	1	1	3	2	47	48	48	47	47	50
163	Other Mine Owned	7	9	9	7	48	52	50	48	48	50
164	Other Mine Owned	7	9	9	7	48	51	49	48	48	50
165	Other Mine Owned	7	8	11	6	48	51	49	48	48	50
166	Other Mine Owned - Vacant	43	31	25	13	82	80	72	57	51	50
178	Private	0	0	1	1	47	47	47	47	47	50
209	Private	0	0	0	0	47	47	47	47	47	50
210	Private	0	0	1	0	47	47	47	47	47	50
211	Private	0	0	1	1	47	47	47	47	47	50
212	Private	0	0	1	1	47	47	47	47	47	50

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
213	Private	0	0	1	1	47	47	47	47	47	50
259	Private	2	2	3	2	47	48	48	48	47	50
260	Private	2	2	3	2	47	48	48	48	47	50
280	Private	5	7	9	6	47	53	51	49	47	50
281	Private	5	6	9	6	47	53	51	49	47	50
282	Private	5	9	8	6	48	55	52	50	47	50
288	Private	3	6	5	4	47	48	48	47	47	50
289	Private	4	7	6	5	47	48	48	48	47	50
290	Private	5	9	7	6	47	51	49	48	47	50
291	Private	6	9	8	6	48	53	50	48	47	50
292a	Private	5	9	8	6	47	50	48	48	47	50
292b	Private	6	9	8	6	47	50	48	48	47	50
293	Private	7	8	10	6	48	50	49	48	48	50
294	Private	6	7	8	6	47	48	48	48	47	50
295	Private	6	8	10	6	47	50	49	48	47	50
296	Private	6	8	10	7	47	50	49	48	47	50
297a	Private	7	9	12	7	48	53	52	48	48	50
297b	Private	7	9	12	7	48	53	52	48	48	50
297c	Private	7	9	12	7	48	53	52	48	48	50
297d	Private	5	8	9	6	47	49	48	48	47	50
299	Private	7	9	12	7	48	54	52	49	48	50
300	Private	8	10	12	7	48	55	54	50	48	50
302	Private	7	11	11	6	48	56	54	51	47	50
303	Private	4	6	7	5	47	47	47	47	47	50
305	Private	5	7	9	6	47	48	47	47	47	50
306	Private	6	8	9	5	47	49	48	47	47	50
307	Private	6	8	9	5	47	49	48	47	47	50
308	Private	6	9	10	5	47	50	49	48	47	50
309	Private	6	9	10	5	47	51	50	48	47	50
310	Private	6	9	10	5	47	51	50	48	47	50
311	Private	6	9	10	5	47	51	50	48	47	50
312	Private	6	9	9	5	47	51	49	48	47	50
314	Private	7	9	8	4	47	50	49	48	47	50
315	Private	8	10	8	4	47	51	50	48	47	50
316	Private	8	10	9	4	47	53	51	48	47	50
317	Private	8	10	9	4	47	53	51	48	47	50
318	Private	7	10	9	5	47	53	51	48	47	50
319	Private	7	10	10	5	47	53	51	48	47	50
320	Private	7	10	10	5	47	53	52	49	47	50
321	Private	7	10	10	5	47	53	52	49	47	50
322	Private	8	10	10	5	47	54	53	49	47	50
323	Private	8	11	9	5	48	55	54	50	47	50
324	Private	8	11	10	5	48	56	54	51	48	50
325	Private	9	11	10	5	48	56	55	51	48	50
326	Private	9	11	9	4	48	56	54	51	48	50
327	Private	9	11	8	4	48	55	53	50	48	50
328	Private	9	10	8	4	48	54	52	49	48	50
329	Private	9	10	7	4	48	54	52	49	48	50
330	Private	8	9	6	3	48	52	51	48	48	50
337	Private	0	0	0	0	47	47	47	47	47	50
342	Private Infrastructure	50	58	50	17	60	75	82	76	56	50
344	Other Mine Owned	7	9	10	6	48	51	49	48	48	50
349a	Private	5	7	10	6	47	48	47	47	47	50

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
349b	Private	5	7	10	6	47	48	48	47	47	50
350	Community Infrastructure	1	1	2	2	47	48	48	47	47	50
351	Other Mine Owned	19	17	15	8	53	61	61	56	51	50
352	Other Mine Owned - Vacant	11	9	8	4	54	72	71	68	53	50
353	Other Mine Owned	9	8	7	4	55	91	90	88	55	50
356	Glencore Owned - Vacant	86	231	585	198	66	105	251	602	213	50
357	Glencore Owned - Vacant	62	107	394	281	70	86	129	419	302	50
358	Glencore Owned - Vacant	30	51	131	96	59	70	71	146	107	50
359	Glencore Owned - Vacant	47	50	43	15	59	73	77	72	56	50
360	Glencore Owned - Vacant	10	12	19	12	51	56	57	56	48	50
361	Glencore Owned - Vacant	8	10	11	7	50	53	62	54	48	50
363	Glencore Owned	10	12	17	12	50	56	56	56	48	50
364	Other Mine Owned	10	9	10	5	53	87	86	55	53	50
365	Other Mine Owned - Vacant	11	11	12	6	53	65	64	55	52	50
366	Other Mine Owned - Vacant	11	10	11	6	53	67	65	55	52	50
367	Other Mine Owned	12	10	11	6	53	67	65	55	52	50
369	Other Mine Owned - Vacant	13	11	11	6	53	68	67	56	52	50
370	Other Mine Owned	12	11	11	6	53	69	69	56	52	50
371	Other Mine Owned	16	13	12	6	53	63	62	56	52	50
372	Other Mine Owned	17	14	13	7	53	62	62	56	52	50
373	Other Mine Owned - Vacant	16	13	13	7	53	62	62	56	52	50
374	Other Mine Owned	18	14	13	7	53	62	61	57	52	50
375	Other Mine Owned	18	15	13	7	53	62	61	56	52	50
376	Other Mine Owned	17	15	14	8	53	61	61	56	51	50
377	Other Mine Owned	18	16	14	8	53	61	61	56	51	50
378	Other Mine Owned	19	17	15	8	53	61	61	56	51	50
379	Other Mine Owned	16	15	15	8	53	62	61	56	51	50
380	Other Mine Owned	18	16	15	8	53	61	61	56	51	50
381	Other Mine Owned	19	17	15	8	53	61	61	56	51	50
382	Other Mine Owned	19	16	14	7	53	61	61	57	51	50
383	Other Mine Owned	19	18	16	8	53	61	61	56	51	50
384	Other Mine Owned	19	18	15	8	53	61	61	56	51	50
385	Other Mine Owned	20	19	16	8	53	61	61	56	51	50
386	Other Mine Owned	20	19	16	8	53	61	61	56	51	50
387	Other Mine Owned	19	18	16	8	54	61	61	56	51	50
388	Other Mine Owned	19	18	17	9	54	61	61	56	51	50
389	Other Mine Owned - Vacant	20	19	16	9	54	61	61	56	51	50
390	Other Mine Owned	20	19	17	9	54	61	61	56	51	50
391	Other Mine Owned	23	21	17	8	54	60	60	57	51	50
392	Other Mine Owned - Vacant	22	19	16	8	53	60	60	57	51	50
394	Other Mine Owned	15	13	12	6	53	65	63	56	52	50
395	Other Mine Owned	15	13	12	6	53	65	63	56	52	50
396	Other Mine Owned	15	13	12	6	53	65	63	56	52	50
397	Other Mine Owned	15	13	12	6	53	65	63	57	52	50
398	Other Mine Owned	15	13	11	6	53	65	64	57	52	50
399	Other Mine Owned	16	13	12	6	53	64	62	57	52	50
400	Other Mine Owned	16	13	12	6	53	64	61	57	52	50
401	Other Mine Owned	14	12	11	6	53	67	66	57	52	50
402	Other Mine Owned	12	11	10	5	53	70	70	57	52	50
403	Other Mine Owned	14	12	11	6	53	66	65	57	52	50
404	Other Mine Owned - Vacant	13	11	11	5	89	71	71	71	71	50
405	Other Mine Owned - Vacant	30	23	19	9	76	90	75	63	58	50
406	Other Mine Owned - Vacant	9	8	7	4	54	115	113	57	54	50

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
407	Other Mine Owned - Vacant	20	17	15	7	53	61	61	57	51	50
408	Other Mine Owned	18	16	14	8	53	61	61	56	51	50
409	Glencore Owned - Vacant	46	50	42	15	59	72	77	72	55	50
411	Glencore Owned - Vacant	3	4	9	6	59	62	57	54	52	50
412	Community Infrastructure	4	6	13	9	54	57	53	51	50	50
415	Private Infrastructure	2	4	8	5	53	54	52	50	49	50
417	Private	0	0	0	0	47	47	47	47	47	50
Days above PM10 criterion (days)											
001	Other Mine Owned - Vacant	0	0	0	0	0	4	4	3	0	-
002	Community Infrastructure	0	0	0	0	1	1	1	1	0	-
003	Other Mine Owned	0	0	0	0	0	1	1	1	0	-
004	Private - Subject to Acq. Rights	0	0	0	0	0	1	1	1	0	-
005	Private - Subject to Acq. Rights	0	0	0	0	0	1	1	1	0	-
006	Community Infrastructure	0	0	0	0	0	1	1	1	0	-
007a	Private	0	0	0	0	0	1	1	1	0	-
007b	Private	0	0	0	0	0	1	1	1	0	-
007c	Private	0	0	0	0	0	1	1	1	0	-
010	Private	0	0	0	0	0	2	2	1	0	-
011	Private	0	0	0	0	0	3	3	1	0	-
012	Private	0	0	0	0	0	3	3	1	0	-
013	Private	0	0	0	0	0	1	0	0	0	-
014	Private	0	0	0	0	0	1	0	0	0	-
015a	Private	0	0	0	0	0	1	0	0	0	-
015b	Private	0	0	0	0	0	1	0	0	0	-
017a	Private	0	0	0	0	0	0	0	0	0	-
017b	Private	0	0	0	0	0	0	0	0	0	-
019	Private	0	0	0	0	0	3	3	1	0	-
021	Private - Subject to Acq. Rights	0	0	0	0	0	3	3	1	0	-
022	Glencore Owned	0	0	0	0	0	3	3	1	0	-
023	Private - Subject to Acq. Rights	0	0	0	0	0	3	3	3	0	-
024	Glencore Owned	0	0	0	0	0	4	5	3	0	-
025	Glencore Owned	0	0	0	0	0	4	7	3	0	-
026	Glencore Owned	0	0	0	0	0	4	6	2	0	-
027	Glencore Owned	0	0	0	0	0	3	9	4	0	-
028	Glencore Owned	0	0	0	0	0	6	11	4	0	-
029	Glencore Owned	0	0	0	0	1	7	14	4	0	-
030	Glencore Owned	0	0	0	0	2	32	115	58	0	-
031	Glencore Owned	0	0	0	0	1	40	120	51	0	-
032	Glencore Owned	0	0	0	0	1	14	35	7	0	-
033	Glencore Owned	0	0	0	0	1	6	13	4	0	-
034	Glencore Owned	0	0	0	0	1	4	7	2	0	-
035	Glencore Owned - Vacant	0	0	0	0	1	3	7	2	0	-
036	Glencore Owned	0	0	0	0	1	6	12	5	0	-
037	Glencore Owned - Vacant	0	0	0	0	2	24	47	8	0	-
038	Glencore Owned	0	0	0	0	2	42	110	18	0	-
039	Glencore Owned	0	0	0	0	2	23	73	9	0	-
040	Glencore Owned	0	0	0	0	0	1	1	1	0	-
041	Private	0	0	0	0	0	0	0	0	0	-
042	Private	0	0	0	0	0	0	0	0	0	-
043	Private	0	0	0	0	0	0	0	0	0	-
044a	Private	0	0	0	0	0	0	0	0	0	-
044b	Private	0	0	0	0	0	0	0	0	0	-

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
045	Private	0	0	0	0	0	0	0	0	0	-
046	Private	0	0	0	0	0	0	0	0	0	-
047	Private	0	0	0	0	0	0	0	0	0	-
048	Private	0	0	0	0	0	0	0	0	0	-
049	Private	0	0	0	0	0	0	0	0	0	-
050	Private	0	0	0	0	0	0	0	0	0	-
051	Private	0	0	0	0	0	0	0	0	0	-
052	Private	0	0	0	0	0	0	0	0	0	-
053	Private	0	0	0	0	0	0	0	0	0	-
054	Private	0	0	0	0	0	0	0	0	0	-
055	Private	0	0	0	0	0	0	0	0	0	-
056a	Private	0	0	0	0	0	0	0	0	0	-
056b	Private	0	0	0	0	0	0	0	0	0	-
057	Private	0	0	0	0	0	0	0	0	0	-
058	Private	0	0	0	0	0	0	0	0	0	-
059	Private	0	0	0	0	0	0	0	0	0	-
060	Private	0	0	0	0	0	0	0	0	0	-
061	Private	0	0	0	0	0	0	0	0	0	-
062	Private	0	0	0	0	0	0	0	0	0	-
063a	Private	0	0	0	0	0	0	0	0	0	-
068	Private	0	0	0	0	0	0	0	0	0	-
069a	Private	0	0	0	0	0	0	0	0	0	-
069b	Private	0	0	0	0	0	0	0	0	0	-
071	Private	0	0	0	0	0	0	0	0	0	-
072	Private	0	0	0	0	0	0	0	0	0	-
073	Private	0	0	0	0	0	0	0	0	0	-
074	Private	0	0	0	0	0	0	0	0	0	-
075	Private	0	0	0	0	0	0	0	0	0	-
076	Private	0	0	0	0	0	0	0	0	0	-
077	Private	0	0	0	0	0	0	0	0	0	-
082	Private	0	0	0	0	0	0	0	0	0	-
083	Private	0	0	0	0	0	0	0	0	0	-
084a	Private	0	0	0	0	0	0	0	0	0	-
085	Private	0	0	0	0	0	0	0	0	0	-
086	Private	0	0	0	0	0	0	0	0	0	-
087	Private	0	0	0	0	0	0	0	0	0	-
088	Private	0	0	0	0	0	0	0	0	0	-
089	Private	0	0	0	0	0	0	0	0	0	-
090	Other Mine Owned	0	0	0	0	0	0	0	0	0	-
091	Private	0	0	0	0	0	0	0	0	0	-
092	Private	0	0	0	0	0	0	0	0	0	-
093	Private	0	0	0	0	0	1	0	0	0	-
094	Private	0	0	0	0	0	1	0	0	0	-
095	Private	0	0	0	0	0	1	0	0	0	-
096	Private	0	0	0	0	0	0	0	0	0	-
097	Private	0	0	0	0	0	0	0	0	0	-
098	Private	0	0	0	0	0	0	0	0	0	-
099	Private	0	0	0	0	0	0	0	0	0	-
100	Private	0	0	0	0	0	0	0	0	0	-
101	Private	0	0	0	0	0	0	0	0	0	-
102a	Private	0	0	0	0	0	0	0	0	0	-
102b	Private	0	0	0	0	0	0	0	0	0	-
104	Other Mine Owned	0	0	0	0	0	0	0	0	0	-

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
105	Private - Subject to Acq. Rights	0	0	0	0	1	1	1	1	0	-
108	Glencore Owned	0	0	0	0	4	6	2	1	0	-
109	Glencore Owned	0	0	0	0	4	5	2	1	0	-
110	Other Mine Owned - Vacant	0	0	0	0	1	23	18	15	0	-
111	Private - Subject to Acq. Rights	0	0	0	0	1	105	96	80	0	-
112	Private - Subject to Acq. Rights	0	0	0	0	0	2	2	1	0	-
114	Private - Subject to Acq. Rights	0	0	0	0	0	2	2	1	0	-
115	Private - Subject to Acq. Rights	0	0	0	0	0	3	3	2	0	-
116	Glencore Owned	0	0	0	0	0	1	1	1	0	-
117	Glencore Owned	0	0	0	0	1	3	4	2	0	-
120	Glencore Owned - Vacant	0	0	0	0	1	1	2	1	0	-
121	Glencore Owned - Vacant	0	0	0	0	1	3	1	2	0	-
122	Glencore Owned	0	0	0	0	1	4	2	3	0	-
123	Glencore Owned - Vacant	0	0	0	0	1	2	1	1	0	-
125	Glencore Owned	0	0	0	0	4	8	6	3	0	-
126	Glencore Owned - Vacant	0	0	0	0	4	6	4	2	0	-
127a	Private - Subject to Acq. Rights	0	0	0	0	1	15	11	2	1	-
127b	Private - Subject to Acq. Rights	0	0	0	0	7	15	6	1	0	-
127c	Private - Subject to Acq. Rights	0	0	0	0	37	50	12	2	1	-
127d	Private - Subject to Acq. Rights	0	0	0	0	36	45	11	1	0	-
129	Glencore Owned	0	0	0	0	59	57	17	3	0	-
130	Glencore Owned	0	0	0	0	61	62	16	4	0	-
131	Glencore Owned - Vacant	0	0	0	0	1	2	1	1	1	-
134	Private	0	0	0	0	1	1	1	1	0	-
135	Private	0	0	0	0	1	1	1	0	0	-
136	Private	0	0	0	0	1	1	1	0	0	-
143	Private - Subject to Acq. Rights	0	0	0	0	1	10	5	2	1	-
144a	Private - Subject to Acq. Rights	0	0	0	0	6	140	136	5	5	-
144b	Private - Subject to Acq. Rights	0	0	0	0	1	6	6	0	0	-
144c	Private - Subject to Acq. Rights	0	0	0	0	1	5	4	0	0	-
145	Private - Subject to Acq. Rights	0	0	0	0	4	285	284	3	3	-
146	Other Mine Owned	0	0	0	0	1	17	13	1	1	-
147	Private - Subject to Acq. Rights	0	0	0	0	2	71	65	7	1	-
148	Other Mine Owned	0	0	0	0	1	82	76	43	1	-
149	Community Infrastructure	0	0	0	0	1	21	13	2	1	-
150	Private - Subject to Acq. Rights	0	0	0	0	1	19	12	2	1	-
151	Other Mine Owned	0	0	0	0	2	17	8	2	1	-
152	Private - Subject to Acq. Rights	0	0	0	0	1	24	10	2	1	-
154	Private - Subject to Acq. Rights	0	0	0	0	2	20	7	2	1	-
155	Private - Subject to Acq. Rights	0	0	0	0	3	18	6	2	1	-
156	Private - Subject to Acq. Rights	0	0	0	0	7	17	6	1	1	-
157	Glencore Owned - Vacant	0	0	0	0	14	23	13	11	0	-
158	Other Mine Owned - Vacant	0	0	0	0	3	359	359	3	3	-
159	Other Mine Owned - Vacant	0	0	0	0	2	76	66	1	1	-
160	Other Mine Owned - Vacant	0	0	0	0	2	340	340	3	2	-
161	Glencore Owned - Vacant	0	0	0	0	1	140	2	4	1	-
162b	Private	0	0	0	0	0	0	0	0	0	-
163	Other Mine Owned	0	0	0	0	0	1	1	0	0	-
164	Other Mine Owned	0	0	0	0	0	1	0	0	0	-
165	Other Mine Owned	0	0	0	0	0	2	0	0	0	-
166	Other Mine Owned - Vacant	0	0	0	0	60	97	55	15	1	-
178	Private	0	0	0	0	0	0	0	0	0	-
209	Private	0	0	0	0	0	0	0	0	0	-

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
210	Private	0	0	0	0	0	0	0	0	0	-
211	Private	0	0	0	0	0	0	0	0	0	-
212	Private	0	0	0	0	0	0	0	0	0	-
213	Private	0	0	0	0	0	0	0	0	0	-
259	Private	0	0	0	0	0	0	0	0	0	-
260	Private	0	0	0	0	0	0	0	0	0	-
280	Private	0	0	0	0	0	1	1	0	0	-
281	Private	0	0	0	0	0	1	1	0	0	-
282	Private	0	0	0	0	0	1	1	1	0	-
288	Private	0	0	0	0	0	0	0	0	0	-
289	Private	0	0	0	0	0	0	0	0	0	-
290	Private	0	0	0	0	0	1	0	0	0	-
291	Private	0	0	0	0	0	1	0	0	0	-
292a	Private	0	0	0	0	0	0	0	0	0	-
292b	Private	0	0	0	0	0	0	0	0	0	-
293	Private	0	0	0	0	0	2	0	0	0	-
294	Private	0	0	0	0	0	0	0	0	0	-
295	Private	0	0	0	0	0	1	0	0	0	-
296	Private	0	0	0	0	0	1	0	0	0	-
297a	Private	0	0	0	0	0	2	2	0	0	-
297b	Private	0	0	0	0	0	2	2	0	0	-
297c	Private	0	0	0	0	0	2	2	0	0	-
297d	Private	0	0	0	0	0	0	0	0	0	-
299	Private	0	0	0	0	0	2	2	0	0	-
300	Private	0	0	0	0	0	3	2	0	0	-
302	Private	0	0	0	0	0	2	1	1	0	-
303	Private	0	0	0	0	0	0	0	0	0	-
305	Private	0	0	0	0	0	0	0	0	0	-
306	Private	0	0	0	0	0	0	0	0	0	-
307	Private	0	0	0	0	0	0	0	0	0	-
308	Private	0	0	0	0	0	0	0	0	0	-
309	Private	0	0	0	0	0	1	0	0	0	-
310	Private	0	0	0	0	0	1	1	0	0	-
311	Private	0	0	0	0	0	1	0	0	0	-
312	Private	0	0	0	0	0	1	0	0	0	-
314	Private	0	0	0	0	0	1	0	0	0	-
315	Private	0	0	0	0	0	1	1	0	0	-
316	Private	0	0	0	0	0	1	1	0	0	-
317	Private	0	0	0	0	0	1	1	0	0	-
318	Private	0	0	0	0	0	1	1	0	0	-
319	Private	0	0	0	0	0	1	1	0	0	-
320	Private	0	0	0	0	0	1	1	0	0	-
321	Private	0	0	0	0	0	1	1	0	0	-
322	Private	0	0	0	0	0	1	1	0	0	-
323	Private	0	0	0	0	0	1	1	1	0	-
324	Private	0	0	0	0	0	1	1	1	0	-
325	Private	0	0	0	0	0	1	1	1	0	-
326	Private	0	0	0	0	0	1	1	1	0	-
327	Private	0	0	0	0	0	1	1	0	0	-
328	Private	0	0	0	0	0	1	1	0	0	-
329	Private	0	0	0	0	0	2	1	0	0	-
330	Private	0	0	0	0	0	2	1	0	0	-
337	Private	0	0	0	0	0	0	0	0	0	-

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
342	Private Infrastructure	0	3	0	0	5	41	59	21	2	-
344	Other Mine Owned	0	0	0	0	0	1	0	0	0	-
349a	Private	0	0	0	0	0	0	0	0	0	-
349b	Private	0	0	0	0	0	0	0	0	0	-
350	Community Infrastructure	0	0	0	0	0	0	0	0	0	-
351	Other Mine Owned	0	0	0	0	1	19	6	2	1	-
352	Other Mine Owned - Vacant	0	0	0	0	1	67	61	36	1	-
353	Other Mine Owned	0	0	0	0	1	104	100	72	1	-
356	Glencore Owned - Vacant	18	222	339	204	32	123	275	361	256	-
357	Glencore Owned - Vacant	1	29	312	343	14	23	104	329	359	-
358	Glencore Owned - Vacant	0	1	55	30	7	57	16	134	94	-
359	Glencore Owned - Vacant	0	0	0	0	7	45	60	14	2	-
360	Glencore Owned - Vacant	0	0	0	0	1	2	2	1	0	-
361	Glencore Owned - Vacant	0	0	0	0	0	3	4	3	0	-
363	Glencore Owned	0	0	0	0	1	3	3	1	0	-
364	Other Mine Owned	0	0	0	0	2	149	138	1	1	-
365	Other Mine Owned - Vacant	0	0	0	0	1	40	32	1	1	-
366	Other Mine Owned - Vacant	0	0	0	0	1	60	49	1	1	-
367	Other Mine Owned	0	0	0	0	1	54	41	1	1	-
369	Other Mine Owned - Vacant	0	0	0	0	1	38	30	1	1	-
370	Other Mine Owned	0	0	0	0	1	46	35	1	1	-
371	Other Mine Owned	0	0	0	0	1	31	23	2	1	-
372	Other Mine Owned	0	0	0	0	1	31	20	2	1	-
373	Other Mine Owned - Vacant	0	0	0	0	1	30	21	2	1	-
374	Other Mine Owned	0	0	0	0	1	28	19	2	1	-
375	Other Mine Owned	0	0	0	0	1	26	18	2	1	-
376	Other Mine Owned	0	0	0	0	1	20	8	2	1	-
377	Other Mine Owned	0	0	0	0	1	21	9	2	1	-
378	Other Mine Owned	0	0	0	0	3	19	9	2	1	-
379	Other Mine Owned	0	0	0	0	1	15	7	2	1	-
380	Other Mine Owned	0	0	0	0	1	19	8	2	1	-
381	Other Mine Owned	0	0	0	0	1	19	7	2	1	-
382	Other Mine Owned	0	0	0	0	1	24	10	2	1	-
383	Other Mine Owned	0	0	0	0	5	19	8	2	1	-
384	Other Mine Owned	0	0	0	0	4	19	6	2	1	-
385	Other Mine Owned	0	0	0	0	5	18	7	2	1	-
386	Other Mine Owned	0	0	0	0	5	18	7	2	1	-
387	Other Mine Owned	0	0	0	0	5	19	8	2	1	-
388	Other Mine Owned	0	0	0	0	5	20	9	2	1	-
389	Other Mine Owned - Vacant	0	0	0	0	5	20	8	2	1	-
390	Other Mine Owned	0	0	0	0	5	20	10	2	1	-
391	Other Mine Owned	0	0	0	0	4	16	6	2	1	-
392	Other Mine Owned - Vacant	0	0	0	0	3	18	6	2	1	-
394	Other Mine Owned	0	0	0	0	1	32	23	1	1	-
395	Other Mine Owned	0	0	0	0	1	31	23	1	1	-
396	Other Mine Owned	0	0	0	0	1	31	22	1	1	-
397	Other Mine Owned	0	0	0	0	1	30	22	2	1	-
398	Other Mine Owned	0	0	0	0	1	30	21	1	1	-
399	Other Mine Owned	0	0	0	0	1	27	19	2	1	-
400	Other Mine Owned	0	0	0	0	1	28	20	2	1	-
401	Other Mine Owned	0	0	0	0	1	30	23	1	1	-
402	Other Mine Owned	0	0	0	0	1	26	15	1	1	-
403	Other Mine Owned	0	0	0	0	1	25	14	1	1	-

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
404	Other Mine Owned - Vacant	0	0	0	0	34	90	72	33	21	-
405	Other Mine Owned - Vacant	0	0	0	0	42	93	68	23	3	-
406	Other Mine Owned - Vacant	0	0	0	0	2	126	114	1	1	-
407	Other Mine Owned - Vacant	0	0	0	0	1	23	8	2	1	-
408	Other Mine Owned	0	0	0	0	1	20	9	2	1	-
409	Glencore Owned - Vacant	0	0	0	0	6	44	60	14	2	-
411	Glencore Owned - Vacant	0	0	0	0	1	1	1	1	1	-
412	Community Infrastructure	0	0	0	0	1	1	1	1	0	-
415	Private Infrastructure	0	0	0	0	1	1	1	1	0	-
417	Private	0	0	0	0	0	0	0	0	0	-
Annual average PM10 (ug/m3)											
001	Other Mine Owned - Vacant	0.7	1.0	1.7	1.1	19	31	30	30	16	25
002	Community Infrastructure	0.8	1.2	1.9	1.3	19	28	27	27	16	25
003	Other Mine Owned	0.7	1.1	1.7	1.1	19	27	26	26	16	25
004	Private - Subject to Acq. Rights	0.7	1.1	1.8	1.2	19	24	24	23	16	25
005	Private - Subject to Acq. Rights	0.7	1.0	1.7	1.1	19	25	24	24	16	25
006	Community Infrastructure	0.7	1.0	1.6	1.0	18	23	23	22	16	25
007a	Private	0.6	0.9	1.5	1.0	18	23	23	22	16	25
007b	Private	0.6	0.9	1.5	1.0	18	23	23	22	16	25
007c	Private	0.5	0.8	1.3	0.9	18	22	22	21	16	25
010	Private	0.5	0.7	1.2	0.8	18	22	22	20	16	25
011	Private	0.5	0.7	1.1	0.7	18	22	22	20	16	25
012	Private	0.5	0.7	1.1	0.7	18	22	22	20	16	25
013	Private	0.3	0.5	0.8	0.5	17	19	19	18	15	25
014	Private	0.3	0.4	0.7	0.5	17	19	19	17	15	25
015a	Private	0.3	0.4	0.7	0.4	17	18	18	17	15	25
015b	Private	0.3	0.4	0.7	0.4	17	18	18	17	15	25
017a	Private	0.2	0.3	0.6	0.4	16	18	18	16	15	25
017b	Private	0.3	0.4	0.6	0.4	17	18	18	17	15	25
019	Private	0.4	0.6	1.0	0.7	19	22	22	20	16	25
021	Private - Subject to Acq. Rights	0.5	0.7	1.2	0.8	19	23	23	21	16	25
022	Glencore Owned	0.5	0.7	1.2	0.8	19	23	23	21	16	25
023	Private - Subject to Acq. Rights	0.5	0.7	1.2	0.8	19	23	24	21	16	25
024	Glencore Owned	0.5	0.7	1.2	0.8	20	24	25	22	16	25
025	Glencore Owned	0.5	0.7	1.2	0.8	20	24	25	22	16	25
026	Glencore Owned	0.5	0.7	1.2	0.8	20	24	25	22	16	25
027	Glencore Owned	0.6	0.8	1.4	0.9	20	25	26	23	16	25
028	Glencore Owned	0.5	0.8	1.3	0.8	20	25	27	23	16	25
029	Glencore Owned	0.6	0.8	1.4	0.9	21	26	28	24	16	25
030	Glencore Owned	0.6	0.9	1.6	1.1	23	31	40	33	17	25
031	Glencore Owned	0.6	0.8	1.5	1.0	23	31	41	32	17	25
032	Glencore Owned	0.4	0.6	1.1	0.7	21	26	30	24	16	25
033	Glencore Owned	0.4	0.6	1.0	0.6	20	24	26	21	16	25
034	Glencore Owned	0.4	0.5	0.9	0.6	19	23	24	20	15	25
035	Glencore Owned - Vacant	0.3	0.5	0.9	0.6	19	22	23	20	15	25
036	Glencore Owned	0.4	0.5	1.0	0.6	20	24	26	21	16	25
037	Glencore Owned - Vacant	0.4	0.6	1.0	0.7	22	28	33	25	16	25
038	Glencore Owned	0.4	0.6	1.2	0.8	23	31	40	29	17	25
039	Glencore Owned	0.4	0.6	1.1	0.7	22	29	35	26	16	25
040	Glencore Owned	0.2	0.3	0.6	0.4	17	18	18	17	15	25
041	Private	0.1	0.1	0.2	0.2	15	15	15	14	14	25
042	Private	0.1	0.1	0.2	0.2	15	15	15	14	14	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
043	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
044a	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
044b	Private	0.1	0.1	0.2	0.1	14	14	14	14	14	25
045	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
046	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
047	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
048	Private	0.1	0.1	0.2	0.2	15	15	15	14	14	25
049	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
050	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
051	Private	0.1	0.1	0.2	0.1	14	15	15	14	14	25
052	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
053	Private	0.1	0.1	0.2	0.1	14	14	14	14	14	25
054	Private	0.1	0.1	0.2	0.1	14	15	14	14	14	25
055	Private	0.1	0.1	0.2	0.1	14	14	14	14	14	25
056a	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
056b	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
057	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
058	Private	0.1	0.1	0.2	0.1	14	15	15	14	14	25
059	Private	0.1	0.1	0.2	0.1	15	15	15	14	14	25
060	Private	0.1	0.1	0.2	0.1	14	15	15	14	14	25
061	Private	0.1	0.1	0.2	0.1	14	15	15	14	14	25
062	Private	0.1	0.1	0.2	0.1	15	15	15	14	14	25
063a	Private	0.1	0.1	0.2	0.1	14	15	15	14	14	25
068	Private	0.1	0.1	0.2	0.2	15	15	15	15	14	25
069a	Private	0.1	0.2	0.3	0.2	15	15	15	15	14	25
069b	Private	0.1	0.1	0.2	0.2	15	15	15	15	14	25
071	Private	0.1	0.2	0.3	0.2	15	15	15	15	14	25
072	Private	0.1	0.2	0.3	0.2	15	15	15	15	14	25
073	Private	0.1	0.2	0.3	0.2	15	16	15	15	14	25
074	Private	0.2	0.3	0.5	0.3	16	17	16	16	14	25
075	Private	0.1	0.2	0.3	0.2	15	16	15	15	14	25
076	Private	0.1	0.2	0.3	0.2	15	16	16	15	14	25
077	Private	0.1	0.2	0.3	0.2	15	16	15	15	14	25
082	Private	0.2	0.2	0.4	0.2	15	16	16	15	14	25
083	Private	0.2	0.3	0.5	0.3	16	17	17	16	15	25
084a	Private	0.2	0.3	0.5	0.3	15	16	16	16	14	25
085	Private	0.2	0.3	0.5	0.3	16	17	17	16	15	25
086	Private	0.3	0.4	0.6	0.4	16	17	17	16	15	25
087	Private	0.2	0.3	0.6	0.4	16	17	17	16	15	25
088	Private	0.3	0.4	0.7	0.4	16	18	18	17	15	25
089	Private	0.3	0.5	0.8	0.5	17	19	18	17	15	25
090	Other Mine Owned	0.3	0.5	0.8	0.5	17	19	18	18	15	25
091	Private	0.4	0.5	0.9	0.6	17	19	19	18	15	25
092	Private	0.4	0.6	1.0	0.7	17	20	20	19	15	25
093	Private	0.4	0.6	0.9	0.6	18	20	20	19	15	25
094	Private	0.3	0.5	0.7	0.5	17	19	19	17	15	25
095	Private	0.3	0.4	0.7	0.4	17	18	18	17	15	25
096	Private	0.3	0.5	0.8	0.5	16	18	18	17	15	25
097	Private	0.3	0.5	0.8	0.5	16	18	18	17	15	25
098	Private	0.3	0.4	0.7	0.5	16	18	18	17	15	25
099	Private	0.4	0.6	0.9	0.6	17	19	19	18	15	25
100	Private	0.4	0.6	1.1	0.7	17	20	20	19	15	25
101	Private	0.4	0.6	1.0	0.6	17	19	19	18	15	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
102a	Private	0.5	0.7	1.1	0.7	17	20	20	19	15	25
102b	Private	0.5	0.7	1.1	0.7	17	21	20	20	15	25
104	Other Mine Owned	0.5	0.7	1.1	0.7	17	21	20	20	15	25
105	Private - Subject to Acq. Rights	0.9	1.4	2.3	1.5	20	25	25	24	17	25
108	Glencore Owned	2.9	3.9	4.3	2.4	25	31	30	29	18	25
109	Glencore Owned	3.0	4.0	4.4	2.4	24	30	29	29	18	25
110	Other Mine Owned - Vacant	2.8	3.3	3.1	1.6	24	36	36	34	18	25
111	Private - Subject to Acq. Rights	3.0	3.2	2.9	1.4	25	44	43	42	19	25
112	Private - Subject to Acq. Rights	0.6	0.9	1.5	1.0	19	23	24	22	16	25
114	Private - Subject to Acq. Rights	0.9	1.2	2.1	1.4	20	25	26	25	17	25
115	Private - Subject to Acq. Rights	0.9	1.3	2.2	1.5	20	26	27	26	17	25
116	Glencore Owned	0.9	1.3	2.2	1.5	20	26	25	25	17	25
117	Glencore Owned	1.1	1.5	2.6	1.7	20	27	27	26	17	25
120	Glencore Owned - Vacant	1.4	2.1	3.3	2.1	21	28	27	27	18	25
121	Glencore Owned - Vacant	2.2	3.3	4.6	2.8	24	29	28	28	18	25
122	Glencore Owned	2.2	3.4	4.8	2.9	24	29	28	28	19	25
123	Glencore Owned - Vacant	1.8	2.7	4.0	2.5	22	29	28	28	18	25
125	Glencore Owned	3.0	4.5	5.5	3.1	25	30	29	29	19	25
126	Glencore Owned - Vacant	2.9	4.2	4.9	2.8	25	30	29	28	19	25
127a	Private - Subject to Acq. Rights	2.4	2.2	1.9	0.9	24	35	34	30	20	25
127b	Private - Subject to Acq. Rights	5.0	4.5	3.2	1.5	27	37	34	31	19	25
127c	Private - Subject to Acq. Rights	7.7	6.1	4.1	1.9	31	38	34	30	20	25
127d	Private - Subject to Acq. Rights	7.2	5.9	4.1	1.9	31	38	35	30	20	25
129	Glencore Owned	8.5	7.2	4.9	2.2	33	38	35	30	20	25
130	Glencore Owned	8.8	7.1	4.7	2.2	33	39	35	30	20	25
131	Glencore Owned - Vacant	0.7	1.1	2.8	1.9	21	25	19	19	17	25
134	Private	0.3	0.4	0.8	0.5	16	17	16	15	15	25
135	Private	0.2	0.4	0.7	0.5	16	17	16	15	15	25
136	Private	0.2	0.3	0.6	0.4	16	16	15	15	14	25
143	Private - Subject to Acq. Rights	3.8	3.3	2.6	1.2	25	33	31	27	20	25
144a	Private - Subject to Acq. Rights	0.8	0.8	0.8	0.4	25	46	45	26	24	25
144b	Private - Subject to Acq. Rights	0.4	0.4	0.5	0.2	22	28	27	22	21	25
144c	Private - Subject to Acq. Rights	0.4	0.4	0.5	0.2	22	27	27	22	21	25
145	Private - Subject to Acq. Rights	0.8	0.8	0.8	0.4	24	85	84	25	23	25
146	Other Mine Owned	1.6	1.5	1.5	0.7	23	34	33	28	21	25
147	Private - Subject to Acq. Rights	1.3	1.2	1.2	0.6	26	41	40	33	25	25
148	Other Mine Owned	1.5	1.4	1.4	0.7	25	42	41	37	23	25
149	Community Infrastructure	2.9	2.8	2.4	1.2	25	36	34	27	21	25
150	Private - Subject to Acq. Rights	2.9	2.8	2.4	1.2	25	35	34	27	21	25
151	Other Mine Owned	3.5	3.3	2.7	1.3	26	35	33	27	20	25
152	Private - Subject to Acq. Rights	3.4	3.1	2.6	1.3	26	35	34	28	21	25
154	Private - Subject to Acq. Rights	3.8	3.5	2.8	1.3	26	34	33	27	20	25
155	Private - Subject to Acq. Rights	4.1	3.7	2.9	1.4	26	34	32	27	20	25
156	Private - Subject to Acq. Rights	5.0	4.3	3.2	1.5	27	34	31	27	20	25
157	Glencore Owned - Vacant	4.6	6.0	5.7	2.9	28	33	32	30	19	25
158	Other Mine Owned - Vacant	1.2	1.2	1.2	0.6	24	197	196	26	23	25
159	Other Mine Owned - Vacant	1.5	1.5	1.5	0.7	24	40	39	28	23	25
160	Other Mine Owned - Vacant	1.3	1.3	1.3	0.6	24	107	106	26	22	25
161	Glencore Owned - Vacant	1.3	2.0	6.2	4.6	24	44	21	24	20	25
162b	Private	0.1	0.1	0.2	0.2	15	15	15	14	14	25
163	Other Mine Owned	0.8	1.1	1.4	0.8	18	22	21	21	16	25
164	Other Mine Owned	0.8	1.1	1.4	0.8	18	22	21	21	16	25
165	Other Mine Owned	0.9	1.1	1.4	0.8	18	22	21	21	16	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
166	Other Mine Owned - Vacant	8.6	6.5	4.6	2.1	34	42	38	31	22	25
178	Private	0.0	0.1	0.1	0.1	14	14	14	14	14	25
209	Private	0.0	0.0	0.1	0.0	14	14	14	14	14	25
210	Private	0.0	0.1	0.1	0.1	14	14	14	14	14	25
211	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
212	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
213	Private	0.1	0.1	0.1	0.1	14	14	14	14	14	25
259	Private	0.2	0.2	0.4	0.3	15	16	16	15	14	25
260	Private	0.2	0.2	0.4	0.2	15	16	16	15	14	25
280	Private	0.6	0.9	1.2	0.8	17	21	21	20	16	25
281	Private	0.6	0.9	1.3	0.8	17	21	21	21	16	25
282	Private	0.8	1.0	1.4	0.8	18	22	21	21	16	25
288	Private	0.4	0.6	0.8	0.5	16	18	18	17	15	25
289	Private	0.5	0.7	1.0	0.6	17	19	19	19	15	25
290	Private	0.7	0.9	1.2	0.7	17	21	20	20	16	25
291	Private	0.8	1.0	1.3	0.8	17	21	21	21	16	25
292a	Private	0.7	0.9	1.2	0.7	17	21	20	20	16	25
292b	Private	0.7	0.9	1.2	0.7	17	21	20	20	16	25
293	Private	0.8	1.1	1.3	0.8	18	22	21	21	16	25
294	Private	0.7	0.9	1.1	0.7	17	20	20	19	16	25
295	Private	0.8	1.0	1.2	0.7	18	21	21	20	16	25
296	Private	0.8	1.0	1.2	0.7	18	21	21	20	16	25
297a	Private	0.8	1.0	1.1	0.6	18	22	21	21	17	25
297b	Private	0.8	1.0	1.1	0.6	18	22	21	21	17	25
297c	Private	0.8	1.0	1.1	0.6	18	22	21	21	17	25
297d	Private	0.7	0.9	1.0	0.6	17	20	20	19	16	25
299	Private	0.8	1.0	1.1	0.6	18	22	21	21	17	25
300	Private	0.8	1.0	1.0	0.5	18	22	21	21	17	25
302	Private	0.8	0.9	0.9	0.5	18	22	21	21	17	25
303	Private	0.5	0.6	0.7	0.4	16	18	18	18	15	25
305	Private	0.6	0.7	0.8	0.4	17	19	19	18	16	25
306	Private	0.6	0.7	0.7	0.4	17	20	19	19	16	25
307	Private	0.6	0.7	0.7	0.4	17	20	20	19	16	25
308	Private	0.6	0.8	0.7	0.4	17	20	20	19	16	25
309	Private	0.7	0.8	0.8	0.4	17	20	20	19	16	25
310	Private	0.7	0.8	0.8	0.4	18	21	20	20	17	25
311	Private	0.7	0.8	0.8	0.4	18	20	20	19	17	25
312	Private	0.6	0.7	0.7	0.4	18	20	20	19	17	25
314	Private	0.6	0.7	0.7	0.3	18	21	20	20	17	25
315	Private	0.7	0.7	0.7	0.3	18	21	21	20	17	25
316	Private	0.7	0.8	0.7	0.4	18	21	21	20	17	25
317	Private	0.7	0.8	0.7	0.4	18	21	21	20	17	25
318	Private	0.7	0.8	0.8	0.4	18	21	21	20	17	25
319	Private	0.7	0.8	0.8	0.4	18	21	21	20	17	25
320	Private	0.7	0.8	0.8	0.4	18	21	21	20	17	25
321	Private	0.7	0.8	0.8	0.4	18	21	21	20	17	25
322	Private	0.7	0.8	0.8	0.4	18	21	21	20	17	25
323	Private	0.7	0.8	0.8	0.4	19	22	21	21	17	25
324	Private	0.8	0.9	0.8	0.4	19	22	22	21	17	25
325	Private	0.8	0.9	0.8	0.4	19	22	22	21	18	25
326	Private	0.7	0.8	0.8	0.4	19	22	22	21	18	25
327	Private	0.7	0.8	0.7	0.4	19	22	22	21	18	25
328	Private	0.7	0.8	0.7	0.4	19	22	21	21	18	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
329	Private	0.7	0.7	0.6	0.3	19	22	22	21	18	25
330	Private	0.6	0.7	0.6	0.3	19	22	21	21	18	25
337	Private	0.0	0.0	0.1	0.0	14	14	14	14	14	25
342	Private Infrastructure	9.3	12.3	8.4	3.1	31	39	37	30	23	25
344	Other Mine Owned	0.9	1.2	1.4	0.8	18	22	21	21	16	25
349a	Private	0.6	0.7	0.8	0.4	17	19	19	19	16	25
349b	Private	0.6	0.7	0.8	0.4	17	19	19	19	16	25
350	Community Infrastructure	0.1	0.1	0.2	0.1	14	15	15	14	14	25
351	Other Mine Owned	3.7	3.4	2.8	1.3	26	35	33	27	20	25
352	Other Mine Owned - Vacant	1.5	1.4	1.3	0.7	23	40	39	36	21	25
353	Other Mine Owned	1.3	1.2	1.2	0.6	25	44	43	39	23	25
356	Glencore Owned - Vacant	17.4	70.0	266.5	64.3	37	46	91	286	81	25
357	Glencore Owned - Vacant	7.9	20.9	131.9	126.0	34	36	41	150	142	25
358	Glencore Owned - Vacant	4.1	8.4	27.0	22.3	33	40	27	45	38	25
359	Glencore Owned - Vacant	8.8	11.0	6.9	2.7	31	38	36	30	23	25
360	Glencore Owned - Vacant	1.2	1.8	2.9	1.9	21	28	27	27	17	25
361	Glencore Owned - Vacant	0.8	1.2	2.0	1.3	20	26	27	25	17	25
363	Glencore Owned	1.2	1.7	2.8	1.8	21	27	27	27	17	25
364	Other Mine Owned	1.7	1.7	1.6	0.8	24	46	45	26	22	25
365	Other Mine Owned - Vacant	2.0	2.0	1.9	0.9	24	38	37	26	21	25
366	Other Mine Owned - Vacant	1.9	1.9	1.8	0.9	24	39	38	26	21	25
367	Other Mine Owned	2.0	2.0	1.8	0.9	24	39	37	26	21	25
369	Other Mine Owned - Vacant	2.1	2.0	1.9	0.9	25	38	36	27	22	25
370	Other Mine Owned	2.0	2.0	1.8	0.9	24	38	37	27	22	25
371	Other Mine Owned	2.6	2.4	2.2	1.1	25	37	36	28	22	25
372	Other Mine Owned	2.8	2.6	2.3	1.1	26	37	35	28	22	25
373	Other Mine Owned - Vacant	2.7	2.5	2.2	1.1	25	37	35	28	21	25
374	Other Mine Owned	2.8	2.6	2.3	1.1	26	37	35	29	22	25
375	Other Mine Owned	3.0	2.8	2.4	1.2	26	36	35	28	21	25
376	Other Mine Owned	3.2	3.1	2.6	1.2	26	35	33	27	20	25
377	Other Mine Owned	3.3	3.1	2.6	1.3	26	35	33	27	21	25
378	Other Mine Owned	3.7	3.4	2.8	1.3	26	35	33	27	20	25
379	Other Mine Owned	3.1	3.0	2.5	1.2	25	35	33	27	20	25
380	Other Mine Owned	3.4	3.2	2.7	1.3	26	35	33	27	20	25
381	Other Mine Owned	3.7	3.4	2.8	1.3	26	35	33	27	20	25
382	Other Mine Owned	3.4	3.1	2.6	1.3	26	35	33	28	21	25
383	Other Mine Owned	3.9	3.6	2.9	1.4	26	34	33	27	20	25
384	Other Mine Owned	3.9	3.6	2.9	1.4	26	34	32	27	20	25
385	Other Mine Owned	4.1	3.7	3.0	1.4	26	34	32	27	20	25
386	Other Mine Owned	4.2	3.8	3.0	1.4	26	34	32	27	20	25
387	Other Mine Owned	4.0	3.7	2.9	1.4	26	35	33	27	20	25
388	Other Mine Owned	3.9	3.7	3.0	1.4	26	35	33	27	20	25
389	Other Mine Owned - Vacant	4.2	3.8	3.0	1.4	27	34	33	27	20	25
390	Other Mine Owned	4.2	3.8	3.0	1.4	27	35	33	27	20	25
391	Other Mine Owned	4.6	4.1	3.1	1.5	27	34	32	27	20	25
392	Other Mine Owned - Vacant	4.2	3.7	2.9	1.4	26	34	32	27	20	25
394	Other Mine Owned	2.4	2.3	2.1	1.0	25	37	36	28	22	25
395	Other Mine Owned	2.5	2.3	2.1	1.1	25	37	36	28	22	25
396	Other Mine Owned	2.4	2.3	2.1	1.0	25	37	35	28	22	25
397	Other Mine Owned	2.4	2.3	2.1	1.0	25	37	35	28	22	25
398	Other Mine Owned	2.4	2.3	2.1	1.0	25	37	35	28	22	25
399	Other Mine Owned	2.5	2.4	2.1	1.1	25	37	35	28	22	25
400	Other Mine Owned	2.6	2.4	2.2	1.1	25	37	35	28	22	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
401	Other Mine Owned	2.3	2.2	2.0	1.0	25	37	35	28	22	25
402	Other Mine Owned	2.0	1.9	1.8	0.9	24	36	35	28	22	25
403	Other Mine Owned	2.2	2.1	2.0	1.0	25	36	35	28	21	25
404	Other Mine Owned - Vacant	2.1	1.8	1.6	0.8	32	42	40	32	29	25
405	Other Mine Owned - Vacant	4.4	3.5	2.6	1.2	32	43	40	31	25	25
406	Other Mine Owned - Vacant	1.3	1.3	1.3	0.7	24	45	44	28	23	25
407	Other Mine Owned - Vacant	3.6	3.3	2.7	1.3	26	35	33	28	21	25
408	Other Mine Owned	3.3	3.1	2.6	1.3	26	35	33	27	21	25
409	Glencore Owned - Vacant	8.9	11.2	7.0	2.7	31	38	36	29	23	25
411	Glencore Owned - Vacant	0.4	0.6	1.3	0.9	19	21	18	17	16	25
412	Community Infrastructure	0.4	0.6	1.4	0.9	18	19	17	17	15	25
415	Private Infrastructure	0.3	0.4	0.8	0.5	16	17	16	15	15	25
417	Private	0.0	0.0	0.0	0.0	14	14	14	14	14	25
Maximum 24-hour average PM2.5 (ug/m3)											
001	Other Mine Owned - Vacant	2	3	3	2	19	25	25	25	19	25
002	Community Infrastructure	3	3	3	2	19	23	23	23	19	25
003	Other Mine Owned	2	3	3	2	19	22	22	22	19	25
004	Private - Subject to Acq. Rights	2	3	3	2	19	20	21	20	19	25
005	Private - Subject to Acq. Rights	2	3	3	2	19	21	21	21	19	25
006	Community Infrastructure	2	3	3	2	19	21	21	21	19	25
007a	Private	2	3	3	1	19	20	20	20	19	25
007b	Private	2	3	3	1	19	20	20	20	19	25
007c	Private	2	2	3	1	19	20	20	20	19	25
010	Private	2	3	3	2	19	20	20	20	19	25
011	Private	2	3	3	1	19	20	20	20	19	25
012	Private	2	3	3	2	19	20	20	20	19	25
013	Private	1	2	2	1	19	19	20	19	19	25
014	Private	1	2	2	1	19	19	19	19	19	25
015a	Private	1	2	2	1	19	19	19	19	19	25
015b	Private	1	2	2	1	19	19	19	19	19	25
017a	Private	1	2	2	1	19	19	19	19	19	25
017b	Private	1	2	2	1	19	19	19	19	19	25
019	Private	2	2	3	2	19	20	20	20	19	25
021	Private - Subject to Acq. Rights	2	3	4	2	19	20	20	20	19	25
022	Glencore Owned	2	3	3	2	19	20	20	20	19	25
023	Private - Subject to Acq. Rights	2	3	4	2	19	20	20	20	19	25
024	Glencore Owned	2	3	4	2	19	20	20	20	19	25
025	Glencore Owned	2	3	4	2	19	20	20	20	19	25
026	Glencore Owned	2	3	4	2	19	20	20	20	19	25
027	Glencore Owned	2	3	4	2	19	20	20	20	19	25
028	Glencore Owned	2	3	4	2	19	20	20	20	19	25
029	Glencore Owned	2	3	4	2	19	20	20	20	19	25
030	Glencore Owned	2	3	5	3	19	20	22	21	19	25
031	Glencore Owned	1	3	4	2	19	20	22	21	19	25
032	Glencore Owned	1	2	3	2	19	20	20	20	19	25
033	Glencore Owned	1	2	3	2	19	20	20	20	19	25
034	Glencore Owned	1	2	3	2	19	20	20	20	19	25
035	Glencore Owned - Vacant	1	2	3	2	19	20	20	20	19	25
036	Glencore Owned	1	2	3	2	19	20	20	20	19	25
037	Glencore Owned - Vacant	1	1	3	2	19	20	21	21	19	25
038	Glencore Owned	1	2	3	2	19	21	21	21	19	25
039	Glencore Owned	1	2	3	2	19	20	21	21	19	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
040	Glencore Owned	1	1	1	1	19	20	20	20	19	25
041	Private	0	0	1	0	19	19	19	19	19	25
042	Private	0	0	1	0	19	19	19	19	19	25
043	Private	0	0	1	0	19	19	19	19	19	25
044a	Private	0	0	0	0	19	19	19	19	19	25
044b	Private	0	0	1	0	19	19	19	19	19	25
045	Private	0	0	0	0	19	19	19	19	19	25
046	Private	0	0	0	0	19	19	19	19	19	25
047	Private	0	0	0	0	19	19	19	19	19	25
048	Private	0	0	1	0	19	19	19	19	19	25
049	Private	0	0	0	0	19	19	19	19	19	25
050	Private	0	0	0	0	19	19	19	19	19	25
051	Private	0	0	0	0	19	19	19	19	19	25
052	Private	0	0	0	0	19	19	19	19	19	25
053	Private	0	0	0	0	19	19	19	19	19	25
054	Private	0	0	0	0	19	19	19	19	19	25
055	Private	0	0	0	0	19	19	19	19	19	25
056a	Private	0	0	0	0	19	19	19	19	19	25
056b	Private	0	0	0	0	19	19	19	19	19	25
057	Private	0	0	0	0	19	19	19	19	19	25
058	Private	0	0	1	0	19	19	19	19	19	25
059	Private	0	0	1	0	19	19	19	19	19	25
060	Private	0	0	1	0	19	19	19	19	19	25
061	Private	0	0	1	0	19	19	19	19	19	25
062	Private	0	0	1	1	19	19	19	19	19	25
063a	Private	0	1	1	1	19	19	19	19	19	25
068	Private	0	1	1	1	19	19	19	19	19	25
069a	Private	1	1	1	1	19	19	19	19	19	25
069b	Private	0	1	1	1	19	19	19	19	19	25
071	Private	1	1	1	1	19	19	19	19	19	25
072	Private	1	1	1	1	19	19	19	19	19	25
073	Private	1	1	1	1	19	19	19	19	19	25
074	Private	1	1	2	1	19	19	19	19	19	25
075	Private	1	1	1	1	19	19	19	19	19	25
076	Private	1	1	1	1	19	19	19	19	19	25
077	Private	1	1	1	1	19	19	19	19	19	25
082	Private	1	1	1	1	19	19	19	19	19	25
083	Private	1	1	2	1	19	19	19	19	19	25
084a	Private	1	1	1	1	19	19	19	19	19	25
085	Private	1	1	1	1	19	19	19	19	19	25
086	Private	1	1	2	1	19	19	19	19	19	25
087	Private	1	1	2	1	19	19	19	19	19	25
088	Private	1	1	2	1	19	19	19	19	19	25
089	Private	1	2	2	1	19	19	19	19	19	25
090	Other Mine Owned	1	2	2	1	19	19	19	19	19	25
091	Private	1	2	2	1	19	20	20	20	19	25
092	Private	1	2	2	1	19	20	20	20	19	25
093	Private	1	2	2	1	19	20	20	20	19	25
094	Private	1	2	2	1	19	19	19	19	19	25
095	Private	1	2	2	1	19	19	19	19	19	25
096	Private	1	1	1	1	19	19	19	19	19	25
097	Private	1	1	2	1	19	19	19	19	19	25
098	Private	1	1	2	1	19	19	19	19	19	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
099	Private	1	2	2	1	19	19	19	19	19	25
100	Private	1	2	2	1	19	19	19	19	19	25
101	Private	1	1	2	1	19	19	19	19	19	25
102a	Private	1	1	2	2	19	19	19	19	19	25
102b	Private	1	1	2	2	19	19	19	19	19	25
104	Other Mine Owned	1	1	2	2	19	19	19	19	19	25
105	Private - Subject to Acq. Rights	3	4	4	2	19	21	21	21	19	25
108	Glencore Owned	5	6	6	3	20	21	21	21	19	25
109	Glencore Owned	6	6	6	3	20	21	21	21	19	25
110	Other Mine Owned - Vacant	4	5	6	3	20	23	23	23	20	25
111	Private - Subject to Acq. Rights	4	5	5	3	21	25	25	25	20	25
112	Private - Subject to Acq. Rights	2	3	4	2	19	20	20	20	19	25
114	Private - Subject to Acq. Rights	3	4	4	2	19	21	21	21	19	25
115	Private - Subject to Acq. Rights	3	4	5	3	19	21	21	21	19	25
116	Glencore Owned	3	4	4	2	19	21	21	21	19	25
117	Glencore Owned	4	5	6	3	20	21	21	21	19	25
120	Glencore Owned - Vacant	4	5	6	3	20	21	21	21	19	25
121	Glencore Owned - Vacant	4	6	7	3	20	21	21	21	19	25
122	Glencore Owned	5	6	8	4	20	21	21	21	19	25
123	Glencore Owned - Vacant	4	6	6	3	20	21	21	21	19	25
125	Glencore Owned	5	8	7	4	20	21	21	21	19	25
126	Glencore Owned - Vacant	5	7	6	3	20	21	21	21	19	25
127a	Private - Subject to Acq. Rights	4	4	4	2	20	22	22	22	20	25
127b	Private - Subject to Acq. Rights	7	7	6	2	20	23	23	22	20	25
127c	Private - Subject to Acq. Rights	10	9	7	3	21	23	22	22	20	25
127d	Private - Subject to Acq. Rights	10	9	7	3	20	22	22	22	20	25
129	Glencore Owned	10	10	9	4	21	22	22	22	20	25
130	Glencore Owned	11	10	8	4	22	23	22	22	20	25
131	Glencore Owned - Vacant	2	3	5	3	21	23	21	21	20	25
134	Private	1	1	2	1	20	20	20	20	19	25
135	Private	1	1	2	1	20	20	20	19	19	25
136	Private	1	1	2	1	20	20	20	19	19	25
143	Private - Subject to Acq. Rights	5	5	5	2	20	22	22	21	20	25
144a	Private - Subject to Acq. Rights	2	2	2	1	20	31	30	20	20	25
144b	Private - Subject to Acq. Rights	1	1	1	1	19	21	21	20	19	25
144c	Private - Subject to Acq. Rights	1	1	1	1	19	21	21	20	19	25
145	Private - Subject to Acq. Rights	2	2	2	1	20	58	57	21	20	25
146	Other Mine Owned	3	3	3	1	20	22	22	21	20	25
147	Private - Subject to Acq. Rights	3	3	3	1	21	35	34	23	21	25
148	Other Mine Owned	3	3	3	1	21	27	27	23	20	25
149	Community Infrastructure	4	5	5	3	20	23	23	21	20	25
150	Private - Subject to Acq. Rights	5	5	5	2	20	23	23	21	20	25
151	Other Mine Owned	5	5	5	3	20	23	23	21	20	25
152	Private - Subject to Acq. Rights	6	6	5	2	20	23	22	21	20	25
154	Private - Subject to Acq. Rights	6	6	5	2	20	22	22	21	20	25
155	Private - Subject to Acq. Rights	6	6	5	2	20	22	22	21	20	25
156	Private - Subject to Acq. Rights	6	6	6	3	20	22	22	21	20	25
157	Glencore Owned - Vacant	8	8	8	4	20	21	21	21	20	25
158	Other Mine Owned - Vacant	2	3	3	2	20	112	111	21	20	25
159	Other Mine Owned - Vacant	3	3	3	2	20	28	27	21	20	25
160	Other Mine Owned - Vacant	2	3	3	2	20	81	81	21	20	25
161	Glencore Owned - Vacant	3	4	9	6	22	27	21	22	21	25
162b	Private	0	1	1	1	19	19	19	19	19	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
163	Other Mine Owned	2	2	2	2	19	19	19	19	19	25
164	Other Mine Owned	2	2	2	2	19	19	19	19	19	25
165	Other Mine Owned	2	2	3	2	19	19	19	19	19	25
166	Other Mine Owned - Vacant	13	10	8	4	22	23	23	21	20	25
178	Private	0	0	0	0	19	19	19	19	19	25
209	Private	0	0	0	0	19	19	19	19	19	25
210	Private	0	0	0	0	19	19	19	19	19	25
211	Private	0	0	0	0	19	19	19	19	19	25
212	Private	0	0	0	0	19	19	19	19	19	25
213	Private	0	0	0	0	19	19	19	19	19	25
259	Private	1	1	1	1	19	19	19	19	19	25
260	Private	1	1	1	1	19	19	19	19	19	25
280	Private	1	2	2	1	19	19	19	19	19	25
281	Private	1	2	2	1	19	19	19	19	19	25
282	Private	1	2	2	1	19	19	19	19	19	25
288	Private	1	1	1	1	19	19	19	19	19	25
289	Private	1	2	2	1	19	19	19	19	19	25
290	Private	1	2	2	1	19	19	19	19	19	25
291	Private	1	2	2	1	19	19	19	19	19	25
292a	Private	1	2	2	1	19	19	19	19	19	25
292b	Private	1	2	2	1	19	19	19	19	19	25
293	Private	2	2	3	1	19	19	19	19	19	25
294	Private	1	2	2	1	19	19	19	19	19	25
295	Private	2	2	3	1	19	19	19	19	19	25
296	Private	2	2	3	2	19	19	19	19	19	25
297a	Private	2	2	3	2	19	19	19	19	19	25
297b	Private	2	2	3	2	19	19	19	19	19	25
297c	Private	2	2	3	2	19	19	19	19	19	25
297d	Private	1	2	2	1	19	19	19	19	19	25
299	Private	2	2	3	2	19	19	19	19	19	25
300	Private	2	2	3	2	19	19	19	19	19	25
302	Private	2	2	3	1	19	19	19	19	19	25
303	Private	1	1	2	1	19	19	19	19	19	25
305	Private	1	2	2	1	19	19	19	19	19	25
306	Private	1	2	2	1	19	19	19	19	19	25
307	Private	1	2	2	1	19	19	19	19	19	25
308	Private	1	2	3	1	19	19	19	19	19	25
309	Private	2	2	3	1	19	19	19	19	19	25
310	Private	2	2	3	1	19	19	19	19	19	25
311	Private	2	2	3	1	19	19	19	19	19	25
312	Private	1	2	2	1	19	19	19	19	19	25
314	Private	2	2	2	1	19	19	19	19	19	25
315	Private	2	2	2	1	19	19	19	19	19	25
316	Private	2	2	2	1	19	19	19	19	19	25
317	Private	2	2	2	1	19	19	19	19	19	25
318	Private	2	2	3	1	19	19	19	19	19	25
319	Private	2	2	3	1	19	19	19	19	19	25
320	Private	2	2	3	1	19	19	19	19	19	25
321	Private	2	2	3	1	19	19	19	19	19	25
322	Private	2	2	3	1	19	19	19	19	19	25
323	Private	2	3	3	1	19	19	19	19	19	25
324	Private	2	3	3	1	19	19	19	19	19	25
325	Private	2	3	3	1	19	19	19	19	19	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
326	Private	2	3	2	1	19	19	19	19	19	25
327	Private	2	3	2	1	19	19	19	19	19	25
328	Private	2	3	2	1	19	19	19	19	19	25
329	Private	2	2	2	1	19	19	19	19	19	25
330	Private	2	2	2	1	19	19	19	19	19	25
337	Private	0	0	0	0	19	19	19	19	19	25
342	Private Infrastructure	13	21	19	6	22	23	28	28	21	25
344	Other Mine Owned	2	2	2	2	19	19	19	19	19	25
349a	Private	1	2	2	1	19	19	19	19	19	25
349b	Private	1	2	2	1	19	19	19	19	19	25
350	Community Infrastructure	0	1	1	1	19	19	19	19	19	25
351	Other Mine Owned	6	6	5	3	20	22	22	21	20	25
352	Other Mine Owned - Vacant	3	3	3	1	20	24	23	23	20	25
353	Other Mine Owned	3	3	3	1	21	29	29	24	21	25
356	Glencore Owned - Vacant	20	51	179	54	24	26	56	186	60	25
357	Glencore Owned - Vacant	15	26	74	73	23	23	33	81	81	25
358	Glencore Owned - Vacant	7	12	30	21	22	23	22	35	25	25
359	Glencore Owned - Vacant	13	18	17	5	22	23	25	27	21	25
360	Glencore Owned - Vacant	4	5	6	3	20	21	21	21	19	25
361	Glencore Owned - Vacant	3	4	5	2	19	20	21	21	19	25
363	Glencore Owned	4	5	6	3	20	21	21	21	19	25
364	Other Mine Owned	3	3	4	2	20	28	28	21	20	25
365	Other Mine Owned - Vacant	3	4	4	2	20	24	24	21	20	25
366	Other Mine Owned - Vacant	3	3	4	2	20	24	24	21	20	25
367	Other Mine Owned	3	3	4	2	20	24	24	21	20	25
369	Other Mine Owned - Vacant	4	4	4	2	20	23	23	21	20	25
370	Other Mine Owned	4	4	4	2	20	23	23	21	20	25
371	Other Mine Owned	5	4	4	2	20	23	23	21	20	25
372	Other Mine Owned	6	5	4	2	20	23	23	21	20	25
373	Other Mine Owned - Vacant	5	5	4	2	20	23	23	21	20	25
374	Other Mine Owned	6	5	4	2	20	23	23	21	20	25
375	Other Mine Owned	6	5	4	2	20	23	23	21	20	25
376	Other Mine Owned	5	5	5	3	20	23	23	21	20	25
377	Other Mine Owned	6	5	5	3	20	23	23	21	20	25
378	Other Mine Owned	6	5	5	3	20	23	22	21	20	25
379	Other Mine Owned	4	5	5	3	20	23	23	21	20	25
380	Other Mine Owned	5	5	5	3	20	23	23	21	20	25
381	Other Mine Owned	6	5	5	3	20	22	22	21	20	25
382	Other Mine Owned	6	6	5	2	20	23	22	21	20	25
383	Other Mine Owned	6	6	5	3	20	22	22	21	20	25
384	Other Mine Owned	6	6	5	3	20	22	22	21	20	25
385	Other Mine Owned	6	6	5	3	20	22	22	21	20	25
386	Other Mine Owned	6	6	5	3	20	22	22	21	20	25
387	Other Mine Owned	6	6	5	3	21	23	22	21	20	25
388	Other Mine Owned	5	6	6	3	21	23	22	21	20	25
389	Other Mine Owned - Vacant	6	6	6	3	21	22	22	21	20	25
390	Other Mine Owned	6	6	6	3	21	23	22	21	20	25
391	Other Mine Owned	6	6	5	3	20	22	22	21	20	25
392	Other Mine Owned - Vacant	6	6	5	2	20	22	22	21	20	25
394	Other Mine Owned	5	4	4	2	20	23	23	21	20	25
395	Other Mine Owned	5	4	4	2	20	23	23	21	20	25
396	Other Mine Owned	5	4	4	2	20	23	23	21	20	25
397	Other Mine Owned	5	4	4	2	20	23	23	21	20	25

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
398	Other Mine Owned	5	4	4	2	20	23	23	21	20	25
399	Other Mine Owned	5	5	4	2	20	23	23	21	20	25
400	Other Mine Owned	5	5	4	2	20	23	23	21	20	25
401	Other Mine Owned	5	4	4	2	20	23	23	21	20	25
402	Other Mine Owned	4	4	3	2	20	22	22	21	20	25
403	Other Mine Owned	5	4	4	2	20	22	22	21	20	25
404	Other Mine Owned - Vacant	4	4	4	2	22	23	23	21	20	25
405	Other Mine Owned - Vacant	9	8	7	3	21	24	23	21	20	25
406	Other Mine Owned - Vacant	3	3	3	1	21	37	37	21	20	25
407	Other Mine Owned - Vacant	6	6	5	2	20	22	22	21	20	25
408	Other Mine Owned	5	5	5	3	20	23	23	21	20	25
409	Glencore Owned - Vacant	12	18	17	5	22	23	25	27	21	25
411	Glencore Owned - Vacant	1	1	2	2	21	22	21	20	20	25
412	Community Infrastructure	1	2	3	2	20	21	20	20	19	25
415	Private Infrastructure	1	1	2	1	20	20	20	20	19	25
417	Private	0	0	0	0	19	19	19	19	19	25
Annual average PM2.5 (ug/m3)											
001	Other Mine Owned - Vacant	0.2	0.3	0.5	0.3	7	11	11	11	6	8
002	Community Infrastructure	0.3	0.4	0.6	0.3	7	9	9	9	6	8
003	Other Mine Owned	0.2	0.3	0.5	0.3	7	9	9	9	6	8
004	Private - Subject to Acq. Rights	0.2	0.3	0.5	0.3	7	8	8	8	6	8
005	Private - Subject to Acq. Rights	0.2	0.3	0.5	0.3	7	8	8	8	6	8
006	Community Infrastructure	0.2	0.3	0.5	0.3	7	8	8	8	6	8
007a	Private	0.2	0.3	0.5	0.3	7	8	8	8	6	8
007b	Private	0.2	0.3	0.5	0.3	7	8	8	8	6	8
007c	Private	0.2	0.2	0.4	0.2	6	8	8	7	6	8
010	Private	0.2	0.2	0.4	0.2	7	8	8	7	6	8
011	Private	0.2	0.2	0.3	0.2	7	7	7	7	6	8
012	Private	0.2	0.2	0.4	0.2	7	7	7	7	6	8
013	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
014	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8
015a	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8
015b	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8
017a	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
017b	Private	0.1	0.1	0.2	0.1	6	7	6	6	6	8
019	Private	0.2	0.2	0.3	0.2	7	7	7	7	6	8
021	Private - Subject to Acq. Rights	0.2	0.2	0.4	0.2	7	8	8	7	6	8
022	Glencore Owned	0.2	0.2	0.4	0.2	7	8	8	7	6	8
023	Private - Subject to Acq. Rights	0.2	0.3	0.4	0.2	7	8	8	7	6	8
024	Glencore Owned	0.2	0.3	0.4	0.2	7	8	8	8	6	8
025	Glencore Owned	0.2	0.2	0.4	0.2	7	8	8	8	6	8
026	Glencore Owned	0.2	0.2	0.4	0.2	7	8	8	8	6	8
027	Glencore Owned	0.2	0.3	0.4	0.3	7	8	8	8	6	8
028	Glencore Owned	0.2	0.3	0.4	0.3	7	8	8	8	6	8
029	Glencore Owned	0.2	0.3	0.5	0.3	7	8	9	8	6	8
030	Glencore Owned	0.2	0.3	0.5	0.3	7	9	10	10	7	8
031	Glencore Owned	0.2	0.3	0.5	0.3	7	9	10	10	7	8
032	Glencore Owned	0.2	0.2	0.4	0.2	7	8	9	8	6	8
033	Glencore Owned	0.1	0.2	0.3	0.2	7	8	8	7	6	8
034	Glencore Owned	0.1	0.2	0.3	0.2	7	7	8	7	6	8
035	Glencore Owned - Vacant	0.1	0.2	0.3	0.2	7	7	8	7	6	8
036	Glencore Owned	0.1	0.2	0.3	0.2	7	8	8	8	6	8

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
037	Glencore Owned - Vacant	0.2	0.2	0.4	0.2	7	8	9	8	6	8
038	Glencore Owned	0.2	0.2	0.4	0.2	7	9	10	9	6	8
039	Glencore Owned	0.2	0.2	0.4	0.2	7	9	10	9	6	8
040	Glencore Owned	0.1	0.1	0.2	0.1	6	7	7	6	6	8
041	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
042	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
043	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
044a	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
044b	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
045	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
046	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
047	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
048	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
049	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
050	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
051	Private	0.0	0.1	0.1	0.0	6	6	6	6	6	8
052	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
053	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
054	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
055	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
056a	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
056b	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
057	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
058	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
059	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
060	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
061	Private	0.0	0.0	0.1	0.1	6	6	6	6	6	8
062	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
063a	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
068	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
069a	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
069b	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
071	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
072	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
073	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
074	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
075	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
076	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
077	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
082	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
083	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
084a	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
085	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
086	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
087	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
088	Private	0.1	0.1	0.2	0.1	6	7	6	6	6	8
089	Private	0.1	0.2	0.2	0.2	6	7	7	7	6	8
090	Other Mine Owned	0.1	0.2	0.2	0.2	6	7	7	7	6	8
091	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
092	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
093	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
094	Private	0.1	0.2	0.2	0.1	6	7	7	7	6	8
095	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
096	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8
097	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8
098	Private	0.1	0.1	0.2	0.1	6	7	7	6	6	8
099	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
100	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
101	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
102a	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
102b	Private	0.1	0.2	0.3	0.2	6	7	7	7	6	8
104	Other Mine Owned	0.2	0.2	0.3	0.2	6	7	7	7	6	8
105	Private - Subject to Acq. Rights	0.3	0.4	0.7	0.4	7	8	8	8	6	8
108	Glencore Owned	0.8	1.1	1.3	0.7	8	10	9	9	7	8
109	Glencore Owned	0.8	1.1	1.3	0.7	8	9	9	9	7	8
110	Other Mine Owned - Vacant	0.8	0.9	1.0	0.5	8	11	11	10	7	8
111	Private - Subject to Acq. Rights	0.8	0.9	0.9	0.4	8	13	12	12	7	8
112	Private - Subject to Acq. Rights	0.2	0.3	0.5	0.3	7	8	8	8	6	8
114	Private - Subject to Acq. Rights	0.3	0.4	0.6	0.4	7	8	8	8	6	8
115	Private - Subject to Acq. Rights	0.3	0.4	0.7	0.4	7	9	9	9	6	8
116	Glencore Owned	0.3	0.4	0.7	0.4	7	8	8	8	6	8
117	Glencore Owned	0.4	0.5	0.8	0.5	7	9	9	9	7	8
120	Glencore Owned - Vacant	0.5	0.6	1.0	0.6	7	9	9	9	7	8
121	Glencore Owned - Vacant	0.6	1.0	1.3	0.8	8	9	9	9	7	8
122	Glencore Owned	0.7	1.0	1.4	0.8	8	9	9	9	7	8
123	Glencore Owned - Vacant	0.6	0.8	1.2	0.7	8	9	9	9	7	8
125	Glencore Owned	0.9	1.3	1.6	0.9	8	9	9	9	7	8
126	Glencore Owned - Vacant	0.8	1.2	1.5	0.8	8	9	9	9	7	8
127a	Private - Subject to Acq. Rights	0.8	0.8	0.7	0.3	8	11	11	10	7	8
127b	Private - Subject to Acq. Rights	1.4	1.4	1.1	0.5	9	11	11	10	7	8
127c	Private - Subject to Acq. Rights	2.2	1.9	1.5	0.6	10	12	11	10	7	8
127d	Private - Subject to Acq. Rights	2.0	1.8	1.4	0.6	9	12	11	10	7	8
129	Glencore Owned	2.3	2.2	1.7	0.7	10	12	11	10	7	8
130	Glencore Owned	2.4	2.2	1.7	0.7	10	12	11	10	7	8
131	Glencore Owned - Vacant	0.2	0.3	0.7	0.5	7	8	7	7	6	8
134	Private	0.1	0.1	0.2	0.2	6	6	6	6	6	8
135	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
136	Private	0.1	0.1	0.2	0.1	6	6	6	6	6	8
143	Private - Subject to Acq. Rights	1.1	1.1	1.0	0.4	8	10	10	9	7	8
144a	Private - Subject to Acq. Rights	0.3	0.3	0.3	0.2	8	14	14	8	8	8
144b	Private - Subject to Acq. Rights	0.2	0.2	0.2	0.1	8	9	9	7	7	8
144c	Private - Subject to Acq. Rights	0.2	0.2	0.2	0.1	7	9	9	7	7	8
145	Private - Subject to Acq. Rights	0.3	0.3	0.3	0.2	8	21	21	8	7	8
146	Other Mine Owned	0.5	0.6	0.6	0.3	8	11	11	9	7	8
147	Private - Subject to Acq. Rights	0.4	0.5	0.5	0.2	9	13	13	11	8	8
148	Other Mine Owned	0.5	0.5	0.5	0.2	9	13	12	11	8	8
149	Community Infrastructure	0.9	1.0	0.9	0.4	8	11	11	9	7	8
150	Private - Subject to Acq. Rights	0.9	1.0	0.9	0.4	8	11	11	9	7	8
151	Other Mine Owned	1.1	1.2	1.0	0.4	8	11	11	9	7	8
152	Private - Subject to Acq. Rights	1.1	1.1	1.0	0.4	8	11	11	9	7	8
154	Private - Subject to Acq. Rights	1.2	1.2	1.1	0.5	8	11	10	9	7	8
155	Private - Subject to Acq. Rights	1.2	1.2	1.1	0.5	8	11	10	9	7	8
156	Private - Subject to Acq. Rights	1.5	1.4	1.2	0.5	9	11	10	9	7	8
157	Glencore Owned - Vacant	1.3	1.7	1.8	0.8	9	10	10	10	7	8
158	Other Mine Owned - Vacant	0.4	0.5	0.5	0.2	8	57	57	8	8	8
159	Other Mine Owned - Vacant	0.5	0.6	0.6	0.3	8	13	13	9	8	8

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
160	Other Mine Owned - Vacant	0.5	0.5	0.5	0.2	8	34	34	9	8	8
161	Glencore Owned - Vacant	0.4	0.6	1.5	1.2	8	13	7	8	7	8
162b	Private	0.0	0.1	0.1	0.1	6	6	6	6	6	8
163	Other Mine Owned	0.2	0.3	0.4	0.2	6	7	7	7	6	8
164	Other Mine Owned	0.2	0.3	0.4	0.2	6	7	7	7	6	8
165	Other Mine Owned	0.2	0.3	0.4	0.2	6	7	7	7	6	8
166	Other Mine Owned - Vacant	2.7	2.3	1.8	0.7	10	13	12	10	8	8
178	Private	0.0	0.0	0.0	0.0	6	6	6	6	6	8
209	Private	0.0	0.0	0.0	0.0	6	6	6	6	5	8
210	Private	0.0	0.0	0.0	0.0	6	6	6	6	5	8
211	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
212	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
213	Private	0.0	0.0	0.1	0.0	6	6	6	6	6	8
259	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
260	Private	0.1	0.1	0.1	0.1	6	6	6	6	6	8
280	Private	0.2	0.3	0.4	0.2	6	7	7	7	6	8
281	Private	0.2	0.3	0.4	0.2	6	8	7	7	6	8
282	Private	0.2	0.3	0.4	0.2	6	8	7	7	6	8
288	Private	0.1	0.2	0.2	0.1	6	7	7	6	6	8
289	Private	0.2	0.2	0.3	0.2	6	7	7	7	6	8
290	Private	0.2	0.3	0.3	0.2	6	7	7	7	6	8
291	Private	0.2	0.3	0.4	0.2	6	7	7	7	6	8
292a	Private	0.2	0.3	0.3	0.2	6	7	7	7	6	8
292b	Private	0.2	0.3	0.3	0.2	6	7	7	7	6	8
293	Private	0.2	0.3	0.4	0.2	6	7	7	7	6	8
294	Private	0.2	0.3	0.3	0.2	6	7	7	7	6	8
295	Private	0.2	0.3	0.4	0.2	6	7	7	7	6	8
296	Private	0.2	0.3	0.3	0.2	6	7	7	7	6	8
297a	Private	0.2	0.3	0.3	0.2	7	7	7	7	6	8
297b	Private	0.2	0.3	0.3	0.2	7	7	7	7	6	8
297c	Private	0.2	0.3	0.3	0.2	7	7	7	7	6	8
297d	Private	0.2	0.2	0.3	0.2	6	7	7	7	6	8
299	Private	0.2	0.3	0.3	0.2	7	7	7	7	6	8
300	Private	0.2	0.3	0.3	0.2	7	7	7	7	6	8
302	Private	0.2	0.3	0.3	0.1	7	7	7	7	6	8
303	Private	0.1	0.2	0.2	0.1	6	7	7	6	6	8
305	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
306	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
307	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
308	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
309	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
310	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
311	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
312	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
314	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
315	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
316	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
317	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
318	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
319	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
320	Private	0.2	0.2	0.3	0.1	7	7	7	7	6	8
321	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
322	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
323	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
324	Private	0.2	0.2	0.3	0.1	7	7	7	7	6	8
325	Private	0.2	0.2	0.3	0.1	7	8	7	7	6	8
326	Private	0.2	0.2	0.2	0.1	7	8	7	7	6	8
327	Private	0.2	0.2	0.2	0.1	7	8	7	7	6	8
328	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
329	Private	0.2	0.2	0.2	0.1	7	8	7	7	6	8
330	Private	0.2	0.2	0.2	0.1	7	7	7	7	6	8
337	Private	0.0	0.0	0.0	0.0	6	6	6	6	5	8
342	Private Infrastructure	2.5	4.0	3.5	1.0	10	12	12	11	8	8
344	Other Mine Owned	0.2	0.3	0.4	0.2	6	7	7	7	6	8
349a	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
349b	Private	0.2	0.2	0.2	0.1	6	7	7	7	6	8
350	Community Infrastructure	0.0	0.0	0.1	0.0	6	6	6	6	6	8
351	Other Mine Owned	1.2	1.2	1.1	0.5	8	11	11	9	7	8
352	Other Mine Owned - Vacant	0.5	0.5	0.5	0.2	8	12	12	11	7	8
353	Other Mine Owned	0.4	0.4	0.5	0.2	9	13	13	12	8	8
356	Glencore Owned - Vacant	4.0	13.8	87.4	20.2	12	13	21	94	27	8
357	Glencore Owned - Vacant	2.0	4.9	25.8	28.3	11	11	12	32	34	8
358	Glencore Owned - Vacant	1.1	2.1	6.2	4.8	10	12	9	13	11	8
359	Glencore Owned - Vacant	2.4	3.8	2.9	0.9	10	12	12	10	8	8
360	Glencore Owned - Vacant	0.4	0.6	0.9	0.5	7	9	9	9	7	8
361	Glencore Owned - Vacant	0.3	0.4	0.6	0.4	7	8	9	8	6	8
363	Glencore Owned	0.4	0.5	0.8	0.5	7	9	9	9	7	8
364	Other Mine Owned	0.6	0.6	0.6	0.3	8	15	14	9	7	8
365	Other Mine Owned - Vacant	0.7	0.7	0.7	0.3	8	12	12	9	7	8
366	Other Mine Owned - Vacant	0.6	0.7	0.7	0.3	8	12	12	9	7	8
367	Other Mine Owned	0.7	0.7	0.7	0.3	8	12	12	9	7	8
369	Other Mine Owned - Vacant	0.7	0.8	0.7	0.3	8	12	12	9	7	8
370	Other Mine Owned	0.7	0.7	0.7	0.3	8	12	12	9	7	8
371	Other Mine Owned	0.9	0.9	0.8	0.4	8	12	11	9	8	8
372	Other Mine Owned	0.9	0.9	0.9	0.4	9	12	11	9	8	8
373	Other Mine Owned - Vacant	0.9	0.9	0.9	0.4	8	12	11	9	7	8
374	Other Mine Owned	0.9	1.0	0.9	0.4	9	12	11	9	8	8
375	Other Mine Owned	1.0	1.0	0.9	0.4	9	11	11	9	7	8
376	Other Mine Owned	1.0	1.1	1.0	0.4	8	11	11	9	7	8
377	Other Mine Owned	1.1	1.1	1.0	0.4	8	11	11	9	7	8
378	Other Mine Owned	1.2	1.2	1.1	0.5	8	11	11	9	7	8
379	Other Mine Owned	1.0	1.1	1.0	0.4	8	11	11	9	7	8
380	Other Mine Owned	1.1	1.1	1.0	0.4	8	11	11	9	7	8
381	Other Mine Owned	1.1	1.2	1.1	0.5	8	11	11	9	7	8
382	Other Mine Owned	1.1	1.1	1.0	0.4	8	11	11	9	7	8
383	Other Mine Owned	1.2	1.3	1.1	0.5	8	11	10	9	7	8
384	Other Mine Owned	1.2	1.2	1.1	0.5	8	11	10	9	7	8
385	Other Mine Owned	1.3	1.3	1.1	0.5	8	11	10	9	7	8
386	Other Mine Owned	1.3	1.3	1.1	0.5	9	11	10	9	7	8
387	Other Mine Owned	1.2	1.3	1.1	0.5	9	11	11	9	7	8
388	Other Mine Owned	1.2	1.3	1.1	0.5	8	11	10	9	7	8
389	Other Mine Owned - Vacant	1.3	1.3	1.1	0.5	9	11	10	9	7	8
390	Other Mine Owned	1.3	1.3	1.2	0.5	9	11	11	9	7	8
391	Other Mine Owned	1.4	1.4	1.2	0.5	9	11	10	9	7	8
392	Other Mine Owned - Vacant	1.3	1.3	1.1	0.5	8	11	10	9	7	8
394	Other Mine Owned	0.8	0.8	0.8	0.4	8	12	11	9	8	8

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
395	Other Mine Owned	0.8	0.9	0.8	0.4	8	12	11	9	8	8
396	Other Mine Owned	0.8	0.9	0.8	0.4	8	12	11	9	8	8
397	Other Mine Owned	0.8	0.9	0.8	0.4	8	12	11	9	8	8
398	Other Mine Owned	0.8	0.8	0.8	0.4	8	12	11	9	8	8
399	Other Mine Owned	0.8	0.9	0.8	0.4	8	12	11	9	8	8
400	Other Mine Owned	0.9	0.9	0.8	0.4	8	12	11	9	8	8
401	Other Mine Owned	0.8	0.8	0.8	0.4	8	12	11	9	8	8
402	Other Mine Owned	0.7	0.7	0.7	0.3	8	11	11	9	7	8
403	Other Mine Owned	0.8	0.8	0.8	0.3	8	11	11	9	7	8
404	Other Mine Owned - Vacant	0.7	0.7	0.7	0.3	10	12	12	9	9	8
405	Other Mine Owned - Vacant	1.4	1.3	1.0	0.4	10	12	12	9	8	8
406	Other Mine Owned - Vacant	0.5	0.5	0.5	0.2	8	14	14	9	8	8
407	Other Mine Owned - Vacant	1.1	1.1	1.0	0.4	8	11	11	9	7	8
408	Other Mine Owned	1.0	1.1	1.0	0.4	8	11	11	9	7	8
409	Glencore Owned - Vacant	2.4	3.9	2.9	0.9	10	12	12	10	8	8
411	Glencore Owned - Vacant	0.1	0.2	0.4	0.3	7	7	7	6	6	8
412	Community Infrastructure	0.1	0.2	0.4	0.3	6	7	6	6	6	8
415	Private Infrastructure	0.1	0.1	0.2	0.1	6	6	6	6	6	8
417	Private	0.0	0.0	0.0	0.0	5	6	6	5	5	8
Annual average TSP (ug/m3)											
001	Other Mine Owned - Vacant	0.4	0.6	1.2	0.9	71	83	83	83	70	90
002	Community Infrastructure	0.5	0.7	1.4	1.1	71	78	77	78	70	90
003	Other Mine Owned	0.4	0.6	1.3	0.9	71	77	77	77	70	90
004	Private - Subject to Acq. Rights	0.4	0.6	1.3	1.0	71	75	74	75	70	90
005	Private - Subject to Acq. Rights	0.4	0.6	1.2	0.9	71	76	75	75	70	90
006	Community Infrastructure	0.4	0.6	1.1	0.9	71	75	74	74	70	90
007a	Private	0.3	0.5	1.1	0.8	71	74	74	74	70	90
007b	Private	0.3	0.5	1.1	0.8	71	74	74	74	70	90
007c	Private	0.3	0.4	0.9	0.7	71	74	73	73	70	90
010	Private	0.2	0.4	0.8	0.6	71	74	74	73	70	90
011	Private	0.2	0.3	0.7	0.5	71	74	74	73	70	90
012	Private	0.2	0.3	0.7	0.5	71	74	74	73	70	90
013	Private	0.1	0.2	0.5	0.4	71	72	72	71	69	90
014	Private	0.1	0.2	0.4	0.3	70	72	72	71	69	90
015a	Private	0.1	0.2	0.4	0.3	70	71	71	70	69	90
015b	Private	0.1	0.2	0.4	0.3	70	72	71	70	69	90
017a	Private	0.1	0.2	0.3	0.3	70	71	71	70	69	90
017b	Private	0.1	0.2	0.3	0.3	70	71	71	70	69	90
019	Private	0.2	0.3	0.6	0.5	72	74	75	73	70	90
021	Private - Subject to Acq. Rights	0.2	0.3	0.7	0.5	72	75	75	73	70	90
022	Glencore Owned	0.2	0.3	0.7	0.6	71	74	75	73	70	90
023	Private - Subject to Acq. Rights	0.2	0.3	0.7	0.6	72	75	76	74	70	90
024	Glencore Owned	0.2	0.3	0.7	0.6	72	75	76	74	70	90
025	Glencore Owned	0.2	0.3	0.7	0.5	72	76	77	75	70	90
026	Glencore Owned	0.2	0.3	0.6	0.5	72	76	77	75	70	90
027	Glencore Owned	0.2	0.4	0.8	0.6	72	76	77	75	70	90
028	Glencore Owned	0.2	0.3	0.7	0.6	73	77	78	76	70	90
029	Glencore Owned	0.2	0.4	0.8	0.6	73	77	79	77	70	90
030	Glencore Owned	0.2	0.4	0.9	0.7	74	80	86	84	71	90
031	Glencore Owned	0.2	0.3	0.8	0.6	74	81	87	85	71	90
032	Glencore Owned	0.1	0.2	0.5	0.4	73	78	79	77	70	90
033	Glencore Owned	0.1	0.2	0.5	0.4	73	76	76	74	70	90

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
034	Glencore Owned	0.1	0.2	0.5	0.4	72	75	75	73	70	90
035	Glencore Owned - Vacant	0.1	0.2	0.4	0.4	72	74	74	72	69	90
036	Glencore Owned	0.1	0.2	0.5	0.4	73	76	76	74	70	90
037	Glencore Owned - Vacant	0.1	0.2	0.5	0.4	74	79	80	78	70	90
038	Glencore Owned	0.1	0.2	0.6	0.5	75	82	87	83	71	90
039	Glencore Owned	0.1	0.2	0.6	0.5	74	80	84	80	71	90
040	Glencore Owned	0.1	0.1	0.2	0.2	70	71	70	69	69	90
041	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
042	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
043	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
044a	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
044b	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
045	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
046	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
047	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
048	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
049	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
050	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
051	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
052	Private	0.0	0.0	0.1	0.1	68	68	68	68	68	90
053	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
054	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
055	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
056a	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
056b	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
057	Private	0.0	0.0	0.1	0.0	68	68	68	68	68	90
058	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
059	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
060	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
061	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
062	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
063a	Private	0.0	0.0	0.1	0.1	68	69	68	68	68	90
068	Private	0.0	0.1	0.1	0.1	69	69	69	68	68	90
069a	Private	0.0	0.1	0.1	0.1	69	69	69	69	68	90
069b	Private	0.0	0.1	0.1	0.1	69	69	69	68	68	90
071	Private	0.0	0.1	0.1	0.1	69	69	69	69	68	90
072	Private	0.1	0.1	0.1	0.1	69	69	69	69	68	90
073	Private	0.1	0.1	0.2	0.1	69	69	69	69	68	90
074	Private	0.1	0.1	0.3	0.2	69	70	70	69	69	90
075	Private	0.1	0.1	0.2	0.1	69	69	69	69	68	90
076	Private	0.1	0.1	0.2	0.1	69	69	69	69	68	90
077	Private	0.1	0.1	0.2	0.1	69	69	69	69	68	90
082	Private	0.1	0.1	0.2	0.2	69	70	69	69	68	90
083	Private	0.1	0.2	0.3	0.2	70	70	70	70	69	90
084a	Private	0.1	0.1	0.3	0.2	69	70	70	69	69	90
085	Private	0.1	0.2	0.3	0.3	69	70	70	70	69	90
086	Private	0.1	0.2	0.4	0.3	70	71	70	70	69	90
087	Private	0.1	0.2	0.4	0.3	70	71	70	70	69	90
088	Private	0.2	0.2	0.4	0.3	70	71	71	70	69	90
089	Private	0.2	0.3	0.6	0.4	70	71	71	71	69	90
090	Other Mine Owned	0.2	0.3	0.6	0.4	70	71	71	71	69	90
091	Private	0.2	0.3	0.6	0.5	70	72	72	71	69	90
092	Private	0.2	0.4	0.7	0.5	71	73	72	72	69	90

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
093	Private	0.2	0.3	0.6	0.5	71	73	73	72	69	90
094	Private	0.2	0.2	0.5	0.4	70	72	72	71	69	90
095	Private	0.1	0.2	0.4	0.3	70	71	71	70	69	90
096	Private	0.2	0.3	0.6	0.4	70	71	71	70	69	90
097	Private	0.2	0.3	0.5	0.4	70	71	71	70	69	90
098	Private	0.2	0.3	0.5	0.4	70	71	71	70	69	90
099	Private	0.2	0.4	0.7	0.5	70	72	71	71	69	90
100	Private	0.3	0.4	0.8	0.6	70	72	72	71	69	90
101	Private	0.3	0.4	0.7	0.5	70	72	71	71	69	90
102a	Private	0.3	0.5	0.8	0.6	70	72	72	72	69	90
102b	Private	0.3	0.5	0.8	0.6	70	73	72	72	69	90
104	Other Mine Owned	0.3	0.5	0.9	0.6	70	73	72	72	69	90
105	Private - Subject to Acq. Rights	0.5	0.8	1.7	1.3	71	76	75	75	70	90
108	Glencore Owned	2.1	2.8	3.2	1.9	74	78	78	78	71	90
109	Glencore Owned	2.3	3.0	3.4	2.0	74	77	77	77	71	90
110	Other Mine Owned - Vacant	2.4	2.5	2.2	1.1	74	81	81	80	70	90
111	Private - Subject to Acq. Rights	2.5	2.4	1.9	0.9	74	86	86	85	70	90
112	Private - Subject to Acq. Rights	0.3	0.5	1.0	0.8	71	75	75	74	70	90
114	Private - Subject to Acq. Rights	0.4	0.6	1.4	1.1	71	75	75	75	70	90
115	Private - Subject to Acq. Rights	0.4	0.7	1.5	1.2	71	76	75	76	70	90
116	Glencore Owned	0.4	0.7	1.6	1.2	71	76	75	75	70	90
117	Glencore Owned	0.5	0.8	1.8	1.4	71	76	75	76	70	90
120	Glencore Owned - Vacant	0.7	1.2	2.4	1.8	72	77	75	76	70	90
121	Glencore Owned - Vacant	1.3	2.1	3.6	2.4	73	76	75	77	71	90
122	Glencore Owned	1.3	2.2	3.7	2.5	73	76	75	76	71	90
123	Glencore Owned - Vacant	1.0	1.7	3.0	2.1	72	77	75	77	71	90
125	Glencore Owned	1.9	3.1	4.3	2.7	74	77	76	77	71	90
126	Glencore Owned - Vacant	2.0	3.0	3.8	2.3	74	77	77	77	71	90
127a	Private - Subject to Acq. Rights	1.4	0.9	0.5	0.2	73	79	78	77	71	90
127b	Private - Subject to Acq. Rights	4.4	3.3	1.7	0.7	75	82	80	78	71	90
127c	Private - Subject to Acq. Rights	6.7	4.1	1.8	0.7	77	82	79	76	71	90
127d	Private - Subject to Acq. Rights	6.4	4.2	2.0	0.8	77	82	79	76	71	90
129	Glencore Owned	7.8	5.4	2.7	1.1	78	83	79	76	71	90
130	Glencore Owned	8.0	5.2	2.4	0.9	79	83	79	76	71	90
131	Glencore Owned - Vacant	0.4	0.5	1.5	1.3	73	76	72	71	70	90
134	Private	0.1	0.2	0.4	0.3	70	70	69	69	69	90
135	Private	0.1	0.2	0.3	0.3	69	70	69	69	69	90
136	Private	0.1	0.1	0.3	0.2	69	70	69	69	68	90
143	Private - Subject to Acq. Rights	2.6	1.7	0.8	0.3	74	79	77	75	71	90
144a	Private - Subject to Acq. Rights	0.1	0.1	0.1	0.1	74	85	84	75	74	90
144b	Private - Subject to Acq. Rights	0.1	0.1	0.1	0.0	72	74	74	72	72	90
144c	Private - Subject to Acq. Rights	0.1	0.1	0.1	0.0	72	74	74	72	72	90
145	Private - Subject to Acq. Rights	0.1	0.1	0.1	0.1	73	122	122	74	74	90
146	Other Mine Owned	0.5	0.4	0.3	0.2	72	78	77	75	72	90
147	Private - Subject to Acq. Rights	0.4	0.3	0.2	0.1	73	80	80	76	73	90
148	Other Mine Owned	0.7	0.5	0.3	0.2	73	81	80	78	72	90
149	Community Infrastructure	0.9	0.7	0.5	0.3	73	80	79	75	71	90
150	Private - Subject to Acq. Rights	1.0	0.7	0.5	0.3	73	79	78	75	71	90
151	Other Mine Owned	1.4	1.0	0.7	0.3	74	79	78	75	71	90
152	Private - Subject to Acq. Rights	1.4	1.0	0.6	0.3	73	79	78	75	71	90
154	Private - Subject to Acq. Rights	2.0	1.3	0.7	0.3	74	79	78	75	71	90
155	Private - Subject to Acq. Rights	2.4	1.5	0.8	0.4	74	79	77	75	71	90
156	Private - Subject to Acq. Rights	3.5	2.1	1.0	0.4	74	79	77	75	71	90

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
157	Glencore Owned - Vacant	3.6	4.6	4.3	2.3	75	79	78	78	71	90
158	Other Mine Owned - Vacant	0.2	0.2	0.2	0.1	73	493	492	74	74	90
159	Other Mine Owned - Vacant	0.4	0.3	0.2	0.1	73	81	81	74	73	90
160	Other Mine Owned - Vacant	0.3	0.2	0.2	0.1	73	221	221	74	73	90
161	Glencore Owned - Vacant	0.7	1.0	3.5	3.2	76	93	74	75	73	90
162b	Private	0.0	0.1	0.1	0.1	69	69	69	68	68	90
163	Other Mine Owned	0.6	0.8	1.0	0.6	70	73	72	72	69	90
164	Other Mine Owned	0.7	0.8	1.0	0.6	70	73	72	72	69	90
165	Other Mine Owned	0.7	0.8	1.0	0.6	70	73	72	72	69	90
166	Other Mine Owned - Vacant	4.2	2.3	1.2	0.5	77	83	81	77	71	90
178	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
209	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
210	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
211	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
212	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
213	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
259	Private	0.1	0.1	0.2	0.2	69	70	69	69	68	90
260	Private	0.1	0.1	0.2	0.2	69	70	69	69	68	90
280	Private	0.5	0.7	0.9	0.6	70	73	72	72	69	90
281	Private	0.5	0.7	0.9	0.6	70	73	73	73	69	90
282	Private	0.6	0.8	1.0	0.7	70	73	73	73	69	90
288	Private	0.3	0.4	0.5	0.3	69	71	70	70	69	90
289	Private	0.4	0.5	0.7	0.4	70	71	71	71	69	90
290	Private	0.5	0.7	0.9	0.6	70	72	72	72	69	90
291	Private	0.6	0.8	1.0	0.6	70	73	72	72	69	90
292a	Private	0.5	0.7	0.8	0.5	70	72	72	72	69	90
292b	Private	0.6	0.7	0.9	0.5	70	72	72	72	69	90
293	Private	0.7	0.8	0.9	0.6	70	73	72	72	69	90
294	Private	0.5	0.7	0.8	0.5	70	72	71	71	69	90
295	Private	0.6	0.7	0.8	0.5	70	72	72	72	69	90
296	Private	0.6	0.7	0.8	0.5	70	72	72	72	69	90
297a	Private	0.6	0.7	0.7	0.4	70	73	72	72	69	90
297b	Private	0.6	0.7	0.7	0.4	70	73	72	72	69	90
297c	Private	0.6	0.7	0.7	0.4	70	73	72	72	69	90
297d	Private	0.5	0.6	0.7	0.4	70	72	71	71	69	90
299	Private	0.6	0.7	0.7	0.4	70	73	72	72	69	90
300	Private	0.6	0.7	0.6	0.3	70	73	72	72	69	90
302	Private	0.6	0.6	0.6	0.3	70	73	72	72	70	90
303	Private	0.3	0.4	0.4	0.2	69	71	70	70	69	90
305	Private	0.4	0.5	0.5	0.3	70	71	71	71	69	90
306	Private	0.4	0.5	0.4	0.2	70	72	71	71	69	90
307	Private	0.4	0.5	0.4	0.2	70	72	71	71	69	90
308	Private	0.5	0.5	0.5	0.2	70	72	72	71	69	90
309	Private	0.5	0.5	0.5	0.3	70	72	72	71	69	90
310	Private	0.5	0.5	0.5	0.3	70	72	72	71	69	90
311	Private	0.5	0.5	0.5	0.2	70	72	72	71	69	90
312	Private	0.5	0.5	0.4	0.2	70	72	72	71	70	90
314	Private	0.4	0.4	0.4	0.2	70	72	72	71	70	90
315	Private	0.5	0.5	0.4	0.2	70	72	72	72	70	90
316	Private	0.5	0.5	0.4	0.2	70	72	72	72	70	90
317	Private	0.5	0.5	0.4	0.2	70	72	72	72	70	90
318	Private	0.5	0.5	0.4	0.2	70	72	72	72	70	90
319	Private	0.5	0.5	0.5	0.3	70	72	72	72	70	90

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
320	Private	0.5	0.5	0.5	0.3	70	72	72	72	70	90
321	Private	0.5	0.5	0.5	0.2	70	72	72	72	70	90
322	Private	0.5	0.5	0.5	0.2	70	72	72	72	70	90
323	Private	0.5	0.5	0.5	0.2	70	73	72	72	70	90
324	Private	0.5	0.6	0.5	0.3	70	73	73	72	70	90
325	Private	0.6	0.6	0.5	0.2	71	73	73	72	70	90
326	Private	0.5	0.5	0.4	0.2	71	73	73	72	70	90
327	Private	0.5	0.5	0.4	0.2	71	73	73	72	70	90
328	Private	0.5	0.5	0.4	0.2	71	73	73	72	70	90
329	Private	0.5	0.4	0.4	0.2	71	73	73	73	71	90
330	Private	0.4	0.4	0.3	0.2	71	73	73	72	71	90
337	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
342	Private Infrastructure	7.3	7.6	3.9	0.9	76	82	80	76	71	90
344	Other Mine Owned	0.7	0.8	1.0	0.6	70	73	72	72	69	90
349a	Private	0.4	0.5	0.5	0.3	70	71	71	71	69	90
349b	Private	0.4	0.5	0.5	0.3	70	71	71	71	69	90
350	Community Infrastructure	0.0	0.0	0.1	0.1	68	69	68	68	68	90
351	Other Mine Owned	1.8	1.2	0.7	0.3	73	79	78	75	71	90
352	Other Mine Owned - Vacant	0.8	0.6	0.4	0.2	73	81	81	79	72	90
353	Other Mine Owned	0.5	0.4	0.3	0.1	73	82	81	79	73	90
356	Glencore Owned - Vacant	15.0	56.5	609.4	125.1	80	90	127	679	194	90
357	Glencore Owned - Vacant	4.7	12.2	87.4	188.6	78	81	82	157	257	90
358	Glencore Owned - Vacant	2.6	5.1	20.2	19.6	80	88	75	90	88	90
359	Glencore Owned - Vacant	6.3	6.1	2.4	0.7	75	81	79	75	71	90
360	Glencore Owned - Vacant	0.6	1.0	2.1	1.6	71	76	75	76	70	90
361	Glencore Owned - Vacant	0.4	0.6	1.3	1.0	71	76	76	76	70	90
363	Glencore Owned	0.6	0.9	2.0	1.5	71	76	75	76	70	90
364	Other Mine Owned	0.4	0.3	0.3	0.2	73	89	89	74	73	90
365	Other Mine Owned - Vacant	0.5	0.4	0.3	0.2	72	81	80	74	72	90
366	Other Mine Owned - Vacant	0.5	0.4	0.3	0.2	72	82	81	74	72	90
367	Other Mine Owned	0.5	0.4	0.3	0.2	73	81	81	74	72	90
369	Other Mine Owned - Vacant	0.6	0.4	0.4	0.2	73	80	79	74	72	90
370	Other Mine Owned	0.5	0.4	0.3	0.2	73	80	79	74	72	90
371	Other Mine Owned	0.8	0.6	0.4	0.2	73	79	79	75	72	90
372	Other Mine Owned	0.9	0.6	0.5	0.2	73	79	78	75	72	90
373	Other Mine Owned - Vacant	0.8	0.6	0.5	0.2	73	79	79	75	72	90
374	Other Mine Owned	0.9	0.7	0.5	0.2	73	79	78	75	72	90
375	Other Mine Owned	1.1	0.7	0.5	0.3	73	79	78	75	71	90
376	Other Mine Owned	1.3	0.9	0.6	0.3	73	79	78	75	71	90
377	Other Mine Owned	1.4	1.0	0.6	0.3	73	79	78	75	71	90
378	Other Mine Owned	1.6	1.1	0.7	0.3	74	79	78	75	71	90
379	Other Mine Owned	1.1	0.8	0.6	0.3	73	79	79	75	71	90
380	Other Mine Owned	1.4	1.0	0.6	0.3	73	79	78	75	71	90
381	Other Mine Owned	1.7	1.2	0.7	0.3	74	79	78	75	71	90
382	Other Mine Owned	1.5	1.0	0.6	0.3	73	79	78	75	71	90
383	Other Mine Owned	1.9	1.3	0.7	0.3	74	79	78	75	71	90
384	Other Mine Owned	2.0	1.3	0.8	0.3	74	79	78	75	71	90
385	Other Mine Owned	2.1	1.4	0.8	0.4	74	79	78	75	71	90
386	Other Mine Owned	2.2	1.4	0.8	0.4	74	79	78	75	71	90
387	Other Mine Owned	1.8	1.3	0.7	0.3	74	79	78	75	71	90
388	Other Mine Owned	1.7	1.2	0.7	0.3	74	80	78	75	71	90
389	Other Mine Owned - Vacant	2.1	1.4	0.8	0.4	74	79	78	75	71	90
390	Other Mine Owned	2.0	1.4	0.8	0.4	74	79	78	75	71	90

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
391	Other Mine Owned	3.0	1.8	0.9	0.4	74	79	77	75	71	90
392	Other Mine Owned - Vacant	2.6	1.6	0.8	0.4	74	79	77	75	71	90
394	Other Mine Owned	0.7	0.5	0.4	0.2	73	79	78	75	72	90
395	Other Mine Owned	0.7	0.5	0.4	0.2	73	79	78	75	72	90
396	Other Mine Owned	0.8	0.5	0.4	0.2	73	79	78	75	72	90
397	Other Mine Owned	0.8	0.5	0.4	0.2	73	79	78	75	72	90
398	Other Mine Owned	0.8	0.5	0.4	0.2	73	79	78	75	72	90
399	Other Mine Owned	0.8	0.6	0.4	0.2	73	79	78	75	72	90
400	Other Mine Owned	0.8	0.6	0.4	0.2	73	79	78	75	72	90
401	Other Mine Owned	0.7	0.5	0.4	0.2	73	79	78	75	72	90
402	Other Mine Owned	0.6	0.4	0.3	0.2	73	78	78	75	72	90
403	Other Mine Owned	0.7	0.5	0.4	0.2	73	78	78	75	72	90
404	Other Mine Owned - Vacant	0.5	0.3	0.3	0.1	76	85	85	78	77	90
405	Other Mine Owned - Vacant	1.5	0.9	0.5	0.2	76	84	84	77	74	90
406	Other Mine Owned - Vacant	0.3	0.2	0.2	0.1	73	89	88	74	73	90
407	Other Mine Owned - Vacant	1.7	1.1	0.7	0.3	73	79	78	75	71	90
408	Other Mine Owned	1.3	0.9	0.6	0.3	73	79	78	75	71	90
409	Glencore Owned - Vacant	6.6	6.5	2.5	0.7	75	81	80	75	71	90
411	Glencore Owned - Vacant	0.2	0.2	0.5	0.4	72	74	72	71	69	90
412	Community Infrastructure	0.2	0.3	0.7	0.6	70	71	70	70	69	90
415	Private Infrastructure	0.1	0.2	0.4	0.3	70	70	69	69	69	90
417	Private	0.0	0.0	0.0	0.0	68	68	68	68	68	90
Annual average dust deposition (g/m2/month)											
001	Other Mine Owned - Vacant	0.1	0.1	0.2	0.1	2.4	3.4	3.3	3.3	2.2	4
002	Community Infrastructure	0.1	0.1	0.2	0.2	2.4	3.1	3.0	3.1	2.2	4
003	Other Mine Owned	0.1	0.1	0.2	0.1	2.4	3.0	2.9	2.9	2.2	4
004	Private - Subject to Acq. Rights	0.0	0.1	0.2	0.2	2.4	2.8	2.7	2.8	2.3	4
005	Private - Subject to Acq. Rights	0.1	0.1	0.2	0.1	2.4	2.9	2.8	2.8	2.2	4
006	Community Infrastructure	0.0	0.1	0.2	0.1	2.4	2.8	2.7	2.7	2.2	4
007a	Private	0.0	0.1	0.2	0.1	2.4	2.8	2.7	2.7	2.2	4
007b	Private	0.0	0.1	0.2	0.1	2.4	2.8	2.7	2.7	2.2	4
007c	Private	0.0	0.1	0.1	0.1	2.4	2.7	2.7	2.6	2.2	4
010	Private	0.0	0.0	0.1	0.1	2.5	2.8	2.8	2.7	2.2	4
011	Private	0.0	0.0	0.1	0.1	2.5	2.8	2.8	2.7	2.2	4
012	Private	0.0	0.0	0.1	0.1	2.5	2.8	2.9	2.7	2.2	4
013	Private	0.0	0.0	0.1	0.1	2.4	2.7	2.6	2.4	2.2	4
014	Private	0.0	0.0	0.1	0.0	2.4	2.6	2.5	2.4	2.2	4
015a	Private	0.0	0.0	0.1	0.0	2.3	2.5	2.5	2.3	2.2	4
015b	Private	0.0	0.0	0.1	0.0	2.3	2.5	2.5	2.3	2.2	4
017a	Private	0.0	0.0	0.0	0.0	2.3	2.5	2.4	2.3	2.1	4
017b	Private	0.0	0.0	0.0	0.0	2.3	2.5	2.4	2.3	2.1	4
019	Private	0.0	0.0	0.1	0.1	2.5	2.9	3.0	2.7	2.3	4
021	Private - Subject to Acq. Rights	0.0	0.0	0.1	0.1	2.5	3.0	3.0	2.8	2.3	4
022	Glencore Owned	0.0	0.0	0.1	0.1	2.5	2.9	3.0	2.8	2.3	4
023	Private - Subject to Acq. Rights	0.0	0.0	0.1	0.1	2.6	3.0	3.1	2.8	2.3	4
024	Glencore Owned	0.0	0.0	0.1	0.1	2.6	3.1	3.2	2.9	2.3	4
025	Glencore Owned	0.0	0.0	0.1	0.1	2.6	3.1	3.2	2.9	2.3	4
026	Glencore Owned	0.0	0.0	0.1	0.1	2.6	3.1	3.2	2.9	2.3	4
027	Glencore Owned	0.0	0.0	0.1	0.1	2.6	3.1	3.2	3.0	2.3	4
028	Glencore Owned	0.0	0.0	0.1	0.1	2.6	3.2	3.3	3.0	2.3	4
029	Glencore Owned	0.0	0.0	0.1	0.1	2.6	3.2	3.4	3.1	2.3	4
030	Glencore Owned	0.0	0.0	0.1	0.1	2.7	3.5	4.0	3.8	2.4	4

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
031	Glencore Owned	0.0	0.0	0.1	0.1	2.8	3.6	4.3	3.9	2.4	4
032	Glencore Owned	0.0	0.0	0.1	0.1	2.8	3.4	3.5	3.0	2.3	4
033	Glencore Owned	0.0	0.0	0.1	0.1	2.7	3.1	3.1	2.7	2.3	4
034	Glencore Owned	0.0	0.0	0.1	0.0	2.7	3.0	2.9	2.6	2.2	4
035	Glencore Owned - Vacant	0.0	0.0	0.1	0.0	2.7	2.9	2.9	2.5	2.2	4
036	Glencore Owned	0.0	0.0	0.1	0.1	2.7	3.2	3.1	2.7	2.3	4
037	Glencore Owned - Vacant	0.0	0.0	0.1	0.1	3.0	3.5	3.5	3.0	2.3	4
038	Glencore Owned	0.0	0.0	0.1	0.1	3.1	4.1	4.5	3.7	2.4	4
039	Glencore Owned	0.0	0.0	0.1	0.1	3.0	3.8	4.0	3.4	2.4	4
040	Glencore Owned	0.0	0.0	0.0	0.0	2.2	2.3	2.2	2.1	2.1	4
041	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
042	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
043	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
044a	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
044b	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
045	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
046	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
047	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
048	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
049	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
050	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
051	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
052	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
053	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
054	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
055	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
056a	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
056b	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
057	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
058	Private	0.0	0.0	0.0	0.0	2.0	2.1	2.0	2.0	2.0	4
059	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
060	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
061	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
062	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.0	2.0	4
063a	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.0	2.0	4
068	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.1	2.0	4
069a	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.1	2.0	4
069b	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.1	2.0	4
071	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.1	2.0	4
072	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.1	2.0	4
073	Private	0.0	0.0	0.0	0.0	2.1	2.2	2.1	2.1	2.0	4
074	Private	0.0	0.0	0.0	0.0	2.2	2.3	2.3	2.2	2.1	4
075	Private	0.0	0.0	0.0	0.0	2.1	2.2	2.2	2.1	2.1	4
076	Private	0.0	0.0	0.0	0.0	2.1	2.2	2.2	2.1	2.1	4
077	Private	0.0	0.0	0.0	0.0	2.1	2.2	2.1	2.1	2.1	4
082	Private	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.1	2.1	4
083	Private	0.0	0.0	0.0	0.0	2.2	2.4	2.3	2.2	2.1	4
084a	Private	0.0	0.0	0.0	0.0	2.2	2.3	2.2	2.2	2.1	4
085	Private	0.0	0.0	0.1	0.0	2.2	2.3	2.3	2.2	2.1	4
086	Private	0.0	0.0	0.1	0.0	2.2	2.4	2.3	2.3	2.1	4
087	Private	0.0	0.0	0.1	0.0	2.3	2.4	2.3	2.3	2.1	4
088	Private	0.0	0.0	0.1	0.1	2.3	2.4	2.4	2.3	2.1	4
089	Private	0.0	0.0	0.1	0.1	2.3	2.5	2.4	2.4	2.2	4

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
090	Other Mine Owned	0.0	0.0	0.1	0.1	2.3	2.5	2.5	2.4	2.2	4
091	Private	0.0	0.0	0.1	0.1	2.3	2.5	2.5	2.4	2.2	4
092	Private	0.0	0.1	0.1	0.1	2.4	2.6	2.6	2.5	2.2	4
093	Private	0.0	0.0	0.1	0.1	2.4	2.7	2.7	2.5	2.2	4
094	Private	0.0	0.0	0.1	0.1	2.4	2.6	2.5	2.4	2.2	4
095	Private	0.0	0.0	0.1	0.1	2.3	2.5	2.5	2.3	2.2	4
096	Private	0.0	0.0	0.1	0.1	2.3	2.4	2.4	2.3	2.1	4
097	Private	0.0	0.0	0.1	0.1	2.3	2.4	2.4	2.3	2.1	4
098	Private	0.0	0.0	0.1	0.1	2.3	2.4	2.4	2.3	2.1	4
099	Private	0.0	0.1	0.1	0.1	2.3	2.5	2.4	2.4	2.2	4
100	Private	0.0	0.1	0.1	0.1	2.3	2.5	2.5	2.4	2.2	4
101	Private	0.0	0.1	0.1	0.1	2.3	2.5	2.4	2.4	2.2	4
102a	Private	0.0	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
102b	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
104	Other Mine Owned	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.5	2.2	4
105	Private - Subject to Acq. Rights	0.1	0.1	0.2	0.2	2.4	2.9	2.7	2.9	2.3	4
108	Glencore Owned	0.3	0.4	0.4	0.2	2.7	3.1	3.1	3.1	2.4	4
109	Glencore Owned	0.3	0.4	0.4	0.3	2.7	3.1	3.1	3.1	2.4	4
110	Other Mine Owned - Vacant	0.3	0.3	0.3	0.1	2.7	3.4	3.3	3.2	2.3	4
111	Private - Subject to Acq. Rights	0.3	0.3	0.2	0.1	2.7	3.9	3.8	3.7	2.3	4
112	Private - Subject to Acq. Rights	0.0	0.1	0.1	0.1	2.5	2.9	2.9	2.8	2.3	4
114	Private - Subject to Acq. Rights	0.0	0.1	0.2	0.2	2.4	2.9	2.8	2.9	2.3	4
115	Private - Subject to Acq. Rights	0.1	0.1	0.2	0.2	2.4	2.9	2.8	2.9	2.3	4
116	Glencore Owned	0.1	0.1	0.2	0.2	2.4	2.9	2.7	2.8	2.3	4
117	Glencore Owned	0.1	0.1	0.3	0.2	2.4	2.9	2.7	2.9	2.3	4
120	Glencore Owned - Vacant	0.1	0.2	0.3	0.3	2.5	3.0	2.7	2.9	2.3	4
121	Glencore Owned - Vacant	0.2	0.3	0.5	0.3	2.6	3.0	2.9	3.0	2.4	4
122	Glencore Owned	0.2	0.3	0.5	0.3	2.6	2.9	2.8	3.0	2.4	4
123	Glencore Owned - Vacant	0.1	0.2	0.4	0.3	2.6	3.0	2.8	3.0	2.4	4
125	Glencore Owned	0.2	0.4	0.6	0.3	2.7	3.0	3.0	3.1	2.4	4
126	Glencore Owned - Vacant	0.3	0.4	0.5	0.3	2.7	3.0	3.0	3.1	2.4	4
127a	Private - Subject to Acq. Rights	0.2	0.1	0.0	0.0	2.6	3.4	3.3	3.1	2.4	4
127b	Private - Subject to Acq. Rights	0.6	0.4	0.2	0.1	2.9	3.7	3.4	3.1	2.3	4
127c	Private - Subject to Acq. Rights	0.8	0.5	0.2	0.1	3.1	3.7	3.3	2.9	2.3	4
127d	Private - Subject to Acq. Rights	0.8	0.5	0.2	0.1	3.1	3.7	3.4	3.0	2.3	4
129	Glencore Owned	1.0	0.7	0.3	0.1	3.4	3.8	3.4	2.9	2.3	4
130	Glencore Owned	1.0	0.7	0.3	0.1	3.4	3.9	3.4	2.9	2.3	4
131	Glencore Owned - Vacant	0.0	0.1	0.1	0.1	2.5	2.8	2.4	2.4	2.2	4
134	Private	0.0	0.0	0.0	0.0	2.2	2.2	2.2	2.1	2.1	4
135	Private	0.0	0.0	0.0	0.0	2.2	2.2	2.1	2.1	2.1	4
136	Private	0.0	0.0	0.0	0.0	2.1	2.2	2.1	2.1	2.1	4
143	Private - Subject to Acq. Rights	0.3	0.2	0.1	0.0	2.7	3.3	3.1	2.9	2.3	4
144a	Private - Subject to Acq. Rights	0.0	0.0	0.0	0.0	2.8	3.7	3.7	2.9	2.9	4
144b	Private - Subject to Acq. Rights	0.0	0.0	0.0	0.0	2.5	2.7	2.7	2.5	2.5	4
144c	Private - Subject to Acq. Rights	0.0	0.0	0.0	0.0	2.5	2.7	2.7	2.5	2.5	4
145	Private - Subject to Acq. Rights	0.0	0.0	0.0	0.0	2.8	6.9	6.9	2.9	2.9	4
146	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.1	2.9	2.5	4
147	Private - Subject to Acq. Rights	0.0	0.0	0.0	0.0	2.7	3.4	3.4	3.0	2.7	4
148	Other Mine Owned	0.1	0.1	0.0	0.0	2.6	3.4	3.4	3.2	2.6	4
149	Community Infrastructure	0.1	0.1	0.0	0.0	2.7	3.3	3.3	2.9	2.5	4
150	Private - Subject to Acq. Rights	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4
151	Other Mine Owned	0.1	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
152	Private - Subject to Acq. Rights	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
154	Private - Subject to Acq. Rights	0.2	0.1	0.1	0.0	2.7	3.3	3.1	2.9	2.4	4
155	Private - Subject to Acq. Rights	0.3	0.2	0.1	0.0	2.7	3.3	3.1	2.9	2.4	4
156	Private - Subject to Acq. Rights	0.4	0.2	0.1	0.0	2.8	3.4	3.1	2.8	2.3	4
157	Glencore Owned - Vacant	0.5	0.6	0.6	0.3	2.9	3.2	3.2	3.1	2.4	4
158	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.7	44.9	44.9	2.9	2.8	4
159	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.6	3.4	3.4	2.8	2.6	4
160	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.7	15.0	15.0	2.9	2.8	4
161	Glencore Owned - Vacant	0.1	0.1	0.3	0.3	2.8	4.5	2.6	2.7	2.5	4
162b	Private	0.0	0.0	0.0	0.0	2.1	2.1	2.1	2.0	2.0	4
163	Other Mine Owned	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.6	2.2	4
164	Other Mine Owned	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.5	2.2	4
165	Other Mine Owned	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.5	2.2	4
166	Other Mine Owned - Vacant	0.4	0.2	0.1	0.0	2.9	3.6	3.3	3.0	2.4	4
178	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
209	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
210	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
211	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
212	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
213	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
259	Private	0.0	0.0	0.0	0.0	2.2	2.3	2.2	2.1	2.1	4
260	Private	0.0	0.0	0.0	0.0	2.2	2.3	2.2	2.1	2.1	4
280	Private	0.1	0.1	0.1	0.1	2.3	2.7	2.6	2.6	2.2	4
281	Private	0.1	0.1	0.1	0.1	2.3	2.7	2.6	2.6	2.2	4
282	Private	0.1	0.1	0.2	0.1	2.3	2.7	2.6	2.6	2.2	4
288	Private	0.0	0.1	0.1	0.1	2.2	2.4	2.3	2.3	2.1	4
289	Private	0.1	0.1	0.1	0.1	2.2	2.5	2.4	2.4	2.1	4
290	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
291	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.5	2.2	4
292a	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
292b	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
293	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.5	2.2	4
294	Private	0.1	0.1	0.1	0.1	2.3	2.5	2.5	2.4	2.2	4
295	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
296	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.5	2.5	2.2	4
297a	Private	0.1	0.1	0.1	0.1	2.3	2.7	2.6	2.6	2.2	4
297b	Private	0.1	0.1	0.1	0.1	2.3	2.7	2.6	2.6	2.2	4
297c	Private	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.6	2.2	4
297d	Private	0.1	0.1	0.1	0.1	2.3	2.5	2.5	2.4	2.2	4
299	Private	0.1	0.1	0.1	0.1	2.3	2.7	2.6	2.5	2.2	4
300	Private	0.1	0.1	0.1	0.0	2.3	2.7	2.6	2.5	2.2	4
302	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
303	Private	0.0	0.1	0.1	0.0	2.2	2.4	2.4	2.3	2.1	4
305	Private	0.1	0.1	0.1	0.0	2.2	2.5	2.5	2.4	2.2	4
306	Private	0.1	0.1	0.1	0.0	2.3	2.5	2.5	2.4	2.2	4
307	Private	0.1	0.1	0.1	0.0	2.3	2.5	2.5	2.4	2.2	4
308	Private	0.1	0.1	0.1	0.0	2.3	2.5	2.5	2.4	2.2	4
309	Private	0.1	0.1	0.1	0.0	2.3	2.5	2.5	2.5	2.2	4
310	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.5	2.5	2.2	4
311	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.5	2.5	2.2	4
312	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.5	2.5	2.2	4
314	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
315	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.3	4
316	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
317	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
318	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
319	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
320	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
321	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
322	Private	0.1	0.1	0.1	0.0	2.3	2.6	2.6	2.5	2.2	4
323	Private	0.1	0.1	0.1	0.0	2.3	2.7	2.6	2.5	2.2	4
324	Private	0.1	0.1	0.1	0.0	2.3	2.7	2.6	2.5	2.2	4
325	Private	0.1	0.1	0.1	0.0	2.4	2.7	2.7	2.6	2.3	4
326	Private	0.1	0.1	0.1	0.0	2.4	2.7	2.6	2.6	2.3	4
327	Private	0.1	0.1	0.1	0.0	2.4	2.7	2.6	2.6	2.3	4
328	Private	0.1	0.1	0.1	0.0	2.4	2.7	2.6	2.5	2.3	4
329	Private	0.1	0.1	0.0	0.0	2.4	2.7	2.7	2.6	2.3	4
330	Private	0.1	0.1	0.0	0.0	2.4	2.7	2.6	2.5	2.3	4
337	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4
342	Private Infrastructure	0.8	0.7	0.3	0.1	2.9	3.5	3.2	2.7	2.3	4
344	Other Mine Owned	0.1	0.1	0.1	0.1	2.3	2.6	2.6	2.5	2.2	4
349a	Private	0.1	0.1	0.1	0.0	2.2	2.5	2.5	2.4	2.2	4
349b	Private	0.1	0.1	0.1	0.0	2.3	2.5	2.5	2.4	2.2	4
350	Community Infrastructure	0.0	0.0	0.0	0.0	2.1	2.1	2.0	2.0	2.0	4
351	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
352	Other Mine Owned - Vacant	0.1	0.1	0.0	0.0	2.6	3.6	3.5	3.3	2.5	4
353	Other Mine Owned	0.1	0.0	0.0	0.0	2.7	3.5	3.4	3.2	2.6	4
356	Glencore Owned - Vacant	1.5	5.9	57.5	11.1	3.4	4.4	8.2	59.7	13.2	4
357	Glencore Owned - Vacant	0.4	1.2	7.9	16.5	3.2	3.4	3.4	10.1	18.5	4
358	Glencore Owned - Vacant	0.2	0.5	2.2	2.1	3.4	4.1	2.7	4.3	4.2	4
359	Glencore Owned - Vacant	0.6	0.5	0.2	0.1	2.9	3.4	3.1	2.6	2.3	4
360	Glencore Owned - Vacant	0.1	0.1	0.3	0.2	2.4	2.9	2.7	2.9	2.3	4
361	Glencore Owned - Vacant	0.0	0.1	0.2	0.2	2.5	2.9	2.9	2.9	2.3	4
363	Glencore Owned	0.1	0.1	0.3	0.2	2.4	2.9	2.7	2.9	2.3	4
364	Other Mine Owned	0.0	0.0	0.0	0.0	2.6	4.0	3.9	2.8	2.6	4
365	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.6	3.4	3.3	2.8	2.5	4
366	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.6	3.4	3.4	2.8	2.6	4
367	Other Mine Owned	0.0	0.0	0.0	0.0	2.6	3.4	3.3	2.8	2.6	4
369	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.6	3.3	3.2	2.8	2.5	4
370	Other Mine Owned	0.0	0.0	0.0	0.0	2.6	3.3	3.3	2.8	2.6	4
371	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.3	3.2	2.9	2.5	4
372	Other Mine Owned	0.1	0.1	0.0	0.0	2.6	3.3	3.2	2.9	2.5	4
373	Other Mine Owned - Vacant	0.1	0.1	0.0	0.0	2.6	3.3	3.2	2.9	2.5	4
374	Other Mine Owned	0.1	0.1	0.0	0.0	2.6	3.3	3.2	2.9	2.5	4
375	Other Mine Owned	0.1	0.1	0.0	0.0	2.6	3.3	3.2	2.9	2.5	4
376	Other Mine Owned	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4
377	Other Mine Owned	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4
378	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
379	Other Mine Owned	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4
380	Other Mine Owned	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4
381	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
382	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
383	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
384	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
385	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
386	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
387	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4

ID	Status	Project in isolation				Cumulative					Criteria
		Year 1	Year 6	Year 13	Year 18	2014	Year 1	Year 6	Year 13	Year 18	
388	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
389	Other Mine Owned - Vacant	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
390	Other Mine Owned	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
391	Other Mine Owned	0.3	0.2	0.1	0.0	2.8	3.3	3.1	2.9	2.3	4
392	Other Mine Owned - Vacant	0.3	0.2	0.1	0.0	2.7	3.3	3.1	2.9	2.4	4
394	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
395	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
396	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
397	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
398	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
399	Other Mine Owned	0.1	0.1	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
400	Other Mine Owned	0.1	0.1	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
401	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.2	2.9	2.5	4
402	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.1	2.9	2.5	4
403	Other Mine Owned	0.1	0.0	0.0	0.0	2.6	3.2	3.1	2.9	2.5	4
404	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	3.1	4.3	4.2	3.3	3.2	4
405	Other Mine Owned - Vacant	0.1	0.1	0.0	0.0	2.9	3.7	3.7	3.0	2.8	4
406	Other Mine Owned - Vacant	0.0	0.0	0.0	0.0	2.7	4.0	4.0	2.9	2.7	4
407	Other Mine Owned - Vacant	0.2	0.1	0.1	0.0	2.7	3.3	3.2	2.9	2.4	4
408	Other Mine Owned	0.1	0.1	0.0	0.0	2.7	3.3	3.2	2.9	2.4	4
409	Glencore Owned - Vacant	0.7	0.5	0.2	0.1	2.9	3.4	3.1	2.6	2.3	4
411	Glencore Owned - Vacant	0.0	0.0	0.1	0.0	2.5	2.7	2.5	2.3	2.2	4
412	Community Infrastructure	0.0	0.0	0.1	0.1	2.3	2.4	2.2	2.2	2.1	4
415	Private Infrastructure	0.0	0.0	0.0	0.0	2.2	2.3	2.2	2.1	2.1	4
417	Private	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4

Appendix H. Model Inputs for Construction Activities

Emission inventory
Glendell Mine Construction

	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables						
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	Area (m2)	(ws/2.2)^1.3	Moisture (%)	kg/VKT	t/truck	km/trip	Silt (%)
MIA - dozers working	16798	4059	1764	0	1004	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	10
MIA - excavators loading	2696	1275	193	0	1655310	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
MIA - trucks hauling	10455	3089	314	85	1655310	t/y	0.04211	kg/t	0.01244	kg/t	0.001	kg/t	-	-	-	4	190	2	-
MIA - trucks dumping	2696	1275	193	0	1655310	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
MIA - wind erosion	27031	13934	2027	0	32	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
HVAR - dozers working	16798	4059	1764	0	1004	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	10
HVAR - excavators loading	2652	1254	190	0	1628234	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
HVAR - trucks hauling	10284	3039	309	85	1628234	t/y	0.04211	kg/t	0.01244	kg/t	0.001	kg/t	-	-	-	4	190	2	-
HVAR - trucks dumping	2652	1254	190	0	1628234	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
HVAR - wind erosion	27031	13934	2027	0	32	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Hebden Rd - dozers working	16798	4059	1764	0	1004	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	10
Hebden Rd - excavators loading	972	460	70	0	596530	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
Hebden Rd - trucks hauling	3768	1113	113	85	596530	t/y	0.04211	kg/t	0.01244	kg/t	0.001	kg/t	-	-	-	4	190	2	-
Hebden Rd - trucks dumping	972	460	70	0	596530	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
Hebden Rd - wind erosion	27031	13934	2027	0	32	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Yorks Ck - dozers working	16798	4059	1764	0	1004	h/y	16.7	kg/h	4.04419	kg/h	1.757	kg/h	-	-	2	-	-	-	10
Yorks Ck - excavators loading	627	297	45	0	385174	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
Yorks Ck - trucks hauling	2433	719	73	85	385174	t/y	0.04211	kg/t	0.01244	kg/t	0.001	kg/t	-	-	-	4	190	2	-
Yorks Ck - trucks dumping	627	297	45	0	385174	t/y	0.00163	kg/t	0.00077	kg/t	0.0001	kg/t	-	1.38	2	-	-	-	-
Yorks Ck - wind erosion	27031	13934	2027	0	32	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Blasting	4045	2103	121	0	52	blasts/y	77.8	kg/blast	40.4	kg/blast	2.3	kg/blast	5000	-	-	-	-	-	-
Total (Construction)	220195	88608	17089																
Total (Operations Year 1)	2241625	681177	128378																
	10%	13%	13%																

JACOBS

Source locations
Glendell Mine Construction

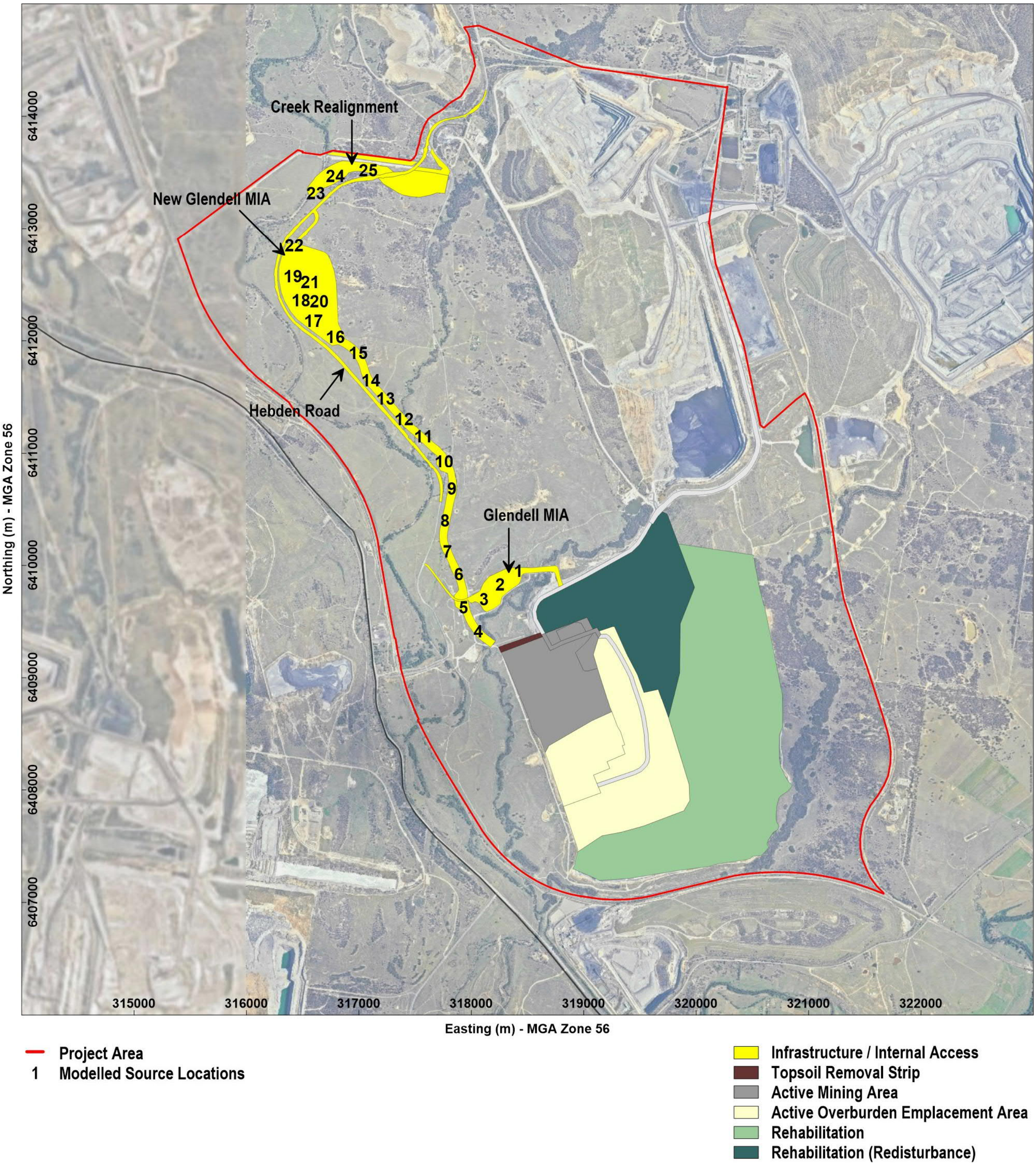


Figure H1 Location of modelled sources for construction

Source allocations
Glendell Mine Construction

```
 --------------------------------      26-Nov-2019 13:55
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : MIA - dozers working
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 16798 kg/y TSP  4059 kg/y PM10  1764 kg/y PM2.5
 FROM SOURCES  : 8
15 16 17 18 19 20 21 22
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : MIA - excavators loading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2696 kg/y TSP  1275 kg/y PM10  193 kg/y PM2.5
 FROM SOURCES  : 8
15 16 17 18 19 20 21 22
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : MIA - trucks hauling
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 10455 kg/y TSP  3089 kg/y PM10  314 kg/y PM2.5
 FROM SOURCES  : 8
15 16 17 18 19 20 21 22
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : MIA - trucks dumping
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2696 kg/y TSP  1275 kg/y PM10  193 kg/y PM2.5
 FROM SOURCES  : 8
15 16 17 18 19 20 21 22
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : MIA - wind erosion
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 27031 kg/y TSP  13934 kg/y PM10  2027 kg/y PM2.5
 FROM SOURCES  : 8
15 16 17 18 19 20 21 22
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : HVAR - dozers working
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 16798 kg/y TSP  4059 kg/y PM10  1764 kg/y PM2.5
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : HVAR - excavators loading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2652 kg/y TSP  1254 kg/y PM10  190 kg/y PM2.5
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : HVAR - trucks hauling
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 10284 kg/y TSP  3039 kg/y PM10  309 kg/y PM2.5
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : HVAR - trucks dumping
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2652 kg/y TSP  1254 kg/y PM10  190 kg/y PM2.5
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : HVAR - wind erosion
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 27031 kg/y TSP  13934 kg/y PM10  2027 kg/y PM2.5
 FROM SOURCES  : 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hebden Rd - dozers working
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 16798 kg/y TSP  4059 kg/y PM10  1764 kg/y PM2.5
 FROM SOURCES  : 15
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Hebden Rd - excavators loading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 972 kg/y TSP  460 kg/y PM10  70 kg/y PM2.5
```

```
 FROM SOURCES  : 15
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Hebden Rd - trucks hauling
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3768 kg/y TSP  1113 kg/y PM10  113 kg/y PM2.5
 FROM SOURCES  : 15
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Hebden Rd - trucks dumping
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 972 kg/y TSP  460 kg/y PM10  70 kg/y PM2.5
 FROM SOURCES  : 15
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Hebden Rd - wind erosion
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 27031 kg/y TSP  13934 kg/y PM10  2027 kg/y PM2.5
 FROM SOURCES  : 15
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Yorks Ck - dozers working
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 16798 kg/y TSP  4059 kg/y PM10  1764 kg/y PM2.5
 FROM SOURCES  : 3
23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Yorks Ck - excavators loading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 627 kg/y TSP  297 kg/y PM10  45 kg/y PM2.5
 FROM SOURCES  : 3
23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Yorks Ck - trucks hauling
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2433 kg/y TSP  719 kg/y PM10  73 kg/y PM2.5
 FROM SOURCES  : 3
23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Yorks Ck - trucks dumping
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 627 kg/y TSP  297 kg/y PM10  45 kg/y PM2.5
 FROM SOURCES  : 3
23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Yorks Ck - wind erosion
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 27031 kg/y TSP  13934 kg/y PM10  2027 kg/y PM2.5
 FROM SOURCES  : 3
23 24 25
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 4045 kg/y TSP  2103 kg/y PM10  121 kg/y PM2.5
 FROM SOURCES  : 25
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0
```