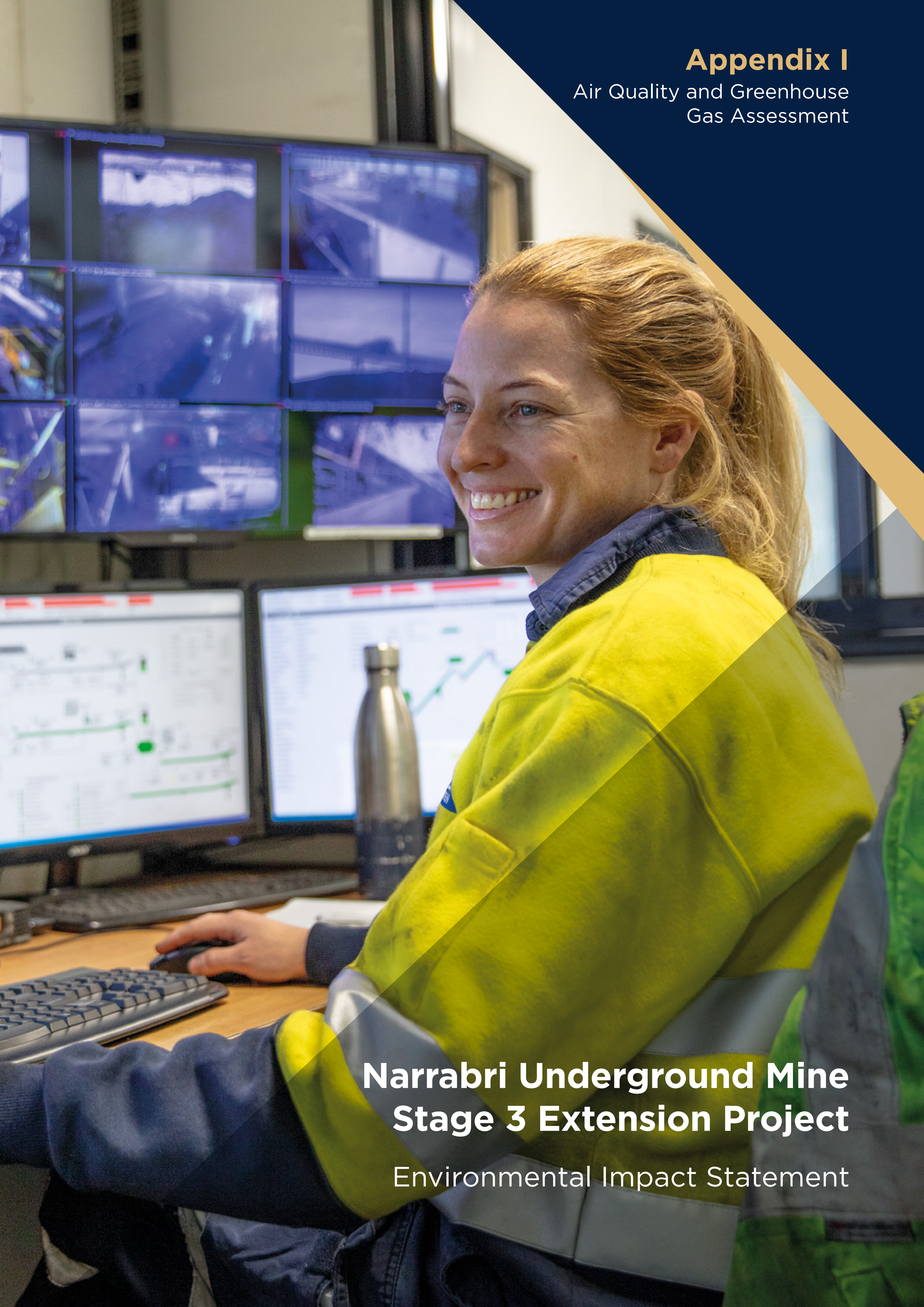

Appendix I

Air Quality and Greenhouse Gas Assessment

Narrabri Underground Mine Stage 3 Extension Project

Environmental Impact Statement

Narrabri Underground Mine Stage 3 Extension Project

Narrabri Coal Operations Pty Ltd

Air Quality and Greenhouse Gas Assessment

Final Report

24 August 2020

-

Narrabri Underground Mine Stage 3 Extension Project

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Document history and status

Revision	Date	Description	By	Review	Approved
F1R1	24/8/20	Final Report	SL	RS	PH

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Acronyms and definitions

Abbreviation	Definition
BoM	Bureau of Meteorology
CALPUFF	Computer-based air dispersion model
CHPP	Coal handling and preparation plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEE	Department of Environment and Energy (now the Department of Agriculture, Water and the Environment)
DPIE	Department of Planning, Industry and Environment
EPA	NSW Environment Protection Authority
EPL	Environmental Protection Licence
GHG	Greenhouse gas
GWP	Global warming potential
HVAS	High volume air sampler
Jacobs	Jacobs Group (Australia) Pty Limited
Mtpa	Million tonnes per annum
NCOPL	Narrabri Coal Operations Pty Ltd
NEPM	National Environment Protection Measure
NEPC	National Environmental Protection Council of Australia
NGA Factors	National Greenhouse Accounts Factors
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
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 presents the results of the air quality assessment for the Narrabri Underground Mine Stage 3 Extension Project (the Project) including quantification of greenhouse gas emissions. 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. Greenhouse gas emissions have also been estimated in accordance with recognised methodologies.

The main potential air quality issue was identified as dust, that is, particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}) or particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) from the general mining activities. This issue was the focus of the assessment.

A detailed review of the existing environment was carried out to understand any current air quality related issues. The following conclusions were made in relation to the existing environment:

- The most common winds in the area are from the northwest and southeast.
- Particulate matter levels were heavily influenced by drought conditions in 2017 and 2018. The Office of Environment and Heritage (OEH) (now within the Department of Planning, Industry and Environment [DPIE] – Biodiversity Conservation Division) reported that, in 2018, particle levels increased across New South Wales (NSW) due to dust from the intense widespread drought, and smoke from bushfires and hazard reduction burning (OEH, 2019b).
- PM_{10} (as 24-hour and annual average) concentrations comply with the NSW Environment Protection Authority (EPA) criteria, based on data collected in the vicinity of the Narrabri Mine.
- $PM_{2.5}$ concentrations comply with EPA criteria, if estimated from PM_{10} measurements using relationships measured at the Narrabri Mine.
- TSP concentrations comply with EPA criteria, if estimated from PM_{10} measurements using relationships measured in rural areas (NSW Minerals Council, 2000; Jacobs, 2018).
- Deposited dust levels comply with EPA criteria, based on data collected in the vicinity of the Narrabri Mine.
- Conditions in 2014 were representative, and continue to be 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. 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 focus of the assessment was on the potential change in air quality, noting that the Narrabri Mine will already contribute to the existing air quality.

The main conclusions of the assessment were as follows:

- 24-hour and annual average PM_{10} concentrations would not exceed EPA or NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP) criteria at any private sensitive receptor, based on model predictions. This outcome is consistent with historical ambient air quality monitoring which has not shown any exceedances in the past six years (except during regional dust events).
- 24-hour and annual average $PM_{2.5}$ concentrations would not exceed EPA or VLAMP criteria at any private sensitive receptor, based on model predictions.
- Annual average TSP concentrations and dust deposition levels would not exceed EPA or VLAMP criteria at any private sensitive receptor, based on model predictions.
- The estimated annual average Scope 1 and 2 emissions from the Project represent approximately 0.22 per cent (%) of Australia's 2017 emissions.

It has therefore been concluded that the Project could proceed without causing adverse air quality impacts at private sensitive receptors. This conclusion has been informed by monitoring data which show that activities at the existing approved Narrabri Mine are generally not causing adverse off-site air quality impacts and predicted compliance with relevant criteria. Accordingly, continuation of current air quality mitigation and management measures is proposed.

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 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. 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

The Narrabri Mine is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah within the Narrabri Shire Council Local Government Area (LGA) of New South Wales (NSW) (**Figure 1**). The Narrabri Mine is operated by Narrabri Coal Operations Pty Limited (NCOPL).

Jacobs Group (Australia) Pty Ltd (Jacobs) has been engaged by NCOPL to complete an air quality and greenhouse gas assessment for the Project. The purpose of the assessment is to form part of the Environmental Impact Statement (EIS) to accompany an application for Development Consent under the State Significant Development provisions of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The air quality impact assessment has been carried out in accordance with relevant guidelines published by the NSW Environment Protection Authority (EPA), namely, the “Approved Methods for the Modelling and Assessment of Air Pollutants in NSW” (EPA, 2016) (hereafter referred to as “the Approved Methods”). 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:

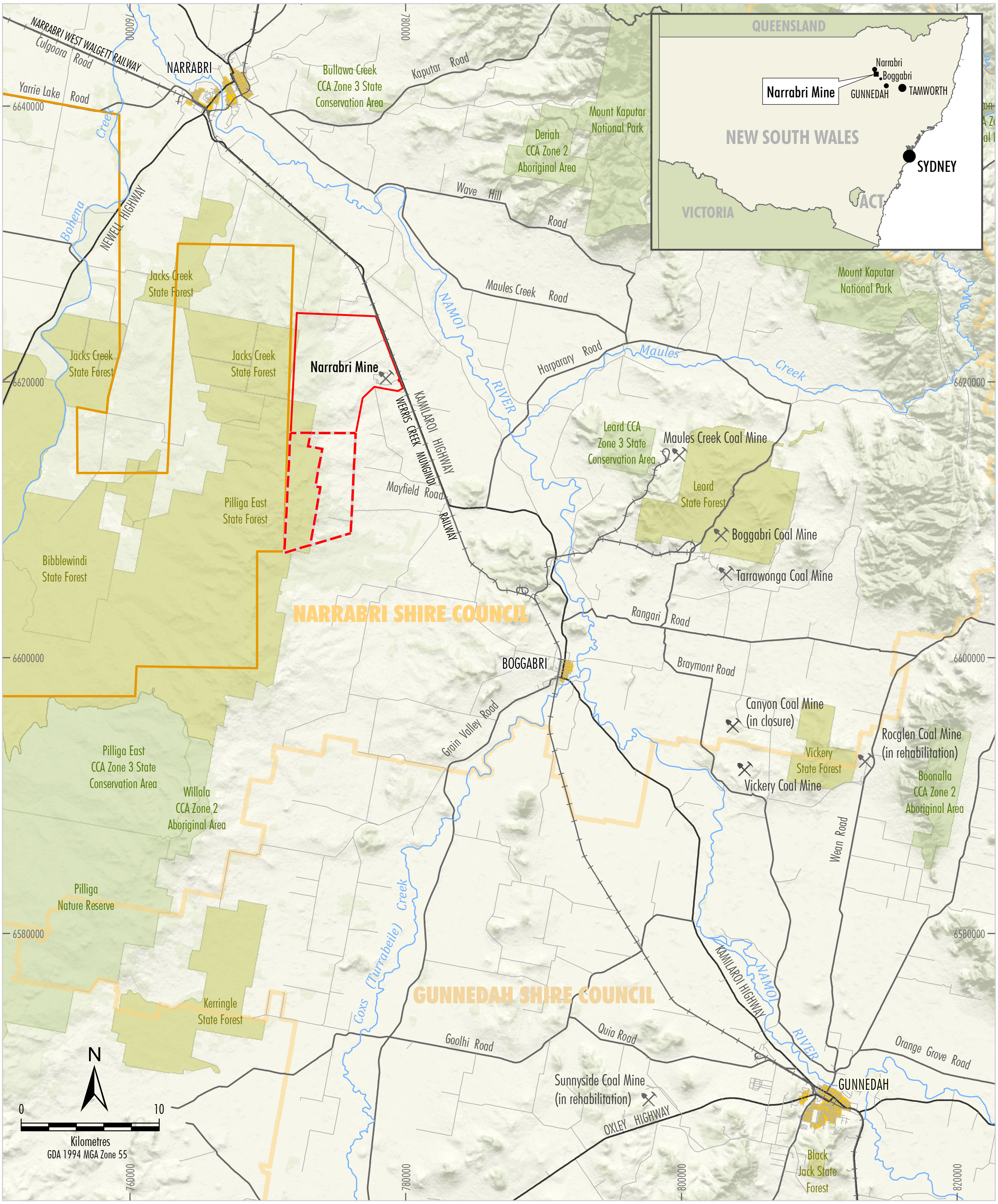
- Identify potential air quality and greenhouse gas issues;
- Quantify existing and potential air quality and greenhouse gas impacts; and
- Identify suitable air quality and greenhouse gas management measures, as appropriate, to minimise impacts.

The Secretary’s Environmental Assessment Requirements (SEARs) for the Project were issued by the Department of Planning, Industry and Environment (DPIE) and identify the specific requirements to be addressed by the Project EIS. 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. **Appendix A** lists the EPA and NSW Health requirements that accompany the SEARs.

Table 1 Relevant matters raised in the SEARs

Requirement	Section(s) where addressed
Air quality – including: - an assessment of the likely air quality impacts of the development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*; and - an assessment of the likely greenhouse gas emissions of the development;	This report, in particular: - **Section 3** (identification of issues) - **Section 8** (assessment of air quality impacts) - **Section 9** (assessment of greenhouse gas emissions)

The air quality assessment was based on the use of an air dispersion model, CALPUFF (TRC, 2007), 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. The greenhouse gas assessment was carried out with reference to the Department of Environment and Energy’s (DEE’s) (now the Department of Agriculture, Water and the Environment) “National Greenhouse Accounts Factors” (NGA Factors) (DEE, 2019) and the “Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia” (DEE, 2017).



WHC-17-54_NSP_Stg3_EIS App AQA_203B

LEGEND

- Mine Site
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Local Government Boundary
- State Forest
- State Conservation Area, Aboriginal Area
- Narrabri Gas Project (Santos NSW [Eastern] Pty Ltd)

Source: Geoscience Australia (2011); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Regional Location

Figure 1

In summary, the report provides information on the following:

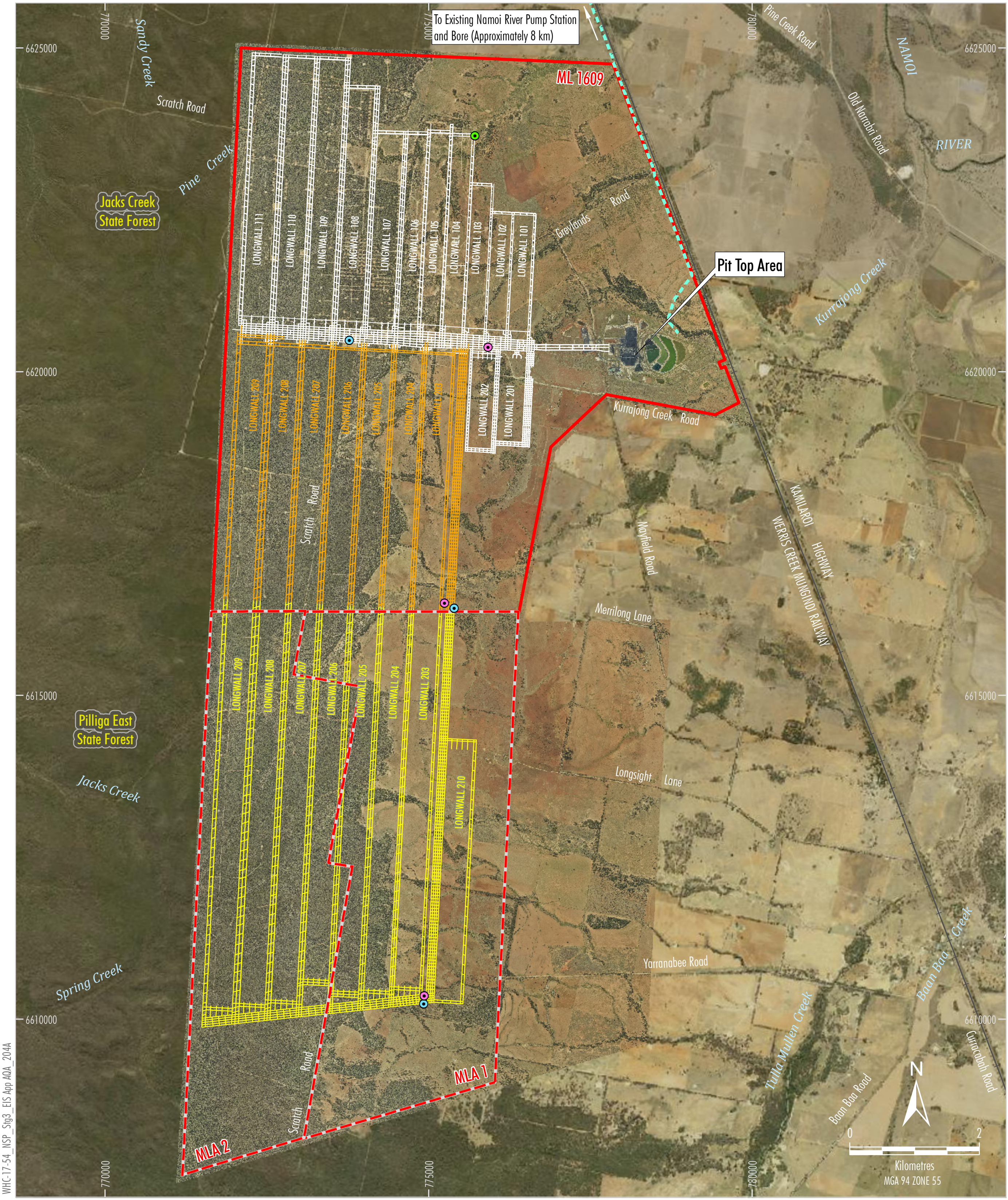
- Proposed mining activities (**Section 2**);
- Potential air quality issues (**Section 3**);
- Relevant policy relating to air quality and greenhouse gas (**Section 4**);
- Existing meteorological and air quality conditions (**Section 5**);
- Emissions to air from proposed mining activities (**Section 6**);
- Methods used to predict air quality impacts and assess greenhouse gas emissions (**Section 7**);
- Expected air quality impacts, as determined by a comparison of model results with air quality assessment criteria (**Section 8**); and
- An assessment of greenhouse gas emissions (**Section 9**).

2. Project Description

The Project involves an extension to the south of the approved underground mining area to gain access to additional coal reserves within Mining Lease Applications (MLA) 1 and 2 (**Figure 2**), an extension of the mine life to 2044 and development of supporting surface infrastructure. ROM coal production would occur at a rate of up to 11 Mtpa, consistent with the currently approved limit. A detailed description of the Project is provided in Section 2 in the Main Report of the EIS.

Figure 3 shows the location of the Narrabri Mine including the nearest sensitive receptors[1].

[1] Receivers at Baan Baa have been removed to minimise duplicated results. Receiver 738a is located on the north-west edge of Baan Baa has been retained and is conservatively assumed to be representative of receivers at Baan Baa.



LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing Namoi River Pipeline (Buried)
- Approved Underground Mining Layout
- Indicative Underground Mining Layout to be Extended for Project
- Indicative Underground Project Mining Layout
- Indicative Ventilation Complex (Downcast)
- Indicative Ventilation Complex (Upcast)
- Indicative Ventilation Complex (Upcast - Decommissioned)

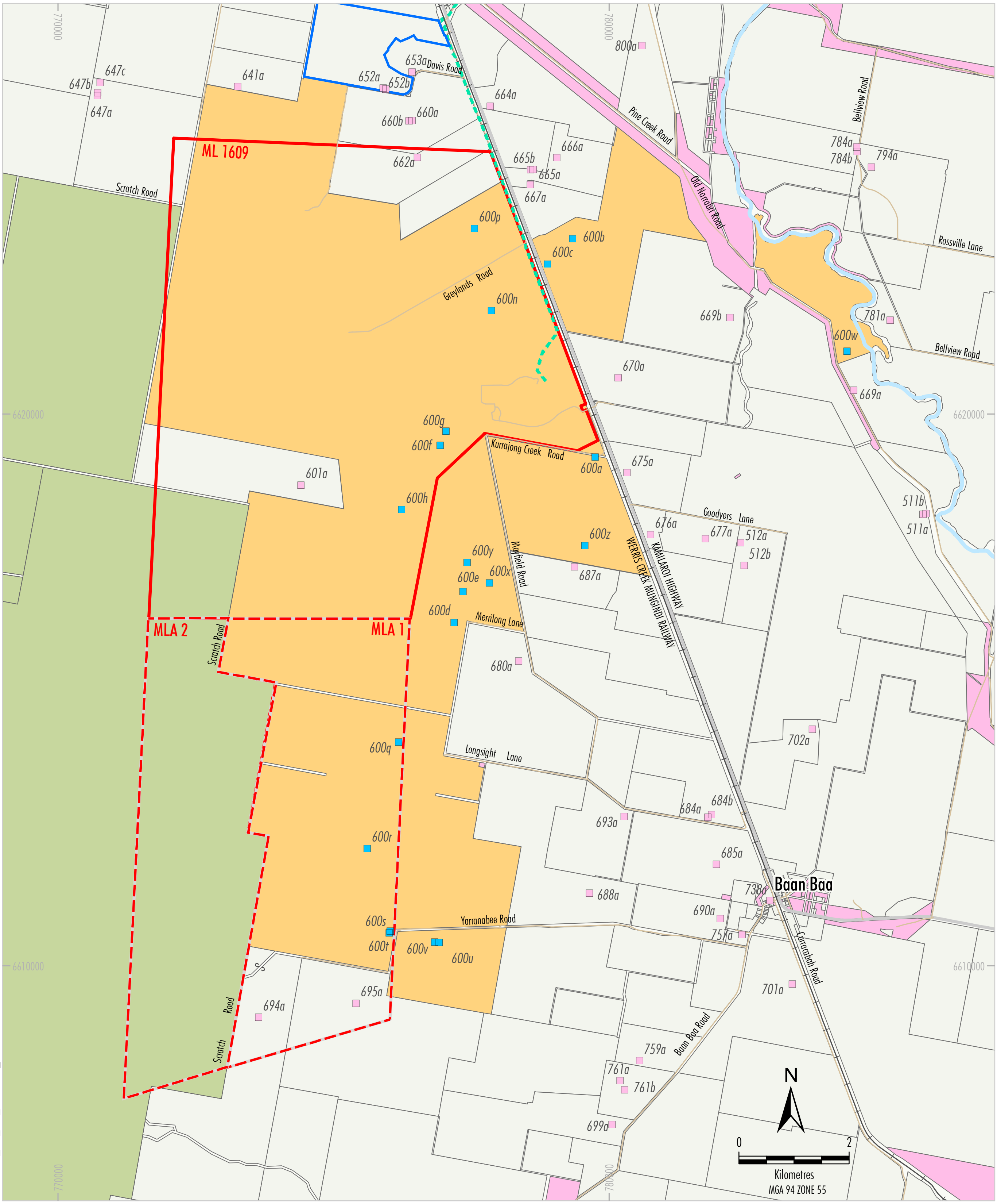
Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Project General Arrangement - Indicative Underground Mining Layout

Figure 2



LEGEND
Mining Lease (ML 1609)
Provisional Mining Lease Application Area
Existing Water Supply Pipeline (Buried)
State Forest
Crown Land
NCOPL Owned Land
Privately Owned Land - Under Contract with NCOPL
Privately Owned Land and Other Land
Private Dwelling
NCOPL Owned Dwelling

Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Location of Narrabri Mine and Nearest Sensitive Receivers

Figure 3

3. Potential 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, and wind erosion from coal stockpile. These emissions would mainly comprise 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). Odour has been detected in the past from some sources including brine storage ponds.

The area around the Narrabri Mine also contains various emission sources that will contribute to local air quality including farming and agriculture. In addition, the Narrabri Gas Project is proposing progressive installation of up to 850 new gas wells on up to 425 new well pads over approximately 20 years, and the construction and operation of gas processing and water treatment facilities. The Narrabri Gas Project (State Significant Development [SSD] 6456) was approved by the Independent Planning Commission of NSW on 30 September 2020.

Therefore, cumulative impacts are an important issue to address. In summary, the key potential air quality issue associated with the Project has been identified as dust (that is, particulate matter in the form of TSP, deposited dust, PM_{10} or $PM_{2.5}$) from the coal handling, processing and stockpiling activities. This issue is the focus of the air quality component of the assessment. Measures for odour management have also been identified as well as dust during construction.

4. Policy Setting

4.1 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 one or more 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 coal processing and stockpiling activities.

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 (NEPMs) (NEPC, 1998). To measure compliance with ambient air quality criteria, the NSW Government has established a network of monitoring stations across NSW 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. 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 Project Approval (PA) for the Narrabri Mine (PA 08_0144) are also included in **Table 2** for comparison. The criteria from PA 08_0144 are numerically identical to the criteria in an earlier version of the Approved Methods (see Department of Environment and Conservation (NSW) [DEC], 2005) applicable at the time of approval. However, 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

Pollutant	Averaging time	Criterion*	[d] Impact assessment criteria from Project Approval (08_0144)
Particulate matter (PM_{10})	24-hour	50 $\mu g/m^3$	[a]50 $\mu g/m^3$
	Annual	25 $\mu g/m^3$	[a]30 $\mu g/m^3$
Particulate matter ($PM_{2.5}$)	24-hour	25 $\mu g/m^3$	Nil
	Annual	8 $\mu g/m^3$	Nil
Particulate matter (TSP)	Annual	90 $\mu g/m^3$	[a]90 $\mu g/m^3$
[c] Deposited dust	Annual (maximum increase)	2 g/m^2/month	[b]2 g/m^2/month
	Annual (maximum total)	4 g/m^2/month	[a]4 g/m^2/month

[a] *Total impact (i.e. incremental increase in concentrations due to the Project plus background concentrations due to all other sources).*
[b] *Incremental impact (i.e. incremental increase in concentrations due to the Project 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[2].*
[d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Secretary.*
**Source: Table 7.1 of the Approved Methods.*
Note: $\mu g/m^3$ = micrograms per cubic metre.
g/m^2/month = grams per square metre per month.

[2] AS/NZS 3580.10.1:2003 has been superseded by AS/NZS 3580.10.1:2016, however the AS/NZS 3580.10.1:2003 version is referenced in the Approved Methods and it has been adopted in this assessment.

The EPA air quality assessment criteria relate to the total concentration of pollutants 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 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/m³ and 25 µg/m³ respectively, aiming to move to 7 µg/m³ and 20 µg/m³ respectively by 2025. Ministers also agreed to establish an annual average standard for PM_{10} particles of 25 µg/m³. 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/m³ 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. These revised criteria are reflected in **Table 2** and took effect from 20 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 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 (NSW Government, 2018) (VLAMP) 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. The VLAMP brings the air quality criteria in line with the NEPM standards and EPA criteria.

From the VLAMP, 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

Pollutant	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
Total suspended particulates (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

Pollutant	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
Total suspended particulates (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 five 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 Approved Methods.

4.2 Greenhouse Gas

4.2.1 Overview

Greenhouse gas (GHG) is a collective term for a range of gases that are known to trap radiation in the upper atmosphere, where they have the potential to contribute to the greenhouse effect (global warming). GHGs include:

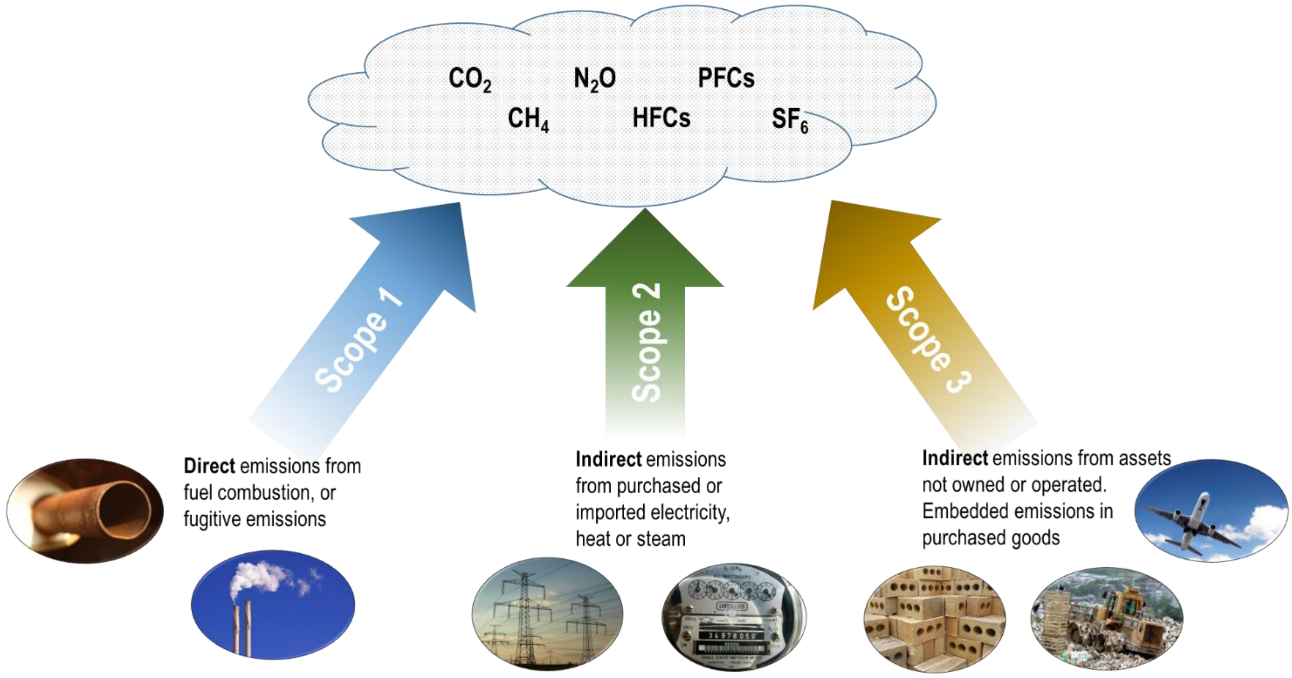
- Carbon dioxide (CO_2); by far the most abundant GHG, primarily released during fuel combustion.
- Methane (CH_4); generated from the anaerobic decomposition of carbon-based material (including enteric fermentation and waste disposal in landfills).
- Nitrous oxide (N_2O); generated from industrial activity, fertiliser use and production.

- Hydrofluorocarbons (HFCs); commonly used as refrigerant gases in cooling systems.
- Perfluorocarbons (PFCs); used in a range of applications including solvents, medical treatments and insulators.
- Sulphur hexafluoride (SF_6); used as a cover gas in magnesium smelting and as an insulator in heavy duty switch gear.

It is common practice to aggregate the emissions of these gases to the equivalent emission of carbon dioxide. This provides a simple figure for comparison of emissions against targets. Aggregation is based on the potential of each gas to contribute to global warming relative to carbon dioxide and is known as the global warming potential (GWP). The resulting number is expressed as carbon dioxide equivalents (or CO_2-e).

GHG emissions that form an inventory can be split into three categories known as 'Scopes'. Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol (GHG Protocol)[3] and can be summarised as follows (refer to **Figure 4)**:

- **Scope 1** – Direct emissions from sources that are owned or operated by the organisation (*examples include combustion of diesel in company owned vehicles or used in on-site generators*).
- **Scope 2** – Indirect emissions associated with the import of energy from another source (*examples include importation of electricity or heat*).
- **Scope 3** – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (*examples include business travel (by air or rail) and product usage*).



Adapted from – World Business Council for Sustainable Development – Greenhouse Gas Protocol

Figure 4 Sources of greenhouse gases

[3] The Greenhouse Gas Protocol is a collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Protocol provides guidance on the calculation and reporting of carbon footprints.

4.2.2 Federal Greenhouse Gas Policy

Paris Climate Conference COP21

During the 21st yearly session of the Conference of Parties (COP) held in Paris in 2015 an agreement was reached 'to achieve a balance between anthropogenic (human induced) emissions by sources and removals by sinks of greenhouse in the second half of this century'. Following COP21, international agreements were made to:

- Keep global warming well below 2.0 degrees Celsius, with an aspirational goal of 1.5 degrees Celsius (based on temperature pre-industrial levels).
- From 2018, countries are to submit revised emission reduction targets every five years, with the first being effective from 2020, and goals set to 2050.
- Define a pathway to improve transparency and disclosure of emissions.
- Make provisions for financing the commitments beyond 2020.

In response to this challenge Australia has committed to reduce emissions to 26-28% on 2005 levels by 2030.

National Greenhouse and Energy Reporting Act 2007

The Federal Government uses the National Greenhouse Gas and Energy Reporting (NGER) legislation for the measurement, reporting and verification of GHG emissions in Australia. This legislation is used for a range of purposes, including international GHG reporting. Corporations which meet the thresholds for reporting under NGER must register and report their GHG emissions.

Under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), constitutional corporations in Australia which exceed thresholds for GHG emissions or energy production or consumption are required to measure and report data to the Clean Energy Regulator on an annual basis. The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* identifies a number of methodologies to account for GHGs from specific sources relevant to the proposal. This includes emissions of GHGs from direct fuel combustion (fuels for transport energy purposes), emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators used during construction), and from consumption of electricity from the grid. NCOPL currently reports its emissions under the NGER Act.

Emissions Reduction Fund (ERF)

Previous legislation passed by the Australian Government to reduce carbon emissions was the *Clean Energy Act 2011*. This legislation established an Emissions Trading Scheme (ETS), also referred to as a carbon price. Under this ETS, approximately 370 companies were required to purchase a permit for every tonne of carbon equivalent they emit.

The *Clean Energy Legislation (Carbon Tax Repeal) Act 2014* repealed the *Clean Energy Act 2011*. This abolished the carbon pricing mechanism from 1 July 2014, and replaced it with the Australian Government's Direct Action Plan, which aims to focus on sourcing low cost emission reductions. The Direct Action Plan includes an Emissions Reduction Fund (ERF); legislation to implement the ERF came into effect on 13 December 2014, and is now considered to be the centrepiece of the Australian Government's policy suite to reduce emissions.

Emissions reduction and sequestration methodologies are available under the ERF which could provide the opportunity to earn carbon credits as a result of emissions reduction activities.

4.2.3 State Greenhouse Gas Policy

NSW Climate Change Policy Statement

In response to national GHG reduction commitments, the NSW government has developed the NSW Climate Change Policy Statement which sets the objective of achieving net-zero emissions by 2050. It intends to achieve this through a combination of policy development, leading by example and advocacy.

4.2.4 Existing Project Approval Condition

As required under the Project Approval (Schedule 4, Condition 7 of PA 08_0144), NCOPL is required to implement all reasonable and feasible measures to minimise GHG emissions from the Narrabri Mine. In addition, a particular focus is required on capturing and/or using these emissions, investigating the feasibility of implementing each option and proposing the measures to be implemented at the site. Further to this, a research program is required to inform the continuous improvement of the GHG minimisation measures on-site.

NCOPL has a number of processes by which the GHG emissions from the mining operations are mitigated, including the Greenhouse Gas Minimisation Plan (SLR, 2012) and Energy Savings Action Plan (Advitech, 2014) (or the latest approved version). These plans set out a range of measures for the management and mitigation of GHGs and opportunities for energy savings. **Section 9.3** provides further details on these measures.

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 existing meteorological and air quality monitoring networks, the locations of which are shown in **Figure 5**. 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.

5.1 Meteorological Conditions

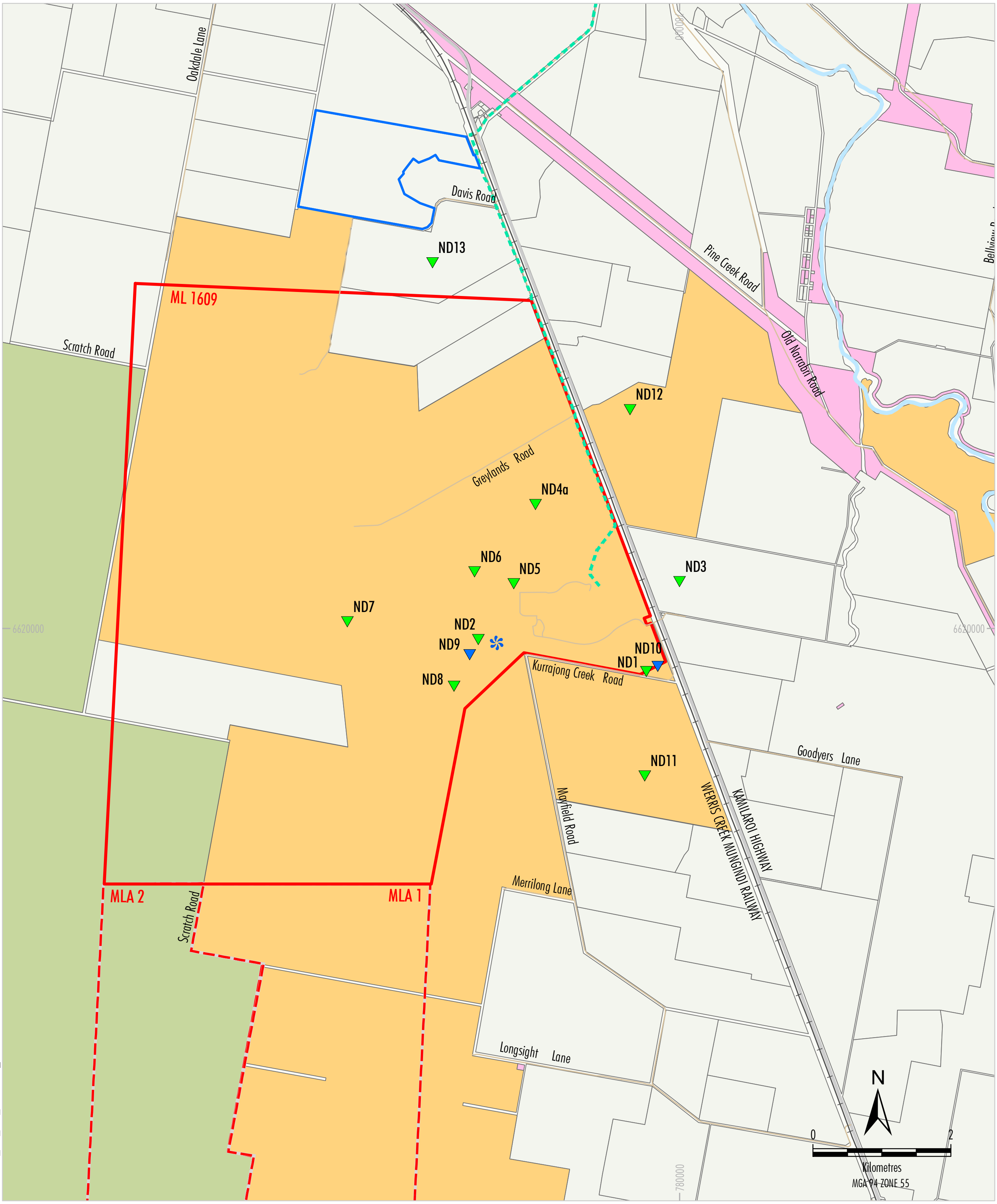
Meteorological conditions are important for determining the direction and rate at which emissions from a source will disperse. The key meteorological requirements of air dispersion models are, typically, hourly records of wind speed, wind direction, temperature and atmospheric stability. For air quality assessments, a minimum of 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.

NCOPL conducts meteorological monitoring at the Narrabri Mine in accordance with Schedule 4, Condition 8 of PA 08_0144. **Figure 5** shows the location of the meteorological station and, based on the proximity of this station to the Pit Top Area, the station would be classified as "site-specific" by the Approved Methods terminology. This means that modelling is to be conducted using a dataset that is of a minimum one year duration and at least 90% complete. NCOPL also operates a meteorological tower on-site which collects temperature data at 10 and 60 metres (m) above ground-level. These data are used to identify temperature inversions and to assist with noise management but are of limited use for air dispersion modelling.

Meteorological data from six recent years (2014 to 2019 inclusive) 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 comparing wind patterns and statistics for each calendar year.

Figure 6 shows the annual wind patterns for each year from 2014 to 2019. It can be seen from these wind-roses that the most common winds in the area are from the southeast and northwest. This pattern of winds is common for the North West Slopes and Plains of NSW (by the Bureau of Meteorology region definition) and reflects the northwest-southeast alignment of the valley, and general route of the Kamilaroi Highway.

It is also clear from **Figure 6** that wind patterns were similar in all six 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.



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LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- State Forest
- Crown Land
- NCOPL Owned Land
- Privately Owned Land - Under Contract with NCOPL
- Privately Owned Land and Other Land
- Dust Deposition Gauge
- High Volume Air Sampler (PM_{10})
- Meteorological Station

Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Location of Air Quality and Meteorological Monitoring Sites

Figure 5

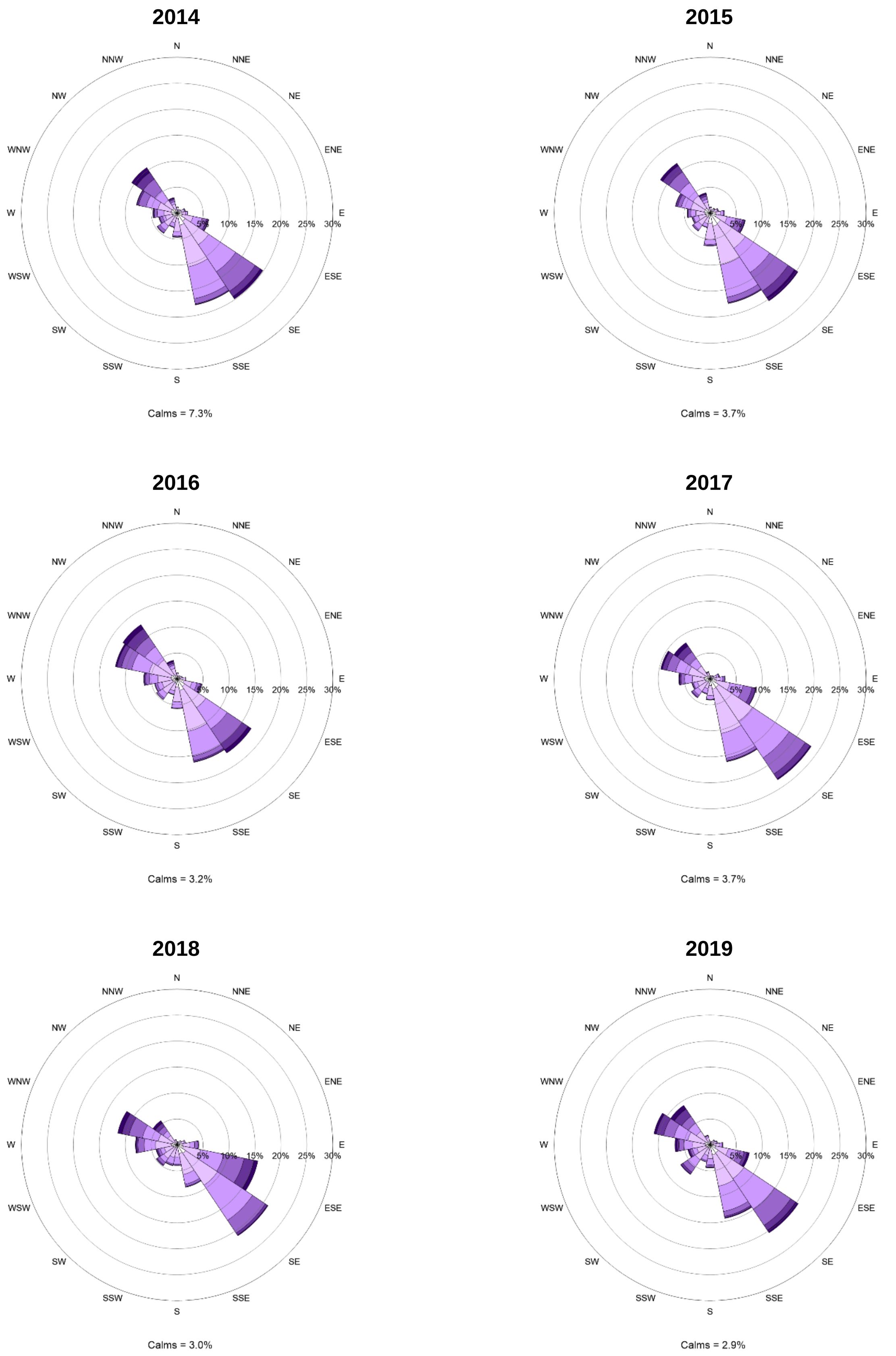


Figure 6 Annual wind-roses for data collected at the Narrabri Mine meteorological station

Figure 7 shows the wind speed data from the Narrabri Mine meteorological station, as well as rainfall data from Narrabri Airport (Bureau of Meteorology station number 054038). In terms of wind conditions, the average and maximum wind speeds exhibited similar ranges across all six years. Maximum wind speeds reached around 12 metres per second (m/s) (as an hourly average) and these winds typically occurred in spring.

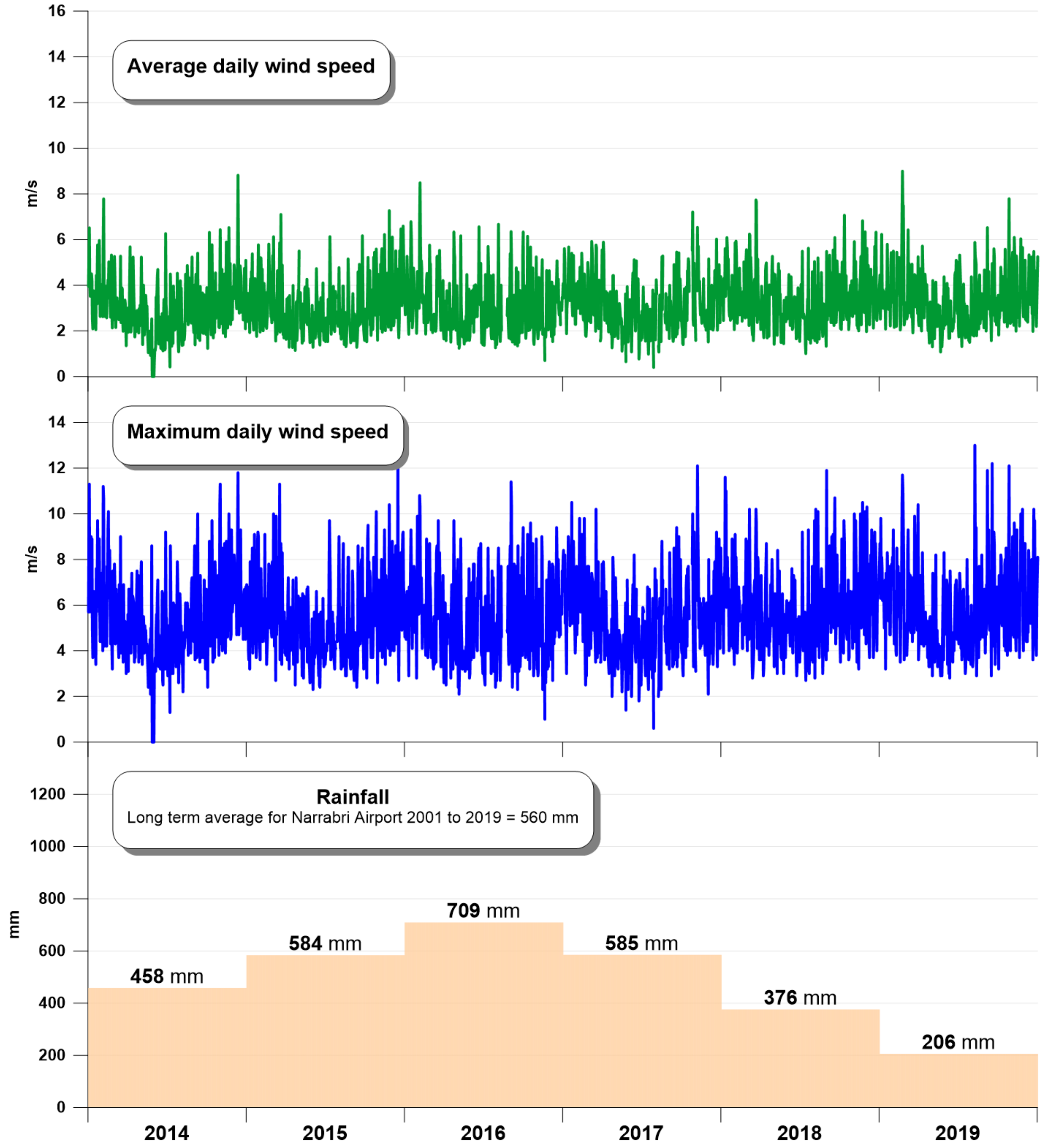


Figure 7 Wind speed and rainfall for data collected between 2014 and 2019

As can be seen from **Figure 7**, the annual rainfall (for 2014 to 2019) has ranged from 206 millimetres (mm) in 2019 to 709 mm in 2015. These annual values can be compared to the longer-term record which is as follows:

- Narrabri Airport (Bureau of Meteorology, 2019) 2001 to 2019 = 560 mm

Figure 7 also shows that rainfall in 2018 and 2019 was much lower than the long-term average. This suggests that 2018 and 2019 were not typical meteorological years, in terms of rainfall.

Finally, the annual data statistics for the 2014 to 2019 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 2014 and 2019

Location	Statistic	2014	2015	2016	2017	2018	2019
Narrabri Mine	Percent complete (%)	99	96	89	85	94	97
Narrabri Mine	Mean wind speed (m/s)	3.0	3.0	3.1	3.1	3.3	3.3
Narrabri Mine	99^{th} percentile wind speed (m/s)	8.6	8.2	8.5	8.0	8.8	8.8
Narrabri Mine	Percentage of calms (%)	7	4	3	4	3	3
Narrabri Mine	Percentage of winds >6 m/s (%)	7	7	8	7	9	10
Narrabri Airport	Rainfall (mm)	458	584	709	585	376	206

Over these six years the mean annual wind speed has ranged from 3.0 to 3.3 m/s, and the percentage of calms (that is, winds less than or equal to 0.5 m/s) has ranged from 3 to 7%. 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 air quality and greenhouse gas 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 close to the long-term average; and
- Air quality conditions that showed similarities to other years and were not adversely influenced by bushfire activity or extreme conditions (as seen in **Section 5.2**).

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 data collected by the meteorological station 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 Narrabri Mine is monitored by NCOPL and includes the measurement of:

- Particulate matter (as PM_{10}); and
- Dust deposition.

The NSW Office of Environment and Heritage (OEH) (now part of DPIE) also commenced monitoring of PM_{10} and $PM_{2.5}$ in late 2017 in Narrabri and Gunnedah. Whitehaven participates in EPA's Namoi region air quality monitoring project which publishes data from industry monitors on the EPA website.

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})

PM_{10} concentrations are measured by two high volume air samplers (HVASs) (ND9 and ND10) located to the southwest and southeast of the Pit Top Area (see **Figure 5**). **Figure 8** shows the measured 24-hour average PM_{10} concentrations for data collected every six days between 2014 and 2019 inclusive. The EPA's air quality assessment criteria for PM_{10} (50 µg/m^3) and the DPIE measurement results from Narrabri and Gunnedah are shown on **Figure 8** for comparison.

The data from **Figure 8** show that there were nine days (two days in 2018 and seven days in 2019) in the six year period when PM_{10} concentrations exceeded 50 µg/m^3.

Dust storms were observed on 21 and 22 November 2018 and affected many parts of eastern Australia including the North West Slopes of NSW. This event adversely impacted on air quality around the Narrabri Mine, resulting in 24-hour average PM_{10} concentrations in the order of 60 to 70 µg/m^3 at both monitors, as can be seen in **Figure 8**. Dust storms were also observed on 15 December 2018 and evident in the NCOPL and DPIE data with 24-hour average PM_{10} concentrations reaching around 300 µg/m^3.

In their "Annual Air Quality Statement 2018" the 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, 2019b). Air quality conditions in the North West Slopes (which includes Narrabri and surrounds) were clearly influenced by the drought conditions in 2017 and 2018 and lower than average rainfall as described in **Section 5.1**.

Late 2019 coincided with a period of unprecedented bushfires in Australia, predominantly across southeast Australia, but also affecting a reported 4 million hectares of land in NSW since early November 2019[4]. The bushfires adversely affected air quality across many parts of NSW including the Narrabri Shire Council LGA and these events are reflected in the data presented in **Figure 8**.

There have not been any other exceedances of 50 µg/m^3 in the 2014 to 2019 period. This result suggests that the activities at the existing operation have not caused adverse off-site air quality impacts with respective to PM_{10}.

[4] Additional detail can be found at https://www.environment.nsw.gov.au/topics/air/air-quality-statement.

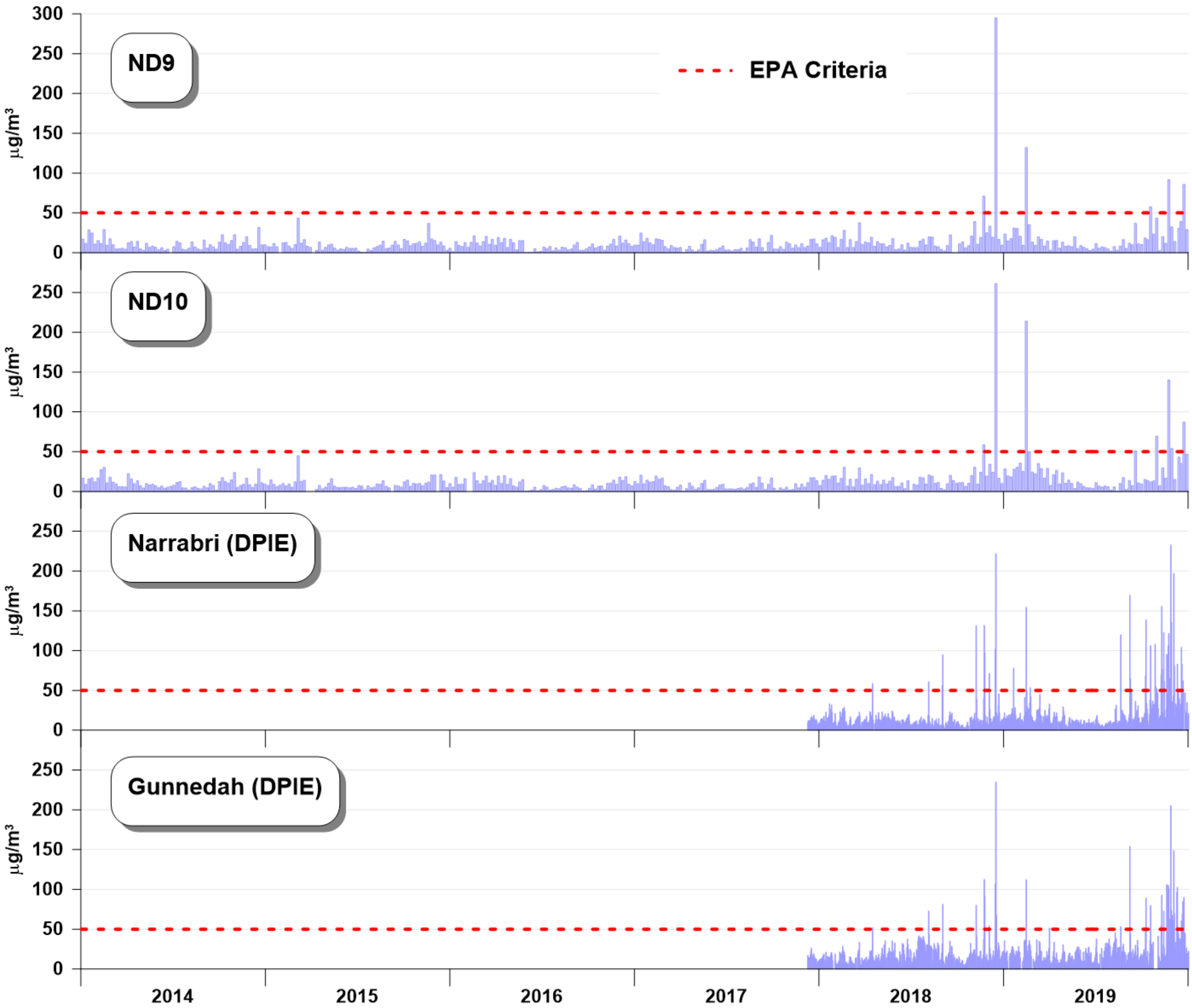


Figure 8 Measured 24-hour average PM_{10} concentrations

Table 6 summarises the measured PM_{10} concentration data for 24-hour and annual average periods, for comparison with the respective EPA criteria. As noted above, there were two days in 2018 and seven days in 2019 when PM_{10} concentrations exceeded the 50 µg/m³ criterion however these results were influenced by regional dust events and bushfires. Annual average PM_{10} concentrations have been recorded as being below the 30 µg/m³ criterion from PA 08_0144. The NEPM outlined an annual average PM_{10} criteria as being 25 µg/m³. This criterion was adopted by the EPA and is applicable from 2017 onwards.

Table 6 Summary of measured PM_{10} concentrations

Year	ND9	ND10	EPA criterion
Maximum 24-hour average in µg/m³			
2014	32	30	50
2015	44	45	
2016	21	24	
2017	22	19	
2018	295	261	
2019	132	214	

Year	ND9	ND10	EPA criterion
Number of days above 24-hour average criteria			
2014	0	0	-
2015	0	0	
2016	0	0	
2017	0	0	
2018	2 (regional dust events on 21/11 and 15/12)	2 (regional dust events on 21/11 and 15/12)	
2019	4 (bushfires)	6 (bushfires)	
Annual average in µg/m^3			
2014	10	10	30
2015	9	9	
2016	9	9	
2017	8	7	25
2018	19	18	
2019	20	25	

Note: shaded cells represent those results above EPA criteria.

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

No known monitoring of $PM_{2.5}$ is conducted in the vicinity of the Narrabri Mine. The closest air quality monitoring stations which record concentrations of $PM_{2.5}$ with publicly available data are located at the Narrabri township (approximately 25 km to the northwest) and Gunnedah township (60 km to the southeast). These stations are operated by the DPIE and use Beta Attenuation Monitors for the measurement of $PM_{2.5}$.

Both the Narrabri and Gunnedah monitoring sites are located close to regional population centres and neither site would measure $PM_{2.5}$ concentrations that are representative of levels in the vicinity of the Narrabri Mine. This is because the Narrabri Mine is well removed from other industries and regional population centres. Consequently, the ambient $PM_{2.5}$ concentrations in the vicinity of the Narrabri Mine would be expected to be lower than those measured at Narrabri and Gunnedah.

Nevertheless, $PM_{2.5}$ concentration data from Narrabri and Gunnedah have been reviewed and presented in this assessment. **Figure 9** shows the measured 24-hour average $PM_{2.5}$ concentrations from the Narrabri and Gunnedah monitoring sites for data collected between 2014 and 2019, noting that data collection began in late 2017. 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 with the 2016 amendment of the NEPM.

$PM_{2.5}$ concentrations at Narrabri exceeded the EPA 24-hour average criterion on one day in 2018 and on 20 days in 2019. The concurrent elevated $PM_{2.5}$ concentrations at both the Narrabri and Gunnedah monitoring stations, at the end of 2019, are indicative of the regional bushfire events. A seasonal variation is also evident at Gunnedah, with higher concentrations tending to occur in winter.

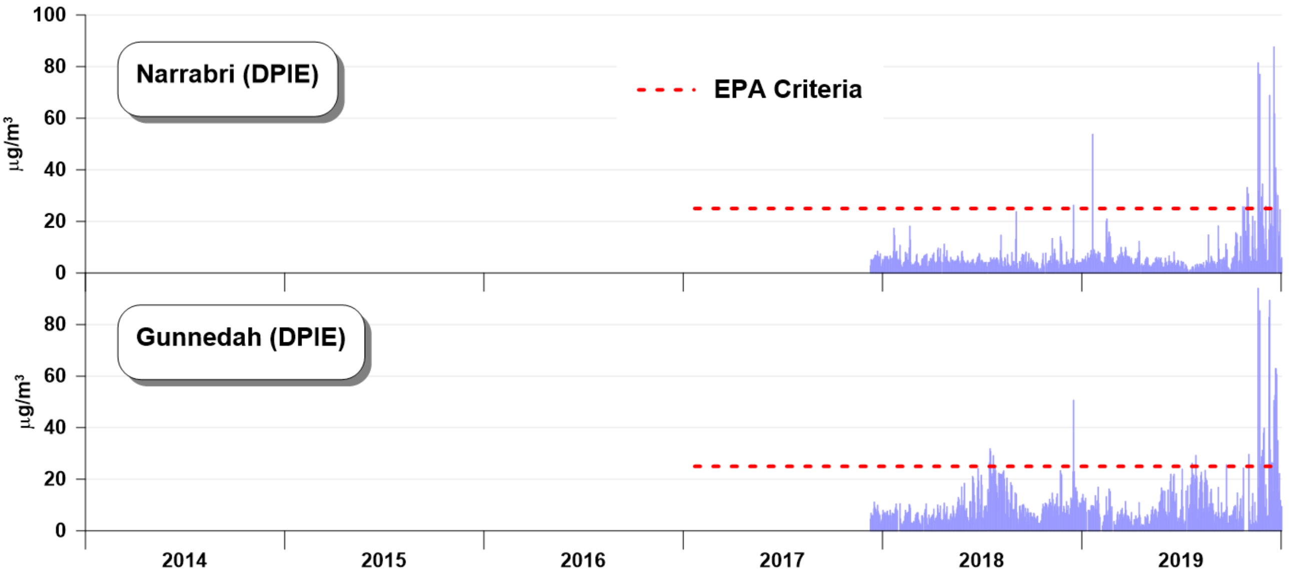


Figure 9 Measured 24-hour average $PM_{2.5}$ concentrations

Table 7 summarises the measured $PM_{2.5}$ concentration data from the Narrabri and Gunnedah monitoring stations. The inclusion of these data in this report is not intended to suggest that these levels are representative of air quality in the vicinity of the Narrabri Mine. Rather, the data are presented to show the types of statistics that are of interest for this assessment, and potentially those that represent the likely upper limit of levels near the Narrabri Mine.

These data show that, at Narrabri, 24-hour average $PM_{2.5}$ concentrations exceeded the EPA 24-hour average criteria on one day in 2018 and on 20 days in 2019. Annual average $PM_{2.5}$ concentrations at the Narrabri monitoring location were 7.8 µg/m³ in 2019 which is less than the EPA's criterion of 8 µg/m³ (applicable from 2017 onwards).

Further analysis of the data from the collocated PM_{10} and $PM_{2.5}$ monitors at Narrabri revealed that the average $PM_{2.5}$ to PM_{10} ratio was 0.38 (i.e. 38%). This ratio was used to estimate $PM_{2.5}$ concentrations from the PM_{10} data in the vicinity of the Narrabri Mine.

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

Year	Narrabri	Gunnedah	EPA criterion
Maximum 24-hour average in µg/m³			
2017 (incomplete)	9	11	25
2018	26	51	
2019	88	94	
Number of days above 24-hour average criteria			
2017 (incomplete)	0	0	-
2018	1	5	
2019	20	24	
Annual average in µg/m³			
2017 (incomplete)	5.4	6.4	8
2018	4.9	9.0	
2019	7.8	11.2	

Note: shaded cells represent those results above EPA criteria.

5.2.3 Particulate Matter (as TSP)

No known monitoring of TSP is conducted in the vicinity of the Project. The NSW Minerals Council (2000) estimated that, for rural environments in NSW, the average PM_{10} concentrations are typically 40% of the TSP concentrations. More recent studies (see for example Jacobs, 2018) have examined PM_{10} and TSP data have also shown that average PM_{10} concentrations are close to 40% of the TSP concentrations in rural environments of NSW. For this assessment it has been conservatively assumed that PM_{10} concentrations would be 50% of the TSP concentrations, an assumption that yields an estimated annual average TSP concentration of 22 µg/m^3 based on the measured annual average PM_{10} concentration of 11 µg/m^3 in 2014.

5.2.4 Deposited Dust

Table 8 shows the annual average deposited dust levels for each gauge from data collected between 2014 and 2019. **Figure 5** shows the location of the monitoring sites. The results in **Table 8** can be compared with the EPA's 4 g/m^2/month criterion.

There have been historical contamination issues at many gauges with sampling records frequently reporting insects, plant material, and/or bird droppings. These issues have influenced many monthly results including those which were used for the determination of the annual averages shown in **Table 8**. The ash contents of results above 4 g/m^2/month were also examined by NCOPL as part of the annual review process and it was reported that these values were not indicative of dust sources associated with the Narrabri Mine (Whitehaven, 2019).

Table 8 Summary of measured deposited dust levels

Year	ND1	ND2	ND3	ND4a	ND5	ND6	ND7	ND8	ND11	ND12	ND13	EPA criterion
Annual average expressed as g/m^2/month												
2014	7.3	1.8	1.3	0.7	7.5	0.8	1.7	0.8	1.7	0.8	ND	4
2015	12.1	12.4	0.9	2.5	3.6	1.1	1.8	3.6	1.7	0.9	ND	
2016	1.7	1.9	0.8	1.7	2.5	0.8	2.1	1.4	2.3	0.8	ND	
2017	3.4	1.7	1.8	1.7	2.4	1.5	1.5	2.2	1.0	1.2	ND	
2018	4.7	1.8	2.4	2.9	2.7	6.3	1.7	3.4	2.0	1.6	1.8	
2019	3.6	1.8	2.3	3.3	4.0	2.2	2.0	2.1	1.3	2.2	1.5	

Note: shaded cells represent those results above EPA criteria. ND = no data.

The monitors that are representative of the nearest private sensitive receptors are ND3, ND11, ND12 and ND13. Deposited dust levels have not exceeded the EPA's 4 g/m^2/month criterion at any of these monitors in during the 2014 to 2019 period.

5.3 Complaints

NCOPL maintains a register of all complaints that may be associated with activities at the Narrabri Mine. **Table 9** shows the number and nature of complaints received in each year from 2014 to 2019. These records indicate a reduction in the number and nature of complaints relating to dust since 2014 and a general reduction in odour and dust complaints compared to the total complaints. From 2014 to 2019 there has been a total of nine odour-related complaints with four complaints in 2019. Further discussion regarding management of brine storage odour is provided in **Section 8.6**.

Table 9 Nature of complaints in the period between 2014 and 2019

Year	Dust	Odour	Total (of all nature)	Percentage of dust and odour complaints compared to total complaints (%)
2014	29	2	39	80
2015	3	0	17	18
2016	12	2	25	56
2017	7	0	12	58
2018	1	1	6	33
2019	3	4	57	12

Source: Narrabri Mine website. Accessible at: http://www.whitehavencoal.com.au/sustainability/environmental-management/narrabri-mine/

5.4 Greenhouse Gas

Greenhouse gas emissions from the Narrabri Mine are calculated and reported in accordance with the NGER Act. **Table 10** shows the reported GHG emissions for 2016-17, 2017-18 and 2018-19.

Table 10 Reported GHG emissions for 2016-17, 2017-18 and 2018-19

Reporting year	Scope 1 emissions (Mt CO_2-e)	Scope 2 emissions (Mt CO_2-e)
2016-17	0.428	0.071
2017-18	0.364	0.072
2018-19	0.484	0.077

5.5 Summary of the Existing Environment

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

- The most common winds in the area are from the northwest and southeast.
- Particulate matter levels were heavily influenced by drought conditions in 2017 and 2018. The OEH reported that, in 2018, particle levels increased across NSW due to dust from the intense widespread drought and smoke from bushfires and hazard reduction burning (OEH, 2019b).
- PM_{10} (as 24-hour and annual average) concentrations comply with EPA criteria, based on data collected in the vicinity of the Narrabri Mine.
- $PM_{2.5}$ concentrations comply with EPA criteria, if estimated from PM_{10} measurements using relationships measured at Narrabri.
- TSP concentrations comply with EPA criteria, if estimated from PM_{10} measurements using relationships measured in rural areas (NSW Minerals Council, 2000; Jacobs, 2018).
- Deposited dust levels comply with EPA criteria, based on data collected in the vicinity of the Narrabri Mine.
- Conditions in 2014 were representative, and continue to be representative, of the longer-term air quality and meteorological conditions.

The monitoring data suggest that the activities at the existing Narrabri Mine are generally not causing adverse off-site air quality impacts.

5.6 Assumed Background Levels

One of the objectives of 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, Project contribution plus other sources. The establishment of background levels also needs to consider that there is an existing mining operation that contributes to measured levels. The estimated background levels that apply at sensitive receptors including the basis for assumptions are shown below in **Table 11**.

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

Pollutant	Averaging time	Assumed background level that applies at sensitive receptors	Notes
Particulate matter (PM_{10})	24-hour	Variable by day	The approach involved developing a daily variable background dataset that was added to the model predictions, as per the EPA "Level 2" contemporaneous assessment approach (EPA, 2016). This dataset was created by interpolation of the maximum ND9 or ND10 measurement result for each day in the 2014 calendar year.
	Annual	11 µg/m^3	Annual average PM_{10} as measured by the ND9 monitor in 2014.
Particulate matter ($PM_{2.5}$)	24-hour	12 µg/m^3	Estimated maximum 24-hour average $PM_{2.5}$ based on a $PM_{2.5}$ to PM_{10} ratio of 38%.
	Annual	4.2 µg/m^3	Estimated annual average $PM_{2.5}$ based on a $PM_{2.5}$ to PM_{10} ratio of 38%. This estimate is slightly below (as would be expected) the annual average $PM_{2.5}$ concentration measured at Narrabri in 2018 (4.9 µg/m^3).
Particulate matter (TSP)	Annual	22 µg/m^3	Estimated from annual average PM_{10} and based on 50% PM_{10} to TSP.
Deposited dust	Annual	1.7 g/m^2/month	Highest deposited dust level from ND3, ND11, ND12 and ND13 in 2014.

6. Emissions to Air

The most significant emission to air from the Project would be dust (particulate matter) due to material handling, processing, and stockpiling. Estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated by analysing the production 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 Unites States Environmental Protection Agency (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
- “Compilation of Air Pollutant Emissions Factors” (AP-42) (US EPA, 1985 and updates).

Dust emission inventories have been developed for each of the modelled scenarios, namely 2025, 2041 and 2042. 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 years 2025, 2041 and 2042 was therefore based on a review of coal handling and processing quantities, and location of active ventilation outlets to identify the scenarios most likely to lead to the highest potential impacts at nearest sensitive receptors. **Figure 10** shows the estimated ROM coal production over the life of the Project. The selected scenarios represent various stages in the life of the Project including the first year of peak production (2025), ventilation and gas drainage concentrated in the southwest (2041) and ventilation and gas drainage concentrated in the southeast (2042).

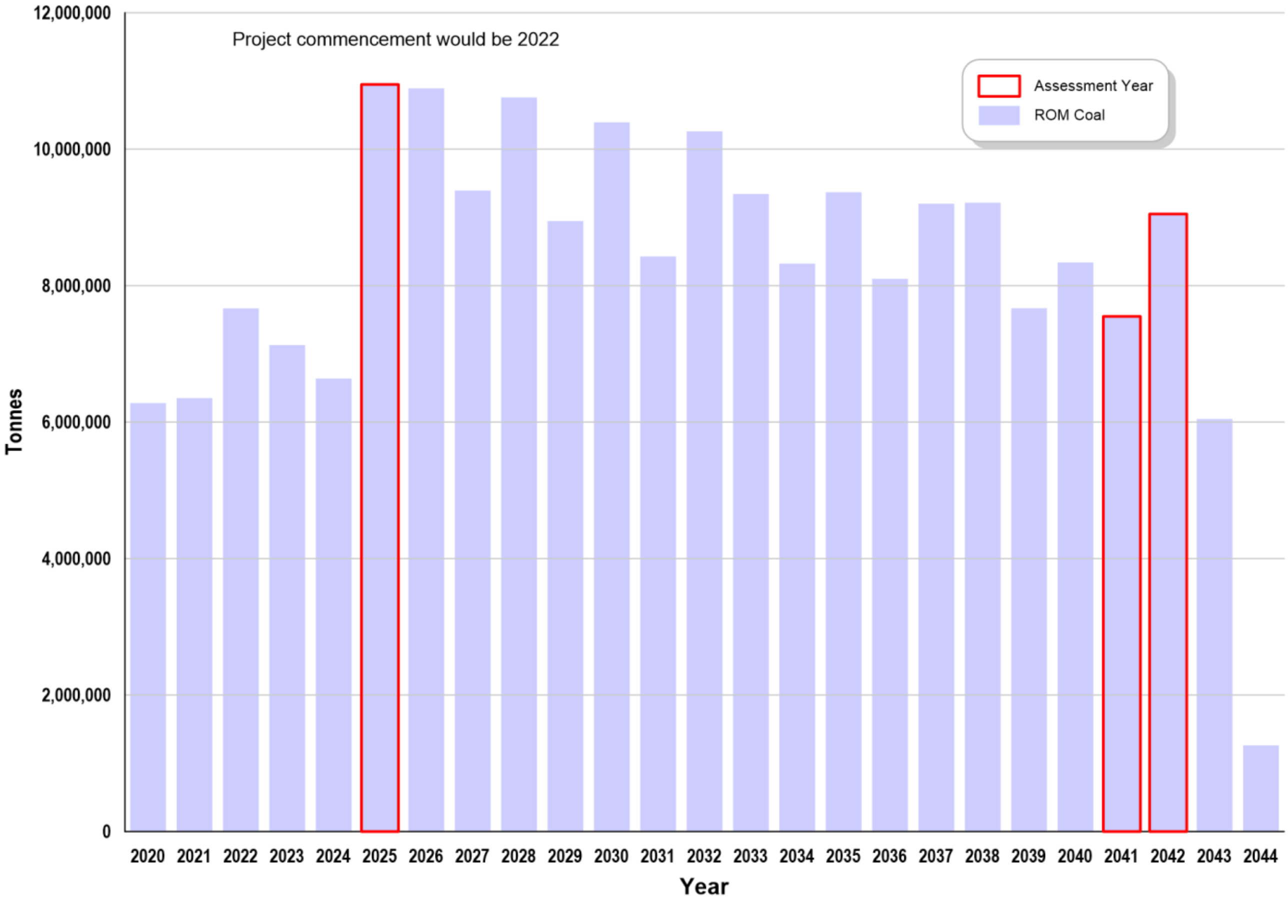


Figure 10 Estimated ROM coal production over the life of the Project

Table 12, **Table 13** and **Table 14** show the estimated annual TSP, PM_{10} and $PM_{2.5}$ emissions (in kilograms per year [kg/y]) due to the Project, respectively. **Appendix C** provides details of the dust emission calculations, including assumptions, emission controls and allocation of emissions to modelled locations.

Table 12 Estimated TSP emissions due to the Project

Activity	Estimated annual emissions (kg/y)		
	2025	2041	2042
Topsoil stripping	855	855	855
Topsoil spreading	258	258	258
ROM coal - loading ROM coal stockpile	1,623	1,119	1,342
ROM coal - dozers on ROM coal stockpiles	184,282	184,282	184,282
ROM coal - rotary breaker	1,336	418	824
ROM coal - dry screening	6,186	1,937	3,815
ROM coal - secondary bypass crushing	1,620	1,620	1,620
ROM coal - conveyor transfer (x4)	6,492	4,476	5,367
Product coal - loading bypass coal	889	889	889
Product coal - loading washed product coal	1,198	375	739
Product coal - conveyor transfer	4,543	3,172	3,778
Product coal - dozers on product coal stockpiles	304,683	304,683	304,683
Product coal - loading trains	4,280	2,989	3,560
Rejects - conveyor transfer (x2)	358	112	221
Rejects - loading rejects stockpile	215	67	132
Rejects - hauling rejects	2,969	930	1,831
Wind erosion - ROM coal stockpile	2,209	2,209	2,209
Wind erosion - product coal stockpile	1,487	1,487	1,487
Wind erosion - soil stockpiles	7,376	7,376	7,376
Wind erosion - active rehabilitation	1,699	1,699	1,699
Ventilation shaft(s)	35,478	35,478	35,478
Grading roads	1,518	1,518	1,518
Total	**571,553**	**557,950**	**563,962**

Table 13 Estimated PM_{10} emissions due to the Project

Activity	Estimated annual emissions (kg/y)		
	2025	2041	2042
Topsoil stripping	215	215	215
Topsoil spreading	155	155	155
ROM coal - loading ROM coal stockpile	768	529	635
ROM coal - dozers on ROM coal stockpiles	49,721	49,721	49,721
ROM coal - rotary breaker	594	186	366
ROM coal - dry screening	2,128	666	1,312
ROM coal - secondary bypass crushing	720	720	720
ROM coal - conveyor transfer (x4)	3,070	2,117	2,538
Product coal - loading bypass coal	421	421	421
Product coal - loading washed product coal	566	177	349
Product coal - conveyor transfer	2,149	1,500	1,787
Product coal - dozers on product coal stockpiles	85,448	85,448	85,448

Activity	Estimated annual emissions (kg/y)		
	2025	2041	2042
Product coal - loading trains	1,819	1,270	1,513
Rejects - conveyor transfer (x2)	169	53	104
Rejects - loading rejects stockpile	102	32	63
Rejects - hauling rejects	877	275	541
Wind erosion - ROM coal stockpile	1,139	1,139	1,139
Wind erosion - product coal stockpile	767	767	767
Wind erosion - soil stockpiles	3,802	3,802	3,802
Wind erosion - active rehabilitation	876	876	876
Ventilation shaft(s)	17,739	17,739	17,739
Grading roads	530	530	530
Total	**173,774**	**168,338**	**170,740**

Table 14 Estimated $PM_{2.5}$ emissions due to the Project

Activity	Estimated annual emissions (kg/y)		
	2025	2041	2042
Topsoil stripping	43	43	43
Topsoil spreading	8	8	8
ROM coal - loading ROM coal stockpile	116	80	96
ROM coal - dozers on ROM coal stockpiles	4,054	4,054	4,054
ROM coal - rotary breaker	67	21	41
ROM coal - dry screening	309	97	191
ROM coal - secondary bypass crushing	81	81	81
ROM coal - conveyor transfer (x4)	465	321	384
Product coal - loading bypass coal	64	64	64
Product coal - loading washed product coal	86	27	53
Product coal - conveyor transfer	325	227	271
Product coal - dozers on product coal stockpiles	6,703	6,703	6,703
Product coal - loading trains	214	149	178
Rejects - conveyor transfer (x2)	26	8	16
Rejects - loading rejects stockpile	15	5	9
Rejects - hauling rejects	89	28	55
Wind erosion - ROM coal stockpile	166	166	166
Wind erosion - product coal stockpile	112	112	112
Wind erosion - soil stockpiles	553	553	553
Wind erosion - active rehabilitation	127	127	127
Ventilation shaft(s)	1,774	1,774	1,774
Grading roads	47	47	47
Total	**15,444**	**14,694**	**15,026**

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, given that the assumed background levels include dust from the existing Narrabri Mine (**Section 5.6)**, there is an element of double counting which leads to a conservative assessment.

Based on management commitments made by NCOPL, the following main emission controls have been assumed to be applicable to the Project:

- Water sprays for loading the ROM coal stockpile (leading to a 70% control on emissions);
- Water sprays for loading the product coal stockpile (leading to a 70% control on emissions);
- Enclosure of the CHPP (leading to a 90% control on emissions);
- Cover conveyors (leading to a 50% control on emissions);
- Watering of unsealed rejects haul route (leading to an 85% control on emissions); and
- Water sprays on ROM and product stockpiles (leading to a 50% control on emissions).

7. Approach to Assessment

7.1 Overview

This assessment has followed the Approved Methods (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.

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 radiosondes or numerical models, such as the Commonwealth Scientific and Industrial Research Organisation's (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 North West Slopes and Plains region that collect suitable upper air data for CALMET. The necessary upper air data were therefore generated by TAPM, using influence from the surface observations at the Narrabri Mine meteorological station. CALMET was then set up with one surface observation station and one upper air station (based on TAPM output for the Narrabri Mine meteorological station). The meteorological modelling followed the guidance of TRC (2011) and adopted the "observations" mode.

Key model settings for TAPM are shown below in **Table 15**.

Table 15 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
Centre of analysis	Narrabri Mine (30º31' S, 149º54' E)
Terrain data source	30 m Shuttle Research Topography Mission (SRTM)
Land use data source	Default
Meteorological data assimilation	Narrabri Mine meteorological station. Radius of influence = 15 km. Number of vertical levels for assimilation = 4

Table 16 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 16 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)	Digitised from aerial imagery
Meteorological grid domain	15 km x 20 km
Meteorological grid resolution	0.2 km
Meteorological grid dimensions	75 x 100 x 9 grid points
Meteorological grid origin	770000 mE, 6607000 mN. MGA Zone 55
Surface meteorological stations	Narrabri Mine (Observations of wind speed and wind direction. TAPM for ceiling height, cloud cover, air pressure, temperature and humidity)
Upper air meteorological stations	Upper air data file for the location of the Narrabri Mine Meteorological 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 m resolution. 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 11** shows the model grid, land use and terrain information, as used by CALMET.

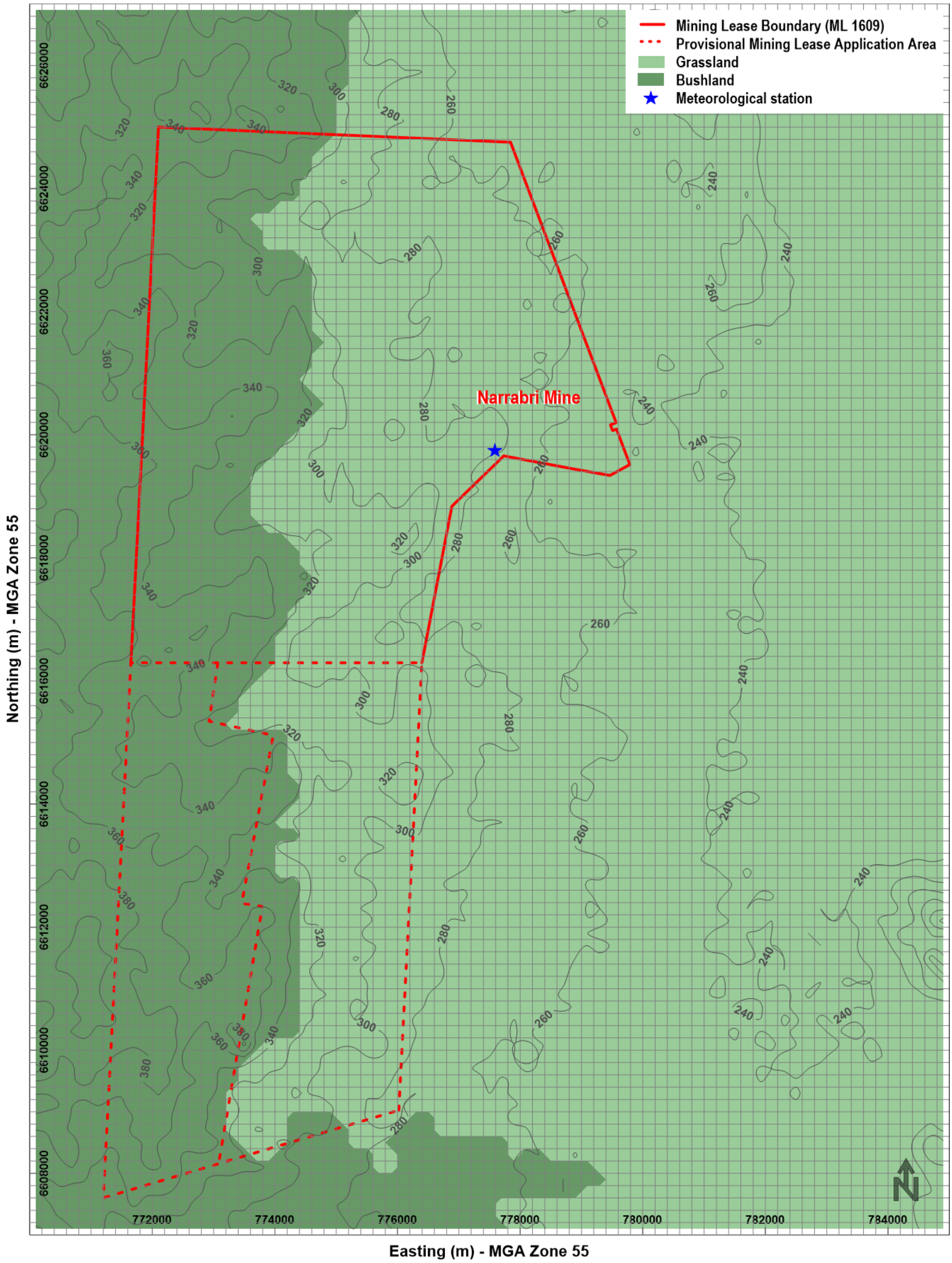


Figure 11 Model domain, grid, land use and terrain information

Figure 12 shows a snapshot of winds at 10 m above ground-level as simulated by the CALMET model under stable conditions.

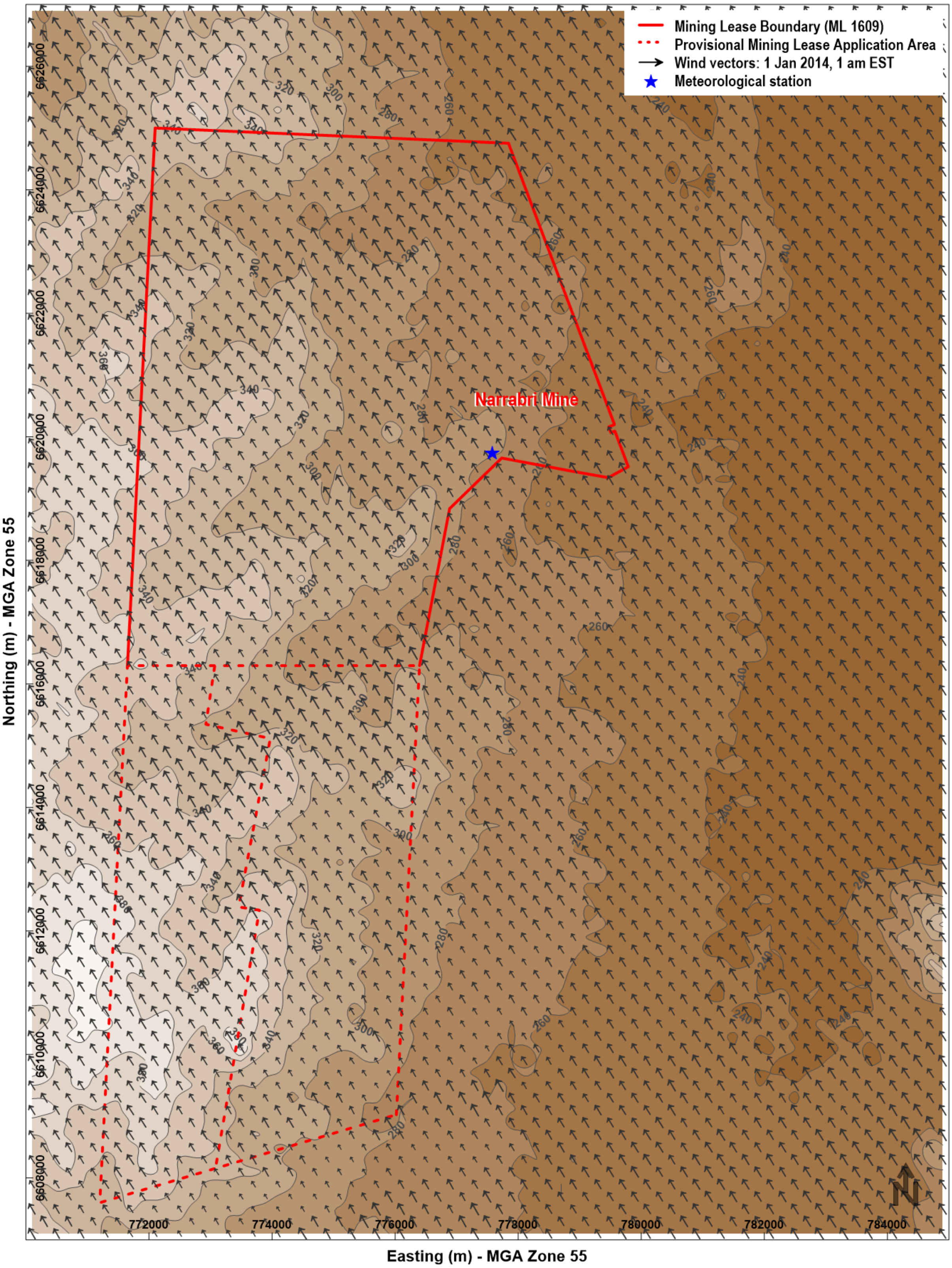


Figure 12 Example of CALMET simulated ground-level wind flows

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).

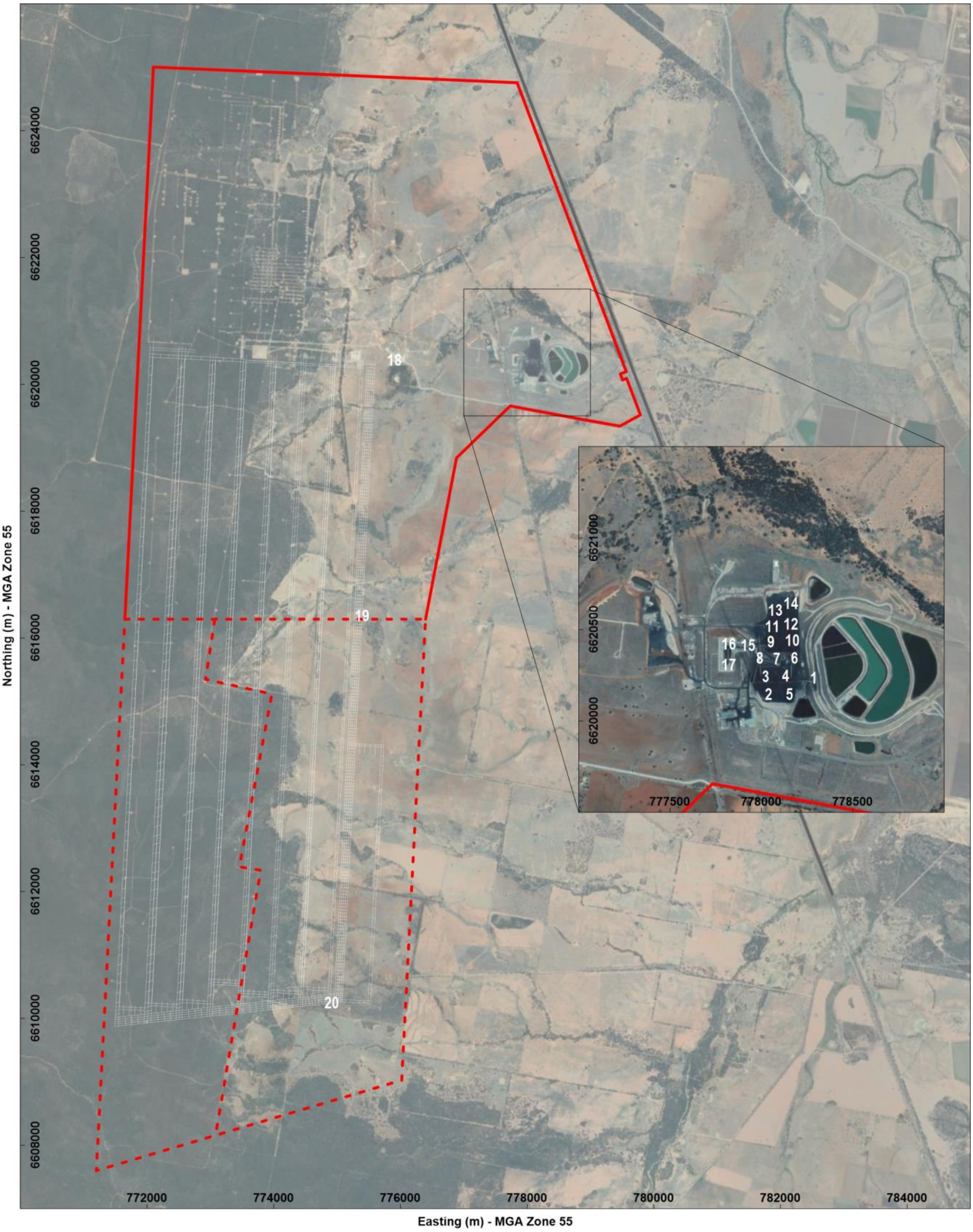
The modelling was performed using the emission estimates from **Section 6** and the meteorological information provided by the CALMET model, described in **Section 7.2**. Predictions were made at 590 discrete points (including sensitive receptors) to allow for contouring of results. The locations of the model receptors are shown in **Appendix D**.

Mining operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. **Figure 13** shows the location of the modelled sources. The emissions from the dust generating activities summarised in **Table 12** to **Table 14** 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 into 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 coal 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 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.



Mining Lease Boundary (ML 1609)
Provisional Mining Lease Application Area
1 Modelled Source Location

Figure 13 Location of modelled sources

Key model settings and inputs for CALPUFF are provided in **Table 17**. These settings have been chosen for consistency with the recommendations of TRC (2011).

Table 17 Model settings and inputs for CALPUFF

Parameter	Value(s)
Model version	6.42
Computational grid domain	75 x 100 grid points
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.
Number of discrete receptors	590. See **Appendix D**.

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.

7.4 Greenhouse Gas

The GHG inventory in this document has been calculated in accordance with the principles of the GHG Protocol. The initial action for a greenhouse gas inventory is to determine the sources of greenhouse gas emissions assess their likely significance and set a boundary for the assessment. Creating an inventory of the likely GHG emissions associated with the Project has the benefit of determining the scale of the emissions and providing a baseline from which to develop and deliver GHG reduction options.

The results of this assessment are presented in terms of the previously mentioned 'Scopes' to help understand the direct and indirect impacts of the Project. The GHG Protocol (and similar reporting schemes) dictates that reporting Scope 1 and 2 sources is mandatory, whilst reporting Scope 3 sources is optional. Reporting *significant* Scope 3 sources is recommended. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities include the extraction and production of purchased materials, transportation of purchased fuels, and use of sold products (i.e. burning of coal) and services. The inventory for this assessment includes all significant sources of GHGs (Scopes 1, 2 and 3) associated with the Project.

GHG emissions associated with operation of the Narrabri Mine are well understood, given that the mine is currently operating. To determine the additional greenhouse gas emissions from the Project, historical emissions were derived from National Greenhouse Emission Reports submitted in 2017, 2018 and 2019 (as required under s19 and s22 of the *NGER Reporting Act 2007*). These reports were evaluated to determine all current operational sources of emissions from associated with the underground mine, and the emissions per tonne of ROM coal production during the same reporting timeframes. Fugitive emissions were calculated from modelled CO_2 and CH_4 emissions (Palaris, 2020). **Table 18** shows the key emission sources that have been considered in this assessment.

Table 18 Greenhouse gas emission sources

Activity	Description	Scope
Diesel usage	Combustion of diesel fuel from mobile and stationary plant and equipment.	1, 3
Fugitive	Fugitive emissions from the extraction of coal including gas venting and drainage.	1
Post-mining	Fugitive emissions from post mining activities such as transportation and stockpiling of coal from the release of residual gases not released during the mining process.	1
Vegetation	Loss of carbon sink due to removal of vegetation.	1
Electricity	Electricity usage.	2, 3
Transport (rail)	Transport of product coal by rail to port.	3
Transport (shipping)	Transport of product coal by ship to market.	3
Energy production	Combustion of thermal coal in power generators by end users.	3
Coking coal	Combustion of coking coal by end users.	3

Table 19 outlines the greenhouse gas emission estimation methodologies for each activity.

Table 19 Greenhouse gas emission estimation methodologies

<table>
<tr><th>Activity</th><th>Emission estimation methodology</th></tr>
<tr><td>Diesel usage</td><td>Estimated from diesel used to ROM coal ratio from NGERS FY17, NGERS FY18 and NGERS FY19 reports (0.00089 kilolitres per tonne [kL/t]).
Emission factors from NGA Factors (DEE, 2019).</td></tr>
<tr><td>Fugitive</td><td>Estimated from modelled CH_4 and CO_2 emissions (Palaris, 2020) for each future longwall, as per below. The CO_2-e emissions were calculated from the gas densities (0.554 kg/m^3 for CH_4 and 1.836 kg/m^3 for CO_2) and global warming potentials (25 for CH_4 and 1 for CO_2). CO_2-e emissions for each longwall were matched to the anticipated future timing of mining each longwall.
<table>
<tr><th>LW</th><th>Weighted Average CH_4 Emission (l/s)</th><th>Weighted Average CO_2 Emission (l/s)</th><th>CO_2-e emission (kg/s)</th></tr>
<tr><td>LW201</td><td>1,091</td><td>6,183</td><td>26.5</td></tr>
<tr><td>LW202</td><td>1,091</td><td>6,183</td><td>26.5</td></tr>
<tr><td>LW203</td><td>963</td><td>3,259</td><td>19.3</td></tr>
<tr><td>LW204</td><td>1,062</td><td>3,318</td><td>20.8</td></tr>
<tr><td>LW205</td><td>1,171</td><td>3,345</td><td>22.4</td></tr>
<tr><td>LW206</td><td>1,738</td><td>3,672</td><td>30.8</td></tr>
<tr><td>LW207</td><td>2,239</td><td>3,629</td><td>37.7</td></tr>
<tr><td>LW208</td><td>2,421</td><td>3,949</td><td>40.8</td></tr>
<tr><td>LW209</td><td>2,466</td><td>4,057</td><td>41.6</td></tr>
<tr><td>LW210</td><td>964</td><td>2,572</td><td>18.1</td></tr>
</table></td></tr>
<tr><td>Post mining</td><td>Emission factors from NGA Factors (DEE, 2019).</td></tr>
<tr><td>Vegetation</td><td>Calculated using “Carbon Gauge” developed by the Transport Authorities Greenhouse Group (TAGG, 2013) with total emissions distributed over the mine life in proportion to the ROM coal.
Vegetation assumed to be “Class D Open woodlands”.
Biomass class set to “Class 3:100-150 (tonnes of dry matter per hectare [t dry matter/ha])” based on Project location.</td></tr>
</table>

Activity	Emission estimation methodology
Electricity	Emission factors from NGA Factors (DEE, 2019).
Transport (rail)	Emission factors from the Department for Environment, Food and Rural Affairs (DEFRA) (2019), based on "Freighting goods / freight train". 370 km assumed distance from mine to port.
Transport (shipping)	Emission factors from DEFRA (2019), based on "Freighting goods / cargo ship, bulk carrier". 8,000 km assumed distance from port to market.
Energy production	Emission factors from NGA Factors (DEE, 2019). Assumed that 95% of coal produced by the Project will be thermal coal.
Coking coal	Emission factors from NGA Factors (DEE, 2019). Assumed that 5% of coal produced by the Project will be coking coal.

8. Air Quality Assessment

This section provides an assessment of the key air quality issues associated with the Project based primarily on comparisons of model predictions to EPA air quality criteria. Assessment against the VLAMP criteria has also been made. Outcomes of this assessment have been determined for all locations but with a focus on private sensitive receptors. Results are presented as contour plots however tabulated data are also provided in **Appendix E**.

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 Narrabri Mine is currently operational and the Project represents the progression of mining into new underground areas. For these objectives it is useful to consider the expected change in impacts.

8.1 Particulate Matter (as PM_{10})

Figure 14 shows the predicted maximum 24-hour average PM_{10} concentrations due to the Project for each assessment scenario. These plots do not include background levels. The 50 µg/m^3 contour represents the VLAMP criterion for the purposes of determining land acquisition and mitigation. It can be seen from these results that the 50 µg/m^3 criterion would not be exceeded at any private sensitive receptor.

The results in Figure 14 have also been used for assessing compliance with the EPA's maximum 24-hour average PM_{10} criterion of 50 µg/m^3. This EPA criterion relates to the total concentration in the air (that is, cumulative) and not just the contribution from the Project. Therefore, some consideration of background levels needs to be made when assessing the potential impacts. The 18 µg/m^3 contour in Figure 14 represents the predicted extent of the EPA's 50 µg/m^3 criterion based on adding the maximum measured background level of 32 µg/m^3 to the maximum Project contribution. This approach of adding maximum background levels to maximum Project contributions represents a "Level 1" assessment methodology as per the Approved Methods (EPA, 2016). With this approach the results highlight a potential for maximum 24-hour average PM_{10} concentrations to exceed the EPA criteria for 24-hour average PM_{10} at one private sensitive receptor (675a). Additional investigation of this potential has therefore been carried out using the approach referred to as a "Level 2" assessment. A Level 2 assessment involves the use of contemporaneous background and predicted Project contributions for each day in the modelling year (EPA, 2016).

Figure 15 shows the predicted 24-hour average PM_{10} concentrations at property 675a for each day of the modelled year. Background levels have been derived as the maximum measured PM_{10} concentration from either ND9 or ND10 and linearly interpolated from six-day records to daily records. These results show compliance with the 50 µg/m^3 criterion for maximum 24-hour average PM_{10} and that the Project would not be the cause of this exceedance.

Figure 16 shows the predicted annual average PM_{10} concentrations due to the Project. Background concentrations are not included in these plots however the potential extent of cumulative impacts has been represented by shaded contours at levels of background subtracted from the EPA criteria. Compliance with the EPA's assessment criterion for annual average PM_{10} (25 µg/m^3) is predicted at all private sensitive receptors.

The potential cumulative impact of the Narrabri Gas Project has also been considered. As noted in **Section 3**, the Narrabri Gas Project is proposing the progressive installation of up to 850 new gas wells on up to approximately 425 new well pads over approximately 20 years, and the construction and operation of gas processing and water treatment facilities. Particulate matter (as PM_{10}) was identified as the key air pollutant during construction and nitrogen dioxide during operation (Air Environment, 2016). The Narrabri Gas Project air quality impact assessment (Air Environment, 2016) showed that the most intense construction works would be located approximately 20 km to the west of the Narrabri Mine. Air quality impacts from other sources such as well pad construction, access track construction, pipeline trenching and road construction would be at low levels at a distance of approximately 200 m from the Narrabri Gas construction sources (Air Environment, 2016). In addition, dispersion modelling for this project showed that PM_{10} concentrations in the vicinity of the Narrabri Mine would be negligible. Therefore no cumulative air quality impacts are anticipated.

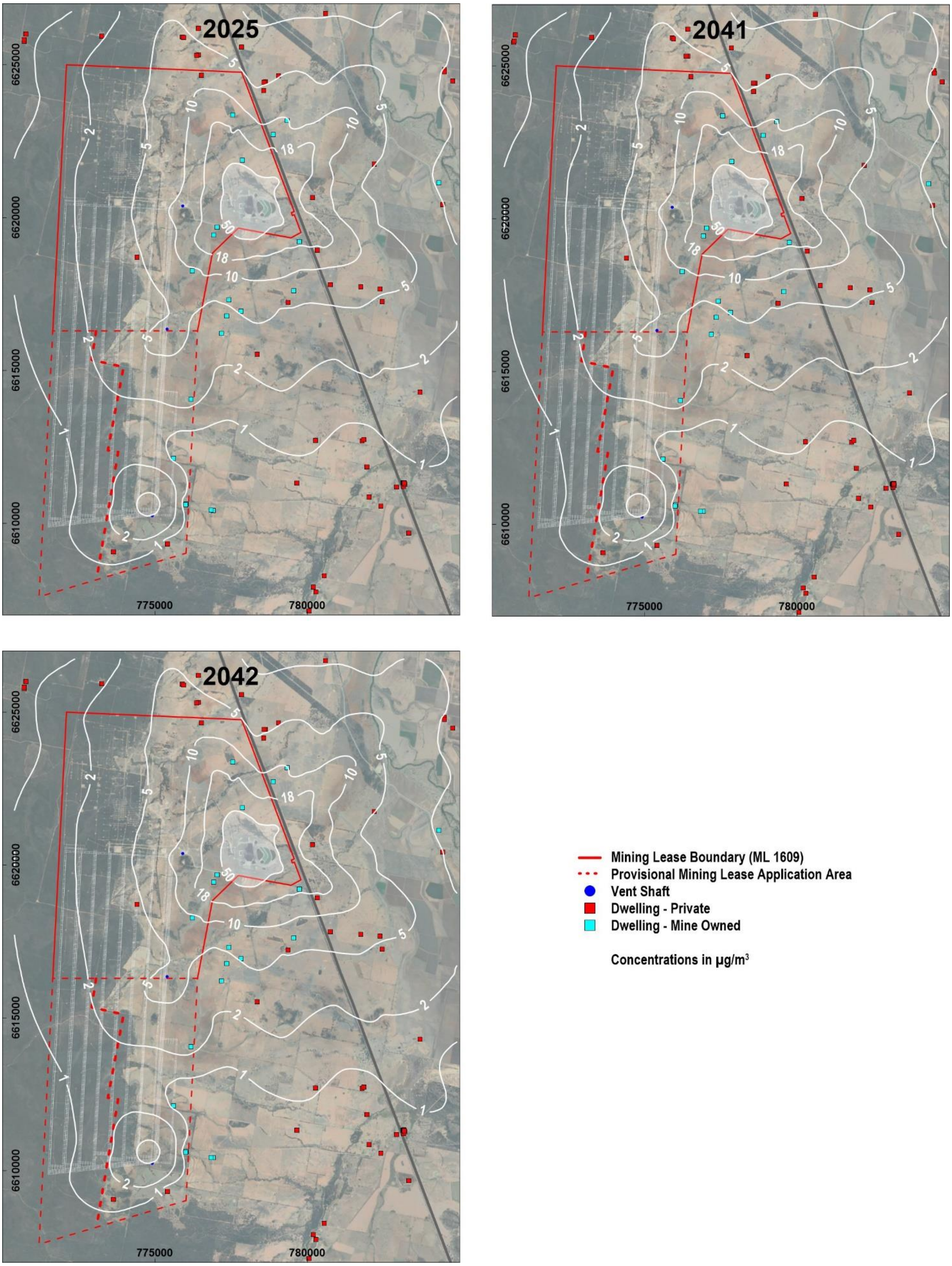


Figure 14 Predicted maximum 24-hour average PM_{10} concentrations due to the Project

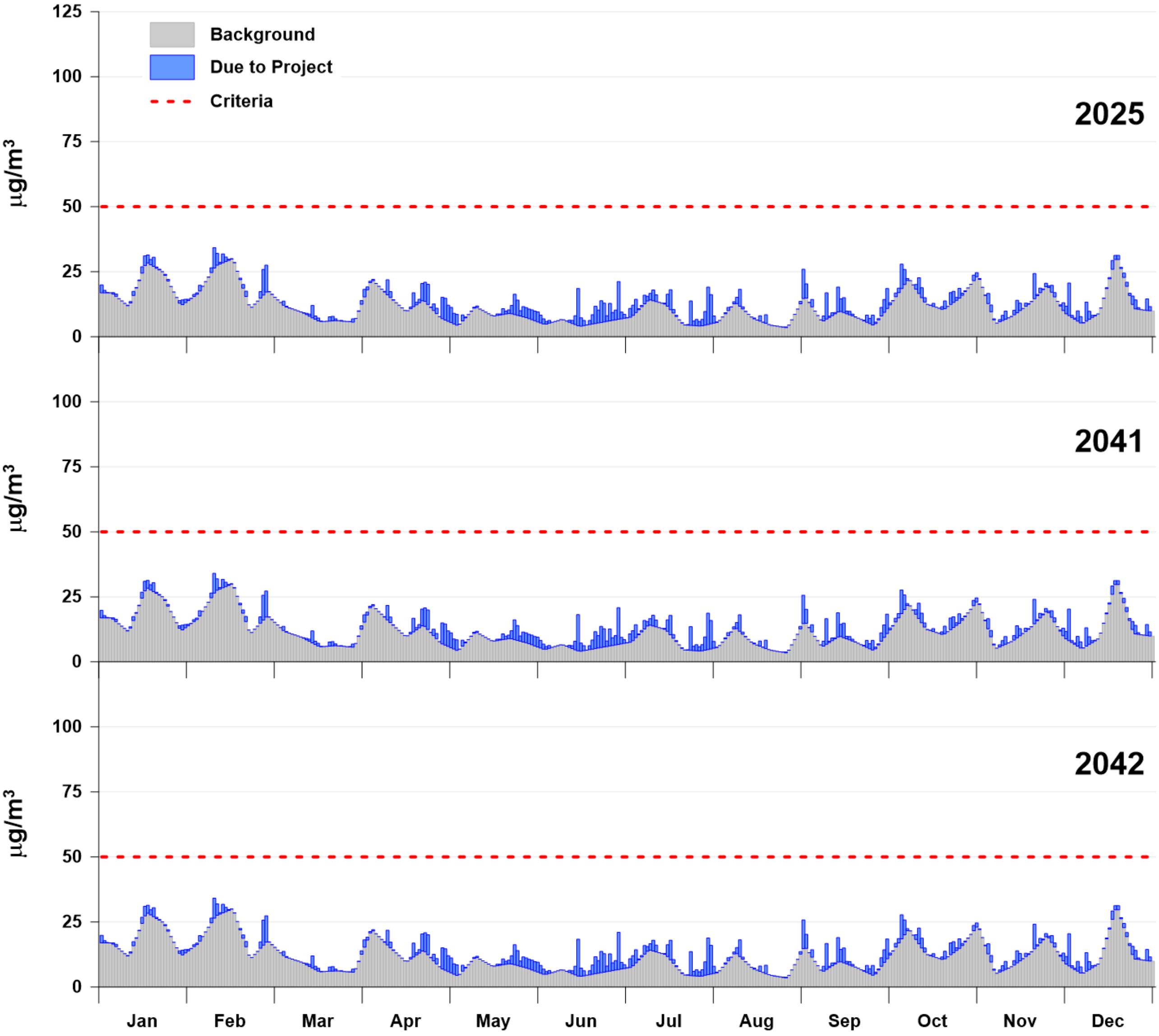


Figure 15 Predicted 24-hour average PM_{10} concentrations at receiver 675a

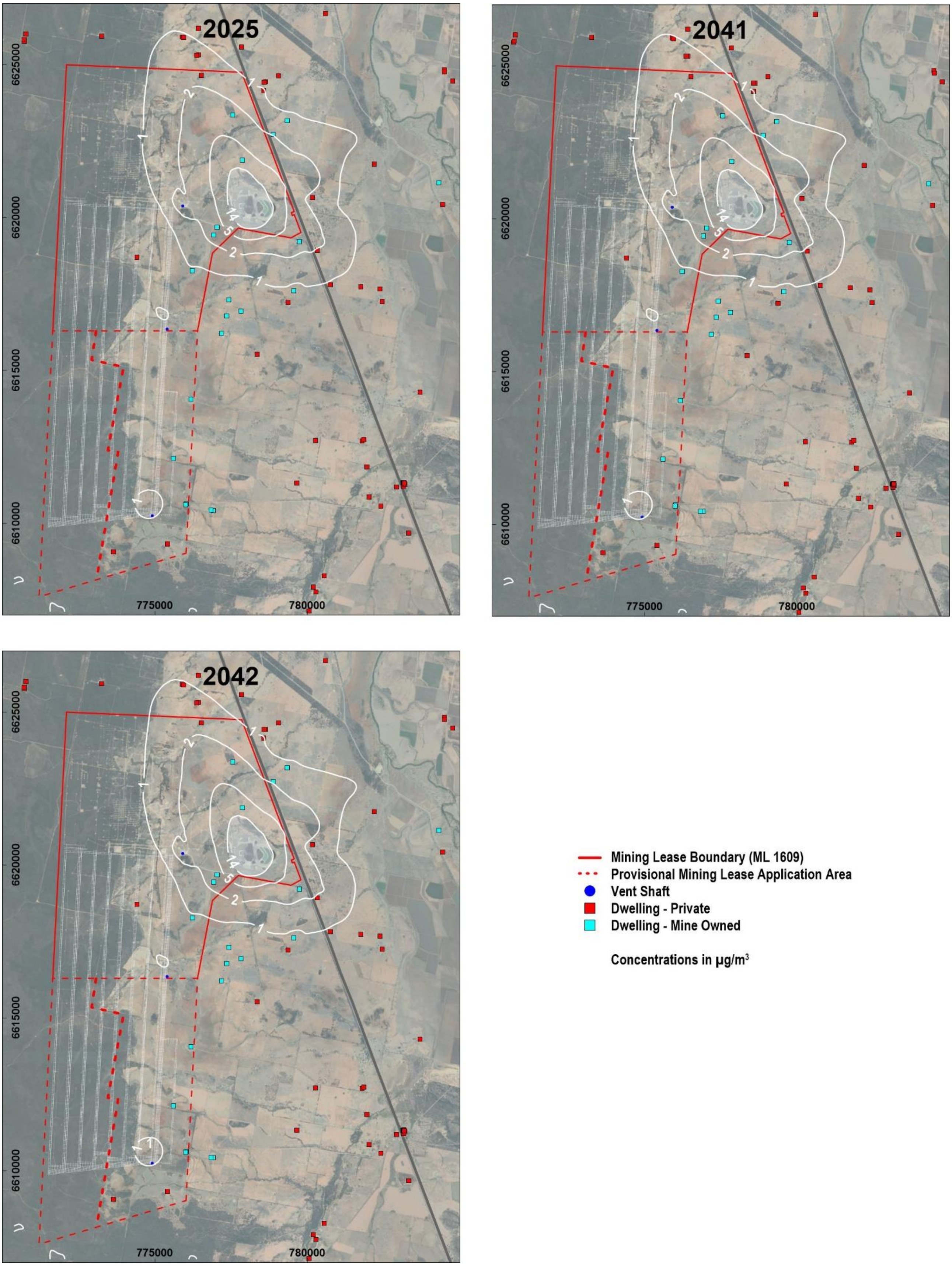


Figure 16 Predicted annual average PM_{10} concentrations due to the Project

From the assessment above, maximum 24-hour and annual average PM_{10} concentrations are expected to comply with EPA criteria for PM_{10} at all private sensitive receptors. This outcome indicates that the Project would not lead to adverse air quality impacts with respect to PM_{10}.

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

Figure 17 shows the predicted maximum 24-hour average $PM_{2.5}$ concentrations due to the Project for each assessment scenario. **Figure 18** shows the predicted annual average $PM_{2.5}$ concentrations. Background concentrations are not included in these plots however the potential extent of cumulative impacts has been represented by shaded contours at levels of background subtracted from the EPA criteria. There is an element of double-counting in the approach of adding Project contributions to the assumed maximum background levels since the background levels will already contain contributions from the existing approved Narrabri Mine. This means that the cumulative results will represent conservative estimates of potential impacts.

Maximum 24-hour and annual average $PM_{2.5}$ concentrations are expected to comply with EPA and VLAMP criteria for $PM_{2.5}$ at all private sensitive receptors. This outcome indicates that the Project would not lead to adverse air quality impacts with respect to $PM_{2.5}$.

8.3 Particulate Matter (as TSP)

Figure 19 shows the predicted annual average TSP concentrations (excluding background concentrations) due to the Project. TSP concentrations are expected to comply with EPA criteria at all private sensitive receptors. This outcome indicates that the Project would not lead to adverse air quality impacts with respect to TSP.

8.4 Deposited Dust

Figure 20 shows the predicted annual average dust deposition (excluding background concentrations) due to the Project. Dust deposition levels are expected to comply with EPA criteria for deposited dust at all private sensitive receptors. This outcome indicates that the Project would not lead to adverse air quality impacts with respect to deposited dust.

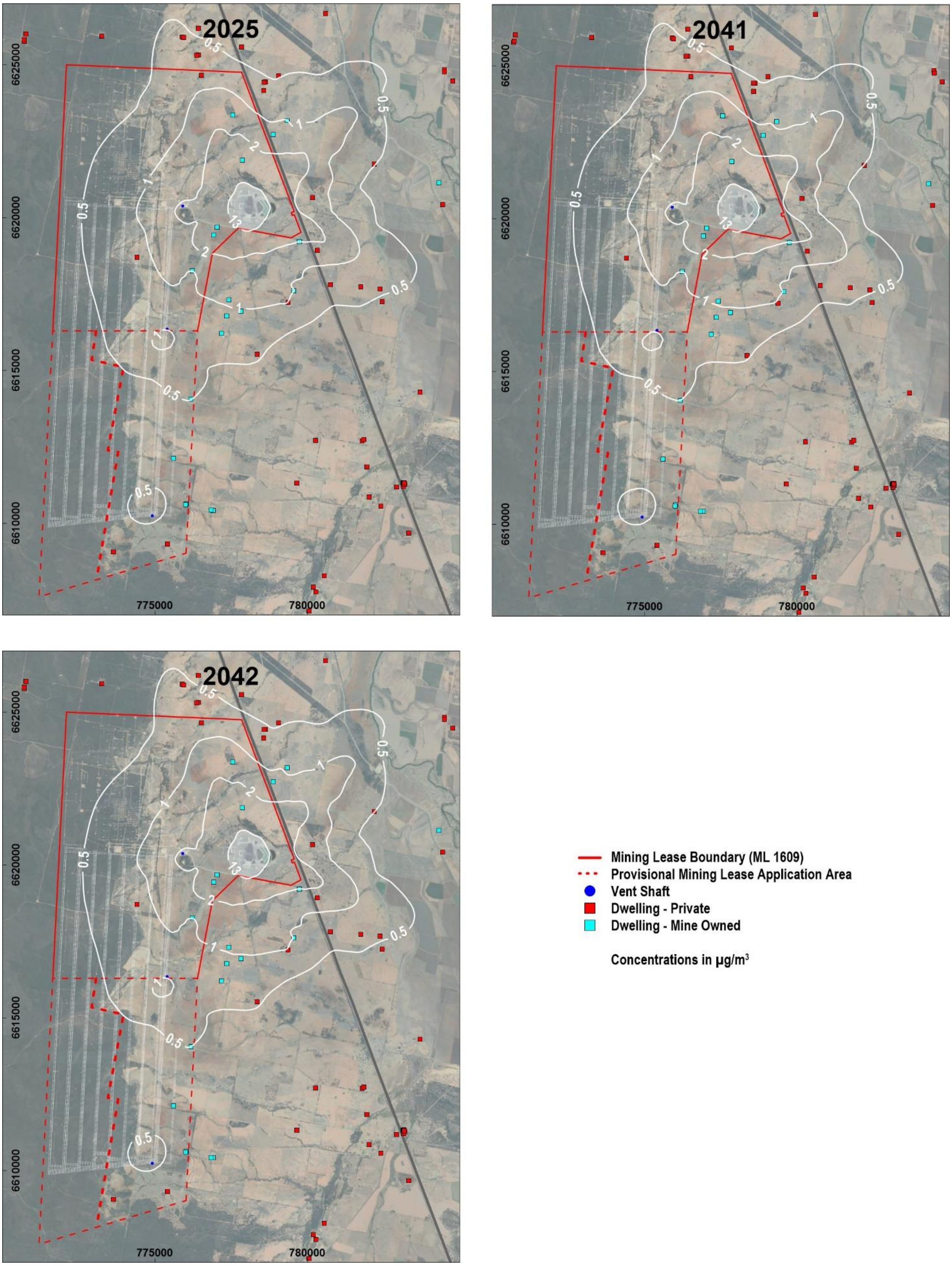


Figure 17 Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to the Project

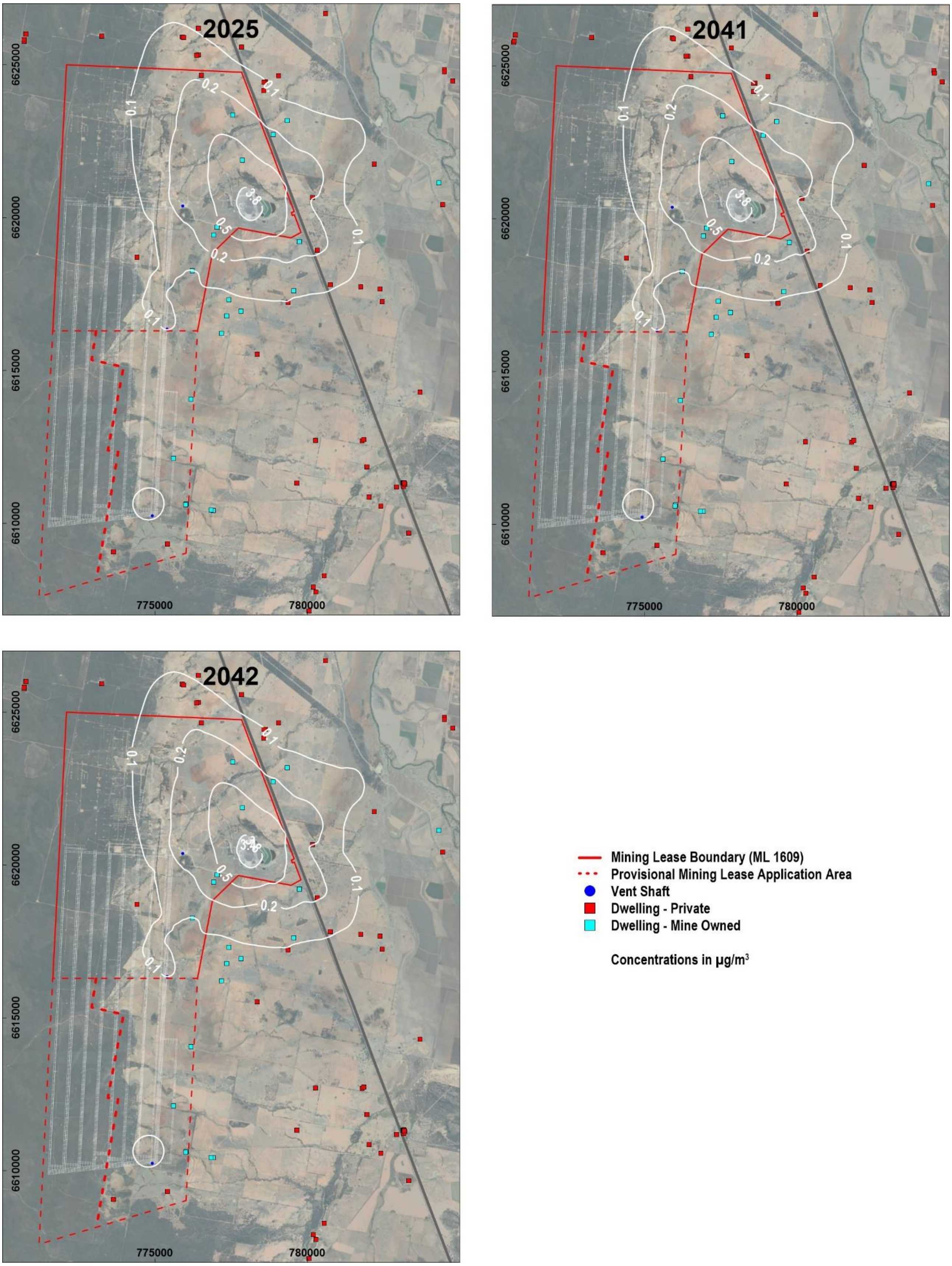


Figure 18 Predicted annual average $PM_{2.5}$ concentrations due to the Project

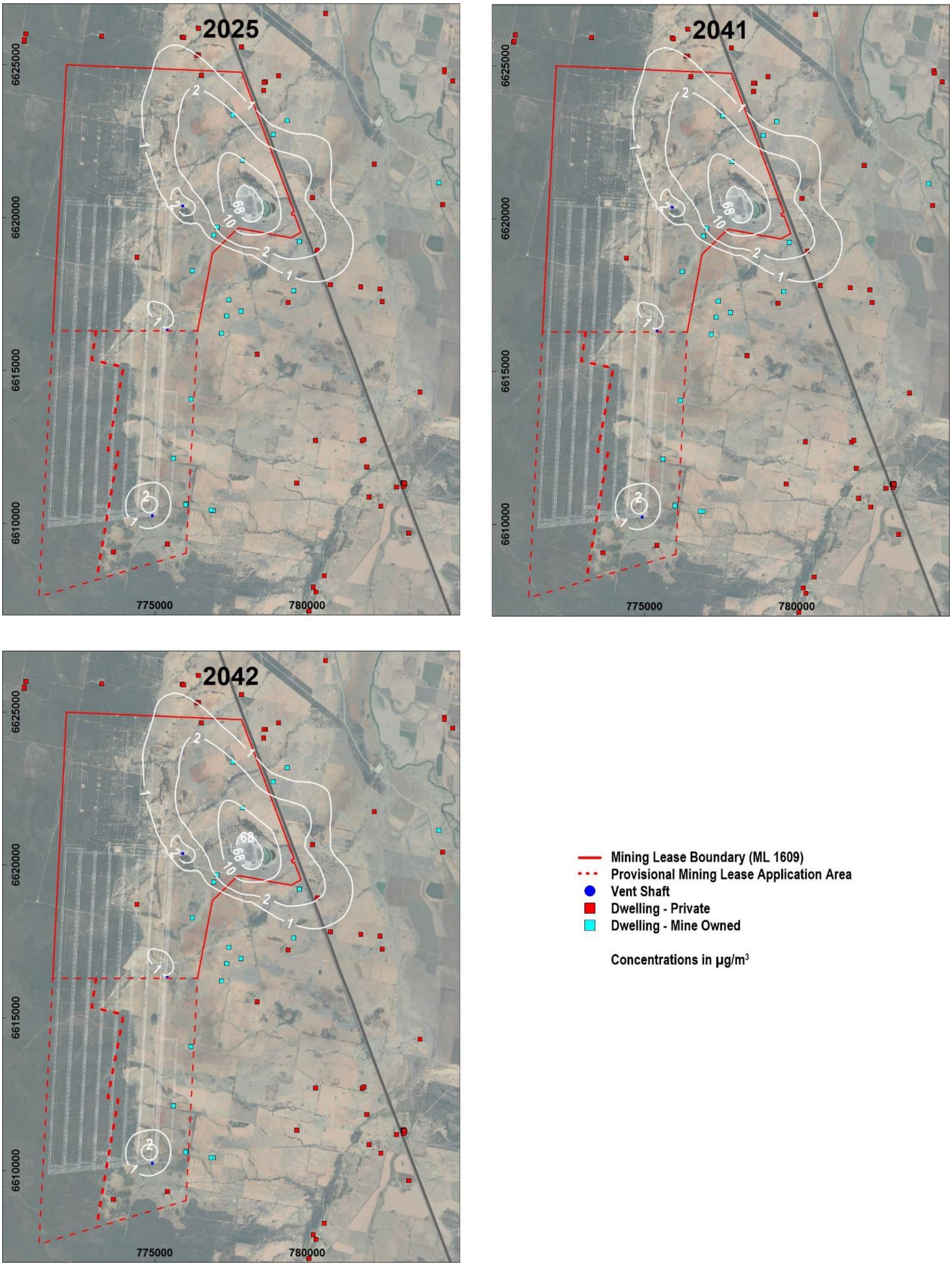


Figure 19 Predicted annual average TSP concentrations due to the Project

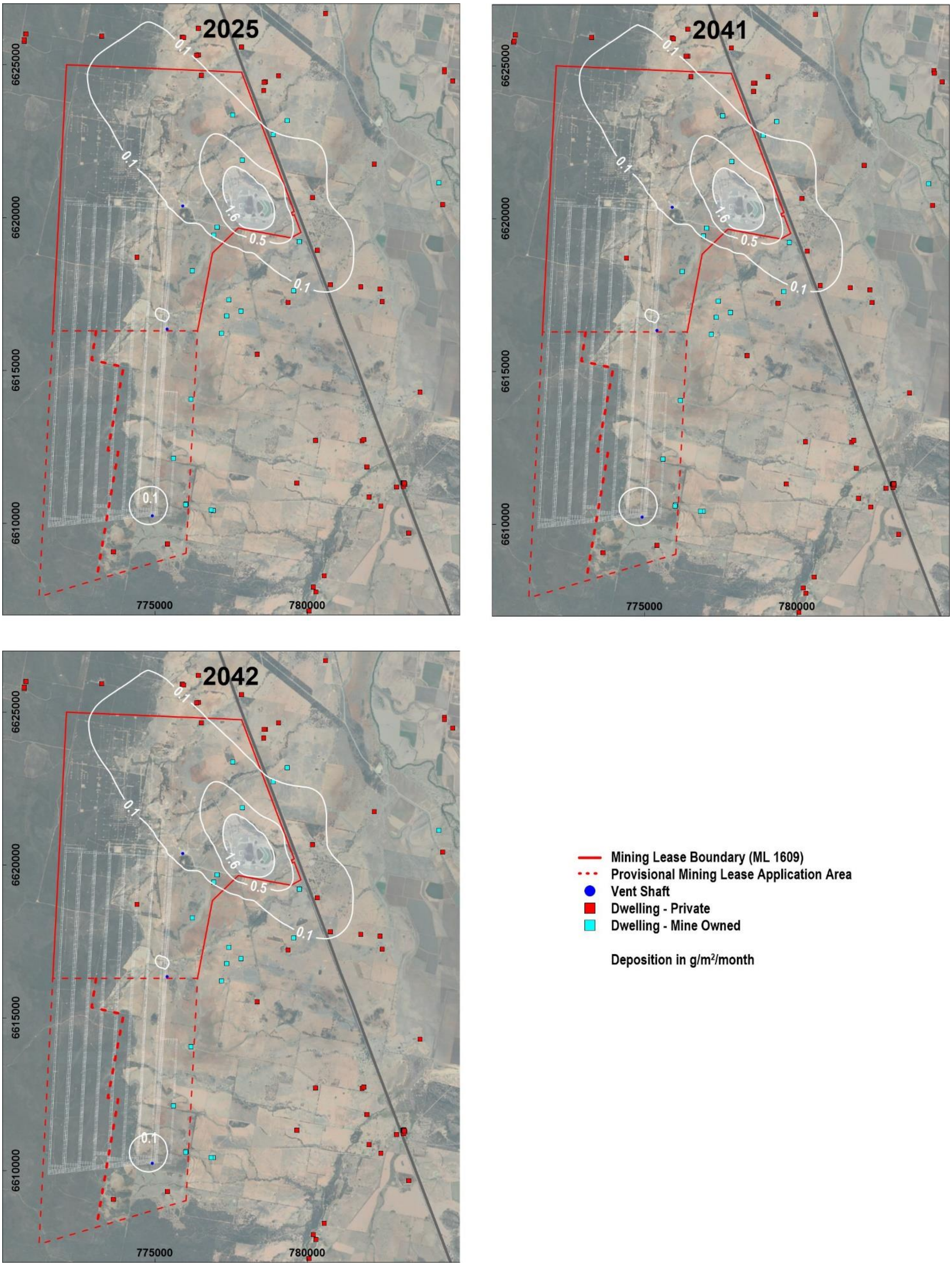


Figure 20 Predicted annual average dust deposition due to the Project

8.5 Management and Monitoring

NCOPL operates the existing Narrabri Mine in accordance with the approved Environmental Management Strategy (Whitehaven, 2015). Based on the operational details provided by NCOPL, **Table 20** outlines the existing dust management measures that are in place at the existing approved Narrabri Mine and the assumed emission control factors that were applied for the modelling. These measures would continue to be adopted as part of the Project. In addition, NCOPL currently implements, and would continue to implement, a Trigger Action Response Plan. This plan identifies specific meteorological conditions that, upon measurement, require action for managing dust.

Table 20 Emission management measures

Activity	Emission management measures	Assumed emission control (%) (NPI, 2012, Katestone, 2011)
Loading ROM stockpiles	Water sprays	70
Loading product stockpiles	Water sprays	70
Coal handling and preparation plant	Enclosure	90
Conveyors	Covered	70
Hauling rejects on unsealed roads	Watering of unsealed haul routes / roads Restricting vehicle speeds Clearly marked haul routes	85
Wind erosion from ROM stockpiles	Water sprays	50
Wind erosion from product stockpiles	Water sprays	50

The modelling showed that the dust concentrations and deposited dust levels due to the Project would be relatively minor and that levels would not exceed relevant EPA assessment criteria at the nearest private sensitive receptors. Therefore, no additional dust emission mitigation would be warranted.

As noted in **Section 5** the current monitoring consists of four dust deposition gauges, two HVASs and one meteorological station. As the modelling showed that the Project would not lead to exceedances of criteria at private sensitive receptors, the current monitoring regime is appropriate and no additional monitoring is proposed.

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.

8.6 Odour

Odour and other substances can be generated from the spontaneous combustion of coal. “Self-heating” occurs when coal and other carbonaceous materials undergo an exothermic reaction when exposed to oxygen in the air, to generate heat. This process causes the temperature of the material to rise which in turn accelerates the oxidation and, in turn, the heat generation process. As the material temperature rises above about 70^{o}C the temperature acceleration is rapid enough to result in ignition of the material. This ignition is referred to as spontaneous combustion and results in the emission of noxious gases including carbon dioxide, carbon monoxide, sulphur dioxide, hydrogen sulphide, nitrogen oxides and a range of volatile organic compounds. These emissions can lead to nuisance odour effects. NCOPL has not reported any issues relating to the spontaneous combustion of coal that would have led to off-site odour impacts, and the existing approved Narrabri Mine does not have a history of material spontaneous combustion issues. The management of Spontaneous Combustion at the Narrabri Mine is outlined in the “Spontaneous Combustion Management Plan for the Narrabri Coal Mine” (Narrabri Coal, 2007) (or the latest approved version).

Potential odour impacts from the ventilation system have previously been quantified for the existing approved Narrabri Mine by Heggies (2009). Computer-based dispersion modelling was used to predict off-site odour levels due to emissions from ventilation, goaf gas and pre-drainage ventilation points. Model predictions (up to 0.5 odour units compared to a criterion of 6 odour units) showed that the odour impacts due to the ventilation system are negligible. The Project would not change the nature of odour emissions from the ventilation system so it is anticipated that adverse odour impacts from this source would not arise from the ventilation system.

Complaints data from 2014 to 2019 have been reviewed in order to identify any persistent odour issues relating to the existing approved Narrabri Mine and potential issues for the Project. From 2014 to 2019 there has been a total of nine odour-related complaints with four complaints in 2019. NCOPL investigated the likely cause and identified that algae and bacteria in brine ponds with low storage levels had led to the odour. Specifically this occurred from anaerobic areas of the dam due to no circulation or agitation below the water surface. Various management options have been identified including:

- Eliminating the anaerobic zones in the dam through circulation of water via pumps; and
- Limiting algal growth to limit food sources for odour generating bacteria through dosing of algaecide.

Water quality testing was completed in 2019 and results from this testing and subsequent analysis were used to identify appropriate options to minimise odour (Ixom, 2019). NCOPL is currently investigating these management options and will continue to manage the brine storage in accordance with the approved Water Management Plan (Whitehaven, 2013) (or the latest approved version) to minimise the potential for odour generation.

8.7 Emissions from Train Wagons

The Project does not propose any change to the daily peak or average train movements. However, the potential emissions from train wagons transporting coal from the Narrabri Mine have historically been subject to detailed assessment. Heggies (2009) carried out air dispersion modelling to quantify the potential impact of particulate matter emissions from uncovered train wagons travelling from site. This modelling showed that maximum 24-hour average TSP concentrations would be in the order of 0.5 µg/m^3 at 100 m from the track. Lower concentrations would occur further from the track. PM_{10} concentrations were not quantified but it can be assumed that the TSP predictions provide a conservative estimate of PM_{10} concentrations. These predictions are not significant enough to cause exceedances of particulate matter criteria at sensitive receptors and, as the Project does not propose any change to train movements, it can be inferred that air quality conditions will not change as a result of emissions from train wagons.

9. Greenhouse Gas Assessment

9.1 Estimated Emissions

Table 21 shows the estimated emissions of greenhouse gases due to all identified GHG-generating activities for each mining year. Over the lifetime of the Project, Scope 1 and 2 emissions are estimated to average 1.161 Mt CO_2-e per year. **Appendix F** provides more detailed breakdowns of the estimated emissions for each activity by mining year.

Table 21 Summary of estimated greenhouse gas emissions

Mining Year	ROM coal (Mt)	Emissions (Mt CO_2-e)		
		Scope 1	Scope 2	Scope 3
2022	7.677	0.625	0.110	17.977
2023	7.140	0.581	0.102	16.760
2024	6.649	0.743	0.095	15.592
2025	10.948	0.829	0.156	25.698
2026	10.901	0.828	0.156	25.465
2027	9.404	0.845	0.134	21.987
2028	10.768	0.872	0.154	25.216
2029	8.958	0.885	0.128	20.890
2030	10.405	0.914	0.149	24.374
2031	8.436	0.875	0.120	19.618
2032	10.271	1.178	0.147	24.094
2033	9.353	1.160	0.134	21.807
2034	8.334	1.356	0.119	19.471
2035	9.379	1.377	0.134	21.805
2036	8.111	1.351	0.116	18.862
2037	9.212	1.471	0.132	21.448
2038	9.225	1.471	0.132	21.418
2039	7.679	1.466	0.110	17.858
2040	8.350	1.480	0.119	19.387
2041	7.550	1.464	0.108	17.558
2042	9.052	0.752	0.129	21.139
2043	6.056	0.956	0.086	14.210
2044	1.273	0.436	0.018	2.986
Average	**8.484**	**1.040**	**0.121**	**19.810**

Note: The Narrabri Mine is approved to mine approximately 170 Mt of ROM coal. The Project (including the approved Narrabri Mine) would involve extraction of approximately 252 Mt of ROM coal (i.e. an increase of approximately 82 Mt relative to the approved Narrabri Mine).

Figure 21 shows the estimated emissions by scope and by activity. These estimates show that fugitive emissions from mine ventilation and gas drainage would be the most significant direct (Scope 1) emissions.

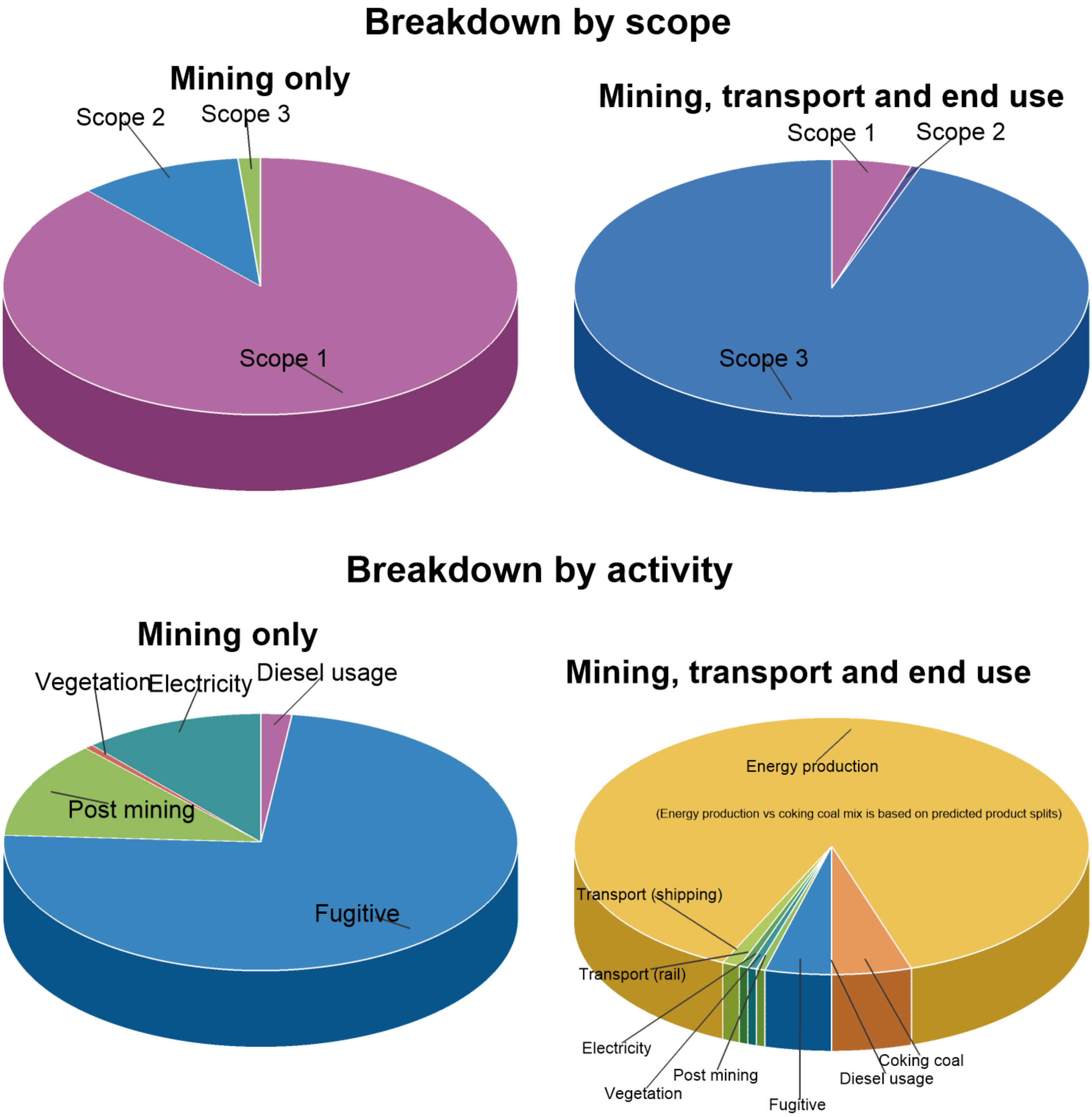


Figure 21 Summary of greenhouse gas emissions by scope and activity

9.2 Greenhouse Gas Impact and Context

The DEE provides a National Greenhouse Gas Inventory, where statistics on emissions per annum are stored, and detailed analysis of sources can be determined. To develop the context for this assessment, the impacts of the emissions projected in this assessment have been compared with the latest emissions officially recorded on the National Greenhouse Gas Inventory. The latest available data through the Inventory is from 2017.

Table 22 presents these national and state figures in context with the projected emissions from the Project. The estimated annual average Scope 1 and 2 emissions from the Project (1.161 Mt CO_2-e) represent approximately 0.22% of Australia's 2017 emissions.

Table 22 Project operational greenhouse gas emissions in State and National context

National Greenhouse Gas Inventory	Value
2017 Total Australia GHG emissions (Mt CO_2e)	530.5
2017 Total NSW GHG emissions (Mt CO_2e)	128.9
Project Greenhouse Gas Emissions	**Value**
Average projected emissions per year (Mt CO_2e)	1.161
Proportion of 2017 total Australia emissions	0.22%
Proportion of 2017 total NSW emissions	0.90%

In addition to the direct emissions associated with the Project, the following emissions sources are relevant to operations:

- Rail and sea transport of the product coal to customers; and
- Combustion of the product coal by customers.

With regard to the latter, these would be the Scope 1 emissions of the users of the coal.

9.3 Management and Mitigation

Mitigation of greenhouse gas emissions is inherent in the development of the mine plan. For example, reducing fuel usage by mobile plant is an objective of mine planning and good practice. Hence, savings of greenhouse gas emissions are attributable to appropriate mine planning.

NCOPL has a number of processes by which the GHG emissions from underground mining operations are mitigated, including the Greenhouse Gas Minimisation Plan (SLR, 2012) and Energy Savings Action Plan (Advitech, 2014) (or the latest approved version). These plans set out a range of measures for the management and mitigation of GHGs and opportunities for energy savings.

Monitoring of both emission sources and GHG concentrations is routinely undertaken at the Narrabri Mine. Data are collated on the following parameters (with indicative schedule):

- Electricity usage (monthly);
- Diesel consumption (monthly);
- Methane emissions (monthly);
- ROM coal production (monthly);
- Sulphur hexafluoride (SF_6) leakage (annually); and
- Waste water treatment (annually).

Consistent with the Greenhouse Gas Minimisation Plan, the mitigation measures to reduce the level of future greenhouse gas emissions from underground operations include:

- Regular maintenance of plant and equipment to minimise fuel consumption and associated emissions;
- Continuing to select plant and equipment that are energy efficient; and
- Training all staff on continuous improvement strategies regarding efficient use of plant and equipment including maintaining equipment to retain high levels of energy efficiency.

10. Construction

The key air quality issue during construction will be dust. 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 would be taking place in each location on the site.

Air quality impacts during construction would largely result from dust generated from work associated with additional infrastructure and upgrades to existing infrastructure that would be required to support the Project. Construction and upgrades of infrastructure would occur in parallel with ongoing mining operations and, of relevance to air quality, would include:

- Development of services corridors and access tracks to surface infrastructure. Services corridors and access tracks would continue to be progressively developed for the Project to provide access from the Pit Top Area to surface infrastructure components.
- Development of mine ventilation infrastructure. The excavated material from the development of the shafts would be used as fill material for the development of sediment dams and other infrastructure construction activities. Excavation of the shafts would occur 24 hours per day, seven days per week.
- Development of gas management infrastructure. Conventional underground in-seam pre-drainage would continue to be undertaken by drilling into the coal seam from gate roads, with gas collected and then pumped to the surface for venting at service boreholes.
- Development of exploration and service boreholes.
- Minor augmentations and upgrades of other surface facilities.

Surface construction and development would generally occur 7.00 am to 6.00 pm seven days per week (except for the operation of drill rigs as part of shaft excavation, which may be 24 hours per day). The existing mobile equipment would generally be required for ongoing development activities including graders, bulldozers, gravel trucks and water carts. During periods of more intense development, additional mobile equipment may be required. The number and type of equipment would vary, depending on the development activity being undertaken.

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 would depend on decisions made by NCOPL, in conjunction with contractor(s), and changes to the construction methods and sequences that are expected to take place during the construction phase.

It will be 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 would require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under unfavourable weather conditions, such as dry wind conditions. Monitoring would also continue to be carried out during the construction phase to assess compliance with Development Consent criteria.

11. Conclusions

This report presents the results of the air quality assessment for the Narrabri Underground Mine Stage 3 Extension Project including quantification of greenhouse gas emissions. 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. Greenhouse gas emissions have also been estimated in accordance with recognised methodologies.

The main potential air quality issue was identified as dust, that is, particulate matter in the form of TSP, PM_{10} or $PM_{2.5}$ from the general mining activities. This issue was the focus of the assessment.

A detailed review of the existing environment was carried out to understand any current air quality related issues. The following conclusions were made in relation to the existing environment:

- The most common winds in the area are from the northwest and southeast.
- Particulate matter levels were heavily influenced by drought conditions in 2017 and 2018. The OEH reported that, in 2018, particle levels increased across the State due to dust from the intense widespread drought and smoke from bushfires and hazard reduction burning (OEH, 2019b).
- PM_{10} (as 24-hour and annual average) concentrations comply with EPA criteria, based on data collected in the vicinity of the Narrabri Mine.
- $PM_{2.5}$ concentrations comply with EPA criteria, if estimated from PM_{10} measurements using relationships measured at the Narrabri Mine.
- TSP concentrations comply with EPA criteria, if estimated from PM_{10} measurements using relationships measured in rural areas (NSW Minerals Council, 2000; Jacobs, 2018).
- Deposited dust levels comply with EPA criteria, based on data collected in the vicinity of the Narrabri Mine.
- Conditions in 2014 were representative, and continue to be 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. 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 focus of the assessment was on the potential change in air quality, noting that the Narrabri Mine will already contribute to the existing air quality.

The main conclusions of the assessment were as follows:

- 24-hour and annual average PM_{10} concentrations would not exceed EPA or VLAMP criteria at any private sensitive receptor, based on model predictions. This outcome is consistent with historical ambient air quality monitoring which has not shown any exceedances in the past six years (except during regional dust events).
- 24-hour and annual average $PM_{2.5}$ concentrations would not exceed EPA or VLAMP criteria at any private sensitive receptor, based on model predictions.
- Annual average TSP concentrations and dust deposition levels would not exceed EPA or VLAMP criteria at any private sensitive receptor, based on model predictions.
- The estimated annual average Scope 1 and 2 emissions from the Project represent approximately 0.22% of Australia's 2017 emissions.

It has therefore been concluded that the Project could proceed without causing adverse air quality impacts at private sensitive receptors. This conclusion has been informed by monitoring data which show that activities at the existing approved Narrabri Mine are generally not causing adverse off-site air quality impacts, predicted compliance with relevant criteria by modelling, and proposed continuation of current air quality mitigation and management measures. The key air quality mitigation and management measures that currently apply and have been assumed for this assessment include:

- Water sprays on the ROM and product stockpiles;
- Enclosure of the coal handling and preparation plant;
- Covered conveyors; and
- Watering of unsealed trafficked roads.

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Appendix A. EPA and NSW Health Assessment Requirements

EPA

3 Air issues

3.1. The EIS must 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 (2002)*. Particular consideration should be given to section 129 of the POEO Act concerning control of "offensive odour".

3.2. The EIS must include an air quality impact assessment (AQIA).

3.3. The AQIA must be carried out in accordance with the document, *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (2005) http://www.epa.nsw.gov.au/resources/air/ammodelling05361.pdf.

3.4. The EIS must detail emission control techniques/practices that will be employed at the site and identify how the proposed control techniques/practices will meet the requirements of the POEO Act, *POEO (Clean Air) Regulation* and associated air quality limits or guideline criteria.

NSW Health

Air – including:

- An assessment of the likely air quality impacts of the development in accordance with the Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW;
- Particulate matter emissions (principally from the Project's coal handling operations) and the impact surrounding receivers;
- Potential for cumulative impact in development stage and operating stage for surrounding communities i.e. Baan Baa, Boggabri.

Appendix B. Annual and Seasonal Wind-roses

Figure B1 Annual and seasonal wind-roses for the Narrabri Mine 2014

Appendix C. Emissions Calculations

Emission factors

Activity	Emission factor			Units	Source
	TSP	PM_{10}	$PM_{2.5}$		
Stripping topsoil	$E_{TSP} = 0.029$	$E_{PM10} = 0.0073 \times E_{TSP}$	$E_{PM2.5} = 0.05 \times E_{TSP}$	kg/t	US EPA / NPI
Topsoil spreading	$E_{TSP} = 0.02$	$E_{PM10} = 0.006 \times E_{TSP}$	$E_{PM2.5} = 0.031 \times E_{TSP}$	kg/t	US EPA / NPI
Loading stockpiles / conveyors	$E_{TSP} = 0.74 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	$E_{PM10} = 0.35 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	$E_{PM2.5} = 0.053 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$	kg/t	US EPA / NPI
Dozers working on coal stockpiles	$E_{TSP} = 35.6 \times (S^{1.2}/M^{1.3})$	$E_{PM10} = 6.33 \times (S^{1.5}/M^{1.4})$	$E_{PM2.5} = 0.022 \times E_{TSP}$	kg/hour	US EPA / NPI
Rotary breaker / crushing	$E_{TSP} = 0.0027$	$E_{PM10} = 0.0012$	$E_{PM2.5} = 0.005 \times E_{TSP}$	kg/t	US EPA
Screening	$E_{TSP} = 0.0125$	$E_{PM10} = 0.0043$	$E_{PM2.5} = 0.005 \times E_{TSP}$	kg/t	US EPA
Loading product coal to trains	$E_{TSP} = 0.0004$	$E_{PM10} = 0.00017$	$E_{PM2.5} = 0.05 \times E_{TSP}$	kg/t	NPI
Hauling rejects on unsealed roads	$E_{TSP} = 4$	$E_{PM10} = 0.3 \times E_{TSP}$	$E_{PM2.5} = 0.03 \times E_{TSP}$	kg/VKT	SPCC
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
Wind erosion from stockpiles	$E_{TSP} = 0.097$	$E_{PM10} = 0.5 \times E_{TSP}$	$E_{PM2.5} = 0.075 \times E_{TSP}$	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

U = wind speed (m/s)
M = moisture content (%)
S = silt content (%)
s = speed (km/h)

Emission inventory
2025

Emission calculations																			
Narrabri 2025																			
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables						
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2)^1.3	Moisture (%)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Topsoil stripping	855	215	43	50	58953	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-
Topsoil spreading	258	155	8	50	25791	t/y	0.02	kg/t	0.012	kg/t	0.001	kg/t	-	-	-	-	-	-	-
ROM coal - loading ROM coal stockpile	1623	768	116	70	10948419	t/y	0.00049	kg/t	0.00023	kg/t	0.0000	kg/t	1.63	5.3	-	-	-	-	-
ROM coal - dozers on ROM coal stockpiles	184282	49721	4054	50	8760	h/y	42.1	kg/h	11.4	kg/h	0.926	kg/h	-	5.3	-	-	-	7	-
ROM coal - rotary breaker	1336	594	67	90	4948419	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-
ROM coal - dry screening	6186	2128	309	90	4948419	t/y	0.01250	kg/t	0.0043	kg/t	0.0006	kg/t	-	-	-	-	-	-	-
ROM coal - secondary bypass crushing	1620	720	81	90	6000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-
ROM coal - conveyor transfer (x4)	6492	3070	465	70	10948419	t/y	0.00198	kg/t	0.00093	kg/t	0.0001	kg/t	1.63	5.3	-	-	-	-	-
Product coal - loading bypass coal	889	421	64	70	6000000	t/y	0.00049	kg/t	0.00023	kg/t	0.0000	kg/t	1.63	5.3	-	-	-	-	-
Product coal - loading washed product coal	1198	566	86	70	4700998	t/y	0.00085	kg/t	0.00040	kg/t	0.0001	kg/t	1.63	3.6	-	-	-	-	-
Product coal - conveyor transfer	4543	2149	325	50	10700998	t/y	0.00085	kg/t	0.00040	kg/t	0.0001	kg/t	1.63	3.6	-	-	-	-	-
Product coal - dozers on product coal stockpiles	304683	85448	6703	50	8760	h/y	69.6	kg/h	19.5	kg/h	1.530	kg/h	-	3.6	-	-	-	7	-
Product coal - loading trains	4280	1819	214	0	10700998	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-
Rejects - conveyor transfer (x2)	358	169	26	50	247421	t/y	0.00289	kg/t	0.00137	kg/t	0.0002	kg/t	1.63	1.5	-	-	-	-	-
Rejects - loading rejects stockpile	215	102	15	70	247421	t/y	0.00289	kg/t	0.00137	kg/t	0.0002	kg/t	1.63	1.5	-	-	-	-	-
Rejects - hauling rejects	2969	877	89	85	247421	t/y	0.08000	kg/t	0.0236	kg/t	0.002	kg/t	-	-	4	50	1	-	-
Wind erosion - ROM coal stockpile	2209	1139	166	50	5.2	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - product coal stockpile	1487	767	112	50	3.5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - soil stockpiles	7376	3802	553	30	12.4	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - active rehabilitation	1699	876	127	0	2.0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Ventilation shaft(s)	35478	17739	1774	0	26280	h/y	1.4	kg/h	0.7	kg/h	0.07	kg/h	-	-	-	-	-	-	-
Grading roads	1518	530	47	50	4932	km/y	0.61547	kg/VKT	0.215	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	8
	571553	173774	15444																

Notes: production data supplied by NCOPL

Emission inventory
2041

Emission calculations																			
Narrabri 2041																			
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables						
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2)^1.3	Moisture (%)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Topsoil stripping	855	215	43	50	58953	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-
Topsoil spreading	258	155	8	50	25791	t/y	0.02	kg/t	0.012	kg/t	0.001	kg/t	-	-	-	-	-	-	-
ROM coal - loading ROM coal stockpile	1119	529	80	70	7549573	t/y	0.00049	kg/t	0.00023	kg/t	0.0000	kg/t	1.63	5.3	-	-	-	-	-
ROM coal - dozers on ROM coal stockpiles	184282	49721	4054	50	8760	h/y	42.1	kg/h	11.4	kg/h	0.926	kg/h	-	5.3	-	-	-	7	-
ROM coal - rotary breaker	418	186	21	90	1549573	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-
ROM coal - dry screening	1937	666	97	90	1549573	t/y	0.01250	kg/t	0.0043	kg/t	0.0006	kg/t	-	-	-	-	-	-	-
ROM coal - secondary bypass crushing	1620	720	81	90	6000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-
ROM coal - conveyor transfer (x4)	4476	2117	321	70	7549573	t/y	0.00198	kg/t	0.00093	kg/t	0.0001	kg/t	1.63	5.3	-	-	-	-	-
Product coal - loading bypass coal	889	421	64	70	6000000	t/y	0.00049	kg/t	0.00023	kg/t	0.0000	kg/t	1.63	5.3	-	-	-	-	-
Product coal - loading washed product coal	375	177	27	70	1472094	t/y	0.00085	kg/t	0.00040	kg/t	0.0001	kg/t	1.63	3.6	-	-	-	-	-
Product coal - conveyor transfer	3172	1500	227	50	7472094	t/y	0.00085	kg/t	0.00040	kg/t	0.0001	kg/t	1.63	3.6	-	-	-	-	-
Product coal - dozers on product coal stockpiles	304683	85448	6703	50	8760	h/y	69.6	kg/h	19.5	kg/h	1.530	kg/h	-	3.6	-	-	-	7	-
Product coal - loading trains	2989	1270	149	0	7472094	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-
Rejects - conveyor transfer (x2)	112	53	8	50	77479	t/y	0.00289	kg/t	0.00137	kg/t	0.0002	kg/t	1.63	1.5	-	-	-	-	-
Rejects - loading rejects stockpile	67	32	5	70	77479	t/y	0.00289	kg/t	0.00137	kg/t	0.0002	kg/t	1.63	1.5	-	-	-	-	-
Rejects - hauling rejects	930	275	28	85	77479	t/y	0.08000	kg/t	0.0236	kg/t	0.002	kg/t	-	-	4	50	1	-	-
Wind erosion - ROM coal stockpile	2209	1139	166	50	5.2	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - product coal stockpile	1487	767	112	50	3.5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - soil stockpiles	7376	3802	553	30	12.4	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - active rehabilitation	1699	876	127	0	2.0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Ventilation shaft(s)	35478	17739	1774	0	26280	h/y	1.4	kg/h	0.7	kg/h	0.07	kg/h	-	-	-	-	-	-	-
Grading roads	1518	530	47	50	4932	km/y	0.61547	kg/VKT	0.215	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	8
	557950	168338	14694																

Notes: production data supplied by NCOPL

Emission inventory
2042

Emission calculations																				
Narrabri 2042																				
	Annual emissions (kg/y)						TSP		PM10		PM2.5		Variables							
Activity	TSP	PM10	PM2.5	Control (%)	Intensity	Units	Factor	Units	Factor	Units	Factor	Units	(ws/2.2)^1.3	Moisture (%)	kg/VKT	t/truck	km/trip	Silt (%)	Speed (km/h)
Topsoil stripping	855	215	43	50	58953	t/y	0.029	kg/t	0.0073	kg/t	0.001	kg/t	-	-	-	-	-	-	-
Topsoil spreading	258	155	8	50	25791	t/y	0.02	kg/t	0.012	kg/t	0.001	kg/t	-	-	-	-	-	-	-
ROM coal - loading ROM coal stockpile	1342	635	96	70	9051665	t/y	0.00049	kg/t	0.00023	kg/t	0.0000	kg/t	1.63	5.3	-	-	-	-	-
ROM coal - dozers on ROM coal stockpiles	184282	49721	4054	50	8760	h/y	42.1	kg/h	11.4	kg/h	0.926	kg/h	-	5.3	-	-	-	7	-
ROM coal - rotary breaker	824	366	41	90	3051665	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-
ROM coal - dry screening	3815	1312	191	90	3051665	t/y	0.01250	kg/t	0.0043	kg/t	0.0006	kg/t	-	-	-	-	-	-	-
ROM coal - secondary bypass crushing	1620	720	81	90	6000000	t/y	0.00270	kg/t	0.0012	kg/t	0.0001	kg/t	-	-	-	-	-	-	-
ROM coal - conveyor transfer (x4)	5367	2538	384	70	9051665	t/y	0.00198	kg/t	0.00093	kg/t	0.0001	kg/t	1.63	5.3	-	-	-	-	-
Product coal - loading bypass coal	889	421	64	70	6000000	t/y	0.00049	kg/t	0.00023	kg/t	0.0000	kg/t	1.63	5.3	-	-	-	-	-
Product coal - loading washed product coal	739	349	53	70	2899082	t/y	0.00085	kg/t	0.00040	kg/t	0.0001	kg/t	1.63	3.6	-	-	-	-	-
Product coal - conveyor transfer	3778	1787	271	50	8899082	t/y	0.00085	kg/t	0.00040	kg/t	0.0001	kg/t	1.63	3.6	-	-	-	-	-
Product coal - dozers on product coal stockpiles	304683	85448	6703	50	8760	h/y	69.6	kg/h	19.5	kg/h	1.530	kg/h	-	3.6	-	-	-	7	-
Product coal - loading trains	3560	1513	178	0	8899082	t/y	0.00040	kg/t	0.00017	kg/t	0.0000	kg/t	-	-	-	-	-	-	-
Rejects - conveyor transfer (x2)	221	104	16	50	152583	t/y	0.00289	kg/t	0.00137	kg/t	0.0002	kg/t	1.63	1.5	-	-	-	-	-
Rejects - loading rejects stockpile	132	63	9	70	152583	t/y	0.00289	kg/t	0.00137	kg/t	0.0002	kg/t	1.63	1.5	-	-	-	-	-
Rejects - hauling rejects	1831	541	55	85	152583	t/y	0.08000	kg/t	0.0236	kg/t	0.002	kg/t	-	-	4	50	1	-	-
Wind erosion - ROM coal stockpile	2209	1139	166	50	5.2	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - product coal stockpile	1487	767	112	50	3.5	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - soil stockpiles	7376	3802	553	30	12.4	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Wind erosion - active rehabilitation	1699	876	127	0	2.0	ha	849.7	kg/ha/y	438.0	kg/ha/y	63.7	kg/ha/y	-	-	-	-	-	-	-
Ventilation shaft(s)	35478	17739	1774	0	26280	h/y	1.4	kg/h	0.7	kg/h	0.07	kg/h	-	-	-	-	-	-	-
Grading roads	1518	530	47	50	4932	km/y	0.61547	kg/VKT	0.215	kg/VKT	0.019	kg/VKT	-	-	-	-	-	-	8
	563962	170740	15026																	

Notes: production data supplied by NCOPL

Source allocations 2025

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 -------------------------------       15-Jun-2020 11:26
  DUST EMISSION CALCULATIONS XL1
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 Number of dust sources : 20
 Number of activities   : 22

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Topsoil stripping
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 855 kg/y TSP  215 kg/y PM10  43 kg/y PM2.5
 FROM SOURCES  : 2
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 : Topsoil spreading
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 258 kg/y TSP  155 kg/y PM10  8 kg/y PM2.5
 FROM SOURCES  : 2
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 : ROM coal - loading ROM coal stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1623 kg/y TSP  768 kg/y PM10  116 kg/y PM2.5
 FROM SOURCES  : 6
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 : ROM coal - dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 184282 kg/y TSP  49721 kg/y PM10  4054 kg/y PM2.5
 FROM SOURCES  : 6
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 : ROM coal - rotary breaker
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1336 kg/y TSP  594 kg/y PM10  67 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - dry screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 6184 kg/y TSP  2127 kg/y PM10  309 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - secondary bypass crushing
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - conveyor transfer (x4)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 6491 kg/y TSP  3070 kg/y PM10  465 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : Product coal - loading bypass coal
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 889 kg/y TSP  421 kg/y PM10  64 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - loading washed product coal
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1197 kg/y TSP  566 kg/y PM10  86 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - conveyor transfer
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 4543 kg/y TSP  2149 kg/y PM10  325 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 304683 kg/y TSP  85448 kg/y PM10  6703 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - loading trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 4280 kg/y TSP  1819 kg/y PM10  214 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 : Rejects - conveyor transfer (x2)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 358 kg/y TSP  169 kg/y PM10  26 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : Rejects - loading rejects stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 215 kg/y TSP  102 kg/y PM10  15 kg/y PM2.5
 FROM SOURCES  : 2
2 5
 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 : Rejects - hauling rejects
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2969 kg/y TSP  877 kg/y PM10  89 kg/y PM2.5
 FROM SOURCES  : 2
2 5
 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 - ROM coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2209 kg/y TSP  1139 kg/y PM10  166 kg/y PM2.5
 FROM SOURCES  : 6
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 - product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1487 kg/y TSP  767 kg/y PM10  112 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 - soil stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 7376 kg/y TSP  3802 kg/y PM10  553 kg/y PM2.5
 FROM SOURCES  : 3
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 : Wind erosion - active rehabilitation
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1699 kg/y TSP  876 kg/y PM10  127 kg/y PM2.5
 FROM SOURCES  : 3
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 : Ventilation shaft(s)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 35478 kg/y TSP  17739 kg/y PM10  1774 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 : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1518 kg/y TSP  530 kg/y PM10  47 kg/y PM2.5
 FROM SOURCES  : 16
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

 Pit retention sources:
```

Source allocations
2041

```
 --------------------------------      15-Jun-2020 11:26
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Number of dust sources : 20
 Number of activities   : 22

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Topsoil stripping
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 855 kg/y TSP  215 kg/y PM10  43 kg/y PM2.5
 FROM SOURCES  : 2
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 : Topsoil spreading
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 258 kg/y TSP  155 kg/y PM10  8 kg/y PM2.5
 FROM SOURCES  : 2
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 : ROM coal - loading ROM coal stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1119 kg/y TSP  529 kg/y PM10  80 kg/y PM2.5
 FROM SOURCES  : 6
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 : ROM coal - dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 184282 kg/y TSP  49721 kg/y PM10  4054 kg/y PM2.5
 FROM SOURCES  : 6
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 : ROM coal - rotary breaker
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 418 kg/y TSP  186 kg/y PM10  21 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - dry screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1937 kg/y TSP  666 kg/y PM10  97 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - secondary bypass crushing
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - conveyor transfer (x4)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 4476 kg/y TSP  2117 kg/y PM10  321 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : Product coal - loading bypass coal
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 889 kg/y TSP  421 kg/y PM10  64 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - loading washed product coal
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 375 kg/y TSP  177 kg/y PM10  27 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - conveyor transfer
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3172 kg/y TSP  1500 kg/y PM10  227 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 304683 kg/y TSP  85448 kg/y PM10  6703 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - loading trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2989 kg/y TSP  1270 kg/y PM10  149 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 : Rejects - conveyor transfer (x2)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 112 kg/y TSP  53 kg/y PM10  8 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : Rejects - loading rejects stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 67 kg/y TSP  32 kg/y PM10  5 kg/y PM2.5
 FROM SOURCES  : 2
2 5
 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 : Rejects - hauling rejects
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 930 kg/y TSP  275 kg/y PM10  28 kg/y PM2.5
 FROM SOURCES  : 2
2 5
 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 - ROM coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2209 kg/y TSP  1139 kg/y PM10  166 kg/y PM2.5
 FROM SOURCES  : 6
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 - product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1487 kg/y TSP  767 kg/y PM10  112 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 - soil stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 7376 kg/y TSP  3802 kg/y PM10  553 kg/y PM2.5
 FROM SOURCES  : 3
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 : Wind erosion - active rehabilitation
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1699 kg/y TSP  876 kg/y PM10  127 kg/y PM2.5
 FROM SOURCES  : 3
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 : Ventilation shaft(s)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 35478 kg/y TSP  17739 kg/y PM10  1774 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 : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1518 kg/y TSP  530 kg/y PM10  47 kg/y PM2.5
 FROM SOURCES  : 16
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

 Pit retention sources:
```

Source allocations
2042

```
 --------------------------------        15-Jun-2020 11:26
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

 Number of dust sources : 20
 Number of activities   : 22

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Topsoil stripping
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 855 kg/y TSP  215 kg/y PM10  43 kg/y PM2.5
 FROM SOURCES  : 2
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 : Topsoil spreading
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 258 kg/y TSP  155 kg/y PM10  8 kg/y PM2.5
 FROM SOURCES  : 2
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 : ROM coal - loading ROM coal stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1342 kg/y TSP  635 kg/y PM10  96 kg/y PM2.5
 FROM SOURCES  : 6
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 : ROM coal - dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 184282 kg/y TSP  49721 kg/y PM10  4054 kg/y PM2.5
 FROM SOURCES  : 6
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 : ROM coal - rotary breaker
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 824 kg/y TSP  366 kg/y PM10  41 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - dry screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3815 kg/y TSP  1312 kg/y PM10  191 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - secondary bypass crushing
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1620 kg/y TSP  720 kg/y PM10  81 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : ROM coal - conveyor transfer (x4)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 5367 kg/y TSP  2538 kg/y PM10  384 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : Product coal - loading bypass coal
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 889 kg/y TSP  421 kg/y PM10  64 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - loading washed product coal
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 739 kg/y TSP  349 kg/y PM10  53 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - conveyor transfer
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3778 kg/y TSP  1787 kg/y PM10  271 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 304683 kg/y TSP  85448 kg/y PM10  6703 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 : Product coal - loading trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3560 kg/y TSP  1513 kg/y PM10  178 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 : Rejects - conveyor transfer (x2)
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 221 kg/y TSP  104 kg/y PM10  16 kg/y PM2.5
 FROM SOURCES  : 3
6 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 : Rejects - loading rejects stockpile
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 132 kg/y TSP  63 kg/y PM10  9 kg/y PM2.5
 FROM SOURCES  : 2
2 5
 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 : Rejects - hauling rejects
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1831 kg/y TSP  541 kg/y PM10  55 kg/y PM2.5
 FROM SOURCES  : 2
2 5
 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 - ROM coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2209 kg/y TSP  1139 kg/y PM10  166 kg/y PM2.5
 FROM SOURCES  : 6
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 - product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1487 kg/y TSP  767 kg/y PM10  112 kg/y PM2.5
 FROM SOURCES  : 4
2 3 4 5
 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 - soil stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 7376 kg/y TSP  3802 kg/y PM10  553 kg/y PM2.5
 FROM SOURCES  : 3
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 : Wind erosion - active rehabilitation
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1699 kg/y TSP  876 kg/y PM10  127 kg/y PM2.5
 FROM SOURCES  : 3
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 : Ventilation shaft(s)
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 35478 kg/y TSP  17739 kg/y PM10  1774 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 : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1518 kg/y TSP  530 kg/y PM10  47 kg/y PM2.5
 FROM SOURCES  : 16
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

 Pit retention sources:
```

Appendix D. Model Receptors

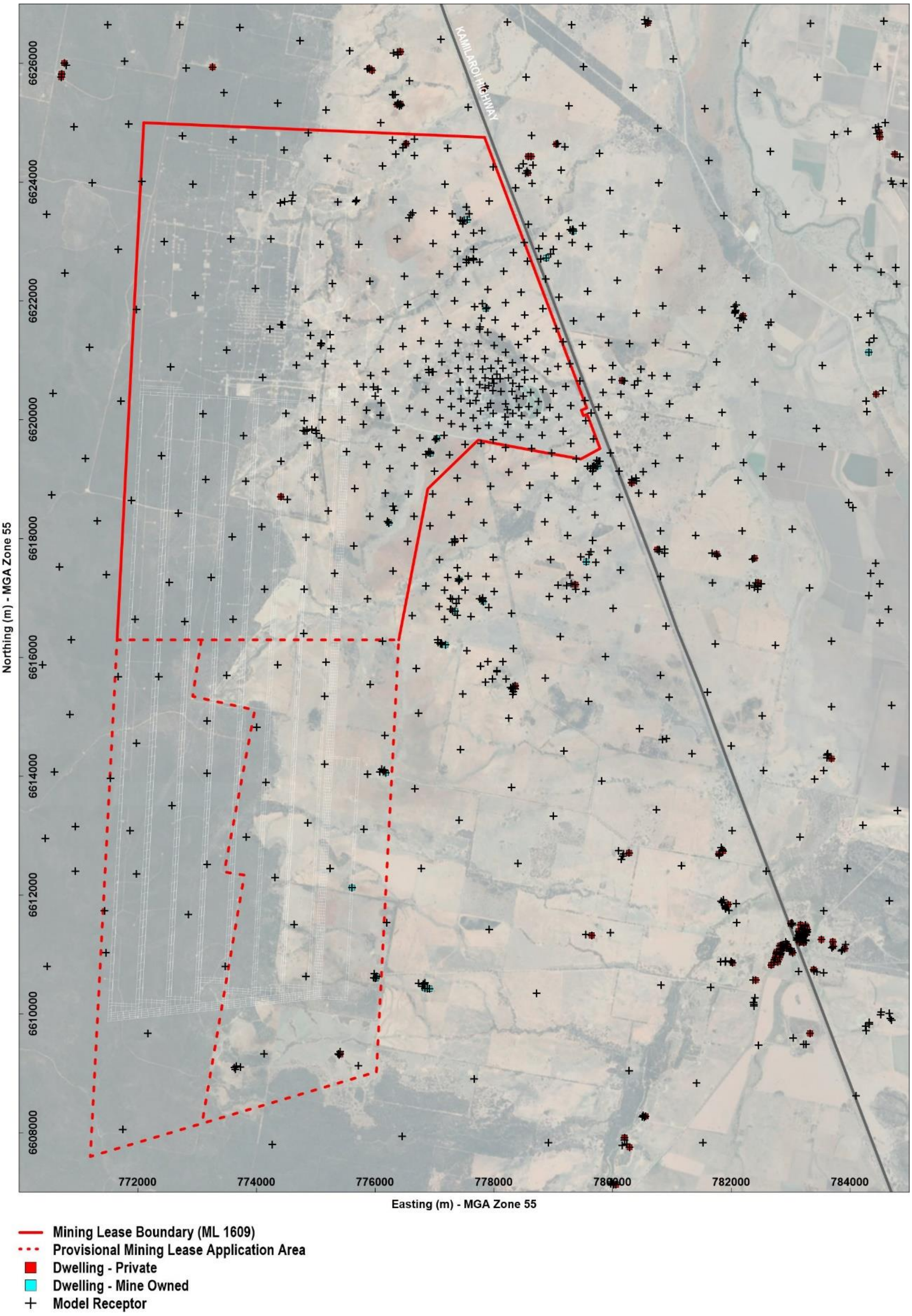

Figure D1 Location of model receptors

Appendix E. Tabulated Model Results

Model Results

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
Predicted maximum 24-hour average PM10 concentrations (ug/m3)									
784a	Privately Owned Land	1.9	1.9	1.9	Variable	30	30	30	50
784b	Privately Owned Land	1.8	1.7	1.8	Variable	30	30	30	50
794a	Privately Owned Land	1.4	1.4	1.4	Variable	30	30	30	50
600w	NCOPL Owned Land	1.8	1.8	1.8	Variable	30	30	30	50
669a	Privately Owned Land	2.1	2.0	2.0	Variable	30	30	30	50
702a	Privately Owned Land	1.4	1.3	1.3	Variable	30	30	30	50
512a	Privately Owned Land	5.6	5.4	5.5	Variable	30	30	30	50
512b	Privately Owned Land	4.3	4.2	4.3	Variable	30	30	30	50
684a	Privately Owned Land	0.8	0.8	0.8	Variable	30	30	30	50
677a	Privately Owned Land	5.9	5.7	5.8	Variable	31	31	31	50
669b	Privately Owned Land	5.1	4.9	5.0	Variable	31	31	31	50
676a	Privately Owned Land	7.7	7.5	7.6	Variable	31	31	31	50
675a	Privately Owned Land	14.5	14.1	14.3	Variable	34	34	34	50
600a	NCOPL Owned Land	21.3	20.8	21.0	Variable	37	37	37	50
670a	Privately Owned Land	13.6	13.2	13.4	Variable	33	33	33	50
600b	NCOPL Owned Land	9.9	9.7	9.8	Variable	32	31	31	50
600c	NCOPL Owned Land	14.6	14.3	14.4	Variable	36	36	36	50
600z	NCOPL Owned Land	6.9	6.8	6.8	Variable	32	32	32	50
687a	Privately Owned Land	5.8	5.6	5.7	Variable	31	31	31	50
680a	Privately Owned Land	2.9	2.9	2.9	Variable	30	30	30	50
600d	NCOPL Owned Land	3.0	3.0	3.0	Variable	30	30	30	50
600e	NCOPL Owned Land	4.2	4.1	4.1	Variable	30	30	30	50
600x	NCOPL Owned Land	5.4	5.3	5.4	Variable	31	31	31	50
600y	NCOPL Owned Land	5.6	5.5	5.5	Variable	30	30	30	50
600f	NCOPL Owned Land	30.5	29.8	30.1	Variable	39	38	38	50
600g	NCOPL Owned Land	35.1	34.3	34.7	Variable	47	46	46	50
600q	NCOPL Owned Land	2.5	2.5	2.5	Variable	30	30	30	50
600h	NCOPL Owned Land	10.0	9.8	9.9	Variable	31	30	31	50
662a	Privately Owned Land	8.6	8.4	8.5	Variable	32	32	32	50
660a	Privately Owned Land	6.2	6.1	6.1	Variable	31	31	31	50
660b	Privately Owned Land	6.6	6.4	6.5	Variable	31	31	31	50
653a	Privately Owned Land	3.7	3.6	3.7	Variable	31	31	31	50
652a	Privately Owned Land	6.2	6.0	6.1	Variable	31	31	31	50
652b	Privately Owned Land	6.1	5.9	6.0	Variable	31	31	31	50
601a	Privately Owned Land	4.6	4.5	4.5	Variable	32	32	32	50
600n	NCOPL Owned Land	36.9	36.2	36.5	Variable	55	54	54	50
600p	NCOPL Owned Land	14.9	14.5	14.7	Variable	32	32	32	50
664a	Privately Owned Land	3.4	3.3	3.3	Variable	30	30	30	50
665a	Privately Owned Land	4.8	4.7	4.7	Variable	31	31	31	50
665b	Privately Owned Land	4.7	4.6	4.7	Variable	31	31	31	50
667a	Privately Owned Land	5.4	5.3	5.3	Variable	32	31	31	50
647a	Privately Owned Land	0.9	0.8	0.8	Variable	30	30	30	50
647b	Privately Owned Land	0.9	0.8	0.8	Variable	30	30	30	50
647c	Privately Owned Land	0.9	0.8	0.8	Variable	30	30	30	50
641a	Privately Owned Land	1.9	1.8	1.9	Variable	30	30	30	50
600r	NCOPL Owned Land	0.9	0.8	0.9	Variable	30	30	30	50
600s	NCOPL Owned Land	0.6	0.6	0.6	Variable	30	30	30	50

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
693a	Privately Owned Land	1.1	1.0	1.1	Variable	30	30	30	50
685a	Privately Owned Land	0.7	0.7	0.7	Variable	30	30	30	50
738a	Privately Owned Land	0.6	0.6	0.6	Variable	30	30	30	50
757a	Privately Owned Land	0.5	0.5	0.5	Variable	30	30	30	50
688a	Privately Owned Land	0.8	0.8	0.8	Variable	30	30	30	50
600u	NCOPL Owned Land	0.5	0.4	0.4	Variable	30	30	30	50
701a	Privately Owned Land	0.3	0.3	0.3	Variable	30	30	30	50
690a	Privately Owned Land	0.5	0.5	0.5	Variable	30	30	30	50
684b	Privately Owned Land	0.8	0.8	0.8	Variable	30	30	30	50
600t	NCOPL Owned Land	0.6	0.6	0.6	Variable	30	30	30	50
600v	NCOPL Owned Land	0.4	0.4	0.4	Variable	30	30	30	50
800a	Privately Owned Land	1.8	1.8	1.8	Variable	30	30	30	50
759a	Privately Owned Land	0.3	0.3	0.3	Variable	30	30	30	50
761a	Privately Owned Land	0.3	0.3	0.3	Variable	30	30	30	50
761b	Privately Owned Land	0.3	0.3	0.3	Variable	30	30	30	50
699a	Privately Owned Land	0.2	0.2	0.2	Variable	30	30	30	50
694a	Privately Owned Land	1.3	1.3	1.3	Variable	30	30	30	50
695a	Privately Owned Land	0.5	0.5	0.5	Variable	30	30	30	50
666a	Privately Owned Land	4.7	4.6	4.6	Variable	31	31	31	50
Predicted annual average PM10 concentrations (ug/m3)									
784a	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
784b	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
794a	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
600w	NCOPL Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
669a	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
702a	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
512a	Privately Owned Land	0.6	0.6	0.6	11	11.6	11.6	11.6	25
512b	Privately Owned Land	0.5	0.5	0.5	11	11.5	11.5	11.5	25
684a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
677a	Privately Owned Land	0.7	0.7	0.7	11	11.7	11.7	11.7	25
669b	Privately Owned Land	0.5	0.5	0.5	11	11.5	11.5	11.5	25
676a	Privately Owned Land	0.9	0.9	0.9	11	11.9	11.9	11.9	25
675a	Privately Owned Land	1.9	1.8	1.9	11	12.9	12.8	12.9	25
600a	NCOPL Owned Land	2.8	2.7	2.7	11	13.8	13.7	13.7	25
670a	Privately Owned Land	1.7	1.7	1.7	11	12.7	12.7	12.7	25
600b	NCOPL Owned Land	1.2	1.1	1.1	11	12.2	12.1	12.1	25
600c	NCOPL Owned Land	2.0	1.9	2.0	11	13.0	12.9	13.0	25
600z	NCOPL Owned Land	0.9	0.9	0.9	11	11.9	11.9	11.9	25
687a	Privately Owned Land	0.7	0.7	0.7	11	11.7	11.7	11.7	25
680a	Privately Owned Land	0.3	0.3	0.3	11	11.3	11.3	11.3	25
600d	NCOPL Owned Land	0.3	0.4	0.4	11	11.3	11.4	11.4	25
600e	NCOPL Owned Land	0.5	0.5	0.5	11	11.5	11.5	11.5	25
600x	NCOPL Owned Land	0.5	0.5	0.5	11	11.5	11.5	11.5	25
600y	NCOPL Owned Land	0.6	0.6	0.6	11	11.6	11.6	11.6	25
600f	NCOPL Owned Land	2.5	2.5	2.5	11	13.5	13.5	13.5	25
600g	NCOPL Owned Land	3.4	3.4	3.4	11	14.4	14.4	14.4	25
600q	NCOPL Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
600h	NCOPL Owned Land	0.8	0.9	0.9	11	11.8	11.9	11.9	25
662a	Privately Owned Land	1.7	1.6	1.7	11	12.7	12.6	12.7	25
660a	Privately Owned Land	1.3	1.2	1.3	11	12.3	12.2	12.3	25

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
660b	Privately Owned Land	1.3	1.3	1.3	11	12.3	12.3	12.3	25
653a	Privately Owned Land	0.8	0.8	0.8	11	11.8	11.8	11.8	25
652a	Privately Owned Land	1.1	1.0	1.1	11	12.1	12.0	12.1	25
652b	Privately Owned Land	1.1	1.0	1.1	11	12.1	12.0	12.1	25
601a	Privately Owned Land	0.5	0.6	0.6	11	11.5	11.6	11.6	25
600n	NCOPL Owned Land	8.8	8.6	8.7	11	19.8	19.6	19.7	25
600p	NCOPL Owned Land	2.7	2.6	2.6	11	13.7	13.6	13.6	25
664a	Privately Owned Land	0.6	0.6	0.6	11	11.6	11.6	11.6	25
665a	Privately Owned Land	0.8	0.8	0.8	11	11.8	11.8	11.8	25
665b	Privately Owned Land	0.9	0.8	0.8	11	11.9	11.8	11.8	25
667a	Privately Owned Land	1.0	0.9	1.0	11	12.0	11.9	12.0	25
647a	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
647b	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
647c	Privately Owned Land	0.1	0.2	0.2	11	11.1	11.2	11.2	25
641a	Privately Owned Land	0.4	0.4	0.4	11	11.4	11.4	11.4	25
600r	NCOPL Owned Land	0.1	0.2	0.2	11	11.1	11.2	11.2	25
600s	NCOPL Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
693a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
685a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
738a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
757a	Privately Owned Land	0.0	0.0	0.0	11	11.0	11.0	11.0	25
688a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
600u	NCOPL Owned Land	0.0	0.1	0.1	11	11.0	11.1	11.1	25
701a	Privately Owned Land	0.0	0.0	0.0	11	11.0	11.0	11.0	25
690a	Privately Owned Land	0.0	0.1	0.1	11	11.0	11.1	11.1	25
684b	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
600t	NCOPL Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
600v	NCOPL Owned Land	0.0	0.1	0.1	11	11.0	11.1	11.1	25
800a	Privately Owned Land	0.2	0.2	0.2	11	11.2	11.2	11.2	25
759a	Privately Owned Land	0.0	0.0	0.0	11	11.0	11.0	11.0	25
761a	Privately Owned Land	0.0	0.0	0.0	11	11.0	11.0	11.0	25
761b	Privately Owned Land	0.0	0.0	0.0	11	11.0	11.0	11.0	25
699a	Privately Owned Land	0.0	0.0	0.0	11	11.0	11.0	11.0	25
694a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
695a	Privately Owned Land	0.1	0.1	0.1	11	11.1	11.1	11.1	25
666a	Privately Owned Land	0.6	0.6	0.6	11	11.6	11.6	11.6	25
Predicted maximum 24-hour average PM2.5 concentrations (ug/m3)									
784a	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
784b	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
794a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
600w	NCOPL Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
669a	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
702a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
512a	Privately Owned Land	0.5	0.5	0.5	12	12.5	12.5	12.5	25
512b	Privately Owned Land	0.5	0.4	0.4	12	12.5	12.4	12.4	25
684a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
677a	Privately Owned Land	0.6	0.6	0.6	12	12.6	12.6	12.6	25
669b	Privately Owned Land	0.5	0.5	0.5	12	12.5	12.5	12.5	25
676a	Privately Owned Land	0.7	0.7	0.7	12	12.7	12.7	12.7	25
675a	Privately Owned Land	1.4	1.3	1.4	12	13.4	13.3	13.4	25

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
600a	NCOPL Owned Land	2.0	2.0	2.0	12	14.0	14.0	14.0	25
670a	Privately Owned Land	1.3	1.2	1.2	12	13.3	13.2	13.2	25
600b	NCOPL Owned Land	0.9	0.9	0.9	12	12.9	12.9	12.9	25
600c	NCOPL Owned Land	1.4	1.3	1.3	12	13.4	13.3	13.3	25
600z	NCOPL Owned Land	1.0	1.0	1.0	12	13.0	13.0	13.0	25
687a	Privately Owned Land	0.9	0.9	0.9	12	12.9	12.9	12.9	25
680a	Privately Owned Land	0.5	0.5	0.5	12	12.5	12.5	12.5	25
600d	NCOPL Owned Land	0.7	0.7	0.7	12	12.7	12.7	12.7	25
600e	NCOPL Owned Land	0.9	0.8	0.9	12	12.9	12.8	12.9	25
600x	NCOPL Owned Land	1.0	0.9	1.0	12	13.0	12.9	13.0	25
600y	NCOPL Owned Land	1.1	1.1	1.1	12	13.1	13.1	13.1	25
600f	NCOPL Owned Land	3.3	3.2	3.2	12	15.3	15.2	15.2	25
600g	NCOPL Owned Land	3.6	3.5	3.6	12	15.6	15.5	15.6	25
600q	NCOPL Owned Land	0.5	0.5	0.5	12	12.5	12.5	12.5	25
600h	NCOPL Owned Land	1.4	1.4	1.4	12	13.4	13.4	13.4	25
662a	Privately Owned Land	0.8	0.8	0.8	12	12.8	12.8	12.8	25
660a	Privately Owned Land	0.7	0.6	0.6	12	12.7	12.6	12.6	25
660b	Privately Owned Land	0.7	0.6	0.6	12	12.7	12.6	12.6	25
653a	Privately Owned Land	0.4	0.4	0.4	12	12.4	12.4	12.4	25
652a	Privately Owned Land	0.6	0.6	0.6	12	12.6	12.6	12.6	25
652b	Privately Owned Land	0.6	0.6	0.6	12	12.6	12.6	12.6	25
601a	Privately Owned Land	0.9	0.8	0.8	12	12.9	12.8	12.8	25
600n	NCOPL Owned Land	4.0	3.9	4.0	12	16.0	15.9	16.0	25
600p	NCOPL Owned Land	1.5	1.5	1.5	12	13.5	13.5	13.5	25
664a	Privately Owned Land	0.4	0.3	0.3	12	12.4	12.3	12.3	25
665a	Privately Owned Land	0.6	0.5	0.5	12	12.6	12.5	12.5	25
665b	Privately Owned Land	0.6	0.5	0.5	12	12.6	12.5	12.5	25
667a	Privately Owned Land	0.6	0.6	0.6	12	12.6	12.6	12.6	25
647a	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
647b	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
647c	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
641a	Privately Owned Land	0.3	0.3	0.3	12	12.3	12.3	12.3	25
600r	NCOPL Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
600s	NCOPL Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
693a	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
685a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
738a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
757a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
688a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
600u	NCOPL Owned Land	0.2	0.1	0.2	12	12.2	12.1	12.2	25
701a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
690a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
684b	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
600t	NCOPL Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
600v	NCOPL Owned Land	0.2	0.1	0.2	12	12.2	12.1	12.2	25
800a	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
759a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
761a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
761b	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
699a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
694a	Privately Owned Land	0.2	0.2	0.2	12	12.2	12.2	12.2	25
695a	Privately Owned Land	0.1	0.1	0.1	12	12.1	12.1	12.1	25
666a	Privately Owned Land	0.5	0.4	0.5	12	12.5	12.4	12.5	25
Predicted annual average PM2.5 concentrations (ug/m3)									
784a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
784b	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
794a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
600w	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
669a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
702a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
512a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
512b	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
684a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
677a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
669b	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
676a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
675a	Privately Owned Land	0.2	0.2	0.2	4.2	4.4	4.4	4.4	8
600a	NCOPL Owned Land	0.3	0.3	0.3	4.2	4.5	4.5	4.5	8
670a	Privately Owned Land	0.2	0.2	0.2	4.2	4.4	4.4	4.4	8
600b	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600c	NCOPL Owned Land	0.2	0.2	0.2	4.2	4.4	4.4	4.4	8
600z	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
687a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
680a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
600d	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600e	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600x	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600y	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600f	NCOPL Owned Land	0.3	0.3	0.3	4.2	4.5	4.5	4.5	8
600g	NCOPL Owned Land	0.4	0.4	0.4	4.2	4.6	4.6	4.6	8
600q	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
600h	NCOPL Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
662a	Privately Owned Land	0.2	0.2	0.2	4.2	4.4	4.4	4.4	8
660a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
660b	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
653a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
652a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
652b	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
601a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600n	NCOPL Owned Land	0.9	0.8	0.9	4.2	5.1	5.0	5.1	8
600p	NCOPL Owned Land	0.3	0.3	0.3	4.2	4.5	4.5	4.5	8
664a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
665a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
665b	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
667a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
647a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
647b	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
647c	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
641a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
600r	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
600s	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
693a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
685a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
738a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
757a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
688a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
600u	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
701a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
690a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
684b	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
600t	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
600v	NCOPL Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
800a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
759a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
761a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
761b	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
699a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
694a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
695a	Privately Owned Land	0.0	0.0	0.0	4.2	4.2	4.2	4.2	8
666a	Privately Owned Land	0.1	0.1	0.1	4.2	4.3	4.3	4.3	8
Predicted annual average TSP concentrations (ug/m3)									
784a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
784b	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
794a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
600w	NCOPL Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
669a	Privately Owned Land	0.2	0.2	0.2	22	22.2	22.2	22.2	90
702a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
512a	Privately Owned Land	0.5	0.5	0.5	22	22.5	22.5	22.5	90
512b	Privately Owned Land	0.4	0.4	0.4	22	22.4	22.4	22.4	90
684a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
677a	Privately Owned Land	0.7	0.6	0.6	22	22.7	22.6	22.6	90
669b	Privately Owned Land	0.3	0.3	0.3	22	22.3	22.3	22.3	90
676a	Privately Owned Land	0.9	0.9	0.9	22	22.9	22.9	22.9	90
675a	Privately Owned Land	2.1	2.0	2.0	22	24.1	24.0	24.0	90
600a	NCOPL Owned Land	3.4	3.3	3.4	22	25.4	25.3	25.4	90
670a	Privately Owned Land	1.6	1.6	1.6	22	23.6	23.6	23.6	90
600b	NCOPL Owned Land	0.8	0.7	0.7	22	22.8	22.7	22.7	90
600c	NCOPL Owned Land	1.3	1.3	1.3	22	23.3	23.3	23.3	90
600z	NCOPL Owned Land	0.6	0.6	0.6	22	22.6	22.6	22.6	90
687a	Privately Owned Land	0.4	0.4	0.4	22	22.4	22.4	22.4	90
680a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
600d	NCOPL Owned Land	0.2	0.2	0.2	22	22.2	22.2	22.2	90
600e	NCOPL Owned Land	0.2	0.2	0.2	22	22.2	22.2	22.2	90
600x	NCOPL Owned Land	0.2	0.2	0.2	22	22.2	22.2	22.2	90
600y	NCOPL Owned Land	0.2	0.2	0.2	22	22.2	22.2	22.2	90
600f	NCOPL Owned Land	1.3	1.3	1.3	22	23.3	23.3	23.3	90
600g	NCOPL Owned Land	2.4	2.4	2.4	22	24.4	24.4	24.4	90
600q	NCOPL Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
600h	NCOPL Owned Land	0.4	0.4	0.4	22	22.4	22.4	22.4	90
662a	Privately Owned Land	1.5	1.4	1.4	22	23.5	23.4	23.4	90

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
660a	Privately Owned Land	1.0	1.0	1.0	22	23.0	23.0	23.0	90
660b	Privately Owned Land	1.0	1.0	1.0	22	23.0	23.0	23.0	90
653a	Privately Owned Land	0.5	0.5	0.5	22	22.5	22.5	22.5	90
652a	Privately Owned Land	0.9	0.8	0.8	22	22.9	22.8	22.8	90
652b	Privately Owned Land	0.9	0.8	0.8	22	22.9	22.8	22.8	90
601a	Privately Owned Land	0.3	0.3	0.3	22	22.3	22.3	22.3	90
600n	NCOPL Owned Land	10.4	10.2	10.3	22	32.4	32.2	32.3	90
600p	NCOPL Owned Land	2.2	2.1	2.2	22	24.2	24.1	24.2	90
664a	Privately Owned Land	0.4	0.3	0.3	22	22.4	22.3	22.3	90
665a	Privately Owned Land	0.5	0.5	0.5	22	22.5	22.5	22.5	90
665b	Privately Owned Land	0.5	0.5	0.5	22	22.5	22.5	22.5	90
667a	Privately Owned Land	0.6	0.5	0.5	22	22.6	22.5	22.5	90
647a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
647b	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
647c	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
641a	Privately Owned Land	0.3	0.3	0.3	22	22.3	22.3	22.3	90
600r	NCOPL Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
600s	NCOPL Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
693a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
685a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
738a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
757a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
688a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
600u	NCOPL Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
701a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
690a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
684b	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
600t	NCOPL Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
600v	NCOPL Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
800a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
759a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
761a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
761b	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
699a	Privately Owned Land	0.0	0.0	0.0	22	22.0	22.0	22.0	90
694a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
695a	Privately Owned Land	0.1	0.1	0.1	22	22.1	22.1	22.1	90
666a	Privately Owned Land	0.3	0.3	0.3	22	22.3	22.3	22.3	90
Predicted annual average dust deposition (g/m2/month)									
784a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
784b	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
794a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600w	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
669a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
702a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
512a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
512b	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
684a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
677a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
669b	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
676a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
675a	Privately Owned Land	0.2	0.2	0.2	2.4	2.6	2.6	2.6	4
600a	NCOPL Owned Land	0.4	0.4	0.4	2.4	2.8	2.8	2.8	4
670a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
600b	NCOPL Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
600c	NCOPL Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
600z	NCOPL Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
687a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
680a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600d	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600e	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600x	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600y	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600f	NCOPL Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
600g	NCOPL Owned Land	0.2	0.2	0.2	2.4	2.6	2.6	2.6	4
600q	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600h	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
662a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
660a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
660b	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
653a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
652a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
652b	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
601a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600n	NCOPL Owned Land	0.8	0.8	0.8	2.4	3.2	3.2	3.2	4
600p	NCOPL Owned Land	0.2	0.2	0.2	2.4	2.6	2.6	2.6	4
664a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
665a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
665b	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
667a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
647a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
647b	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
647c	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
641a	Privately Owned Land	0.1	0.1	0.1	2.4	2.5	2.5	2.5	4
600r	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600s	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
693a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
685a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
738a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
757a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
688a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600u	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
701a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
690a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
684b	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600t	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
600v	NCOPL Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
800a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
759a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
761a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
761b	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4

ID	Status	Project in isolation			Measured or inferred background	Cumulative			Criteria
		2025	2041	2042		2025	2041	2042	
699a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
694a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
695a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4
666a	Privately Owned Land	0.0	0.0	0.0	2.4	2.4	2.4	2.4	4

Appendix F. Greenhouse Gas Emissions by Activity

Diesel usage

Historical data

Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes
ROM Coal Production	t	6667232	7266601	6287535	6447561	
Saleable Coal	t	6237903				
Usage	kL	5939	5693	6626	5499	
Intensity	kL/t	0.00089	0.00078	0.00105	0.00085	

Stage 3 project

			Emission factor (kg CO2-e/kL)			Emissions (t CO2-e/year)		
Year	ROM coal (t)	Usage (kL)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2020	6,288,276	5,602	2709.72	0	138.96	15,180	-	778
2021	6,361,121	5,667	2709.72	0	138.96	15,355	-	787
2022	7,677,061	6,839	2709.72	0	138.96	18,532	-	950
2023	7,140,113	6,361	2709.72	0	138.96	17,236	-	884
2024	6,648,928	5,923	2709.72	0	138.96	16,050	-	823
2025	10,948,419	9,753	2709.72	0	138.96	26,429	-	1,355
2026	10,901,042	9,711	2709.72	0	138.96	26,315	-	1,349
2027	9,404,284	8,378	2709.72	0	138.96	22,701	-	1,164
2028	10,768,160	9,593	2709.72	0	138.96	25,994	-	1,333
2029	8,958,176	7,980	2709.72	0	138.96	21,625	-	1,109
2030	10,404,886	9,269	2709.72	0	138.96	25,117	-	1,288
2031	8,436,476	7,516	2709.72	0	138.96	20,365	-	1,044
2032	10,271,493	9,150	2709.72	0	138.96	24,795	-	1,272
2033	9,353,161	8,332	2709.72	0	138.96	22,578	-	1,158
2034	8,333,605	7,424	2709.72	0	138.96	20,117	-	1,032
2035	9,378,810	8,355	2709.72	0	138.96	22,640	-	1,161
2036	8,110,808	7,226	2709.72	0	138.96	19,579	-	1,004
2037	9,211,533	8,206	2709.72	0	138.96	22,236	-	1,140
2038	9,225,094	8,218	2709.72	0	138.96	22,269	-	1,142
2039	7,678,777	6,841	2709.72	0	138.96	18,536	-	951
2040	8,350,325	7,439	2709.72	0	138.96	20,157	-	1,034
2041	7,549,573	6,726	2709.72	0	138.96	18,224	-	935
2042	9,051,665	8,064	2709.72	0	138.96	21,850	-	1,121
2043	6,055,583	5,395	2709.72	0	138.96	14,618	-	750
2044	1,273,360	1,134	2709.72	0	138.96	3,074	-	158

Fugitive emissions

Historical data

Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes
ROM Coal Production	t	6667232	7266601	6287535	6447561	
Saleable Coal	t	6237903				
Emission	t CO2-e	408976	412602	346068	468257	Includes venting and gas drainage
Intensity	t CO2-e/t	0.06134	0.05678	0.05504	0.07263	

Stage 3 project

			Emission factor (t CO2-e/t CO2-e)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Emission (t CO2-e)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2020	6,288,276	385,730	1	0	0	385,730	-	-	385,730
2021	6,361,121	390,198	1	0	0	390,198	-	-	390,198
2022	7,677,061	470,920	1	0	0	470,920	-	-	470,920
2023	7,140,113	437,983	1	0	0	437,983	-	-	437,983
2024	6,648,928	609,309	1	0	0	609,309	-	-	609,309
2025	10,948,419	609,309	1	0	0	609,309	-	-	609,309
2026	10,901,042	609,309	1	0	0	609,309	-	-	609,309
2027	9,404,284	655,966	1	0	0	655,966	-	-	655,966
2028	10,768,160	655,966	1	0	0	655,966	-	-	655,966
2029	8,958,176	705,138	1	0	0	705,138	-	-	705,138
2030	10,404,886	705,138	1	0	0	705,138	-	-	705,138
2031	8,436,476	705,138	1	0	0	705,138	-	-	705,138
2032	10,271,493	971,722	1	0	0	971,722	-	-	971,722
2033	9,353,161	971,722	1	0	0	971,722	-	-	971,722
2034	8,333,605	1,188,056	1	0	0	1,188,056	-	-	1,188,056
2035	9,378,810	1,188,056	1	0	0	1,188,056	-	-	1,188,056
2036	8,110,808	1,188,056	1	0	0	1,188,056	-	-	1,188,056
2037	9,211,533	1,286,076	1	0	0	1,286,076	-	-	1,286,076
2038	9,225,094	1,286,076	1	0	0	1,286,076	-	-	1,286,076
2039	7,678,777	1,311,984	1	0	0	1,311,984	-	-	1,311,984
2040	8,350,325	1,311,984	1	0	0	1,311,984	-	-	1,311,984
2041	7,549,573	1,311,984	1	0	0	1,311,984	-	-	1,311,984
2042	9,051,665	569,969	1	0	0	569,969	-	-	569,969
2043	6,055,583	834,516	1	0	0	834,516	-	-	834,516
2044	1,273,360	410,870	1	0	0	410,870	-	-	410,870

Post-mining activities								
Historical data								
Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes		
ROM Coal Production	t	6667232	7266601	6287535	6447561			
Saleable Coal	t	6237903						
Emission	t CO2-e	NA						
Factor	t CO2-e/t	0.01700						
Stage 3 project								
			Emission factor (t CO2-e/t CO2-e)			Emissions (t CO2-e/year)		
Year	ROM coal (t)	Emission (t CO2-e)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2020	6,288,276	106,901	1	0	0	106,901	-	-
2021	6,361,121	108,139	1	0	0	108,139	-	-
2022	7,677,061	130,510	1	0	0	130,510	-	-
2023	7,140,113	121,382	1	0	0	121,382	-	-
2024	6,648,928	113,032	1	0	0	113,032	-	-
2025	10,948,419	186,123	1	0	0	186,123	-	-
2026	10,901,042	185,318	1	0	0	185,318	-	-
2027	9,404,284	159,873	1	0	0	159,873	-	-
2028	10,768,160	183,059	1	0	0	183,059	-	-
2029	8,958,176	152,289	1	0	0	152,289	-	-
2030	10,404,886	176,883	1	0	0	176,883	-	-
2031	8,436,476	143,420	1	0	0	143,420	-	-
2032	10,271,493	174,615	1	0	0	174,615	-	-
2033	9,353,161	159,004	1	0	0	159,004	-	-
2034	8,333,605	141,671	1	0	0	141,671	-	-
2035	9,378,810	159,440	1	0	0	159,440	-	-
2036	8,110,808	137,884	1	0	0	137,884	-	-
2037	9,211,533	156,596	1	0	0	156,596	-	-
2038	9,225,094	156,827	1	0	0	156,827	-	-
2039	7,678,777	130,539	1	0	0	130,539	-	-
2040	8,350,325	141,956	1	0	0	141,956	-	-
2041	7,549,573	128,343	1	0	0	128,343	-	-
2042	9,051,665	153,878	1	0	0	153,878	-	-
2043	6,055,583	102,945	1	0	0	102,945	-	-
2044	1,273,360	21,647	1	0	0	21,647	-	-

Vegetation clearance								
Historical data								
Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes		
ROM Coal Production	t	6667232	7266601	6287535	6447561			
Saleable Coal	t	6237903						
Emission	kg	NA						
Intensity	kg/t	NA						
							from Carbon Gauge	
Stage 3 project								
			Emission factor (kg CO2-e/kg)			Emissions (t CO2-e/year)		
Year	ROM coal (t)	Emission (kg)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2020	6,288,276	4,292	1	0	0	4,292	-	-
2021	6,361,121	4,342	1	0	0	4,342	-	-
2022	7,677,061	5,240	1	0	0	5,240	-	-
2023	7,140,113	4,874	1	0	0	4,874	-	-
2024	6,648,928	4,539	1	0	0	4,539	-	-
2025	10,948,419	7,474	1	0	0	7,474	-	-
2026	10,901,042	7,441	1	0	0	7,441	-	-
2027	9,404,284	6,419	1	0	0	6,419	-	-
2028	10,768,160	7,350	1	0	0	7,350	-	-
2029	8,958,176	6,115	1	0	0	6,115	-	-
2030	10,404,886	7,103	1	0	0	7,103	-	-
2031	8,436,476	5,759	1	0	0	5,759	-	-
2032	10,271,493	7,011	1	0	0	7,011	-	-
2033	9,353,161	6,385	1	0	0	6,385	-	-
2034	8,333,605	5,689	1	0	0	5,689	-	-
2035	9,378,810	6,402	1	0	0	6,402	-	-
2036	8,110,808	5,537	1	0	0	5,537	-	-
2037	9,211,533	6,288	1	0	0	6,288	-	-
2038	9,225,094	6,297	1	0	0	6,297	-	-
2039	7,678,777	5,242	1	0	0	5,242	-	-
2040	8,350,325	5,700	1	0	0	5,700	-	-
2041	7,549,573	5,153	1	0	0	5,153	-	-
2042	9,051,665	6,179	1	0	0	6,179	-	-
2043	6,055,583	4,134	1	0	0	4,134	-	-
2044	1,273,360	869	1	0	0	869	-	-

Electricity usage

Historical data

Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes
ROM Coal Production	t	6667232	7266601	6287535	6447561	
Saleable Coal	t	6237903				
Usage	kWh	88181842	84101399	86531000	93913127	
Intensity	kWh/t	13.226	11.574	13.762	14.566	

Stage 3 project

			Emission factor (kg CO2-e/kWh)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kWh)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2020	6,288,276	83,169,710	0	0.81	0.09	-	67,367	7,485	74,853
2021	6,361,121	84,133,172	0	0.81	0.09	-	68,148	7,572	75,720
2022	7,677,061	135,350,146	0	0.81	0.09	-	109,634	12,182	121,815
2023	7,140,113	125,883,497	0	0.81	0.09	-	101,966	11,330	113,295
2024	6,648,928	117,223,686	0	0.81	0.09	-	94,951	10,550	105,501
2025	10,948,419	193,025,701	0	0.81	0.09	-	156,351	17,372	173,723
2026	10,901,042	192,190,430	0	0.81	0.09	-	155,674	17,297	172,971
2027	9,404,284	165,801,893	0	0.81	0.09	-	134,300	14,922	149,222
2028	10,768,160	189,847,651	0	0.81	0.09	-	153,777	17,086	170,863
2029	8,958,176	157,936,795	0	0.81	0.09	-	127,929	14,214	142,143
2030	10,404,886	183,442,970	0	0.81	0.09	-	148,589	16,510	165,099
2031	8,436,476	148,738,984	0	0.81	0.09	-	120,479	13,387	133,865
2032	10,271,493	181,091,180	0	0.81	0.09	-	146,684	16,298	162,982
2033	9,353,161	164,900,556	0	0.81	0.09	-	133,569	14,841	148,411
2034	8,333,605	146,925,319	0	0.81	0.09	-	119,010	13,223	132,233
2035	9,378,810	165,352,769	0	0.81	0.09	-	133,936	14,882	148,817
2036	8,110,808	142,997,301	0	0.81	0.09	-	115,828	12,870	128,698
2037	9,211,533	162,403,596	0	0.81	0.09	-	131,547	14,616	146,163
2038	9,225,094	162,642,680	0	0.81	0.09	-	131,741	14,638	146,378
2039	7,678,777	135,380,389	0	0.81	0.09	-	109,658	12,184	121,842
2040	8,350,325	147,220,098	0	0.81	0.09	-	119,248	13,250	132,498
2041	7,549,573	133,102,472	0	0.81	0.09	-	107,813	11,979	119,792
2042	9,051,665	159,585,052	0	0.81	0.09	-	129,264	14,363	143,627
2043	6,055,583	106,762,742	0	0.81	0.09	-	86,478	9,609	96,086
2044	1,273,360	22,449,926	0	0.81	0.09	-	18,184	2,020	20,205

Transport (Rail)

Historical data

Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes
ROM Coal Production	t.km	6667232	7266601	6287535	6447561	
Saleable Coal	t	6237903				
Emission	kg CO2-e	NA				
Factor	kg CO2-e/t.km	0.03333				DEFRA 2019 - Freighting goods - Freight train
Distance	km	370				Assumed distance to port

Stage 3 project

			Emission factor (kg CO2-e/kg CO2-e)			Emissions (t CO2-e/year)		
Year	ROM coal (t)	Emission (kg CO2-e	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2020	6,288,276	77,547,651	0	0	1	-	-	77,548
2021	6,361,121	78,445,985	0	0	1	-	-	78,446
2022	7,677,061	94,674,286	0	0	1	-	-	94,674
2023	7,140,113	88,052,585	0	0	1	-	-	88,053
2024	6,648,928	81,995,248	0	0	1	-	-	81,995
2025	10,948,419	135,016,999	0	0	1	-	-	135,017
2026	10,901,042	134,432,746	0	0	1	-	-	134,433
2027	9,404,284	115,974,576	0	0	1	-	-	115,975
2028	10,768,160	132,794,026	0	0	1	-	-	132,794
2029	8,958,176	110,473,123	0	0	1	-	-	110,473
2030	10,404,886	128,314,101	0	0	1	-	-	128,314
2031	8,436,476	104,039,468	0	0	1	-	-	104,039
2032	10,271,493	126,669,078	0	0	1	-	-	126,669
2033	9,353,161	115,344,113	0	0	1	-	-	115,344
2034	8,333,605	102,770,851	0	0	1	-	-	102,771
2035	9,378,810	115,660,425	0	0	1	-	-	115,660
2036	8,110,808	100,023,294	0	0	1	-	-	100,023
2037	9,211,533	113,597,547	0	0	1	-	-	113,598
2038	9,225,094	113,764,781	0	0	1	-	-	113,765
2039	7,678,777	94,695,441	0	0	1	-	-	94,695
2040	8,350,325	102,977,042	0	0	1	-	-	102,977
2041	7,549,573	93,102,090	0	0	1	-	-	93,102
2042	9,051,665	111,626,041	0	0	1	-	-	111,626
2043	6,055,583	74,678,060	0	0	1	-	-	74,678
2044	1,273,360	15,703,203	0	0	1	-	-	15,703

Transport (Shipping)								
Historical data								
Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes		
ROM Coal Production	t.km	6667232	7266601	6287535	6447561			
Saleable Coal	t	6237903						
Emission	kg CO2-e	NA						
Factor	kg CO2-e/t.km	0.00354				DEFRA 2019 - Freighting goods - Cargo ship,		
Distance	km	8000				Assumed distance to market		
Stage 3 project								
			Emission factor (kg CO2-e/kg CO2-e)			Emissions (t CO2-e/year)		
Year	ROM coal (t)	Emission (kg CO2-e	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2020	6,288,276	178,033,677	0	0	1	-	-	178,034
2021	6,361,121	180,096,069	0	0	1	-	-	180,096
2022	7,677,061	217,352,956	0	0	1	-	-	217,353
2023	7,140,113	202,150,874	0	0	1	-	-	202,151
2024	6,648,928	188,244,457	0	0	1	-	-	188,244
2025	10,948,419	309,971,641	0	0	1	-	-	309,972
2026	10,901,042	308,630,314	0	0	1	-	-	308,630
2027	9,404,284	266,254,102	0	0	1	-	-	266,254
2028	10,768,160	304,868,147	0	0	1	-	-	304,868
2029	8,958,176	253,623,880	0	0	1	-	-	253,624
2030	10,404,886	294,583,146	0	0	1	-	-	294,583
2031	8,436,476	238,853,514	0	0	1	-	-	238,854
2032	10,271,493	290,806,508	0	0	1	-	-	290,807
2033	9,353,161	264,806,685	0	0	1	-	-	264,807
2034	8,333,605	235,941,026	0	0	1	-	-	235,941
2035	9,378,810	265,532,874	0	0	1	-	-	265,533
2036	8,110,808	229,633,193	0	0	1	-	-	229,633
2037	9,211,533	260,796,924	0	0	1	-	-	260,797
2038	9,225,094	261,180,859	0	0	1	-	-	261,181
2039	7,678,777	217,401,522	0	0	1	-	-	217,402
2040	8,350,325	236,414,399	0	0	1	-	-	236,414
2041	7,549,573	213,743,513	0	0	1	-	-	213,744
2042	9,051,665	256,270,746	0	0	1	-	-	256,271
2043	6,055,583	171,445,678	0	0	1	-	-	171,446
2044	1,273,360	36,051,368	0	0	1	-	-	36,051

Energy Production								
Historical data								
Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes		
ROM Coal Production	t	6667232	7266601	6287535	6447561			
Saleable Coal	t	6237903						
Usage	t	5926008				95%	thermal coal	
Intensity	t/t	0.889				92-100% thermal coal		
Stage 3 project								
			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)		
Year	ROM coal (t)	Usage (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2020	6,288,276	5,496,287	0	0	2436.21	-	-	13,390,109
2021	6,361,121	5,559,957	0	0	2436.21	-	-	13,545,224
2022	7,677,061	6,710,159	0	0	2436.21	-	-	16,347,355
2023	7,140,113	6,115,798	0	0	2436.21	-	-	14,899,367
2024	6,648,928	5,742,256	0	0	2436.21	-	-	13,989,342
2025	10,948,419	9,381,812	0	0	2436.21	-	-	22,856,065
2026	10,901,042	9,717,993	0	0	2436.21	-	-	23,675,071
2027	9,404,284	8,325,657	0	0	2436.21	-	-	20,283,048
2028	10,768,160	9,409,442	0	0	2436.21	-	-	22,923,376
2029	8,958,176	8,098,807	0	0	2436.21	-	-	19,730,395
2030	10,404,886	9,066,795	0	0	2436.21	-	-	22,088,617
2031	8,436,476	7,798,119	0	0	2436.21	-	-	18,997,856
2032	10,271,493	8,848,877	0	0	2436.21	-	-	21,557,723
2033	9,353,161	8,468,588	0	0	2436.21	-	-	20,631,258
2034	8,333,605	7,416,631	0	0	2436.21	-	-	18,068,471
2035	9,378,810	8,680,518	0	0	2436.21	-	-	21,147,565
2036	8,110,808	7,493,665	0	0	2436.21	-	-	18,256,140
2037	9,211,533	8,426,847	0	0	2436.21	-	-	20,529,569
2038	9,225,094	8,631,054	0	0	2436.21	-	-	21,027,060
2039	7,678,777	7,089,780	0	0	2436.21	-	-	17,272,192
2040	8,350,325	7,812,615	0	0	2436.21	-	-	19,033,170
2041	7,549,573	6,969,247	0	0	2436.21	-	-	16,978,550
2042	9,051,665	8,088,173	0	0	2436.21	-	-	19,704,488
2043	6,055,583	5,201,244	0	0	2436.21	-	-	12,671,322
2044	1,273,360	1,099,720	0	0	2436.21	-	-	2,679,149

Coking coal use									
Historical data									
Parameter	Units	Assumed value	NGERS FY17	NGERS FY18	NGERS FY19	Notes			
ROM Coal Production	t	6667232	7266601	6287535	6447561				
Saleable Coal	t	6237903							
Usage	t	311895				5%	coking coal		
Intensity	t/t	0.047				0-8% thermal coal			
Stage 3 project									
			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2020	6,288,276	387,062	0	0	2760.6	-	-	1,068,525	1,068,525
2021	6,361,121	391,546	0	0	2760.6	-	-	1,080,903	1,080,903
2022	7,677,061	472,546	0	0	2760.6	-	-	1,304,512	1,304,512
2023	7,140,113	564,535	0	0	2760.6	-	-	1,558,456	1,558,456
2024	6,648,928	478,521	0	0	2760.6	-	-	1,321,006	1,321,006
2025	10,948,419	861,595	0	0	2760.6	-	-	2,378,519	2,378,519
2026	10,901,042	481,089	0	0	2760.6	-	-	1,328,094	1,328,094
2027	9,404,284	473,049	0	0	2760.6	-	-	1,305,898	1,305,898
2028	10,768,160	665,314	0	0	2760.6	-	-	1,836,666	1,836,666
2029	8,958,176	282,517	0	0	2760.6	-	-	779,915	779,915
2030	10,404,886	668,080	0	0	2760.6	-	-	1,844,301	1,844,301
2031	8,436,476	95,099	0	0	2760.6	-	-	262,530	262,530
2032	10,271,493	761,194	0	0	2760.6	-	-	2,101,351	2,101,351
2033	9,353,161	282,286	0	0	2760.6	-	-	779,279	779,279
2034	8,333,605	380,340	0	0	2760.6	-	-	1,049,967	1,049,967
2035	9,378,810	94,353	0	0	2760.6	-	-	260,472	260,472
2036	8,110,808	94,857	0	0	2760.6	-	-	261,861	261,861
2037	9,211,533	191,519	0	0	2760.6	-	-	528,708	528,708
2038	9,225,094	-	0	0	2760.6	-	-	-	-
2039	7,678,777	94,530	0	0	2760.6	-	-	260,961	260,961
2040	8,350,325	-	0	0	2760.6	-	-	-	-
2041	7,549,573	94,179	0	0	2760.6	-	-	259,991	259,991
2042	9,051,665	380,620	0	0	2760.6	-	-	1,050,739	1,050,739
2043	6,055,583	464,397	0	0	2760.6	-	-	1,282,014	1,282,014
2044	1,273,360	91,643	0	0	2760.6	-	-	252,991	252,991