Central Queensland Coal Project

Chapter 12 - Air Quality and Greenhouse Gas

Central Queensland Coal

CQC SEIS, Version 3

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Terms and Abbreviations

µg/m^3	Micrograms per cubic metre
µm	Micrometre(s)
Air NEPM	National Environment Protection (Ambient Air Quality) Measure
ANFO	Ammonium nitrate/fuel oil
AQMP	Air Quality Management Plan
CDMP	Coal Dust Management Plan
CFC	Chlorofluorocarbons
CIA	Cumulative Impact Assessment
CLR	Contaminated Land Register
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2-e	Equivalent carbon dioxide emissions
CQC	Central Queensland Coal Pty Ltd
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DES	Queensland Department of Environment and Science
DISER	Department of Industry, Science, Energy and Resources
DotEE	(former) Commonwealth Department of the Environment and Energy
DSITIA	(former) Queensland Department of Science, Information Technology, Innovation and the Arts
EA	Environmental Authority
EMP	Environmental Management Plan
EMR	Environmental Management Register
EP Act	*Environmental Protection Act 1994*
EP Regulation	Environmental Protection Regulation 2019
EPP Air	Environmental Protection Air Policy
ERA	Environmentally Relevant Activity
EV	Environmental Values
Fugitive Dust	Dust derived from a mixture of not easily defined sources. Mine dust is commonly derived from such non-point sources such as vehicular traffic on unpaved roads, materials transport and handling.
g	Gram(s)
g/s	Grams per second

GHG	Greenhouse Gas
GHGMP	Greenhouse Gas Management Plan
kL	KiloLitre
km	Kilometre
kWh	Kilowatt per hour
litres/m^2/h	Litres per square metre, per hour
m^2	Square metre
mg/m^2/day	Milligrams per cubic metre, per day
MIA	Mine Infrastructure Area
MIC	Maximum instantaneous charge
MMC	Model Mining Conditions
MMC Guideline	Guideline Mining - Model Mining Conditions
MSES	Matters of State Environmental Significance
MtCO_2-e	Million tonnes of equivalent carbon dioxide emissions
Mtpa	Million tonnes per annum
NGA	National Greenhouse Accounts
NGER Act	Commonwealth *National Greenhouse Energy Reporting Act* 2007
NO_2	Nitrogen dioxide
NPI	National Pollutant Inventory
PM	Particulate Matter
PM_{10}	Particulate Matter measuring less than 10 micrometres (µm)
$PM_{2.5}$	Particulate Matter measuring less than 2.5 micrometres (µm)
ROM	Run of Mine
SEIS	Supplementary Environmental Impact Assessment
SO_2	Sulphur dioxide
t CO_2-e	Tonnes of equivalent carbon dioxide emissions
TAPM	The Air Pollution Model
TLF	Train Loadout Facility
ToR	CQC Project Terms of Reference
TSP	Total Suspended Particles
ULP	Unleaded Petrol

UNFCCC	United National Framework Convention on Climate Change

12 Air Quality and Greenhouse Gas Assessment

12.1 Introduction

Air emissions attributable to activities undertaken during the construction and operation of the Central Queensland Coal Project have the potential to impact the surrounding environment, particularly sensitive locations within the area. This chapter addresses the relevant legislation, guidelines and criteria, the assessment method, the existing air environment and identifies potential impacts and proposes mitigation measures for the construction and operational phases. Greenhouse gas (GHG) emissions are also calculated, and mitigation and management measures are proposed for these, as appropriate.

Air Quality is dealt with in the first part of this Chapter, and the Greenhouse Gas assessment is presented in Section 12.8.

This Chapter has been updated since that presented in the Supplementary Environmental Impact Assessment (SEIS) Version 2 (v2) to reflect the updated technical Air Quality and Greenhouse Gas assessment, undertaken by Vipac Consultants (see Appendix A7 – Air Quality and GHG Technical Report). The technical assessment was updated in 2020 to ensure that it considered changes to the Project layout that have occurred since the SEIS v2. See Chapter 3 – Project Changes and Responses to Regulator Comments for the full description of changes to Project Layout. The main change to the Project layout that necessitated the revision of the air assessment, is the movement of Mine Infrastructure Area 1 (MIA) and Coal Handling and Preparation Plant (CHPP) 1 to the north-west of their former locations (see Chapter 3).

It is recognised that this Chapter was previously revised to reflect comments received in submissions regarding the EIS and SEIS v2. This Chapter retains those amendments. Appendix A13 includes the full details of all submissions received for the EIS and Version 1 of the SEIS. The submissions received relating to the SEIS version 2 are addressed in Chapter 3 of this SEIS (i.e. Version 3).

12.1.1 Environmental Objectives and Outcomes

The environmental objective and performance outcomes relevant to air are provided in Schedule 8, Part 3, Division 1 of the Environmental Protection Regulation 2019 (EP Regulation). Objectives and outcomes for air that are specific to the Project are given in Table 1 of the Project ToR. The overarching objective is to operate the Project in a way that protects the environmental values of air.

12.1.1.1 EP Regulation Environmental Objective and Performance Outcomes

The environmental objective and performance outcomes relating to air outlined in the EP Regulation are:

12.1.1.1.1 Environmental Objective

The activity will be operated in a way that protects the environmental values of air.

12.1.1.1.2 Performance Outcomes

1. There is no discharge to air of contaminants that may cause an adverse effect on the environment from the operation of the activity.
2. All of the following –
    a. Fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised.
    b. Contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air.

c. Releases of contaminants to the atmosphere for dispersions will be managed to prevent or minimise adverse effects on environmental values.

12.1.1.2 ToR Environmental Objectives and Outcomes relevant to the project

The Environmental Objectives and Outcomes for air given in the Project ToR are that the activity will be operated in a way that protects the environmental values of air.

12.1.2 Terms of Reference Addressed in this Chapter

The potential impacts to air and greenhouse gas emissions as a result of the Project have been assessed according to the Project Terms of Reference (ToR), and the DEHP (n.d.) Air – EIS information guideline. A cross reference to where in this Chapter each of the Project ToR are addressed, is provided below in Table 12-1.

Table 12-1: ToR cross-reference

Terms of Reference	Section of the SEIS
8.10 Air	
Describe the existing air environment at the project site and the surrounding region.	Section 12.3
Provide an emissions inventory and description of the characteristics of contaminants or materials that would be released from point and diffuse sources and fugitive emissions when carrying out the activity (point source and fugitive emissions). The description should address the construction, commissioning, operation, upset conditions, and closure of the project.	Section 12.4
Predict the impacts of the releases from the activity on environmental values of the receiving environment using established and accepted methods and in accordance with the EP Regulation, Environmental Protection (Air) Policy 2008 (EPP (Air), and DES' EIS information guideline—Air. The description of impacts should take into consideration the sensitivity and assimilative capacity of the receiving environment and the practices and procedures that would be used to avoid or minimise impacts.	Section 12.6
The impact prediction must address the cumulative impact of the release with other known releases of contaminants, materials or wastes associated with existing development and possible future development (as described by approved plans and existing project approvals).	Section 12.2
It should also quantify the human health risk and amenity impacts associated with emissions from the project for all contaminants whether or not they are covered by the National Environmental Protection (Ambient Air Quality) Measure or the EPP (Air).	Section 12.6
Describe the proposed mitigation measures and how the proposed activity will be consistent with best practice environmental management.	Section 12.7
The EIS must address the compatibility of the project's air emissions with existing or potential land uses in surrounding areas. Potential land uses might be gauged from the zonings of local planning schemes, or State Development Areas, etc.	Section 12.3.2
Describe how the achievement of the objectives would be monitored, audited and reported, and how corrective actions would be managed.	Section 12.7
Proponents are responsible for determining if they have obligations under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and ensuring that information provided in their NGER report meets the requirements of this Act and its subordinate legislation.	Section 12.8.3.1
Provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO2 equivalent' terms.	Section 12.8.3
Estimate emissions from upstream activities associated with the proposed project, including the fossil fuel based electricity to be used.	Sections 12.8.2 and 12.8.3

Terms of Reference	Section of the SEIS
Briefly describe the methods used to make the estimates. NGER guidelines can be used as a reference source for emission estimates and supplemented by other sources where practicable and appropriate. Coal mining projects must include estimates of coal seam methane to be released as well as emissions resulting from such activities as transportation of products and consumables, and energy use at the project site.	Section 12.8.2
Assess the potential impacts of operations within the project area on the state and national greenhouse gas inventories and propose greenhouse gas abatement measures, including: a description of the proposed measures (alternatives and preferred) to avoid and/or minimise greenhouse gas emissions directly resulting from activities of the project, including such activities as transportation of products and consumables, and energy use by the project	Sections 12.8.3, 12.8.4 and 12.8.5
an assessment of how the preferred measures minimise emissions and achieve energy efficiency	Section 12.8.5
a comparison of the preferred measures for emission controls and energy consumption with best practice environmental management in the relevant sector of industry	Section 12.8.5
a description of any opportunities for further offsetting greenhouse gas emissions through indirect means.	Section 12.8.5

12.1.3 Relevant Legislation and Policy Instruments

A number of legislative acts, policies and guidelines have been established to protect air quality values (refer to Chapter 2 – Legislation and Approvals - for further details on the Project's legislative framework). The legislation and policy instruments relevant to air quality are summarised below, and those relevant to Greenhouse Gas assessment are presented in Section 12.8.1.

12.1.3.1 Commonwealth

12.1.3.1.1 National Environment Protection (Ambient Air Quality) Measure

Australia's first national ambient air quality standards were outlined in 1998 as part of the National Environment Protection (Ambient Air Quality) Measure (Air NEPM).

The Air NEPM sets national standards for the key air pollutants: carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide, lead and particles (particulate matter [PM] measuring ≤10 micrometres [µm] [PM_{10}] and PM measuring ≤2.5 µm [$PM_{2.5}$]). The Air NEPM requires State Governments to monitor air quality and to identify potential air quality problems.

12.1.3.2 State

12.1.3.2.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) provides the key legislative framework for environmental management and protection in Queensland. The EP Act utilises several mechanisms to achieve its objectives including: Environmental Protection Policies (EPPs) for water use, noise and air.

12.1.3.2.2 Environmental Protection (Air) Policy 2019

The object of the Environmental Protection Air Policy (EPP Air) is to 'achieve the object of the EP Act in relation to Queensland's air environment' (Section 5 EPP (Air)). The framework to achieve this includes:

- identifying environmental values (EVs) to be enhanced or protected
- specifying air quality indicators and goals to protect or enhance the EVs and
- providing processes which manage the air environment and involve the community in achieving air quality goals that best protect Queensland's air environment.

Ambient air quality goals relevant to this Project are prescribed by the EPP (Air) and criteria for PM_{10} and $PM_{2.5}$ are provided. The most critical of these to the present assessment is the PM_{10} criterion, as the fraction of $PM_{2.5}$ against PM_{10} emissions from mining operations is small (typically less than 10 per cent (%)).

12.1.3.2.3 Guideline Mining - Model Mining Conditions

The EP Act provides for the granting of environmental authorities for resource activities – mining activities. In giving approval under the EP Act, the administering authority must address the regulatory requirements set out in the Environmental Protection Regulation 2008 and the standard criteria contained in the EP Act.

The 'Guideline Mining - Model Mining Conditions' (MMC Guideline) provides a set of model conditions for general environmental protection commitments for the mining activities and the environmental authority conditions pursuant to the EP Act.

The MMC Guideline states that the "model conditions should be applied to all new mining project applications lodged after the guideline is approved", therefore the Project is subject to the air criteria outlined in the MMC Guidelines.

12.1.3.2.4 Wetland Protection

In agency comments on previous versions of the SEIS, the impact of dust on environmental receptors (i.e. Deep Creek, Tooloombah Creek and the two Matters of State Significance (MSES) mapped wetlands near the western boundary (wetland 1 and wetland 2) was raised as an issue for further investigation.

There are no air quality objectives for the deposition of dust for the protection of the health and biodiversity of ecosystems in the Qld Air EPP, or any other statutory limit regarding vegetation, creeks or wetland protection. Furthermore, there is a paucity of research on the impacts of dust deposition on biodiversity values. As such, in the absence of readily available information or assessment criteria for dust deposition on wetland vegetation, criteria for this Project have been adopted from the Cumulative Impact Assessment (CIA) for air quality for Abbot Point (Katestone 2012), for which the former Queensland Department of Environmental and Heritage Protection (now DES) provided design guidance for dust deposition for the avoidance of dust nuisance. This study investigated, in part, the effects of coal dust on vegetation, with particular emphasis on assessment for vegetation in marshes and wetland, at Abbot Point (Katestone 2012). The operational goal of a 120-day rolling average deposition rate of 200 $mg/m^2/day$ was recommended as a result of the CIA air quality assessment. This goal is adopted here for the assessment of dust deposition impacts on the wetland and riverine environments.

12.1.3.2.5 Application Requirements for Activities with Impacts to Air (ESR/2015/1840)

The Application Requirements for Activities with Impacts to Air (ESR/2015/1840) is the air related guideline for ERAs under the EP Act. The guidelines require three key areas to be addressed:

- identify the Environmental Values (EVs) of the receiving air environment including the identification of any nearby sensitive places (Section 12.3)
- identify the possible impacts of the proposed activity and all associated risks to the EVs (Section 12.612.6) and
- identify the management strategies to mitigate the identified risks to the EVs (Section 12.7).

12.1.4 Air Quality Criteria

The strictest applicable criteria for pollutants with the potential to become elevated as a result of Project activities have been selected from the regulatory mechanisms discussed above for use in this assessment. These are presented in Table 12-2.

Table 12-2: Project air quality criteria

Pollutant	Basis	Criteria	Source	Averaging Time
TSP	Human Health	90 µg/m^3	MMC & EPP Air	1-year
PM_{10}	Human Health	50 µg/m^3	Air NEPM & EPP Air	24-hour
	Human Health	25 µg/m^3	Air NEPM & EPP Air	1-year
$PM_{2.5}$	Human Health	25 µg/m^3	MMC & EPP Air	24-hour
	Human Health	8 µg/m^3	Air NEPM & EPP Air	Annual
Dust deposition	Amenity	120 mg/m^2/day	MMC	1-Month
	Wetland Vegetation	200 mg/m^2/day	CIA	3-Month

12.2 Air Quality Assessment Methods

12.2.1 Characterisation of the Existing Environment

The modelling exercise considered the following existing environmental factors:

- terrain
- surrounding land uses and
- sensitive receptor locations.

Information regarding the existing environment is provided in Section 12.3.

The following climate and meteorology data relevant to the Project area was documented in terms of:

- temperature
- rainfall
- wind speed and direction and
- atmospheric stability.

Existing air quality in the region was estimated by considering the monitoring data reported in recent air quality assessments for other mines in Queensland. Information regarding the existing air quality in the region is provided in Section 12.3.5.

12.2.2 Emissions Estimation

An emissions inventory of TSP, PM_{10}, $PM_{2.5}$, deposited dust and gaseous blasting emissions for the Project was compiled using National Pollutant Inventory (NPI) and United States Environmental Protection Agency (US EPA) AP-42 emissions estimation methodology for the construction and operational stages of the Project.

Emissions estimations were calculated for the following Project Stages:

- Construction
- Stage 1 - year 3 operations and
- Stage 2 - year 12 operations.

The scenario assessed for Stage 2 of operations represents maximum capacity (i.e. 10 Mtpa compared with 2-5 Mtpa) when primary dust activities are closest to the nearest sensitive receptors with maximum equipment usage. This scenario is therefore considered representative of worst case scenario conditions.

Estimations of the emissions from the Project activities were made for:

- mobile plant equipment
- dust and particulates and
- gaseous emissions from blasting.

The methods used to estimate these emissions are discussed below.

12.2.2.1 Estimation of Emissions Mobile Plant Equipment

Estimations of the emissions from mobile plant equipment were calculated for the three Project Stages using the information detailed in Table 12-3 below.

Table 12-3: Mobile plant equipment types and amounts required for Construction and Operation

Equipment	Construction	Operation	
		Year 3 (Stage 1)	Year 12 (Stage 2)
CAT 631G Scraper	2	1	1
785D Haul Truck	4		
789D Haul Truck	4	4	8
793D Haul Truck	5	8	36
RH170 Excavator	1	1	2
Liebherr 996 Excavator	1	2	9
EX1200 Excavator	1		
SKS 270mm Drill		1	4
MD5150C Track Drill		1	3
D9 Dozer	1	1	4
D10 Dozer	1	2	5
D11 Dozer	1	2	4
HD605 Water Cart	1	2	4
16M Grader		2	2
24H Grader		1	2
16 Grader	1		
B-Double Coal Haulage Units		2	8
992 Front End Loader	1	3	6
960 Front End Loader	1		
980 Front End Loader	1		
Volvo Semi-Tippers	8		
Service Truck	1	1	2
Pump Truck	1	1	2
Fuel Truck	1	1	3
Franna Crane	1	1	2
Service vehicles		10	19
Generator (520kVA)		3	3
Generator (300kVA)		3	3
Generator (1MW)	1		
UDR800 Drill	1		

12.2.2.2 Estimation of Particulates and Dust Emissions

The NPI Emission Estimation Technique Manual for Mining v3.0 (NPI 2011) provides data on emissions of air pollutants during typical coal mine operations. This data is based on measurements of dust emissions from coal mines in Australia or adopted from US EPA AP-42 emission estimates. The NPI Emission Estimation Technique Manual for Mining v3.0 and US EPA AP-42 were used to provide data to estimate the amount of

TSP, PM_{10} and $PM_{2.5}$ from the various mine activities, based on the amount of coal and overburden material to be mined.

Emission factors are used to estimate a facility's emissions by the general equation:

$$E_{i\,(kg/yr)} = \left[A_{(t/h)} \times OP_{(h/yr)} \right] \times EF_{i\,I(kg/t)} \times \left[1 - \frac{CE_i}{100} \right]$$

Where:

$E_{i\,(kg/yr)}$ = Emission rate of pollutant

$A_{(t/h)}$ = Activity rate

$OP_{(h/yr)}$ = Operating hours

$EF_{i\,I(kg/t)}$ = Uncontrolled emission factor of pollutant

CE_i = Overall control efficiency for pollutant

The emission factors and methodology used to estimate emissions for each source types outlined above are discussed in Appendix A7 – Air Quality and GHG Technical Report.

The predicted cumulative ground level concentration (incremental plus background) values for TSP, PM_{10} and $PM_{2.5}$ as well as dust deposition at each sensitive receptor were compared with relevant Project Air Quality Criteria.

A search of the Queensland Department of Environment and Science (DES) Environmental Management Register (EMR) and Contaminated Land Register (CLR) was undertaken to determine the risk of containments becoming airborne during construction and operational works. The search identified that there are no sites on the EMR or CLR for the Project (see Chapter 5 – Land).

12.2.2.3 Estimation of Gaseous Emissions from Blasting Activities

Gaseous emissions (NO_2, CO and SO_2) from blasting activities were estimated using the emission factors specified in Table 7 of the NPI Emission estimation technique 'manual for explosives detonation and firing ranges Version 3.1'. The estimations were based on the following activity data:

- blasting frequency – 1 per day
- blasting mix – ANFO, Heavy ANFO and Emulsion and
- maximum instantaneous charge (MIC) – 1000 kg / 250 kg.

12.2.3 Air Quality Modelling

The estimated emissions data was used as input for air dispersion modelling. The modelling techniques were based on a combination of The Air Pollution Model (TAPM) prognostic meteorological model (developed by CSIRO), and the CALMET model suite used to generate a three dimensional meteorological dataset for use in the CALPUFF dispersion model.

12.2.3.1 TAPM

To generate the broad scale meteorological inputs to run CALPUFF (see below), the model The Air Pollution Model (TAPM), was used. TAPM is a 3-dimensional prognostic model developed and verified for air pollution studies by the CSIRO. TAPM is Australia's leading air quality model and can be used to predict meteorological and air pollution parameters at both regional and local scales. DES has completed extensive validation of TAPM against data from its own monitoring network.

TAPM was configured as follows:

- centre coordinates – 22˚ 39.0 S, 149˚ 38.0 E
- dates modelled – 1st January 2014 to 31st December 2014
- four nested grid domains of 20 km, 10 km, 3 km and 1 km
- 70 x 70 grid points for all modelling domains
- 25 vertical levels from 10 m to an altitude of 8000 m above sea level and
- the default TAPM databases for terrain, land use and meteorology were used in the model.

12.2.3.2 CALMET

The output from TAPM was used to generate appropriate meteorological data for CALMET. CALMET is the meteorological pre-processor for the CALPUFF modelling system (see below).

CALMET is an advanced non-steady-state diagnostic three-dimensional meteorological model with micro-meteorological modules for overwater and overland boundary layers.

The CALMET simulation was set up in accordance with the best practice guidelines for NSW (Barclay and Scire 2011). The CALMET simulation was run as No-Obs simulation with the gridded TAPM three-dimensional wind field data from the innermost grid. CALMET then adjusts the prognostic data for the kinematic effects of terrain, slope flows, blocking effects and three-dimensional divergence minimisation.

12.2.3.3 CALPUFF

A 3-dimensional dispersion wind field model, CALPUFF, was used to simulate the impacts from the Project.

CALPUFF is a non-steady-state Lagrangian Gaussian puff model. CALPUFF employs the three-dimensional meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal.

The model has been approved for use in the ‘Guideline on Air Quality Models’ (Barclay and Scire 2011) as a preferred model for assessing applications involving complex meteorological conditions such as calm conditions.

Emission sources can be characterised as arbitrarily varying point, area, volume and lines or any combination of those sources within the modelling domain.

The radius of influence of terrain features was set at 5 km while the minimum radius of influence was set as 0.1 km. The terrain data incorporated into the model had a resolution of 1 arc-second (approximately 30 m) in accordance with the “Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the ‘Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia’”.

12.2.3.4 Other Model Input Parameters

Other modelling input parameters included particle size distribution (i.e. (geometric mass mean diameter and standard deviation to compute the dispersion of particulates) and source type and initial source structure.

The following source types were modelled as part of the assessment:

- Wheel-generated dust from trucks travelling on the haul roads was modelled as a number of volume sources that were spread out along the entire haul road route. The emissions for each road section were determined as a proportion of total emissions on the haul road using the ratio of the section length to the total haul road length.

- Coal handling and processing and train load out activities were also modelled as volume sources as they represent dust emissions which are at ambient temperatures and are already mixed with the surrounding air.
- Dust emissions from other sources including wind erosion from ROM stockpiles, haul roads, pit and overburden dump areas were modelled as area sources.

12.3 Description of Environmental Values

The following sections outline the existing environment relevant to the Project area and the air quality assessment.

12.3.1 Terrain

Elevations across the Styx catchment range from 0 – 540 m above sea level. The area predominantly comprises flat or undulating lands, draining via several smaller creeks and tributaries to the Styx River and estuary, and into the Coral Sea. The land within the Project area can be described as gently undulating. The topography of the Project area is discussed in more detail in Chapter 5 - Land.

12.3.2 Surrounding Land Uses

The dominant land use within and adjoining the Project area is beef cattle grazing. The mine component of the Project is located entirely within Mamelon cattle property. The haul road is located on Mamelon, Brussels and Strathmuir and the Train Loadout Facility (TLF) is located on Strathmuir. These properties are used for beef cattle grazing. Land uses within the Project area are discussed in Chapter 5 - Land.

12.3.3 Sensitive Receptors

As defined in the Application Requirements for Activities with Impacts to Air, a sensitive receptor is a residential or accommodation premise, an educational institution, a medical institution, a protected area or a place used as a workplace.

CQC is seeking first to recruit workers who reside in (or are willing to relocate to) the local area, followed by regional and state residents. CQC anticipates all or nearly all of the construction and operational workforces can be recruited from the local and regional study areas, including some workers who may relocate. As such, no accommodation camp is proposed as part of the Project. The Marlborough Caravan Park will be used for any non-local commute personnel.

Nine sensitive residential receptors lie within the locality of the Project. An additional four environmental receptors (Deep and Tooloombah Creeks and two wetlands) have been included in the assessment. The receptor name and location of each receptor is described in Figure 12-4. Except for the Tooloombah Creek Service Station, all identified receptors are isolated homesteads. The Tooloombah Creek Service Station receptor is also the closest receptor to the Project, being located approximately 2 km from Open Cut 1. The entire township of Ogmore has been counted as one sensitive receptor.

Two additional sensitive receptors BAR H-2 and BAR H-3 were incorrectly identified in the original EIS. These two receptors have been discarded from the assessment as: BAR H-2 is an unoccupied and dilapidated house that is unliveable and BAR H-3 is a pump hut.

The owner of BAR H-2 has confirmed the house is unoccupied and the owner has advised there is no intent to return the former residence to a liveable standard. Should the house be returned to a liveable standard at some time in the future Central Queensland Coal will implement noise monitoring to ascertain any potential exceedances from operations.

The sensitive receptor locations and monitoring locations in relation to the Project are shown in Figure 12-1. Overall, there a very few sensitive receptors surrounding the Project given the particularly rural nature of the area.

Table 12-4: Sensitive receptors within 10 km of the Project

Receptor ID	Receptor name	Location		Distance and direction
		Latitude	Longitude	
Sensitive Receptors				
R1	BAR H-1	149.654152	-22.644752	4.1 km (N)
R2	Brussels	149.69164	-22.736011	3.2 km (SE)
R3	Neerim-1	149.716823	-22.761051	6.9 km (SE)
R4	Neerim-2	149.701064	-22.768169	3.4 km (SE)
R5	Oakdean	149.668225	-22.642817	4.5 km (NE)
R6	Ogmore Township	149.658111	-22.619961	6.8 km (N)
R7	Strathmuir	149.732975	-22.705505	6.3 km (E)
R8	Tooloombah Service Station (including two residences)	149.625007	-22.688686	2.2 km (W)
R9	Tooloombah Homestead	149.541997	-22.733402	10.2 km (W)
Wetland Receptors				
R10	Tooloombah Creek	149.625007	-22.688686	2.2 km (W)
R11	Deep Creek	149.679248	-22.710677	0.7 km (E)
R12	Wetland 1	149.636031	-22.709301	0.3 km (W)
R13	Wetland 2	149.635369	-22.697116	0.8 km (W)

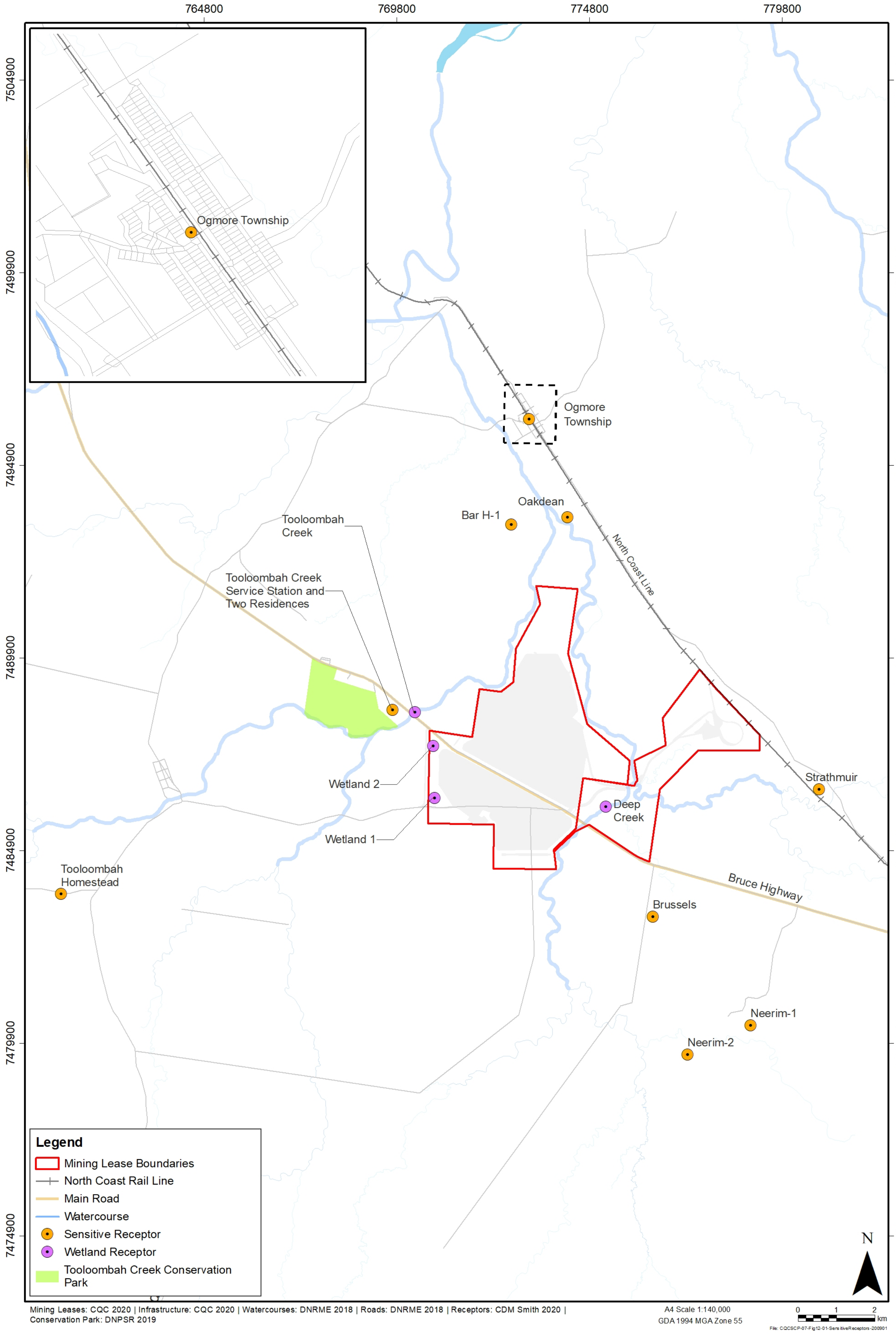


Figure 12-1: Sensitive receptors

12.3.4 Climatic Factors

12.3.4.1 Temperature, Rainfall and Wind Patterns

The modelling undertaken to assess the potential impacts of the Project to air took into account the below climatic and meteorological variables to enable the assessment of the dispersion of the Project emissions. A full description of the climatic and meteorological inputs to the model is given in Appendix A7 - Air Quality and GHG Technical Report. A detailed description of the overall climatic setting of the Project is presented in Chapter 4 – Climate.

- Temperature- The Project region experiences a sub-tropical climate, with cool winters and hot summers. Mean winter (July) temperatures range between around 8 and 25°C, whilst mean summer (December-January) temperatures range between around 23 and 33°C.
- Rainfall - The rainfall in the region is variable, with most rainfall in the warmer months. On average, most of the annual rainfall is received between December and March. Rainfall is lowest between July and September, with a mean annual rainfall of 1018 mm. Rainfall reduces the dispersion of air emissions and therefore the potential impact on visual amenity and health.
- Wind patterns - The dispersal of pollutants is influenced by the wind speed and direction at the source of the pollutant release. The predominant wind directions are from the north northeast during spring and north northeast and southeast during the summer months. In autumn, the winds are primarily from the south easterly directions. Southerly and south south-easterly winds are more frequent during the winter season.

12.3.4.2 Atmospheric Stability

Atmospheric stability is an important factor in the dispersion and transport of particulates. It refers to the tendency of the atmosphere to resist or enhance vertical motion of pollutants. The Pasquill-Turner assignment scheme identifies six Stability Classes (Stability Classes A to F) to categorise the degree of atmospheric stability. These classes indicate the characteristics of the prevailing meteorological conditions and are used in various air dispersion models. The frequency of occurrence for each stability class for 2014 is detailed in Figure 12-5.

Table 12-5: Annual stability class distribution predicted (TAPM-CALMET 2014)

Stability Class	Description	Frequency of Occurrence (%)	Average Wind Speed (m/s)
A	Very unstable, low wind, clear skies, hot daytime conditions	0.6	2.1
B	Unstable clear skies, daytime conditions	5.0	3.0
C	Moderately unstable moderate wind, slightly overcast daytime	16.7	3.4
D	Neutral high winds or cloudy days and nights	43.6	2.5
E	Stable moderate wind, slightly overcast night-time conditions	15.5	2.1
F	Very stable low winds, clear skies, cold night-time conditions	18.6	2.1

12.3.4.3 Mixing Height

The height above ground within which the particulates or other pollutants released at or near ground can mix with ambient air is known as the mixing height. The mixing height is often quite low during stable atmospheric conditions with particulate dispersion limited to the ground level. The mixing height rises during the day as solar radiation heats the air at ground level. While the ground level temperature increases, air above the mixing height is generally colder. The mixing height is dependent on how well the air can mix with the cooler upper levels of air and therefore depends on meteorological factors such as the intensity of solar radiation and wind speed.

Diurnal variations in mixing depths are illustrated in Figure 12-2. As would be expected, an increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of convective mixing layer.

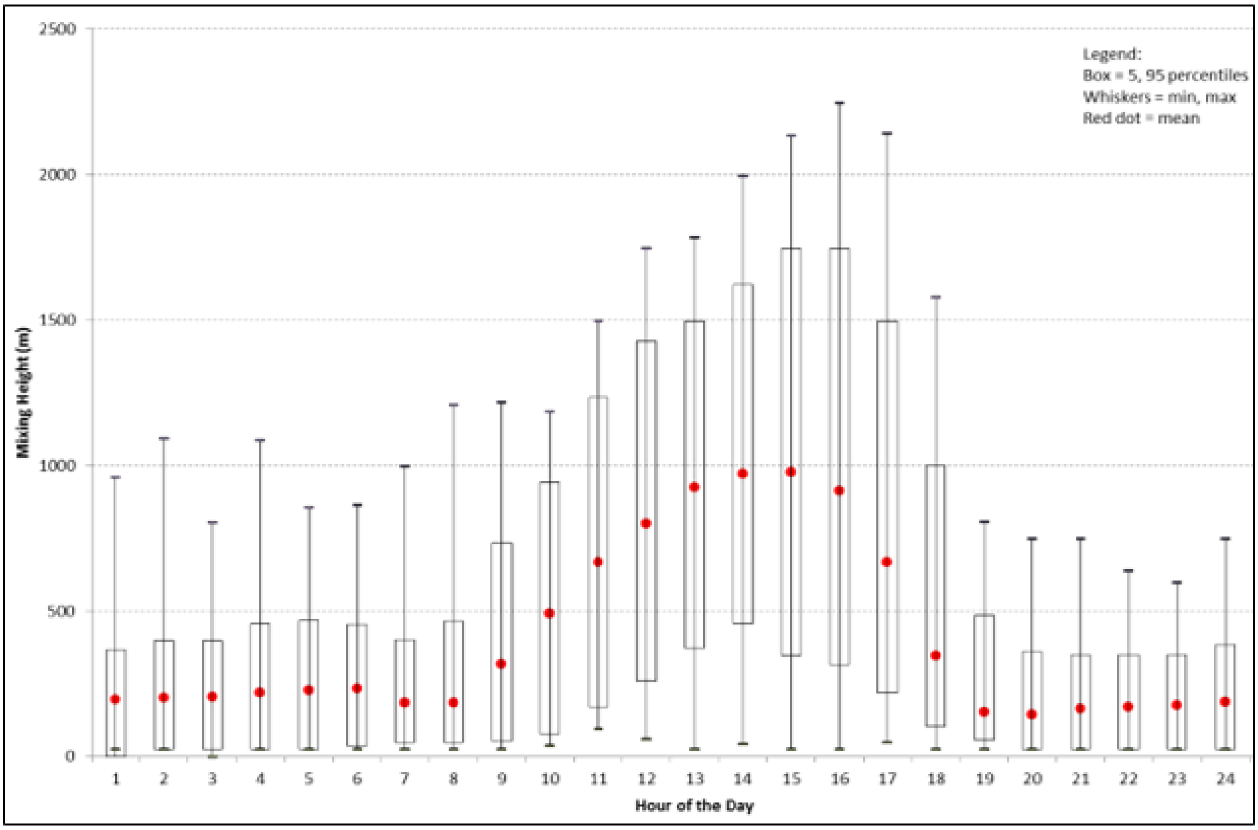


Figure 12-2: Profile of mixing height at the Project

12.3.5 Existing Air Environment

To assess the impact of the Project on the airshed associated with the sensitive receptors, the incremental impact is quantified and added to existing background pollutant concentrations. To achieve this background concentration levels of PM, which are representative of current levels in the region, need to be established. The existing air environment is influenced by natural sources such as fires and wind erosion, and anthropogenic sources such as the open cut coal mines in the broader area.

A review of the NPI emissions database has determined there are three facilities within 100 km of the Project. In addition, there is the Brolga Mine, located 64 km from the Project site; however, no emissions were reported to the NPI in 2014-2015. The emissions of these facilities (Table 12-6) are not expected to have a significant impact on the local background concentrations due to the distances from the Project.

Table 12-6: NPI reported emissions for 2014-2015

Facility	Distance from Project (km)	Emissions			
		PM_{10}	$PM_{2.5}$	NO_X	SO_2
QLD Magnesia Mine	56	432,230	15,431	211,518	112
Foxleigh Coal Mine	93	14,207,290	104,020	1,674,000	1,354
Middlemount Coal Mine	100	4,521,653	90,107	1,460,065	1,417

In line with common practice, to quantify and qualify the impact of a proposed mine on environmental values, the incremental impact is quantified and added to existing background pollutant concentrations. As there are currently no DES monitoring stations operating in the locality of the Project, existing air quality for dust deposition, TSP, PM_{10} and $PM_{2.5}$ has been estimated by considering the monitoring data reported in recent air quality assessments for other mines in Queensland: Taroborah Coal Project; Baralaba Coal Mine; and Rolleston Coal Expansion Project (see Appendix A7 - Air Quality and GHG Technical Report for more details).

Table 12-7 presents the assigned background concentrations for each of these assessments.

Table 12-7: Assigned background levels for recent EIS assessments

Project	Assigned Background Levels				
	TSP (µg/m³)	Dust Deposition (mg/m²/day)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	
	Annual	30 days	24 Hour	24 Hour	Annual
Baralaba Coal	34.1	59.1[A]	19.4	9.7	3.6
Taroborah Coal	28.0 [D]	33.0[B]	20.0[C]	5.4[D]	2.8[D]
Rolleston Coal	36.6	50.0	20.0	7.2	6.6

[A] Reported as 1.8 g/m²/month
[B] Average of dust deposition monitoring at Foxleigh residence (which is not influenced by Middlemount operations)
[C] 70th percentile PM_{10} 24-hour concentration at Middlemount Village
[D] Taken from Ensham Coal mine monitoring

A summary of the assigned background concentrations used in this study are presented Table 12-8. These background concentrations are added to the predicted incremental emissions from the Project to derive total potential concentrations.

Table 12-8: Assigned background concentrations used for this assessment

Parameter	Air Quality Objective	Regulation	Period	Applied Background	Comments
TSP	90 µg/m³	EPP (Air)	Annual	40 µg/m³	Conservative assumption
PM_{10}	50 µg/m³	EPP (Air)	24 Hour	20 µg/m³	Monitoring at Middlemount Mine
	25 µg/m³	EPP (Air)	Annual	10 µg/m³	
$PM_{2.5}$	25 µg/m³	EPP (Air)	24 Hour	9.7 µg/m³	Monitoring by Barabala Mine
	8 µg/m³	EPP (Air)	Annual	3.6 µg/m³	
Dust Deposition	120 mg/m²/day	EPP (Air)	24 Hour	59 mg/m²/day	Conservative assumption

12.4 Potential Impacts of the Project

The Project has the potential to impact on sensitive receptors. The main emissions to air will be dust and particulate matter generated by the onsite construction and mining activities which will primarily occur because of the following activities:

- site clearance of areas for construction activities including vegetation clearance, topsoil removal and storage, and earthworks
- excavation of coal and overburden
- loading / unloading of haul trucks
- bulldozer and grader operations
- wind erosion from disturbed areas and stockpiles
- transfer points
- conveyors
- crushing and screening
- vehicle movements
- blasting and drilling
- diesel combustion and
- rail transport of coal.

In addition, air pollutants from diesel combustion may release other air pollutants such as sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and trace quantities of volatile organic compounds. These substances are not considered to be emitted in sufficient quantities to affect air quality at sensitive receptors beyond the Project boundary and have not been modelled in the air quality assessment.

12.4.1 Dust Control

Dust emissions associated with clearing of areas would be less than emissions associated with excavation of overburden. In addition, they are temporary. Since ground level concentrations of pollutants are below the criteria associated with operations, the impacts due to construction would be even lower.

Dust control measures have been accounted for in the modelling. A summary of key dust control measures and their relative effectiveness is presented in Table 12-9.

Table 12-9: Dust control measures

Activity	Control measure	Reduction (%)
Wheel-generated dust and grading	Level 2 watering of haul roads	75
Drilling	Cyclone / watering	70
Wind erosion	Rehabilitation (dependent on area)	90
Stockpiles (ROM, product, rejects)	Water sprays	50

12.4.2 Emission Estimations for Construction Activities

Discharges to air (in particular, dust) during the construction phase are primarily a management issue and can be minimised with good management practises. The management of the emissions from the Project is discussed in Section 12.7.

The annual emission rates, accounting for the proposed controls, estimated for the main sources of air emissions from the mining activities during the construction stage are summarised at Table 12-10.

Table 12-10: Construction Stage Emission Rates

Source	Emission rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
Wind erosion	7.45	3.53	1.65
Diesel Combustion	-	-	1.0
Power Generation	0.07	0.07	0.07
Wheel generated dust	3.7	1.1	0.1
Site clearance activities	13.73	4.30	0.62
TOTAL	**24.96**	**8.99**	**3.45**

12.4.3 Emission Estimation for Operational Activities

The assessment has been based on the Year 3 and Year 12 of operations. Year 3 represents an average year for Stage 1 of the Project, where only one of the Open Cut mines (Open Cut 2) will be operational. Year 12 (in Stage 2 of the Project in which both Open Cut mines will be operational) represents maximum operational capacity (i.e. 10 Mtpa compared with 2-5 Mtpa) with maximum equipment usage. The open cut mining operations at Open Cut 2 are closest to the sensitive receptors to the north. Mining of Open Cut 1 during Stage 2 is towards the southern end of the pit. This scenario is considered representative of 'worst case' conditions.

The following controls were applied to the dust sources for the estimation of emissions in accordance with the NPI Emission Estimation Technique Manual for Mining v3.0:

- 50% control for water sprays applied to stockpiles and exposed areas
- 90% control for revegetation of exposed areas
- 86% control for level 2 watering of haul routes (>2 litres/m^2/h) and limiting vehicle speeds on haul routes to 40 km/h and
- 70% control for water sprays applied to drilling.

The annual emission rates, accounting for the proposed controls, estimated for the main sources of air emissions from the mining activities during Year 3 (Stage 1) and Year 12 (Stage 2) are summarised in Table 12-11 and Table 12-12, respectively.

Table 12-11: Operational Stage 1 (year 3) Emission Rates

Source	Emission rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
CHPP operations	3.40	1.49	0.31
Waste handling	1.77	0.68	0.19
Wind erosion	8.45	3.75	1.68
Wheel generated dust	11.24	3.31	0.21
Mining operations	25.71	8.63	0.89
Blasting/drilling	48.93	25.35	1.47
Diesel combustion	-	-	4.40
Power generation	0.21	0.21	0.21
Train Loadout	0.51	0.20	0.07
TOTAL	**100.23**	**43.62**	**9.43**

Table 12-12: Operational Stage 2 (year 12) Emission Rates

Source	Emission rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
CHPP operations	8.14	3.36	0.84
Waste handling	11.29	4.25	1.19
Wind erosion	17.23	5.61	1.96
Wheel generated dust	33.87	10.01	0.58
Mining operations	35.15	12.81	1.19
Blasting/drilling	48.93	25.35	1.47
Diesel combustion	-	-	5.41
Power generation	0.40	0.40	0.40
Train Loadout	2.55	0.82	0.24
TOTAL	**157.56**	**62.62**	**13.28**

12.5 Avoidance and Mitigation through Project Design

Discharges to air (in particular, dust) during the construction phase are primarily a management issue and can be minimised with good management practices. The following design elements have been built into the Project design to minimise dust emissions.

12.5.1.1 Engineering Control Measures

Central Queensland Coal has designed engineering control measures into the Project where appropriate and technically possible. These control measures have been applied at the coal handling processes and may include the following:

- enclosure of transfer points and sizing stations
- belt washing and belt scrapers to minimise dust
- reduced drop height from stackers to stockpiles
- eliminating side casting
- enclosure of raw coal surge bins
- implement a coal moisture regulating system at the product coal stockpile and TLF
- install load profiling systems to create a more streamlined and consistent surface of coal in each wagon
- loading system fills the rail wagon completely within the rail wagon and wagon sills will be sloped inwards and
- implement veneering of loaded wagons prior to leaving the TLF.

12.6 Impact Assessment

This section assesses the impacts of the modelled air quality results on the sensitive receptors shown in Figure 12-1. since that presented in the SEIS v2 to reflect the updated technical Air Quality and Greenhouse Gas assessment, undertaken by Vipac Consultants (see Appendix A7 – Air Quality and GHG Technical Report). The technical assessment was updated in 2020 to ensure that it took into account changes to the Project layout and schedule that have occurred since the SEIS v2. See Chapter 3 – Project Changes and Responses to Regulator Comments for the full description of the changes to the Project Layout and Schedule. The main change to the Project layout that necessitated the revision of the air assessment, is the movement of Mine

Infrastructure Area (MIA) 1 to the north-west of its former location (see Chapter 3 for a description of the Project changes that have arisen between version 2 and version 3 of the SEIS).

12.6.1 Assessment of Impacts on Sensitive Receptors

12.6.1.1 Construction Phase

Discharges to air (in particular dust) during the construction phase are primarily a management issue and can be minimised with good management practices. The control of the emissions from the construction phase is discussed in Section 12.7.

The predicted ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition at the nearest sensitive receptors in isolation and with background levels are presented in Table 12-13. Contour plots of the predicted maximum ground-level concentrations with background levels are presented in Figure 12-3 to Figure 12-8, and Appendix C of the air quality assessment report at Appendix A7 – Air Quality and GHG Technical Report.

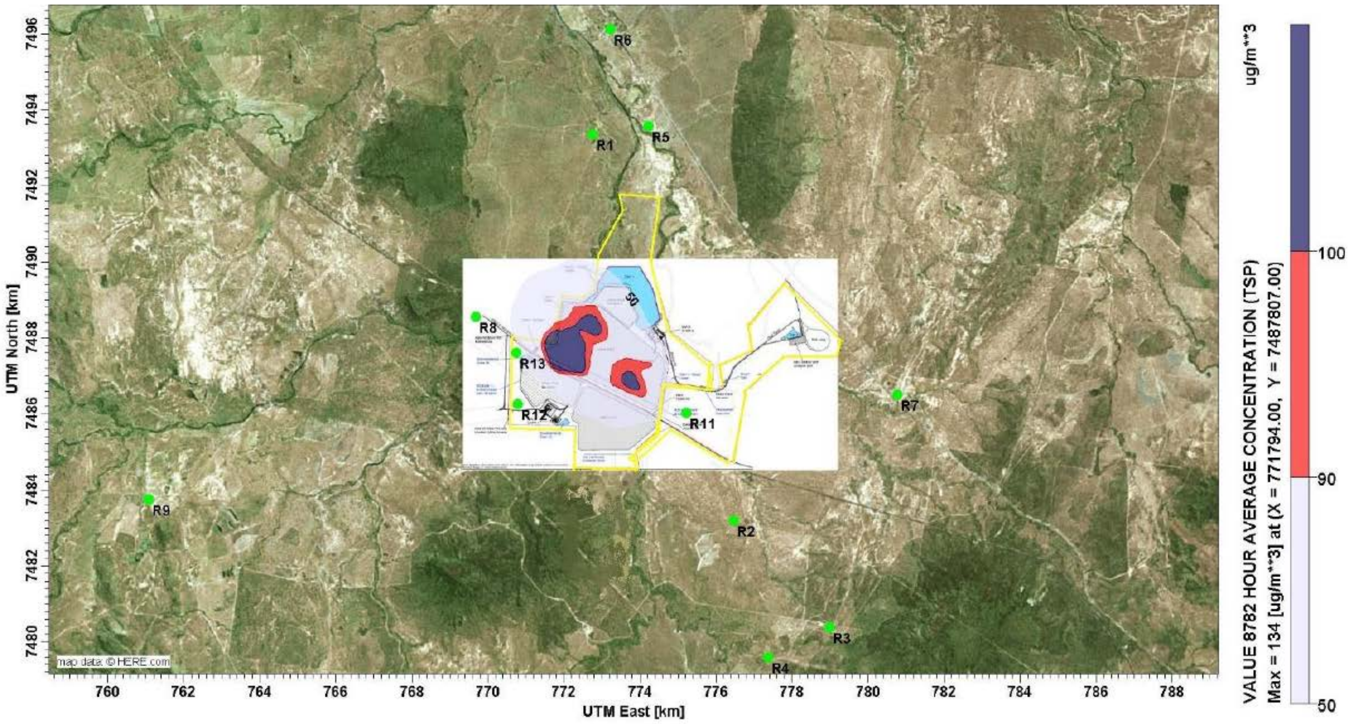
The model results show:

- The highest annual TSP concentrations are below the 90 µg/m³ criterion at all receptors, with the results just above the background concentration of 40 µg/m³.
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 32.6 µg/m³ is predicted to occur at the Tooloombah Creek Service Station (R8), which is below the 50 µg/m³ criterion.
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 14.3 µg/m³ is predicted to occur at the Tooloombah Creek Service Station (R8), which is below the 25 µg/m³ criterion. The highest annual average cumulative ground-level $PM_{2.5}$ concentration is 5.0 µg/m³, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m³ criterion.
- The predicted dust deposition impacts from construction are negligible with the cumulative deposition of 82.6 mg/m²/day which is below the 120 mg/m²/day criterion.

Overall, it can clearly be seen that with the predicted pollutant concentrations from the construction of the Project are well below the relevant criteria.

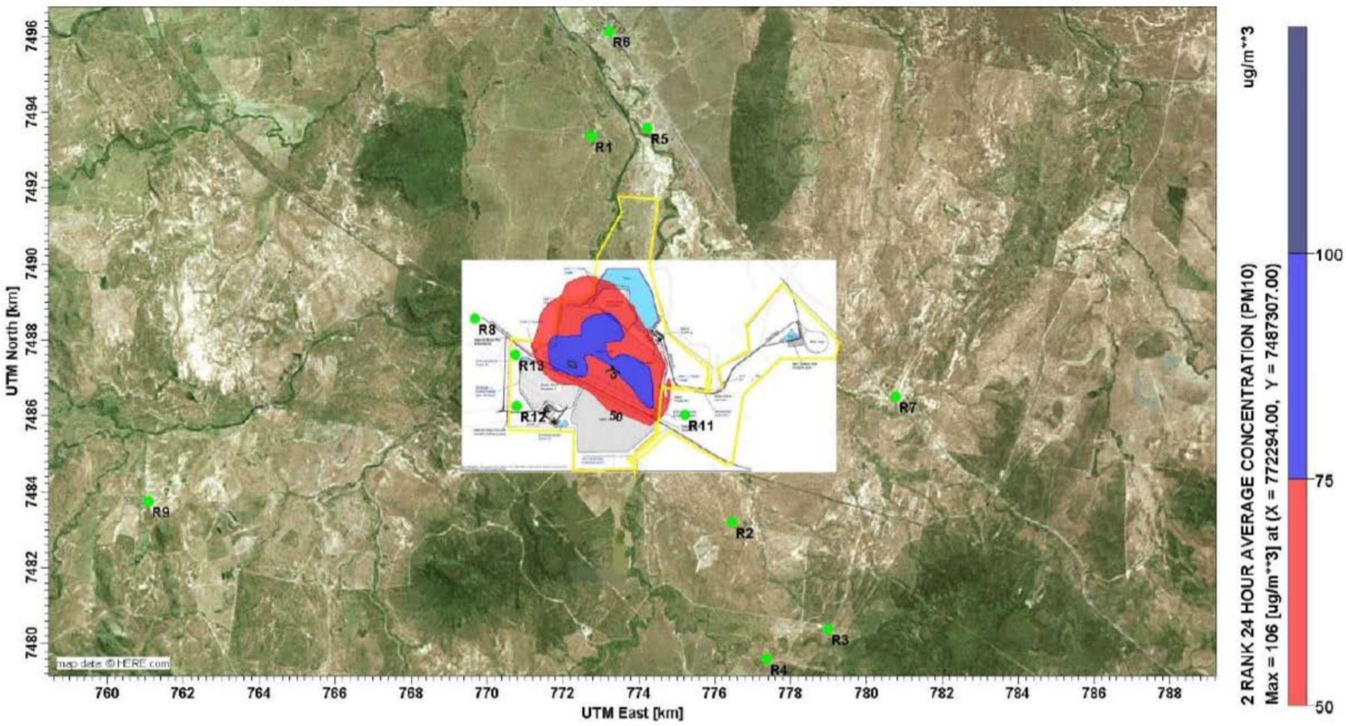
Table 12-13: Predicted maximum ground-level concentrations for the Project Construction

Receptor	In isolation						Cumulative					
	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	Dust Deposition (mg/m²/day)	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	Dust Deposition (mg/m²/day)
	24 Hour	Annual	24 Hour	Annual	24 Hour	1 Month	24 Hour	Annual	24 Hour	Annual	Annual	1 Month
R1	3.17	0.43	12.97	1.75	0.94	7.69	12.87	4.03	26.86	11.75	41.30	66.69
R2	1.02	0.04	3.25	0.11	0.16	0.98	10.72	3.64	22.10	10.11	40.17	59.98
R3	0.28	0.01	0.83	0.03	0.05	0.46	9.98	3.61	20.71	10.03	40.05	59.46
R4	0.24	0.01	0.82	0.04	0.06	0.55	9.94	3.61	20.70	10.04	40.06	59.55
R5	2.78	0.17	11.43	0.68	0.42	4.77	12.48	3.77	24.52	10.68	40.55	63.77
R6	1.77	0.15	7.33	0.63	0.30	2.93	11.47	3.75	23.17	10.63	40.40	61.93
R7	0.21	0.01	0.78	0.03	0.02	0.25	9.91	3.61	21.29	10.03	40.03	59.25
R8	4.55	1.37	17.90	4.81	4.59	23.58	14.25	4.97	32.58	14.81	45.64	82.58
R9	0.48	0.05	1.81	0.16	0.14	0.85	10.18	3.65	21.15	10.16	40.16	59.85
Criteria	**25**	**8**	**50**	**25**	**90**	**120**	**25**	**8**	**50**	**25**	**90**	**120**



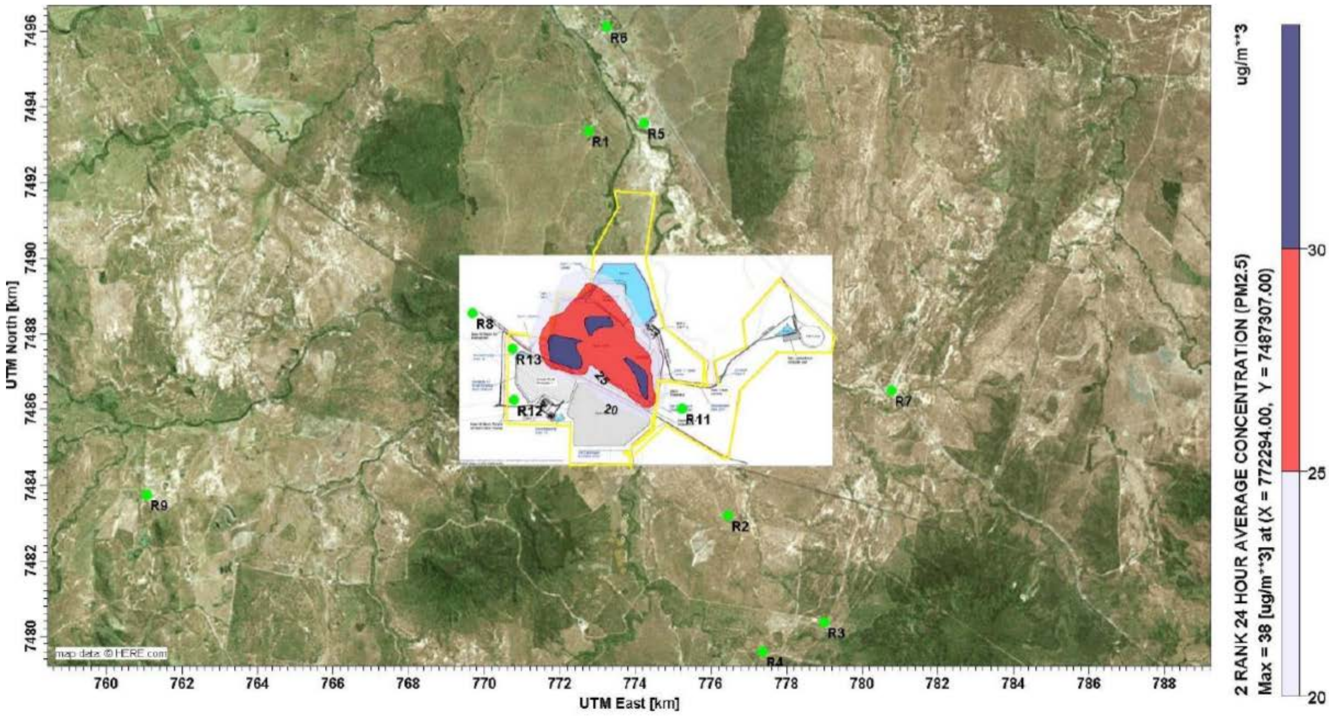
Pollutant	Averaging Period	Percentile	Criteria
TSP	Annual	MAX	90 µg/m^3

Figure 12-3: Construction stage (including background) TSP annual



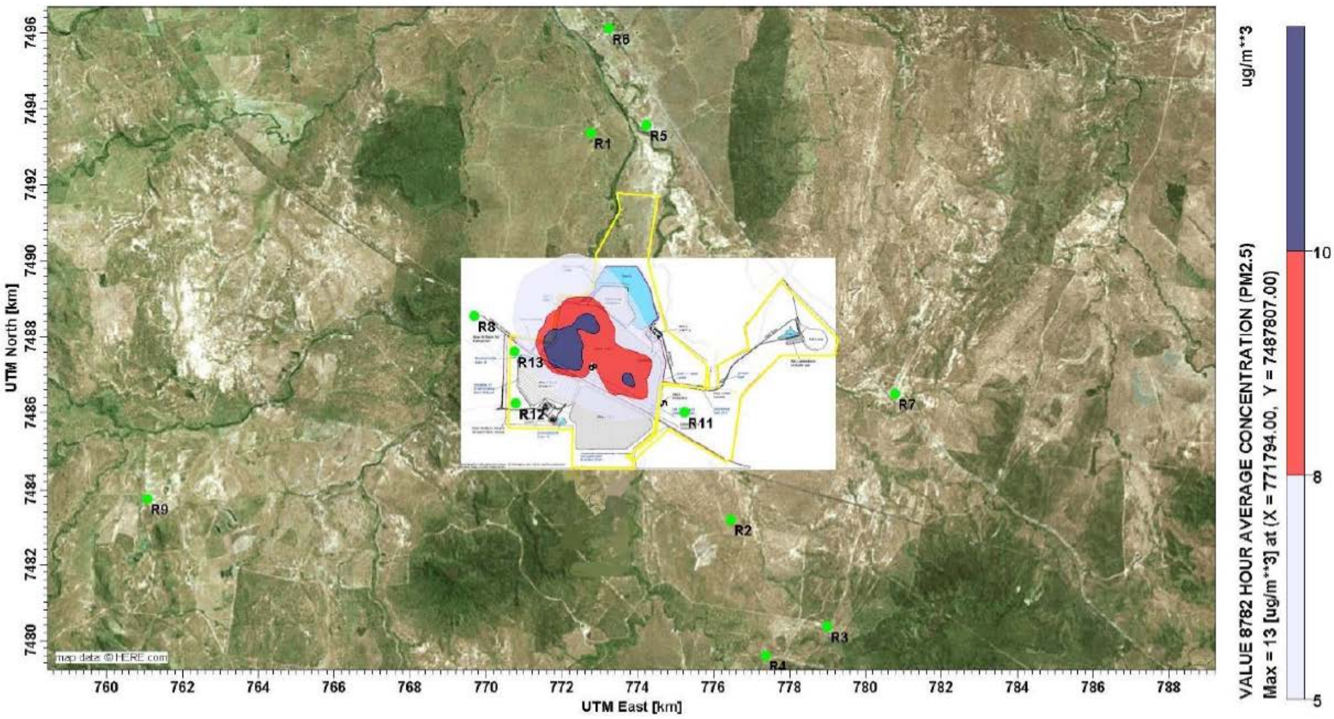
Pollutant	Averaging Period	Percentile	Criteria
PM10	24 hour	MAX	50 µg/m3

Figure 12-4: Construction stage (including background) PM_{10} 24 hour



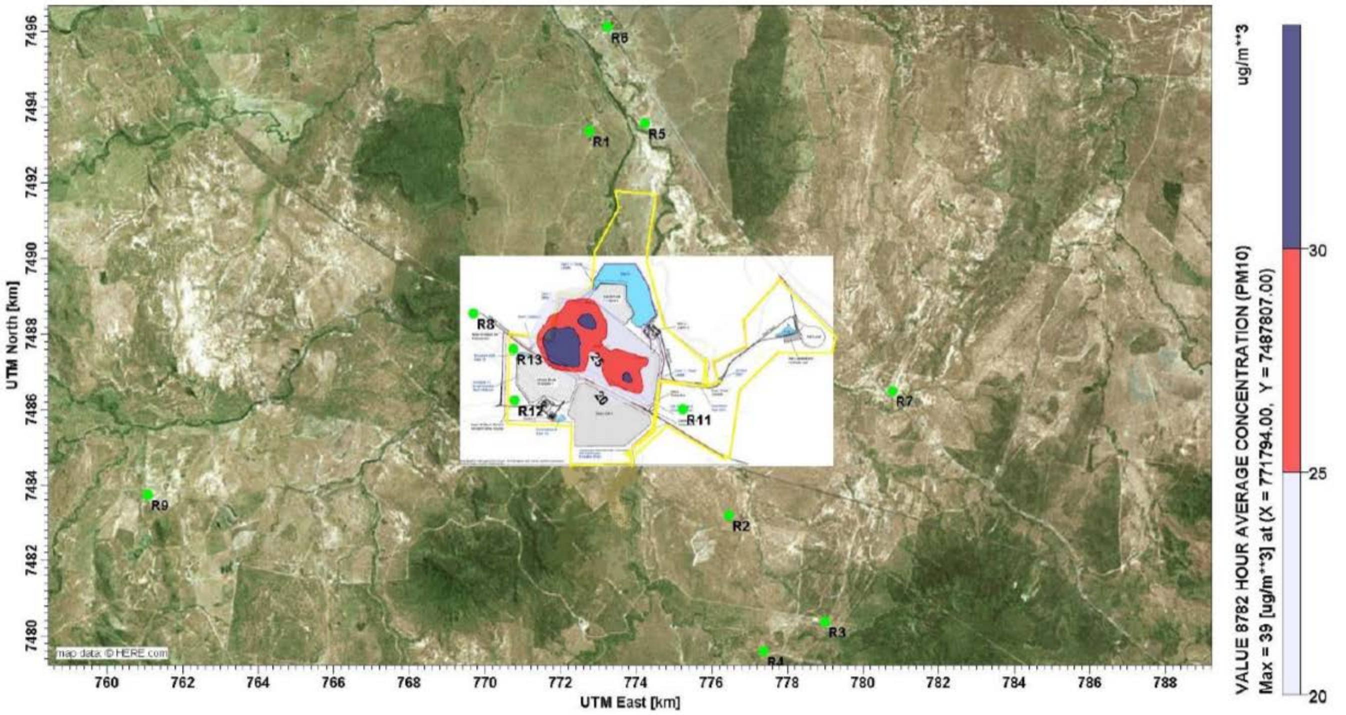
Pollutant	Averaging Period	Percentile	Criteria
$PM_{2.5}$	24 hour	MAX	25 µg/m^3

Figure 12-5: Construction stage (including background) $PM_{2.5}$ 24 hour



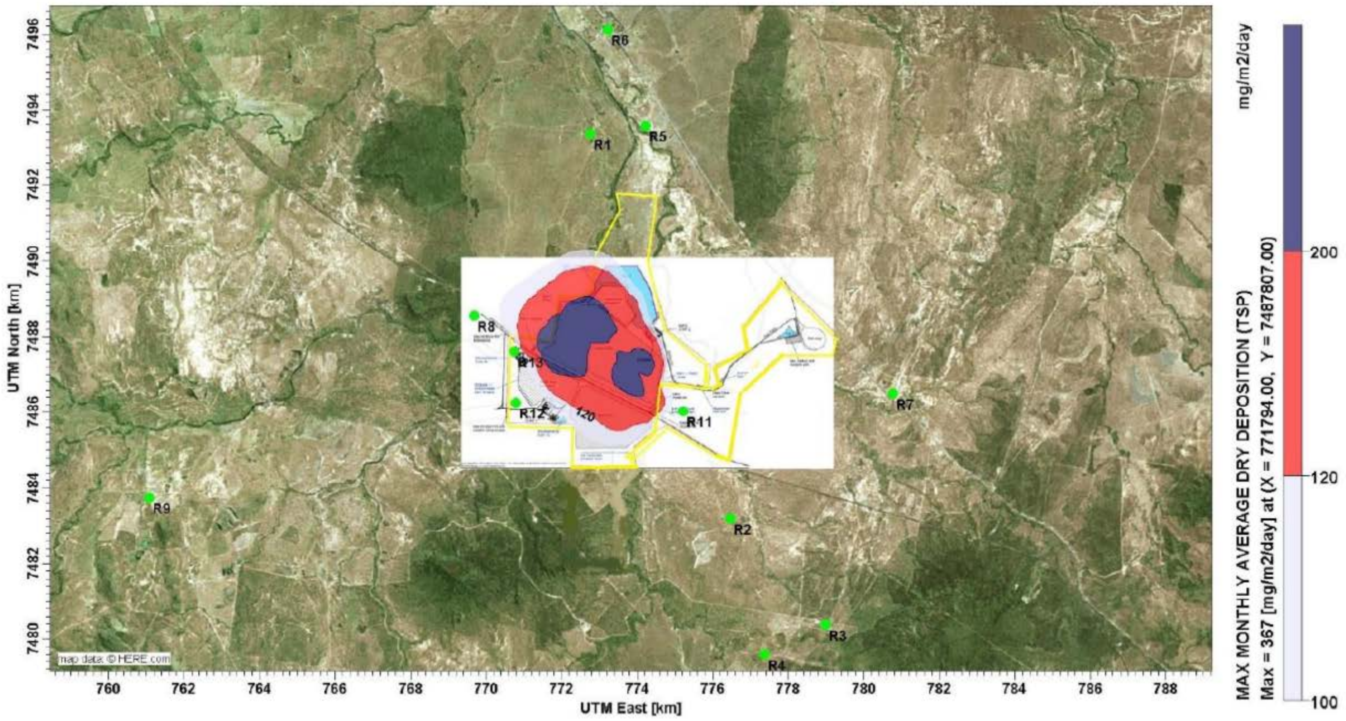
Pollutant	Averaging Period	Percentile	Criteria
$PM_{2.5}$	1 year	MAX	8 µg/m^3

Figure 12-6: Construction stage (including background) $PM_{2.5}$ annual



Pollutant	Averaging Period	Percentile	Criteria
PM_{10}	1 Year	MAX	25 µg/m^3

Figure 12-7: Construction stage (including background) PM_{10} annual



Pollutant	Averaging Period	Percentile	Criteria
Dust deposition	1 month	MAX	120 µg/m^3/day

Figure 12-8: Construction stage (including background) dust deposition one month

12.6.1.2 Operation Phase –Year 3 (Stage 1) and Year 12 (Stage 2)

The predicted ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition for the operation of the Project for year 3 and year 12 at the nearest sensitive receptors are presented Table 12-14 and Table 12-15. Contour plots of the predicted maximum ground-level concentrations (i.e. year 12) including background are presented in Figure 12-9 to Figure 12-14, as well as Appendix C of the Air Quality Assessment Report at Appendix A7 – Air Quality and GHG Technical Report.

The model results for the year 3 operations show:

- The highest annual TSP concentrations are below the 90 µg/m³ criterion at all receptors, with the maximum concentration of 42.6 µg/m³.
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 43.2 µg/m³ is predicted to occur at Tooloombah Creek Service Station (R8), which is above the 50 µg/m³ criterion. The incremental increase in PM_{10} due to the operation of the Project is approximately 23.2 µg/m³ at this receptor.
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 17.4 µg/m³ is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 25 µg/m³ criterion. The highest annual average cumulative ground-level $PM_{2.5}$ concentration is 5.3 µg/m³, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m³ criterion.
- The highest daily dust deposition results show that an incremental increase of 4.4 mg/m²/day will occur at the Tooloombah Creek Service Station receptor, with a total deposition of 63.4 mg/m²/day which is well below the 120 mg/m²/day criterion.

The model results for the year 12 operations show:

- The highest annual TSP concentrations are below the 90 µg/m³ criterion at all receptors, with the maximum concentration of 45.1 µg/m³.
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 47.2 µg/m³ is predicted to occur at Tooloombah Creek Service Station (R8), which is above the 50 µg/m³ criterion. The incremental increase in PM_{10} due to the operation of the Project is approximately 27.2 µg/m³ at this receptor.
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 19.8 µg/m³ is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 25 µg/m³ criterion. The highest annual average cumulative ground-level $PM_{2.5}$ concentration is 6.1 µg/m³, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m³ criterion.
- The highest daily dust deposition results show that an incremental increase of 9.2 mg/m²/day will occur at the Tooloombah Creek Service Station receptor, with a total deposition of 68.2 mg/m²/day which is well below the 120 mg/m²/day criterion.

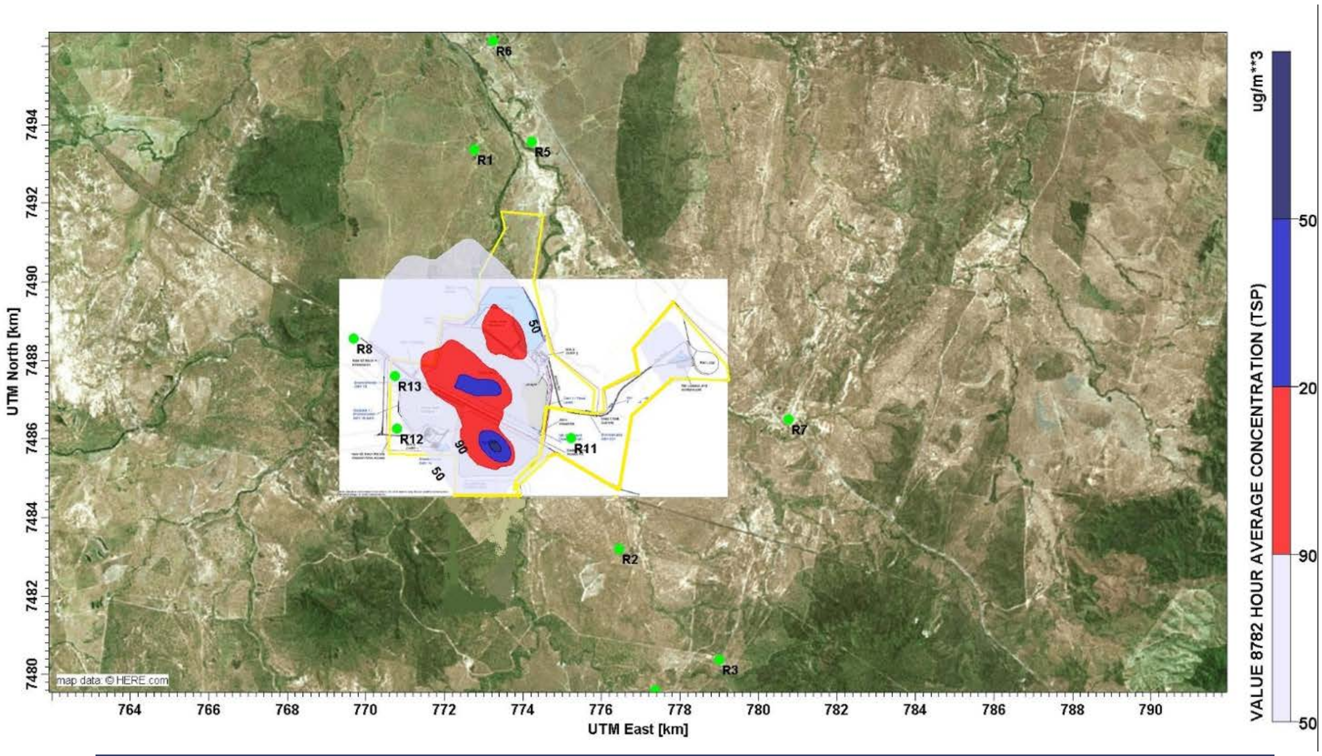
Overall, it can be seen that with the Project operating at 2 Mtpa and 10 Mtpa, the predicted pollutant concentrations are below the relevant criteria due to the distance between the Project and the sensitive receptors.

Table 12-14: Predicted maximum ground-level concentrations for Year 3 of Project Operation

Receptor	In isolation						Cumulative					
	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	Dust Deposition (mg/m²/day)	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	Dust Deposition (mg/m²/day)
	24 Hour	Annual	24 Hour	Annual	24 Hour	1 Month	24 Hour	Annual	24 Hour	Annual	Annual	1 Month
R1	5.83	0.78	19.15	2.69	1.50	3.40	15.53	4.38	39.15	12.69	41.50	62.40
R2	1.05	0.04	3.41	0.15	0.07	0.36	10.75	3.64	23.41	10.15	40.07	59.36
R3	0.25	0.01	0.70	0.04	0.02	0.12	9.95	3.61	20.70	10.04	40.02	59.12
R4	0.32	0.01	1.01	0.05	0.02	0.13	10.02	3.61	21.01	10.05	40.02	59.13
R5	5.12	0.29	21.11	1.04	0.54	2.42	14.82	3.89	41.11	11.04	40.54	61.42
R6	3.36	0.30	12.88	1.00	0.46	1.48	13.06	3.90	32.88	11.00	40.46	60.48
R7	0.44	0.01	1.36	0.03	0.01	0.07	10.14	3.61	21.36	10.03	40.01	59.07
R8	7.68	1.66	23.23	5.17	2.56	4.42	17.38	5.26	43.23	15.17	42.56	63.42
R9	1.02	0.07	2.62	0.23	0.08	0.28	10.72	3.67	22.62	10.23	40.08	59.28
Criteria	**25**	**8**	**50**	**25**	**90**	**120**	**25**	**8**	**50**	**25**	**90**	**120**

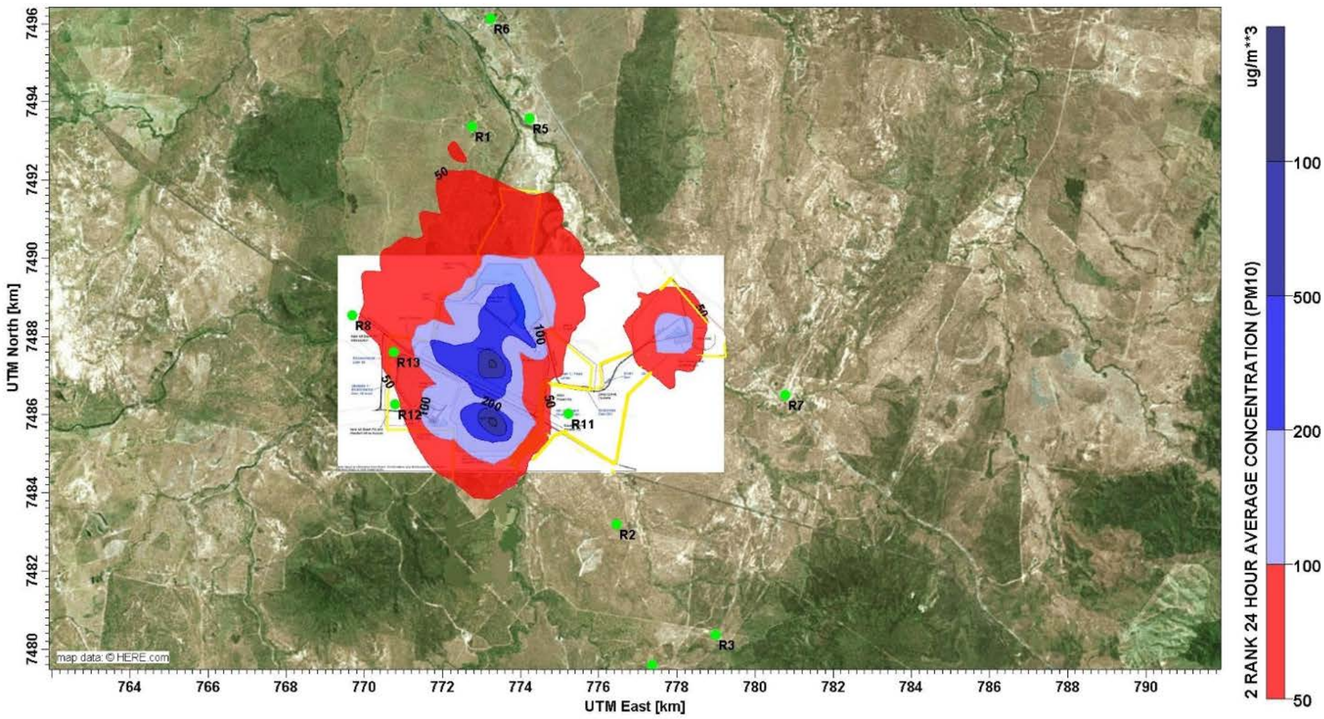
Table 12-15: Predicted maximum ground-level concentrations for Year 12 of Project Operation

Receptor	In isolation						Cumulative					
	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	Dust Deposition (mg/m²/day)	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	Dust Deposition (mg/m²/day)
	24 Hour	Annual	24 Hour	Annual	24 Hour	1 Month	24 Hour	Annual	24 Hour	Annual	Annual	1 Month
R1	6.68	0.98	21.86	2.87	2.88	2.52	16.38	4.58	41.86	12.87	42.88	61.52
R2	1.56	0.11	5.23	0.38	0.30	0.05	11.26	3.71	25.23	10.38	40.30	59.05
R3	0.44	0.02	1.36	0.06	0.05	0.04	10.14	3.62	21.36	10.06	40.05	59.04
R4	0.56	0.03	1.43	0.10	0.08	0.06	10.26	3.63	21.43	10.10	40.08	59.06
R5	5.87	0.39	19.16	1.21	1.04	1.16	15.57	3.99	39.16	11.21	41.04	60.16
R6	4.41	0.42	12.97	1.22	1.02	0.84	14.11	4.02	32.97	11.22	41.02	59.84
R7	0.69	0.02	1.93	0.05	0.03	0.03	10.39	3.62	21.93	10.05	40.03	59.03
R8	10.11	2.47	27.18	7.08	5.07	9.17	19.81	6.07	47.18	17.08	45.07	68.17
R9	1.37	0.11	3.09	0.29	0.16	0.20	11.07	3.71	23.09	10.29	40.16	59.20
Criteria	**25**	**8**	**50**	**25**	**90**	**120**	**25**	**8**	**50**	**25**	**90**	**120**



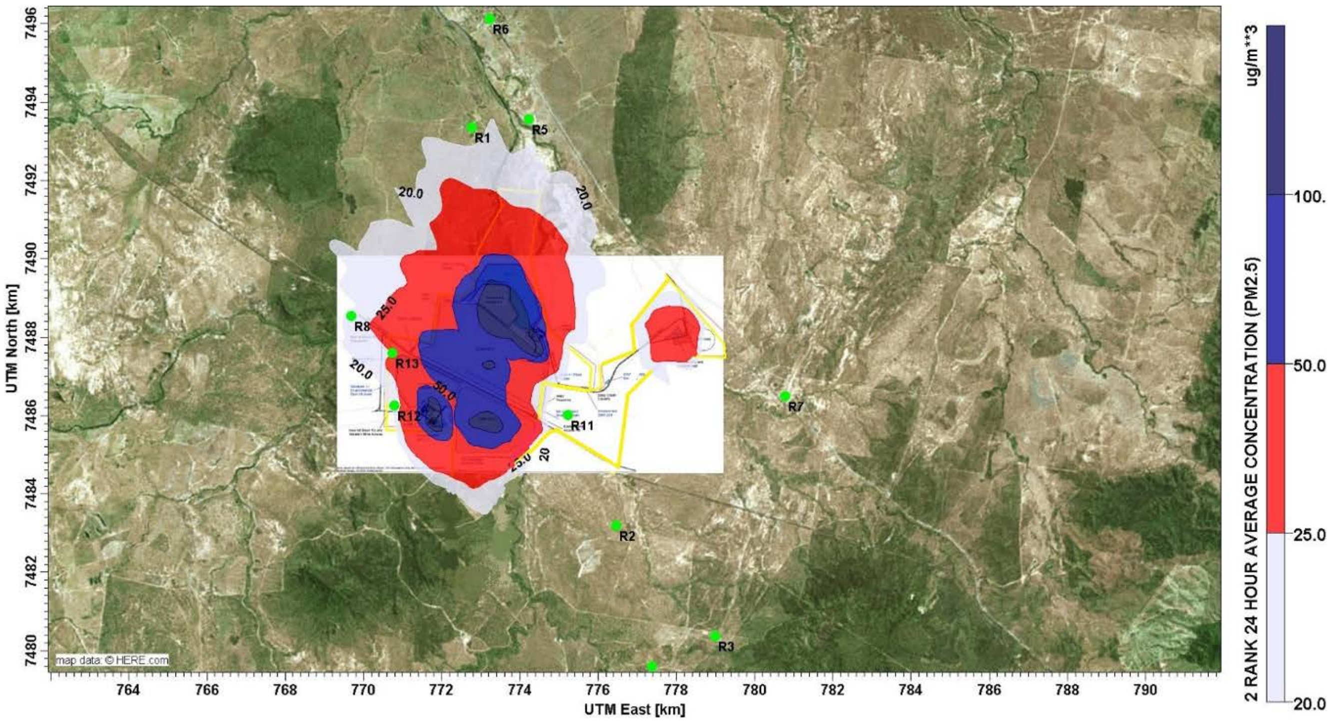
Pollutant	Averaging Period	Percentile	Criteria
TSP	Annual	MAX	90 µg/m^3

Figure 12-9: Year 12 operations (including background) TSP annual



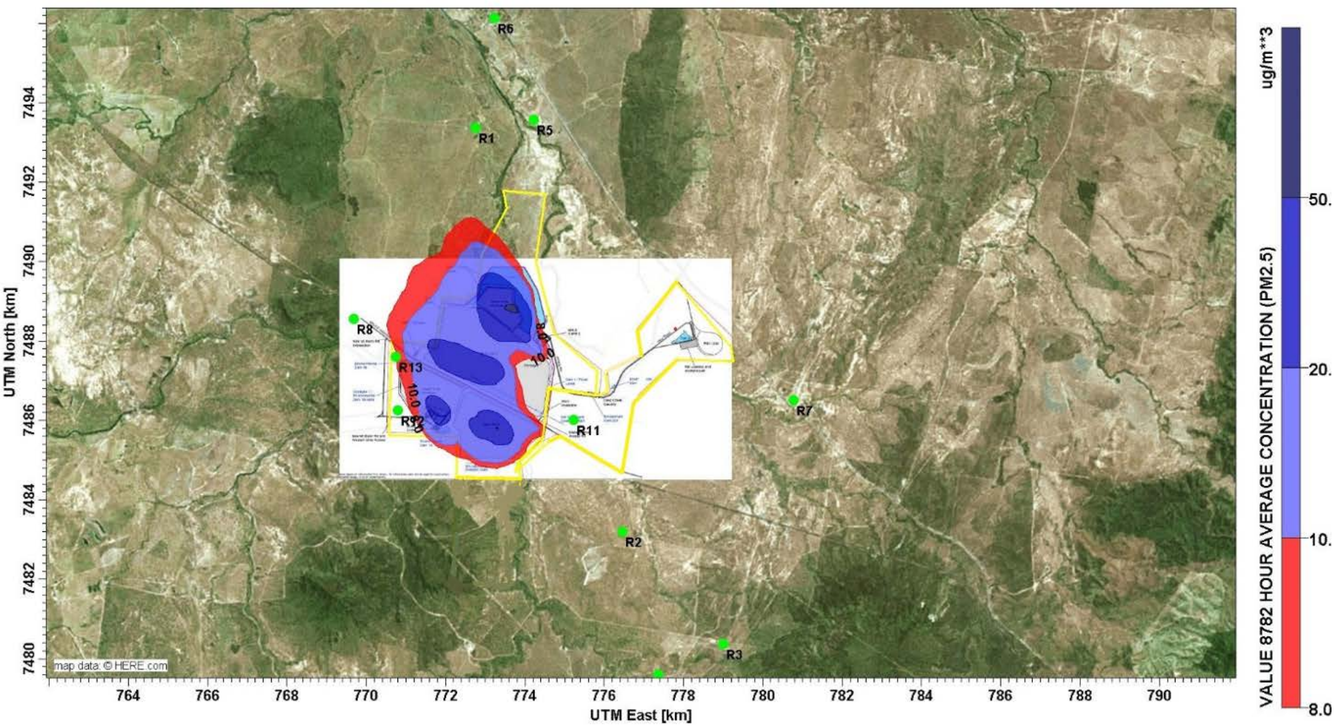
Pollutant	Averaging Period	Percentile	Criteria
PM10	24 hour	MAX	50 µg/m3

Figure 12-10: Year 12 operations (including background) PM_{10} 24 hour



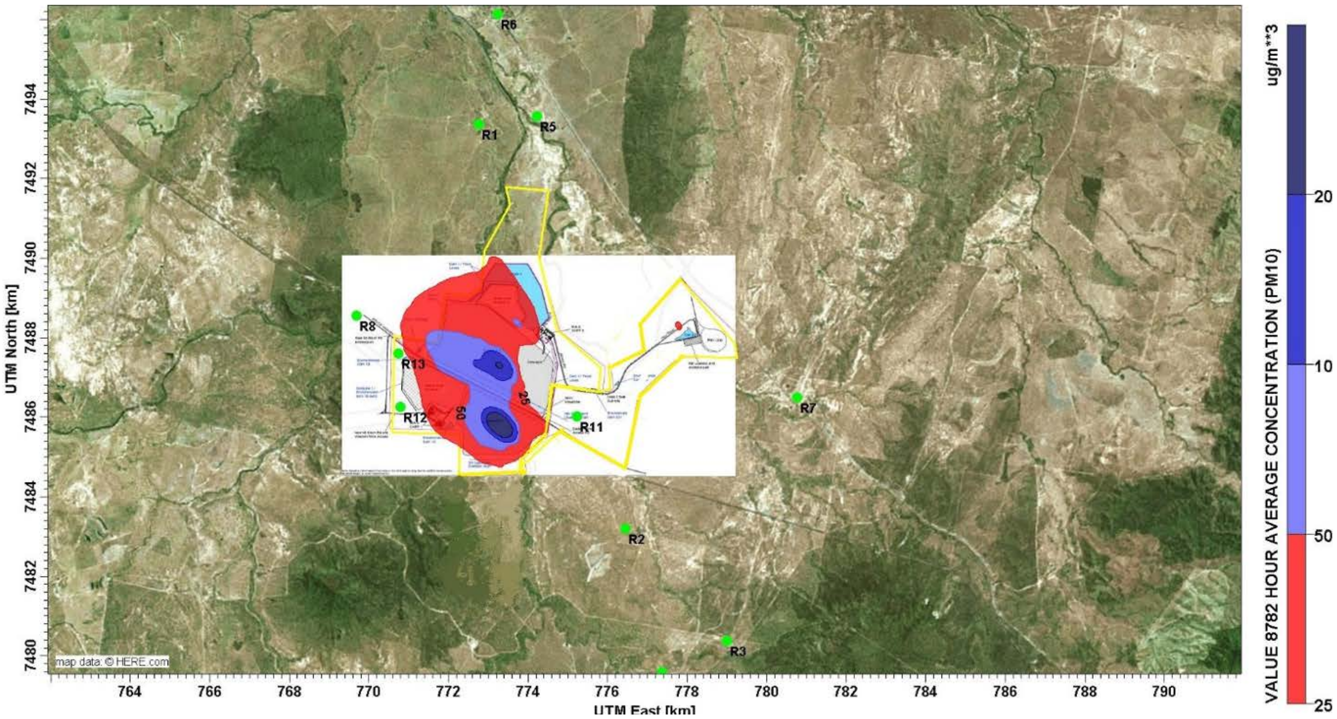
Pollutant	Averaging Period	Percentile	Criteria
$PM_{2.5}$	24 hour	MAX	25 µg/m^3

Figure 12-11: Year 12 operations (including background) $PM_{2.5}$ 24 hour



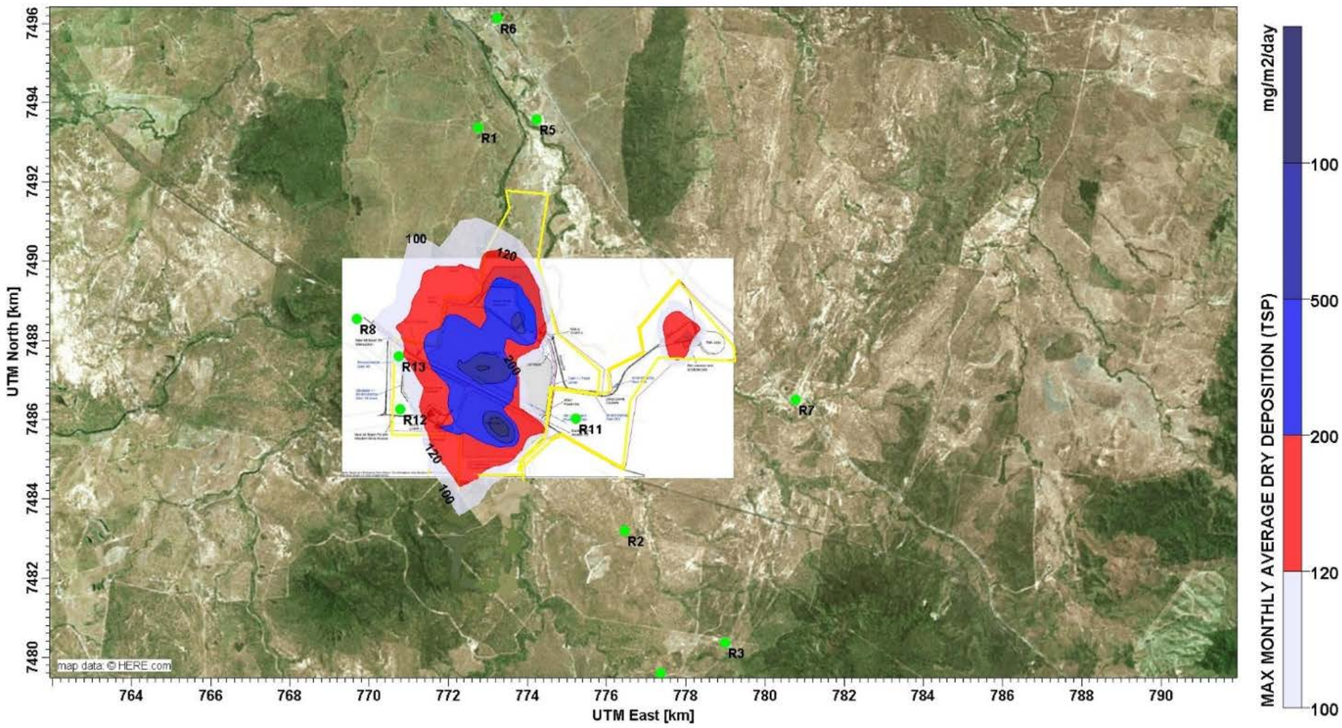
Pollutant	Averaging Period	Percentile	Criteria
$PM_{2.5}$	1 year	MAX	8 µg/m^3

Figure 12-12: Year 12 operations (including background) $PM_{2.5}$ annual



Pollutant	Averaging Period	Percentile	Criteria
PM_{10}	1 Year	MAX	25 µg/m^3

Figure 12-13: Year 12 operations (including background) PM_{10} annual



Pollutant	Averaging Period	Percentile	Criteria
Dust deposition	1 month	MAX	120 µg/m^3/day

Figure 12-14: Year 12 operations (including background) dust deposition one month

12.6.2 Assessment of Impacts on Wetland Receptors

Two major watercourses on each side of the Project site and the two matters of state environmental significance (MSES) wetlands are potentially subject to dust from mine activities. The potential for impacts to these sensitive receptors have been assessed.

The operational goal of a 120-day rolling average deposition rate of 200 mg/m^2/day was recommended as a result of the Abbot Point CIA air quality assessment. This goal is adopted here for the assessment of dust deposition impacts on the wetlands.

The maximum predicted dust deposition rates for the nearest wetlands and a comparison against the adopted goal are presented at Table 12-16. As shown in the results, the model predictions are all below the adopted goal.

Table 12-16: Maximum predicted dust deposition rate on the wetland sensitive receptors

Description	UTM Coordinates (km)		120-day rolling average deposition rate (mg/m2/day)		Criteria
	Easting	Northing	Isolation	Cumulative	
Tooloombah Creek	769.689	7488.548	20.28	79.28	200 mg/m^2/day
Deep Creek	775.226	7486.022	3.11	62.11	
Wetland 1	770.787	7486.254	17.41	76.41	
Wetland 2	770.743	7487.605	26.49	85.49	

12.6.3 Assessment of Impacts from Gaseous Blasting Emissions

Mine blasting near the Bruce Highway has the potential to affect users of the National Highway (the Bruce Highway). An assessment of the impacts of blasting emissions on vehicles travelling along the Highway has therefore been undertaken, as follows:

- Gaseous emissions (NO_2, CO and SO_2) from blasting activities have been estimated (Section 12.6.3).
- The updated mine plan excludes blasting activities within 500 m of the Bruce Highway. The locations of the blasting activities were therefore set at the closest possible distance (500 m) to five sensitive receptors (R13 to R17) selected as representative of vehicles travelling along the Highway. The blasting activities (B1 to B10) were located on each side of the Highway (Figure 12-15).
- Dispersion modelling of the pollutant emissions was carried out in accordance with the methodologies outlined in Section 12.2 and described in more detail at Appendix A7 – Air Quality and GHG Technical Report.

Model predictions of the gaseous ground level concentrations of pollutants were assessed by comparison with the shortest time average specified in the EPP Air ambient air quality criteria for each pollutant modelled (i.e. one hour for SO_2, eight hours for CO and one hour for NO_2). Note this approach is considered conservative since the vehicles are expected to remain on the section of the Highway within the Project area for much shorter durations.

The model predictions at each of the blasting sensitive receptors are presented at Table 12-17. As shown in the table, the model predictions are well below the criteria. Notwithstanding, model predictions will be updated as part of developing the Blast Management Plan for the 500 m buffer area.

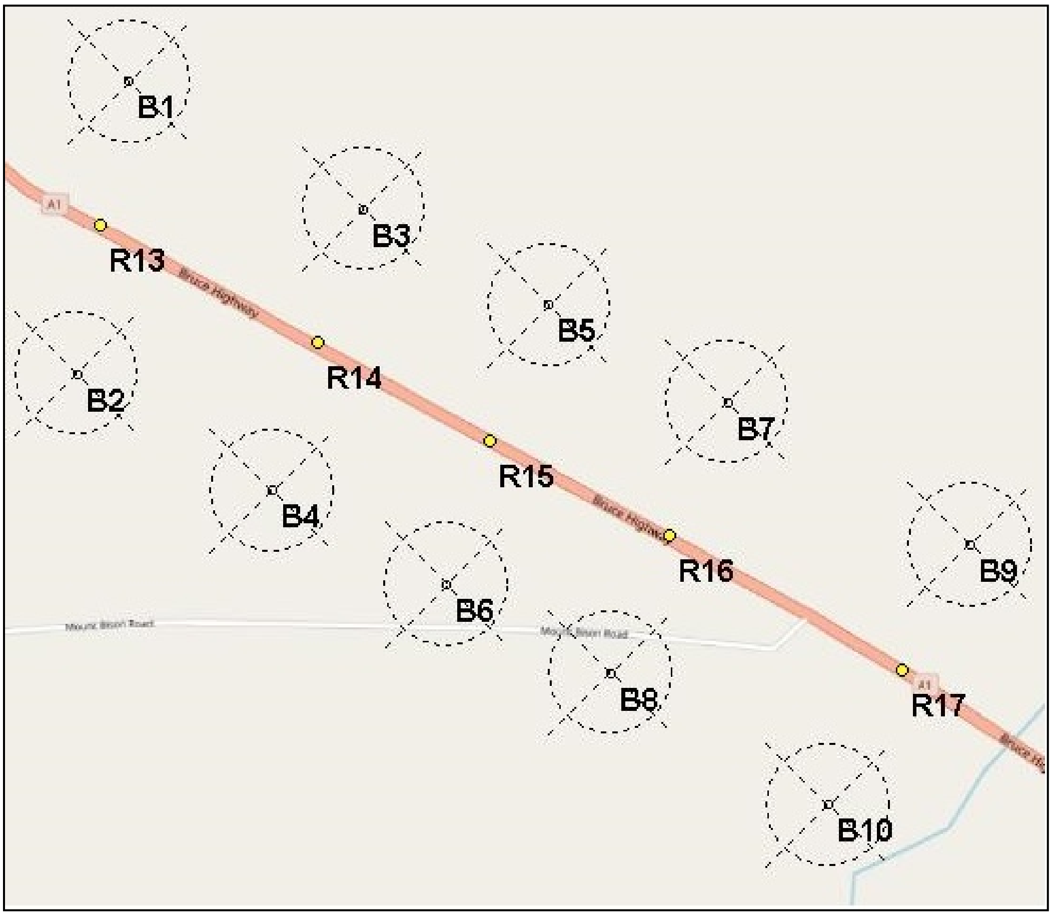


Figure 12-15: Locations of blasting activities and modelled Bruce Highway receptors

Table 12-17: Maximum predicted gaseous pollutant concentrations at the five Bruce Highway receptors

Description	UTM Coordinates (km)		Model prediction (µg/m³)		
	Easting	Northing	1 hour SO_2	1 hour NO_2	8 hour CO
R13	771.466	7487.457	0.02	6.23	10.47
R14	772.222	7487.048	0.02	5.36	10.22
R15	772.824	7486.708	0.02	5.04	8.43
R16	773.45	7486.376	0.02	5.46	7.59
R17	774.26	7485.913	0.03	7.43	6.33
Criteria			**570**	**250**	**11,000**

12.6.4 Assessment of Impacts of Coal Dust from Rail Haulage

The Project proposes to transport the coal via the North Coast Rail and Goonyella rail systems to the Dalrymple Bay Coal Terminal. The proposed rail usage will be within the current approved capacity and usage of the rail system. However, it is acknowledged that there will be trains (laden and unladen) transporting coal on the rail system and that there are concerns from community of Clairview regarding the potential impacts of coal dust from rail haulage (laden and unladen) on the North Coast Rail System including impacts upon ecosystem values and water supply.

For rail transport in general, emissions of particles can be produced by wind erosion of loose soil and other material present in the rail corridor during the passage of trains (this may also occur in the absence of trains during strong winds) and engine emissions from diesel-powered locomotives. In relation to coal trains, particle emissions can also result from erosion of the coal surface of loaded wagons or residual coal in unloaded wagons during transit. In addition, coal leakage from the doors of wagons and coal deposited on sills, shear plates and bogies of wagons during loading can be deposited in the rail corridor, where it can be subsequently re-entrained into the air by wind erosion. The amount and rate of coal dust emitted from coal trains is variable and is dependent upon factors such as the surface area of coal exposed to air currents during transport, the shape or profile of load, the properties of the coal (dustiness, moisture content), the train type, speed, and vibration, the transport distance and route characteristics, and rainfall.

Coal dust particles associated with rail transport would be most likely to be present as larger dust particles that settle from the air, but some will exist as PM_{10} particles.

In response to the concerns about coal dust from rail haulage we refer to the investigation by the former Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA) into particle levels along the Western and Metropolitan Rail Systems used by trains hauling coal from mines in the Clarence-Moreton and Surat Basins in southern Queensland to the Port of Brisbane. The investigation was undertaken in response to this public concern about coal dust emissions from trains and a Queensland Government challenge to improve environmental outcomes for residents living along the rail corridor.

The investigation focused on acquiring data to assess both health and nuisance impacts in the community, together with determination of the contribution of coal particles to overall dust levels. The monitoring program collected information on:

- PM_{10} and $PM_{2.5}$ levels—to assess possible human health impacts
- deposited dust (dust fall)—to assess possible amenity degradation (dust nuisance) impacts and to determine the contribution of coal particles to overall dust levels and
- real-time particle levels—to assess the changes in short-term particle levels associated with the passage of different train types on the Metropolitan rail system.

Monitoring was conducted over a four month period at six locations along the Western and Metropolitan rail systems used to transport coal to the Port of Brisbane (Oakey, Willowburn (Toowoomba), Dinmore, Tennyson, Fairfield and Coorparoo) and one background location on a section of the Metropolitan rail system not used by coal trains (Chelmer). The monitoring locations ranged in distance from the nearest rail track from 2 m to 21 m. Train movements at the six locations during the monitoring period ranged from 10 loaded and 11 unloaded to 19 loaded and 18 unloaded per day.

The monitoring results showed that ambient particle concentrations complied with ambient air quality objectives at all rail corridor monitoring sites during both the pre- and post-veneering monitoring periods. Ambient PM_{10} and $PM_{2.5}$ concentrations did not exceed the Queensland EPP Air 24-hour average air quality objectives of 50 µg/m^3 and 25 µg/m^3 respectively on any day during the investigation period. The highest average $PM_{2.5}$ concentration measured during either the pre- or post-veneering periods was less than the EPP Air annual objective value of 8 µg/m^3. The Queensland Department of Health has therefore concluded that, for people living along the rail corridor, the dust concentrations, resulting from all particle sources, measured during the investigation are unlikely to result in any additional adverse health effects.

Microscopic examination showed that mineral dust (soil or rock dust) was the major component (50 to 90 per cent) of larger particles that settled from the air at each monitoring site during both the pre- and post-veneering monitoring periods. Coal particles typically accounted for about 10 per cent of the total surface area in the deposited dust samples, with the amount present in individual samples ranging from trace levels up to 20 per cent of the total surface coverage. At most locations another black-coloured particle, rubber dust, was found to make up on average about 10 per cent of the deposited dust surface coverage.

Despite the closeness of the sampling sites to the rail (e.g. to a minimum of 2 m), insoluble dust deposition rates did not exceed the trigger level for dust nuisance of 4 g/m^2/30 days above background levels (or 130 mg/m^2/day averaged over a 30-day period) recommended by the New Zealand Ministry for the Environment at any of the rail corridor monitoring sites during both the pre- and post-veneering monitoring periods.

Based on this investigation, it can be concluded that impacts of coal dust from rail haulage (laden and unladen) will be unlikely to result in any additional adverse health effects for people living along the North Coast Rail System corridor.

In addition, on the basis of the dust deposition and analysis results for samples collected extremely close to the rail line it can be concluded that impacts of coal dust on ecosystems and water supplies (at much greater distances to the rail line) will be minimal.

12.7 Mitigation Measures

Modelling results indicate TSP, PM_{10}, $PM_{2.5}$ and dust deposition will not exceed the recommended criteria at any of the sensitive receptors. Best practice will be undertaken and the following mitigation measures will be implemented in accordance with the EPP Air hierarchy. The EPP Air hierarchy defines the following order of preference for the management of air quality impacts:

- avoid (use technology that avoids emissions)
- recycle (reuse emissions for other industrial processes)
- minimise (treat emissions before disposal) and
- manage (source of emissions should be located to minimise impacts).

12.7.1 Environmental Management Framework

CQC have prepared a draft Environmental Management Plan (EMP) for construction and operation of the Project. The draft EMP is contained in Appendix 12 and has been developed to manage and mitigate potential environmental impacts, and to assist Central Queensland Coal to comply with relevant environmental approvals and permit conditions. The draft EMP has been prepared in general accordance with the Commonwealth Environmental Management Plan Guidelines (Commonwealth of Australia 2014) and is modelled on the AS/NZS ISO 14001 (Standards Australia 2016) Plan-Do-Check-Act (PDCA) continual improvement model.

Appendix C of the draft EMP provides the specific sub-plans for managing environmental impacts. The Air Quality Management Plan (AQMP) and Greenhouse Gas Management Plan (GHGMP) are relevant to this chapter. It should be noted that the management plans in Appendix C of the draft EMP are high-level at this stage and will be updated following project approval to reflect the Environmental Authority Conditions.

12.7.2 General Mitigation Measures

General mitigation measures will involve:

- updating and implementing the AQMP (contained in Appendix C of the draft EMP) prior to commencing construction activities on site
- monitoring in the event of a complaint
- engineering control measures
- dust suppression measures
- rehabilitation of exposed surfaces and
- operational procedures.

12.7.2.1 Dust Suppression Measures

Dust suppression measures primarily include the application of water to control dust emissions. As discussed in Chapter 9 – Surface Water, sufficient water is available to support dust suppression. Between 570 and 970 ML per year of water will be required by the Project, dependent on the amount of coal being processed, with the bulk (430 – 590 ML per year) being for dust suppression.

The following dust suppression measures will be considered:

- Minimising topsoil and vegetation removal and revegetation of disturbed areas as soon as possible.
- Minimise pre-strip to a maximum of one block ahead.
- Pave areas where practical around offices, carparks, maintenance and storage areas.
- Visual monitoring of dust daily with ramping down of activities in the instance of high dust emissions.
- Watering of haul roads to suppress dust emissions.
- Minimising speed of on-site traffic, where applicable, to minimise wheel generated dust.
- Watering of ROM stockpiles using water sprays and/or water cannons that are operated on timers. The use of timers avoids the potential for missing a scheduled watering operation. The timers can also be operated manually in particularly hot or windy conditions.
- Fogging system on outlets from transfer points and sizing stations with the potential to generate dust.
- Maintain appropriate moisture content of product coal and reject material as they leave the CHPP which avoids the need for supplementary watering.
- Implement an Integrated Coal Moisture Regulating System to minimise dust emissions from the product coal stockpile and to ensure that product coal delivered for train-loading has a coal -surface water content at the optimum level to ensure the effectiveness of veneering of loaded coal. The Integrated Coal Moisture Regulating System will use a water spray or fogging systems to apply optimum levels of supplementary coal watering.
- Use of benign adhesives if water suppression methods are not effective. Should chemical suppressants be required to control dust, a risk assessment will be undertaken to assess potential for adverse impacts to water quality.

If adverse conditions are encountered during operation of the Project, additional dust suppression measures will be implemented.

12.7.2.2 Rehabilitation of Exposed Surfaces

Rehabilitation of exposed surfaces will be undertaken progressively as mining and stockpiling activities are completed and will include the use of fast-growing temporary cover material to accelerate the effectiveness of dust controls. Where open cut mining areas or waste rock stockpiles remain inactive for a considerable period of time, temporary rehabilitation activities will be undertaken to assist in landform stability.

12.7.2.3 Operational Procedures

The following operational procedures for the Project will be implemented to meet targets for air quality performance:

- Use of water trucks to achieve sufficient watering of haul roads and other high-risk areas to suppress dust emissions, such as areas with relatively high sodic soils which are more vulnerable to wind erosion (refer to Chapter 11 - Rehabilitation and Decommissioning for amelioration and management of sodic soils. The schedule for truck use will be developed for the Project and will incorporate consideration of recent rainfall and weather conditions.
- Use of water sprays and foggers as directed, with additional use as determined by ambient conditions.
- Maintenance of water spray equipment and engineering controls to minimise dust emissions.
- Implementation of an appropriate speed limit for vehicles on unsealed roads, especially where close to sensitive receptors.
- Design haul roads to have a less erodible surface, such as using materials with a lower silt content.
- Chemical suppressants and paving void removal additives may be used for semi-permanent haul roads (not for in-pit haul roads).
- Regular cleaning of machinery and vehicles tyres to prevent wheel entrained dust emissions.
- Manage topsoil stripping so that dust does not become a safety hazard or severe nuisance.
- Restrict land disturbance to that necessary for the operation and minimise the area of land disturbed at any one time.

12.7.3 Rail Coal Haulage Dust Suppression

Dust suppression measures specific to the haulage of coal will be consistent with Aurizon's 2010 Coal Dust Management Plan (CDMP). The CDMP was prepared by Queensland Rail (QR) Network on behalf of QR Limited and the Central Queensland coal supply chain in response to community concerns regarding dust from coal trains, specifically in the Central Queensland coal Goonyella, Blackwater and Moura rail systems connecting to the Ports of Gladstone and Hay Point. The Central Queensland Coal Project will utilise the North Coast Rail Line and then a short section of the Goonyella rail corridor to the Dalrymple Bay Coal Terminal at Hay Point.

The CDMP is a voluntary guide which outlines a range of actions and strategies available across the Central Queensland coal supply chain to address coal dust – specifically at load-out facilities, with coal train operators, rail network managers and at coal terminals and provides an overview of how participants can seek to mitigate coal dust depending on the extent of nuisance caused.

Mitigation measures proposed in the CDMP that are for consideration by the coal producer sector and will be implemented by Central Queensland Coal are summarised in Table 12-18. CQC will prepare and implement a Project specific Coal Dust Management Plan which identifies control measures to effectively mitigate dust emissions from loaded and unloaded coal haulage trains consistent with the measures identified below in Table 12-18.

Table 12-18: Coal producer sector coal dust mitigation activities

Activity	Description
Wagon design	Wagons have been designed such as sloped sills so that no coal 'sits' on the wagon sills or external surfaces. The wagon design also ensures the door design has a proper 'over centre' arrangement to ensure full door contact and the door is adequately stiff (but not too heavy) to ensure continued straightness and no gaps appear in the door seals over time.
Veneer suppressant	Application of a veneer suppressant to the surface of loaded coal wagons binds the surface particles together to provide a membrane that is resistant to dust lift off. The suppressant can be applied to the surface of loaded wagons using a spray system.
Wagon loading practices and profiling	Train loading procedures should be undertaken in such a way that significantly improves the effectiveness of veneering, reduces the amount of parasitic coal that drops off during transit and reduces residual coal at unloading terminals. The load-out operator should commence loading so the first drop of coal impacts the leading inside wall of the wagon, avoiding the kwik-drop doors. The profile must be a flat top surface and spillage over the ends and sides must be avoided.
Coal type testing for dustiness	Determining the dustiness of coal types being produced assists in identification of those more likely to cause nuisance. This allows preventative measures to be effectively implemented before the train causes nuisance.
Load-out facility infrastructure	Consideration of the design and operation of mine load-out infrastructure can improve mitigation of coal dust. Examples include mine load-out equipment and mechanisms that contain the coal within the wagon, load accurate volumes of coal, weigh incoming and outgoing wagons, minimise dumping coal onto wagon doors, and veneer and profile the loaded coal.
Coal Stockpile Dust Suppression System	A system that adds moisture to the surface of the product coal stockpile to maintain an optimum moisture level to reduce dust and improve veneer effectiveness (whiles not attracting moisture penalties from customers) will be implemented.
Sill brushes	Wagons have been designed with features such as sloped sills so that no coal 'sits' on the wagon sills or external surfaces. The wagon design also ensures the door has a proper 'over centre' arrangement to ensure full door contact, and that the door is adequately stiff enough (but not too heavy) to ensure continued straightness and that no gaps appear in the door seals over time.
Internal communications	The Project will raise general awareness of the initiatives being undertaken to reduce coal dust within the organisation. Awareness of the issue will enable staff at all levels to conceive of new initiatives (including improved operating procedures) to help minimise coal dust.
Batch weighing load out systems	Batch weighing systems accurately control the quantity of coal loaded into each wagon, resulting in optimised loads, providing the ideal volume of coal into the wagon minimising dust lift off and spillage in transit.

12.7.4 Monitoring

Dust deposition and suspended particulate monitoring in accordance with relevant Australian Standard methodology will be undertaken to determine whether predicted emissions levels occur. In order to monitor background dust levels, a system of dust monitors will be installed upwind and downwind of the Project. Dust monitors will also be installed at sensitive receptors predicted to receive dust levels close to or reaching the Environmental Authority (EA) conditions. Dust monitoring will also be performed in each of the MIAs. By monitoring dust upwind and downwind of the Project, together with monitoring at sensitive receptors, dust impacts will be quantified.

Visual dust assessments will be also undertaken as part of standard site works by the Project's environmental manager and relevant operations personnel. Any obvious dust cloud or excessive build-up of dust, and any dust complaints, will be recorded and monitoring undertaken if required. Where excessive dust generation has been identified mitigation measures will be implemented.

12.7.4.1 Project Weather Station

The Project has installed, and will continue to maintain, a weather station on the Mamelon Property. The station has been sited in accordance with the requirements in AS 3580.14 (Standards Australia 2014). To be representative of the region, the weather station has been located so that shadows will not be cast on the device or near to objects likely to reflect sunlight. The weather station has been located away from obstructions which are higher than the anemometer, at distances not less than 10 times the difference of the heights of the anemometer and the obstructions.

The Project's weather station will record local wind conditions at the time of any high-dust event to inform future management measures. Management measures will be applied to mitigate emissions impacts wherever an EA condition is confirmed to be exceeded.

The procedures for calibration and maintenance for the weather station are detailed in AS3580.14. The following procedures outline the minimum that will be followed:

- **Wind Sensor and Direction**: Wind speed and direction sensors will be cleaned every six months and recalibrated at an interval not exceeding two years in accordance with AS 3580.14. Dusty or corrosive environmental conditions may require more frequent checks. This will be performed by returning the appropriate sensors to an accredited laboratory as per AS 3580.14. Data integrity will be determined by reviewing the recorded data. Faults are indicated by incorrect zero, low sensitivity at low wind speeds and reduced variability of recorded wind.
- **Temperature**: Regular physical inspection and data-checking will ensure that the sensors are accurately measuring air temperature. The radiation shields can become clogged with dirt, vegetation, or insects, such that airflow or electrical connections can be adversely affected. The frequency of checks will be completed at no less than every six months.
- **Relative Humidity**: Regular physical inspection and data-checking will ensure that the sensors are accurately measuring relative humidity of the air. The radiation shields can become clogged with dirt, vegetation, or insects, such that airflow or electrical connections can be adversely affected. The frequency of checks will be completed at no less than every six months.
- **Pressure**: Routine maintenance procedures will include physical integrity checks of the enclosures to ensure proper ventilation. Signal cables will be maintained in good condition. The frequency of the checks will be completed at no less than every six months.
- **Rainfall Sensor**: The calibration of tipping bucket rain gauges involves two steps: laboratory calibration requires the tipping point of the bucket balance to be adjusted such that the bucket tips only after the correct amount of water has been captured. The second step

requires a known quantity of water to be fed into the rain gauge at a controlled rate. This procedure ensures the system reads correctly under dynamic (continuous rain) conditions. Both of these procedures are often very sensitive and normally not performed in the field. The tipping bucket funnel and tipping apparatus shall be checked and cleaned monthly.

12.7.5 Complaint Protocol

Central Queensland Coal will develop a complaints procedure within its Standard Operating Procedures that will address issues raised by community members or stakeholders in regard to air quality. Complaints will be further investigated, recorded and corrective actions will be implemented if required and where reasonable and actions taken will be communicated back to the complainant. The approach to managing complaints is detailed in Appendix C of Appendix A14c - Social Impact Assessment.

Where appropriate, further monitoring will be undertaken at the affected location. Monitoring will be conducted to provide feedback into the success of mitigation measures, to confirm modelling and determine if further corrective actions are required to protect sensitive receptors. Monitoring will be undertaken in accordance with the requirements of the EA conditions, the MMC and the relevant Australian Standards.

The complaints procedure will include:

- a site contact phone number will be established to allow a timely response to air quality related complaints
- a complaint register
- engaging face to face as much as possible when resolving complaints
- additional monitoring (if appropriate) following a complaint, provided it is not vexatious or frivolous. If additional air quality monitoring is required, it will be conducted at the affected location
- if the applicable criteria or the EA conditions are exceeded corrective actions will be implemented and
- corrective actions will be reported to the affected persons and recorded in the complaints register or as required in the EA conditions.

A site contact number will be provided to neighbours to facilitate lodgement of complaints about air quality.

12.8 Greenhouse Gas Emissions

Greenhouse gases (GHGs) are a natural part of the Earth's atmosphere that trap heat, allowing the temperature of the Earth to be kept at a level that is necessary to maintain life. An increase in the levels of these gases in the atmosphere results in an increase in the amount of heat being trapped, leading to warming of the Earth's surface and oceans commonly known as the enhanced greenhouse effect.

Greenhouse gases include water vapour, carbon dioxide (CO_2), methane, nitrous oxide and some artificial chemicals such as chlorofluorocarbons (CFCs). Water vapour is the most abundant greenhouse gas. These gases vary in effect and longevity in the atmosphere, but scientists have developed a system called Global Warming Potential to allow them to be described in equivalent terms to CO_2 (the most prevalent greenhouse gas) called equivalent carbon dioxide emissions

(CO_2-e). A unit of one tonne of CO_2-e (t CO_2-e) is the basic unit used in carbon accounting. An emissions inventory, or 'carbon footprint', is calculated as the sum of the emission rate of each greenhouse gas multiplied by the global warming potential.

The following section presents an analysis of the anticipated GHG emissions for the construction and operational phases of the Project. The full GHG technical assessment is provided in Appendix A7 – Air Quality and GHG Technical Report.

12.8.1 Legislative Requirements

12.8.1.1 Australia's International Commitments

International commitments regarding climate change and global action are addressed by the United National Framework Convention on Climate Change (UNFCCC). There are currently 197 Parties to the UNFCC including Australia. The UNFCCC is the parent treaty of the 2015 Paris Agreement, the main aim of which is to keep the global average temperature rise this century as close as possible to 1.5 degrees Celsius above pre-industrial levels. The UNFCCC is also the parent treaty of the 1997 Kyoto Protocol. The ultimate objective of all three agreements under the UNFCCC is to stabilize greenhouse gas concentrations in the atmosphere at a level that prevents anthropogenic interference with the climate system, in a time frame which will allow natural adaptation of ecosystems and enables sustainable development.

Since 1 February 2020, climate change adaptation strategy and climate science activities fall under the responsibility of the Department of Agriculture, Water and the Environment. Domestic climate policy and emissions reduction responsibilities were transferred to the Department of Industry, Science, Energy and Resources.

12.8.1.2 Commonwealth

12.8.1.2.1 National Greenhouse Energy Reporting Act 2007

The Commonwealth *National Greenhouse Energy Reporting Act* 2007 (NGER Act) establishes a national framework for the reporting of GHG emissions and the production and consumption of energy. The NGER Act requires corporations to submit an annual report in energy consumption, energy production and greenhouse gas emissions, if any of the following thresholds are met:

- the facility consumes more than 100 terajoules of energy in a financial year or emits greenhouse gases above 25,000 tonnes CO_2-e (facility threshold) and
- all Australian facilities collectively consume more than 200 terajoules of energy in a financial year or emit greenhouse gases above 50,000 tonnes CO_2-e (corporate threshold).

A facility is defined as an activity, or a series of activities (including ancillary activities), if it involves the production of greenhouse gas emissions, the production of energy or the consumption of energy; and forms a single undertaking or enterprise and meets the requirements of the regulations.

12.8.1.3 State

Queensland has a target of achieving zero net emissions by 2050. In order to achieve this the Queensland's climate change response includes two key strategies.

- The Queensland Climate Transition Strategy which outlines how Queensland will transition to a zero net emissions economy. The three key commitments of this strategy are:
  - Powering Queensland with 50% renewable energy by 2030

- Achieving zero net emissions by 2050
- An interim emissions reduction target of at least 30% below 2005 levels by 2030.

- The Queensland Climate Adaptation Strategy outlines how we will prepare for current and future impacts of a changing climate in a way that reduces risk and increases resilience.

12.8.2 Greenhouse Gas Assessment Methods

12.8.2.1 Greenhouse Gas Emissions

The GHG emissions assessment determined the carbon dioxide equivalent (CO_2-e) emissions from the Project according to international and national guidelines. The NGER Act states that the following gases must be reported:

- carbon dioxide – associated with coal mining
- methane – associated with coal mining
- nitrous oxide – associated with the use of explosives in mines
- hydrofluorocarbons – used for refrigeration and air conditioning
- perfluorocarbons – occurs during the manufacture of semi-conductors and used as a refrigerant and
- sulphur hexafluoride – used in the production of magnesium and as an electrical insulator.

The Project is unlikely to store, generate or use any perfluorocarbons or sulphur hexafluoride and will use negligible quantities of hydrofluorocarbons for refrigeration and air conditioning during construction and operation. These gases have therefore been excluded from the assessment. All emissions data has been converted into quantities of carbon dioxide. GHG emissions were calculated in accordance with the GHG protocol emissions scopes. The assessed scopes (Scope 1 and Scope 2) are defined as follows:

- Scope 1 Emissions: direct (or point source) emission factors give the kg of CO_2-e (kg CO_2-e) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, and onsite waste disposal)
- Scope 2 Emissions: indirect emissions from the generation of electricity purchased and consumed by an organisation as kg of CO_2-e per unit of electricity consumed and
- Scope 3 Emissions are indirect emissions from sources not owned or directly controlled by the corporation and therefore have not been assessed.

12.8.2.2 Greenhouse Gas Emissions Estimation

Emission factors used in this assessment have been derived from either the former Department of Environment and Energy (DotEE) site-specific information or from operational details obtained from similar emission sources. The majority of emission factors used in this report have been sourced from the National Greenhouse Accounts (NGA) Factors Workbook (DotEE 2019) as indicated in Table 12-19.

Table 12-19: Emission factors

Scope	Emissions Source	Emission Factor	Source
1	Combustion emissions from ULP (Stationary)	2.38 t CO2-e / kL	NGA Factors Workbook, 2019
	Combustion emissions from diesel (stationary)	2.68 t CO2-e / kL	NGA Factors Workbook, 2019
	Combustion for transport (general)	2.69 t CO2-e / kWh	NGA Factors Workbook, 2019
	Extraction of coal (fugitive) - Queensland	0.02 t CO2-e / tonnes raw coal	NGA Factors Workbook, 2019

For this assessment Scope 1 emissions have been calculated in accordance with the NGA Factors Workbook methodology. Scope 2 emissions have been excluded from the assessment. There is an option however, to provide a source of external power to the site to power six offices, supplied by a future 22kV power line. Should this option be adopted, the impact upon the overall estimated GHG emissions would be expected to be minimal.

12.8.3 Calculated Emissions

The modelling takes into account the worst case scenario, identified at Year 12 when peak production will occur and operations will be at their closest point to sensitive receptors. Furthermore, the GHG emissions estimation and impact assessment is based on the worst case scenario, which is when the project will be at its highest operational state. Table 12-20 outlines the estimated GHG emissions for the construction and maximum operational phase (Year 12) of the Project. The estimated total life of Project emissions is also provided. The following assumptions have been made for this assessment:

- the construction stage will require four months for completion
- the construction and operational equipment list is in accordance with that specified in Table 12-3
- 100 construction staff travelling approximately 1.8 round-trip in 10 vehicles per day
- 500 operational staff travelling approximately 1.8 round-trip in 20 vehicles per day and
- minimal electricity will be purchased from the grid.

Table 12-20: Estimated GHG Emissions (CO_2-e tonnes)

Emission Source	Scope	Annual Emissions (t CO_2-e)		Life of Project Emissions (t-CO_2-e)
		Construction	Operation (Year 12)	
Staff Movements	1 (direct)	4.1	24.9	448
Equipment	1 (direct)	17,574	213,339	2,048,054
Generator	1 (direct)	3.3	1,922	34,596
Haulage	1 (direct)	-	13,174	85,631
Fugitive Coal	1 (direct)	-	200,000	1,282,000
Total		**17,581**	**428,460**	**3,450,730**

12.8.3.1 Summary

The results of the assessment of greenhouse gas emissions from the Project may be summarised as follows:

- the total emissions during the construction phase are 17,581 tonnes CO_2-e with most of the emissions from the diesel consumption by construction equipment
- during the operational phase, the annual emissions are projected to be 428,460 tonnes CO_2-e, which is above the threshold of reporting of 25,000 tonnes CO_2-e. Therefore, this Project will trigger NGER reporting requirements and
- the life of Project emissions is estimated to be 53,450,730 tonnes CO_2-e.

12.8.3.2 Comparison to State and National Inventories

These estimated operation phase emissions (428,460 tonnes CO_2-e,) represent approximately 0.08% of Australia's latest GHG inventory estimates of 532.5 MtCO_2-e (2019).

The estimated maximum annual operational phase emissions (428,460 tonnes CO2-e) represents approximately 0.08% of Australia's latest greenhouse inventory estimates of 532.5 MtCO2-E (2019) and 0.28% of Queensland's latest published estimates of 152.9 MtCO2-E (2016).

As the period of peak production has been modelled and the above figures represent the worst case scenario for greenhouse gas production associated with the project, assessing other years with lower emissions would only demonstrate a lower maximum estimated annual operating emissions (equivalent to approximately 0.05% of the national inventory). As noted, the Project will be required to monitor greenhouse gas emissions in accordance with NGER reporting requirements.

12.8.4 Potential Impacts

12.8.4.1 Construction

During construction, the Project will contribute to GHG emissions through activities such as transport of staff and materials, energy production and other construction processes. As the construction period will be for a relatively short period of time and are anticipated to be relatively low, it is unlikely that GHG emissions during construction of the Project will contribute significantly to Queensland's overall GHG emissions.

12.8.4.2 Operation

Prior to the implementation of mitigation measures, the operation of the Project will contribute to a maximum emission rate of 428,460 tonnes CO_2-e per annum.

12.8.5 Mitigation Measures

The Project will adopt a range of the mitigation and abatement measures during planning and design, construction and operation to reduce emissions, energy consumption and energy costs. A GHG abatement strategy will be developed and implemented prior to construction activities. Central Queensland Coal has provided Ecological Offsets for Matters of State and National Environmental Significance (see Chapter 14 – Terrestrial Ecology) – these will also indirectly provide carbon sequestration benefits. The proposed mitigation measures for each phase of the Project are outlined in Table 12-21.

12.8.5.1 Inspection and Monitoring

Central Queensland Coal will assess the energy efficiency opportunities and estimate GHG emissions associated with the Project in accordance with regulatory requirements. Annual GHG emissions from the Project will be calculated as required under the NGER Act.

Table 12-21: Mitigation measures

Phase	Mitigation Measure
Planning and Design	• Mine layout makes use of existing cleared land as much as practicable, therefore minimising the amount of vegetation removed and • Revegetation for biodiversity habitat and riparian zone stability has been integrated in the design – this will also indirectly provide for carbon sequestration • Provision of environmental offsets for Matters of State and National Environmental Significance have been provided – these will also indirectly provide for carbon sequestration
Construction	• Optimisation of blasting activities during mine planning will reduce the quantity of explosives used, and consequently will reduce the GHG emissions (NOx) associated with this activity • Implementation of operating guidelines to promote efficient operation of vehicles and machinery • Equipment and vehicles will be maintained in good working condition to maximise fuel efficiency and • Procurement policies that promote the selection of energy efficient equipment and vehicles.
Operation	• Regular assessment, review and evaluation of GHG reduction opportunities • Progressive rehabilitation program will be employed to reduce disturbance to the environment and • Monitoring and maintenance of equipment in accordance with manufacturer recommendations.

12.9 Qualitative Risk Assessment

Potential impacts and risks to the surrounding environment from dust and particulate emissions generated during the Project construction and operation have been assessed.

For the purposes of risk associated with air quality, risk levels are defined as follows:

- Extreme – Works must not proceed until suitable mitigation measures have been adopted to minimise the risk
- High – Works should not proceed until suitable mitigation measures have been adopted to minimise the risk
- Medium – Acceptable with formal review. Documented action plan to manage risk is required; and
- Low - Acceptable with review.

A qualitative risk assessment that outlines the potential impacts, the initial risk, mitigation measures and the residual risk following the implementation of the mitigation measures was undertaken for the Project. Results of the assessment are shown in Table 12-22. A summary of the impacts for construction and operation of the Project is provided below.

Table 12-22: Qualitative risk assessment

Issue and associated Project phase	Potential impacts	Potential risk	Mitigation measures	Residual risk
Dust Deposition on Native Vegetation and Pasture (Construction)	Vegetation within and surrounding the Project area including both remnant native vegetation and exotic pastures have the potential to be adversely impacted by the application of high dust loads, in particular vegetation located immediately adjacent to the haul road and waste rock stockpiles. Effects on plant function can include reduced photosynthesis, blockage of stomata, and abrasion of leaf surface leading to infection.	Low	Project activities will only occur on the minimal amount of land required for the Project to minimise the extent of vegetation clearing and ground disturbance. Engineering measures to minimise dust lift off from the haul road and other exposed areas. Most of the dust generated by the Project will be associated with crustal matter which is not toxic to vegetation. Any dust deposited on leaves and vegetation would be periodically removed by wind, morning dew and rainfall. The effects of dust on plant growth have been studied extensively (NSW Minerals Council 2000 and Lodge et al. 1981) and these studies have consistently shown that dust at the levels associated with mining projects has no effect on plant growth. Monitoring of vegetation health in remnant vegetation adjacent to the mining activities to identify whether indirect impacts are occurring because of dust and mine run off contamination.	Low
Dust Deposition - Impacts to High Voltage Transmission Lines (Construction and Operation)	Excessive dust deposition can affect the insulation of high voltage transmission lines. Dust in combination with humidity from fog, rain, or dew and depending on the mixture of the pollutants, can become a conductor of electricity and facilitate short circuiting (Armbrust 2000). The predicted low level of dust generated during the construction and operation of the Project is not anticipated to have a significant impact on the insulation of high voltage transmission lines located in the far south section of the ML.	Low	Dust levels to be controlled through engineering control measures, minimising duration and area of exposed areas, application of water to exposed areas and coal handling processes. Dust deposition and suspended particulate monitoring in accordance with relevant Australian Standard methodology to be implemented at sensitive receptors and onsite.	Low

Issue and associated Project phase	Potential impacts	Potential risk	Mitigation measures	Residual risk
Dust Deposition – Health Impacts Associated with PM (Operation)	Modelling results indicate that PM levels during operation are not expected to pose any significant health impacts to workers or to residents. As indicated in Section 12.5, no elevated levels of PM are predicted to occur during the operation of the Project.	Low	Dust levels to be controlled through engineering control measures, minimising duration and area of exposed areas, application of water to exposed areas and coal handling processes. Dust deposition and suspended particulate monitoring in accordance with relevant Australian Standard methodology to be implemented at sensitive receptors and onsite.	Low
Contaminated land (Construction and Operation)	Mining within areas that have the potential to contain arsenic, heavy metals, pesticides or other residue or contaminants can pose health concerns if these materials become airborne. A search of DES' EMR and CLR (Chapter 5 - Land) did not identify any contaminated areas within the Project area. Therefore, mining activities within Project area are not expected to disturb land that will lead to potentially harmful products becoming airborne. Poor environmental management and waste disposal practices, or accidental spills can result in land contamination.	Low	Contaminated material will be disposed of by a licenced waste contractor as soon as practicable. Trucks used to transport contaminated material shall be covered to ensure material doesn't become airborne. If contaminated land is detected during construction or operation remediation efforts will be applied.	Low
Dust Deposition on Native Vegetation and pasture (Operation)	Dust deposition results indicate that impacts on pasture and native vegetation are very unlikely with the predicted levels being significantly lower than the threshold level with maximum dust deposition during the operation phase being 59 mg/m2/day (Brussels receptor). Dust deposition levels are below human health guideline criteria.	Low	Dust levels to be controlled through engineering control measures, minimising duration and area of exposed areas, application of water to exposed areas and coal handling processes. Monitoring of vegetation health in remnant vegetation adjacent to the mining activities to identify whether indirect impacts are occurring because of dust and mine run off contamination.	Low
Dust Deposition to Houses from laden wagons	Dust deposition on houses from transiting wagons laden with coal is assessed as being unlikely.	Low	Veneering of laden wagons before departing the TLF will minimise the potential for impacts to nearby homes. Dust deposition and suspended particulate monitoring in accordance with relevant Australian Standard methodology to be implemented at sensitive receptors and onsite.	

12.10 Conclusion

12.10.1 Air Quality

The assessment has been carried out for the construction and operational phases of the Project. No assessment was undertaken for the rehabilitation phase as any impacts from this phase are anticipated to be considerably less than for the construction and operation phases.

An air quality assessment was undertaken to evaluate the potential impacts of air pollutants generated from the construction and operational stages of the Project. No assessment was undertaken for the rehabilitation phase as any impacts from this phase are anticipated to be considerably less than for the construction and operation phases. Mitigation measures for any potential impacts that might have an effect on nearby sensitive receptors have been provided. The air quality impact assessment has been carried out as follows:

- An emissions inventory of TSP, PM_{10}, $PM_{2.5}$, and deposited dust and gaseous blasting emissions for the proposed Project was compiled using National Pollutant Inventory (NPI) and United States Environmental Protection Agency (USEPA) AP-42 emissions estimation methodology for the construction, year 3 operations and maximum year 12 operational stages of the Project.
- Estimated emissions data was used as input for air dispersion modelling. The modelling techniques were based on a combination of The Air Pollution Model (TAPM) prognostic meteorological model (developed by CSIRO), and the CALMET model suite used to generate a three dimensional meteorological dataset for use in the CALPUFF dispersion model.
- The atmospheric dispersion modelling results were assessed against air quality and vegetation assessment criteria as part of the impact assessment. Air quality controls are applied to reduce emission rates where applicable.

The following controls were applied to the dust sources for the estimation of emissions in accordance with the NPI Emission Estimation Technique Manual for Mining v3.0:

- 50% control for water sprays applied to stockpiles and exposed areas
- 90% control for revegetation of exposed areas
- 86% control for level 2 watering of haul routes (>2 litres/m^2/h) and limiting vehicle speeds on unpaved haul routes to < 40 km/h and
- 70% control for water sprays applied to drilling.

The results of the construction stage modelling can be summarised as follows:

- The highest annual TSP concentrations are below the 90 µg/m³ criterion at all receptors, with the results just above the background concentration of 40 µg/m³.
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 32.6 µg/m³ is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 50 µg/m³ criterion.
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 14.3. µg/m³ is predicted to occur at the Tooloombah Creek Service Station (R8), which is below the 25 µg/m³ criterion. The highest annual average cumulative ground-level $PM_{2.5}$ concentration is 5.0 µg/m³, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m³ criterion.

- The predicted dust deposition impacts from construction are negligible with the cumulative deposition of 82.6 mg/m^2/day which is below the 120 mg/m^2/day criterion.

The results of the year 3 operational stage modelling can be summarised as follows:

- The highest annual TSP concentrations are below the 90 µg/m^3 criterion at all receptors, with the maximum concentration of 42.6 µg/m^3.
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 43.2 µg/m^3 is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 50 µg/m^3 criterion. The incremental increase in PM_{10} due to the operation of the Project is approximately 23.2 µg/m^3 at this receptor.
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 17.4 µg/m^3 is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 25 µg/m^3 criterion. The highest annual average cumulative ground-level $PM_{2.5}$ concentration is 5.3 µg/m^3, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m^3 criterion.
- The highest daily dust deposition results show that an incremental increase of 4.4 mg/m^2/day will occur at the Tooloombah Creek Service Station receptor, with a total deposition of 63.4 mg/m^2/day which is well below the 120 mg/m^2/day criterion.

The results of the year 12 operational stage modelling can be summarised as follows:

- The highest annual TSP concentrations are below the 90 µg/m^3 criterion at all receptors, with the maximum concentration of 45.1 µg/m^3.
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 47.2 µg/m^3 is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 50 µg/m^3 criterion. The incremental increase in PM_{10} due to the operation of the Project is approximately 27.2 µg/m^3 at this receptor.
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 19.8 µg/m^3 is predicted to occur at Tooloombah Creek Service Station (R8), which is below the 25 µg/m^3 criterion. The highest annual average cumulative ground-level $PM_{2.5}$ concentration is 6.1 µg/m^3, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m^3 criterion.
- The highest daily dust deposition results show that an incremental increase of 9.2 mg/m^2/day will occur at the Tooloombah Creek Service Station receptor, with a total deposition of 68.2 mg/m^2/day which is well below the 120 mg/m^2/day criterion.

Overall, it can be seen that with the construction of the Project and the Project operating at 2 Mtpa and 10 Mtpa, the predicted pollutant concentrations are below the relevant criteria due to the distance between the Project and the sensitive receptors.

Gaseous emissions associated with blasting were modelled and assessed. The model predictions are well below the criteria as and such no impacts to road users are expected.

The potential for impacts from coal dust associated with rail haulage was assessed using recent work undertaken by the former Queensland Government Department DSITIA into particle levels along the Western and Metropolitan Rail Systems used by trains hauling coal from mines in the Clarence-Moreton and Surat Basins in southern Queensland to the Port of Brisbane.

The monitoring results from the DSITIA investigations showed that ambient particle concentrations complied with ambient air quality objectives at all rail corridor monitoring sites during both the pre- and post-veneering monitoring periods. From the results of the DSITIA assessment, it can be concluded that impacts of coal dust from rail haulage (laden and unladen) will be unlikely to result in any additional adverse health effects for people living along the North Coast Rail System corridor.

In addition, on the basis of the dust deposition and analysis results for samples collected extremely close to the rail line it can be concluded that impacts of coal dust on ecosystems and water supplies (at much greater distances to the rail line) will also be minimal.

12.10.2 Greenhouse Gas

A greenhouse gas assessment has also been undertaken for the Project. This assessment determines the carbon dioxide equivalent (CO2-e) emissions from the Project according to international and Federal guidelines. The estimated maximum annual operational phase emissions (428,460 tonnes CO_2-e) represents approximately 0.08% of Australia's latest greenhouse inventory estimates of 532.5 MtCO_2-e (2019) and 0.28% of Queensland's latest published estimates of 152.9 MtCO_2-e (2016). Equipment onsite is the major contributor to the release of GHGs. Other significant contributors include fugitive emissions from the open cut mining operations. Abatement measures, including opportunities for improved energy efficiency of equipment will be evaluated for their cost effectiveness.

Annual greenhouse gas rates are expected to exceed 25,000 t CO_2-e and therefore this Project will trigger NGER reporting requirements.

Modelling results have ascertained that no sensitive receptors will experience an adverse impact in air quality as a direct result of the mining operations. The predicted levels at all sensitive receptors are below the DES criteria. Nevertheless, appropriate mitigation measures will be implemented as best practice.

12.11 Commitments

Central Queensland Coal's commitments, in relation to the protecting the air quality are provided in Table 12-23.

Table 12-23: Commitments – Air Quality

Commitments
Dust
Develop and implement an Air Quality Management Plan prior to commencing activities on site
Develop and implement a dust deposition and suspended particulate monitoring program in accordance with relevant Australian Standard methodology
Implement an appropriate speed limit for vehicles on unsealed roads
Develop a complaints procedure within the Standard Operating Procedures that will address issues raised by community members or stakeholders regarding air quality
Design haul roads to have a less erodible surface, such as using materials with a lower silt content
Should BAR H-2 be renovated back to a liveable condition and used as a residence, air quality monitoring will be undertaken for the receptor
Develop and implement a Coal Dust Management Plan which identifies control measures to mitigate dust emissions from loaded and unloaded coal haulage trains
Greenhouse Gases
Review predicted emissions during detailed design and actual emissions during construction and operation
Regular assessment, review and evaluation of GHG reduction opportunities
Monitoring and reporting of greenhouse gas emissions in accordance with NGER reporting requirements