Central Queensland Coal Project

Chapter 12 – Air Quality

Supplementary Environmental Impact Statement

CDM Smith

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Central Queensland Coal Project
Chapter 12 – Air Quality

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12 Air Quality

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.

This chapter has been updated to reflect comments received in submissions on the EIS. Matters raised in submission to the EIS relating to Chapter 12 – Air Quality were predominately focused on:

- Derivation of emission factors;
- Assessment of additional sources;
- Dust impacts on environmental receptors (i.e. Deep Creek, Tooloombah Creek and the two MSES mapped wetlands near the western boundary);
- PM_{10} Impact assessment;
- Assessment of 2030 as the worst-case operational scenario;
- Dust suppression;
- Inclusion of critical information discussed in Appendix A7 – Air Quality and GHG Technical Report; and
- Potential impacts of coal dust from rail haulage (laden and unladen) on the North Coast Rail System including impacts upon the ecosystem and water supply.

The technical air quality assessment, undertaken by Vipac Consultants (Vipac), is found in Appendix A7 – Air Quality and GHG Technical Report. Appendix A13 includes the full details of all submissions received for the Project.

12.1 Project Overview

Central Queensland Coal Proprietary Limited (Central Queensland Coal) and Fairway Coal Proprietary Limited (Fairway Coal) (the joint Proponents), propose to develop the Central Queensland Coal Mine Project (the Project). As Central Queensland Coal is the senior proponent, Central Queensland Coal is referred to throughout this Supplementary Environmental Impact Statement (SEIS). The Project comprises the Central Queensland Coal Mine where coal mining and processing activities will occur along with a train loadout facility (TLF).

The Project is located 130 km northwest of Rockhampton in the Styx Coal Basin in Central Queensland. The Project is located within the Livingstone Shire Council Local Government Area. The Project is generally located on the "Mamelon" property, described as real property Lot 11 on MC23, Lot 10 on MC493 and Lot 9 on MC496. The TLF is located on the "Strathmuir" property, described as real property Lot 9 on MC230. A small section of the haul road to the TLF is located on the "Brussels" property described as real property Lot 85 on SP164785.

The Project will involve mining a maximum combined tonnage of up to 10 million tonnes per annum (Mtpa) of semi-soft coking coal (SSCC) and high-grade thermal coal (HGTC). The Project will be located within Mining Lease (ML) 80187 and ML 700022, which are adjacent to Mineral Development Licence 468 and Exploration Permit for Coal 1029, both of which are held by the Proponent. It is intended that all aspects of the Project will be authorised by a site-specific environmental authority (EA).

Development of the Project is expected to commence in 2019 with initial early construction works and extend operationally for approximately 19 years until the depletion of the current reserve, and rehabilitation and mine closure activities are successfully completed.

The Project consists of two open cut operations that will be mined using a truck and shovel methodology. The run-of-mine (ROM) coal will ramp up to approximately 2 Mtpa during Stage 1 (2019 - 2022), where coal will be crushed, screened and washed to SSCC grade with an estimate 80% yield. Stage 2 of the Project (2023 - 2038) will include further processing of up to an additional 4 Mtpa ROM coal within another coal handling and preparation plant (CHPP) to SSCC and up to 4 Mtpa of HGTC with an estimated 95% yield. At full production two CHPPs, one servicing Open Cut 1 and the other servicing Open Cut 2, will be in operation. Rehabilitation works will occur progressively through mine operation, with final rehabilitation and mine closure activities occurring between 2036 to 2038.

A new TLF will be developed to connect into the existing Queensland Rail North Coast Rail Line. This connection will allow the product coal to be transported to the established coal loading infrastructure at the Dalrymple Bay Coal Terminal (DBCT).

Access to the Project will be via the Bruce Highway. The Project will employ a peak workforce of approximately 275 people during construction and between 100 (2019) to 500 (2030) during operation, with the workforce reducing to approximately 20 during decommissioning. Central Queensland Coal will manage the Project construction and ongoing operations with the assistance of contractors.

12.2 Relevant Legislation, Guidelines and Criteria

A number of legislative acts, policies and guidelines have been established to protect air quality values (refer to Chapter 1 – Introduction for further details on the Project's legislative framework).

12.2.1 Commonwealth

12.2.1.1 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 [PM measuring ≤10 micrometres (µm) (PM_{10}) and PM measuring ≤2.5 µm ($PM_{2.5}$)] (refer to Table 12-1). The standards are consistent with Queensland's air quality levels identified in the *Environmental Protection (Air) Policy 2008* [EPP (Air)] Schedule 1, Section 8. The Air NEPM requires State Governments to monitor air quality and to identify potential air quality problems.

Table 12-1 Air NEPM ambient air quality standards

Pollutant	Averaging period	Maximum (ambient) concentration	Maximum allowable exceedances (per year)
Carbon monoxide	8 hours	9.0 ppm [(a)]	1 day
Nitrogen dioxide	1 hour	0.12 ppm	1 day
	1 year	0.03 ppm	None
Photochemical oxidants (as ozone)	1 hour	0.10 ppm	1 day
	4 hours	0.08 ppm	1 day
Sulphur dioxide	1 hour	0.20 ppm	1 day
	1 day	0.08 ppm	1 day
	1 year	0.02 ppm	None
Lead	1 year	0.50 µg/m³ [(b)]	None
Particles as PM_{10}	1 day	50 µg/m³	5 days
Particles as $PM_{2.5}$	1 day	25 µg/m³	-
	1 year	8 µg/m³	-

Notes: (a) parts per million (ppm)
(b) micrograms per cubic metre (µg/m³)

12.2.2 State

12.2.2.1 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.

12.2.2.2 Environmental Protection (Air) Policy 2008

The object of the 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 (%)).

12.2.2.3 Guideline Mining - Model Mining Conditions

The Model Mining Conditions (MMC), published by the Department of Environment and Science (DES), provide a set of model conditions to form general environmental protection commitments for the mining activities and the EA conditions. The Project is subject to the air criteria outlined in this guideline.

Deposited dust is commonly used as a measure of the potential for dust nuisance and if present at high levels, can reduce the amenity of an area.

The criterion for dust deposition in Queensland is outlined in the MMC. Dust deposition must not exceed 120 milligrams per square metre per day ($mg/m^2/day$) at a sensitive location.

12.2.2.4 Vegetation Protection

There is limited information available on dust deposition rates to protect wetland environments from air pollutants. For reference, we consider the report prepared for Advisian for the Air Quality Assessment of the Abbott Point Growth Gateway Project (Katestone, 2015). The report notes that there is no statutory limit for the deposition of dust for the protection of vegetation. EHP provides design guidance for dust deposition for the avoidance of dust nuisance, which is related to human perception. In order to provide some guidance, the study on the effects of coal dust on vegetation, with particular emphasis on assessment for vegetation in marshes and wetland, at Abbot Point was conducted as part of the CIA air quality assessment (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 wetlands.

12.2.2.5 Application Requirements for Activities with Impacts to Air (EM960)

The Application Requirements for Activities with Impacts to Air (EM960) is the air related guideline for ERAs under the EP Act. The guidelines require three key areas to be addressed:

- Identify the EVs of the receiving air environment including the identification of any nearby sensitive places (Section 12.5);
- Identify the possible impacts of the proposed activity and all associated risks to the EVs (Section 12.6); and
- Identify the strategies to mitigate the identified risks to the EVs (Section 12.9 and 12.10.5).

The relevant criteria for the Project is addressed in the following section.

12.2.3 Air Quality Criteria

In December 2014, the ‘Guideline Mining - Model Mining Conditions (MMC)’ was published by the then Department of Environment and Heritage Protection. The purpose of this guideline is to provide 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 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 guidelines. Furthermore, the Air NEPM and consequently the Queensland EPP (Air) criteria for PM10 have since been updated to exclude an allowance for natural events (i.e. the PM_{10} criteria is now more stringent). The Project specific air criteria are presented in Table 12-2.

Table 12-2 Project air quality criteria

Pollutant	Basis	Criteria	Averaging time
Particulate matter criteria			
Total Suspended Particulate (TSP)	Human Health	90 µg/m³	1 year
PM_{10}	Human Health	50 µg/m³	24 hour
$PM_{2.5}$	Human Health	25 µg/m³	24 hour
		8 µg/m³	Annual
Dust deposition	Amenity	120 mg/m²/day	1 month
	Vegetation	200 mg/m²/day	3 month

12.3 Environmental Objectives and Performance Outcomes

The following sections outline the environmental objective and performance outcomes relevant to air quality.

12.3.1 Environmental Objectives

The environmental objective relevant to air quality is provided in the *Environmental Protection Regulation 2007* (EP Regulation). In accordance with the EP Regulation, the Project air quality objective is to operate in a way that protects the EVs of air.

12.3.2 Performance Outcomes

The air quality performance criteria are:

- No discharge to air of contaminants at concentrations that may cause an adverse effect on the environment at sensitive receptors; and
- No air quality complaints are received.

12.4 Assessment Method

12.4.1 Overview

The air quality assessment for the Project area and surrounding environment has been undertaken to assess the impacts of the Project on the airshed and sensitive receptors. The air quality assessment was undertaken using three dimensional wind field modelling (TAPM / CALMET) which incorporates local meteorological conditions, emission profiles of equipment and the Project activities. An overview of the impact assessment methodology is summarised below and the full technical air quality assessment is provided in Appendix A7 – Air Quality and GHG Technical Report.

12.4.2 Existing Environment

The existing environment has been described in terms of the following:

- Terrain;
- Surrounding land uses; and
- Sensitive receptor locations.

Information regarding the existing environment is provided in Section 12.5.

Climate and meteorology relevant to the Project area has been documented in terms of:

- Temperature;
- Rainfall;
- Wind speed and direction; and
- Atmospheric stability.

Existing air quality in the region has been 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 12.5.5.

12.4.3 Emissions Estimation

Emissions information associated with the Project activities was compiled using the National Pollutant Inventory (NPI) Emission Estimation Techniques (EET) Manual for Mining which derives emissions factors primarily from the United States Environmental Protection Agency (US EPA) AP-42.

Dispersion modelling has been conducted as follows:

- The Air Pollution Model (TAPM) (developed by CSIRO, version 4.0.1), and CALMET (developed by EarthTec, version 6.4) meteorological models were used to generate broad scale meteorological inputs that best represent the Project area; and
- The broad scale meteorological inputs generated by CALMET were then used as inputs into the CALPUFF (developed by EarthTec, version 6.4) dispersion model, which was then used to predict ground level concentrations and deposition rates for the Project.

The air quality study includes an assessment of TSP, PM_{10}, $PM_{2.5}$ and dust deposition rate for two scenarios:

- Construction Stage; and
- Stage 2 (2030) of 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.

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 have been compared with relevant Project Air Quality Criteria.

A search of 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).

12.5 Existing Environment

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

12.5.1 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.

12.5.2 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 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.

12.5.3 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.

It is anticipated that the Project personnel will be accommodated locally. No accommodation camp is proposed as part of the Project. The Marlborough Caravan Park will be used for non-local commute personnel.

Using aerial imagery and on ground assessments, 10 sensitive receptors were identified within the locality of the Project. The receptor name and location of each receptor is described in Table 12-3. Except for the Tooloombah Creek Service Station, all identified receptors are isolated homesteads. The nearest residential receptor (TSC Res 1) is located approximately 2 km from Open Cut 1. Note that the modelling presented in Appendix A7 – Air Quality and GHG Technical Report did not account for TSC Res 1 and TSC Res 2 as separate from the Tooloombah Creek Service Station due to their proximity, and the same results have been applied. The entire township of Ogmore has been counted as one sensitive receptor.

Two additional sensitive receptors BAR H-2 and BAR H-3 were 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. Photos showing the dilapidated and unliveable state of BAR H-2 are at Plate 12-1 and Plate 12-2.

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.

Plate 12-1 BAR H-2

Plate 12-2 BAR H-2

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 12-3 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 (incl. both 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	Western Boundary 1	149.636031	-22.709301	0.3 km (W)
R13	Western Boundary 2	149.635369	-22.697116	0.8 km (W)

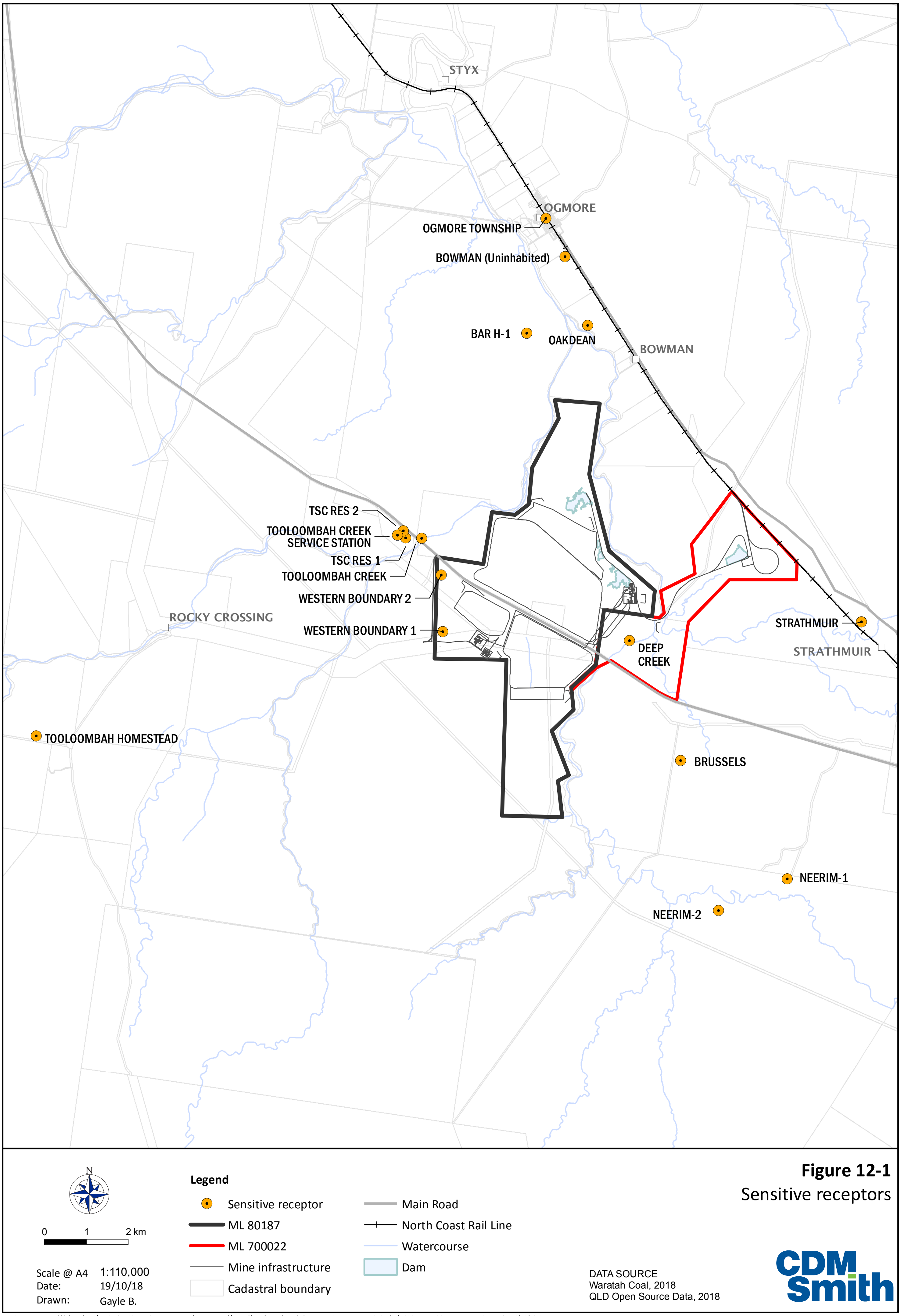

Figure 12-1
Sensitive receptors

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12.5.4 Climatic Factors

Climatic conditions in the Styx catchment are typical of a seasonally dry subtropical region. Higher rainfall in the months of November through to March corresponds with the major climatic drivers in the region being intense cyclonic low pressure influences and associated rain depressions. The overall annual rainfall is relatively low, and evaporation exceeds rainfall typically for all months. Wind speed and direction and atmospheric stability was generated from the TAPM/CALMET meteorological dataset (refer to Chapter 4 – Climate for further detail).

12.5.4.1 Temperature

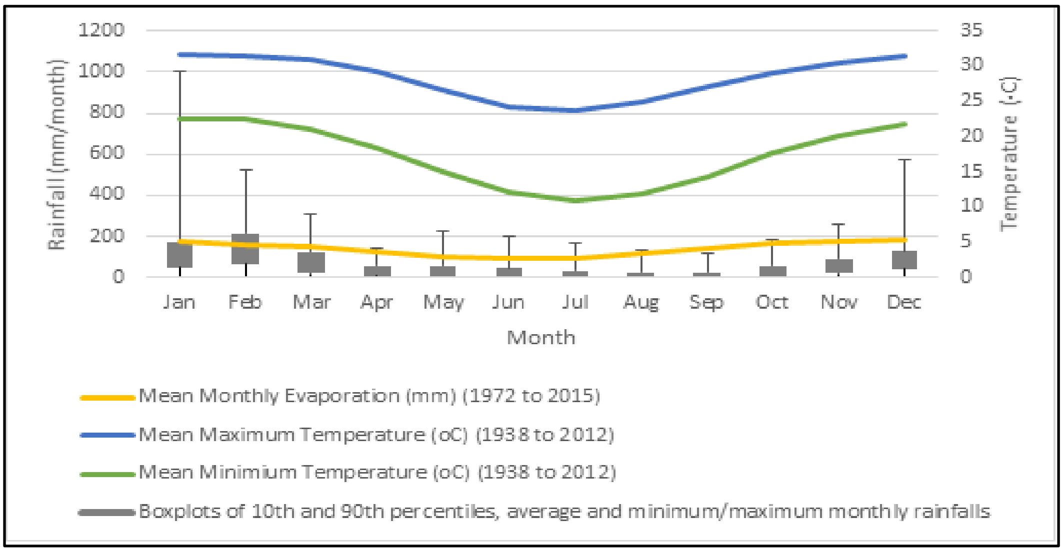
The annual average maximum temperature from the St Lawrence Post Office site (BoM station no. 033065) is 28.4°C, with a relatively small variation in average maximum temperatures across each month (23.8 to 31.7°C). Maximum temperatures above 40°C occur in the record in November to February, with the maximum of 44°C recorded on 5 January 1994. Mean minimum temperatures range from 10.9 to 22.5°C with a mean annual monthly minimum of 17.4°C. The minimum temperature was 2.2°C, which was recorded on 19 July 1963.

Average monthly relative humidity varies between 46% (3pm reading) and 74% (9am reading) throughout the year, with the highest values recorded at 9am between January and June, and the lowest between June and October at 3pm. These values reflect the dry conditions typical of the region.

12.5.4.2 Rainfall

Rainfall in the Styx catchment varies between 800 mm/year in the south to around 1,100 mm/year in the north (Melzer et al, 2008). Several rainfall recording stations are located within the Styx catchment in the vicinity of the ML area. These include Strathmuir and Tooloombah, St Lawrence Post Office and Mystery Park.

Monthly rainfall statistics from Strathmuir (BoM station no. 033189) for the period from 1941 through to 2016 is shown in Figure 12-2. These statistics show that generally November to March receives the most rain, with around 70% of the annual rainfall falling in this period. A larger variation is seen for the summer rainfall months, with January recording the largest variation (up to a maximum of 1,002 mm in January 1951).



Source: Rainfall from Strathmuir (BoM station no. 033189); Temperature and evaporation data from St Lawrence Post Office (BoM station no. 033065)

Figure 12-2 Rainfall, evaporation and temperature trends

The evapotranspiration Climatic Atlas of Australia (BoM, 2001) shows average annual evapotranspiration (areal potential) between 1,700 to 1,800 mm/yr, matched by recorded evaporation data in the area of 1,685 mm/year (St Lawrence Post Office, BoM station no. 033065). Average evaporation exceeds average rainfall for all months as shown in Table 12-4 and Figure 12-2. However, as noted above, the large variation in rainfall means that 90th percentile rainfalls exceed evaporation during the January to March period.

Table 12-4 Monthly average evaporation and rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Monthly Evap. (mm)	174	158	152	129	105	90	96	115	140	167	177	183	1,686
Mean Monthly Rainfall (mm)	138	145	82	36	39	31	26	19	16	40	64	104	740
Difference (Evap. – Rainfall) (mm)	36	13	70	93	66	59	70	96	127	127	113	79	946

Source: Evaporation from St Lawrence Post Office (BoM station no. 033065), rainfall from Strathmuir (BoM station no. 033189)

12.5.4.3 Wind Speed and Direction

The dispersal of pollutants is influenced by the wind speed and direction at the source of the pollutant release. Figure 12-3 shows that 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.

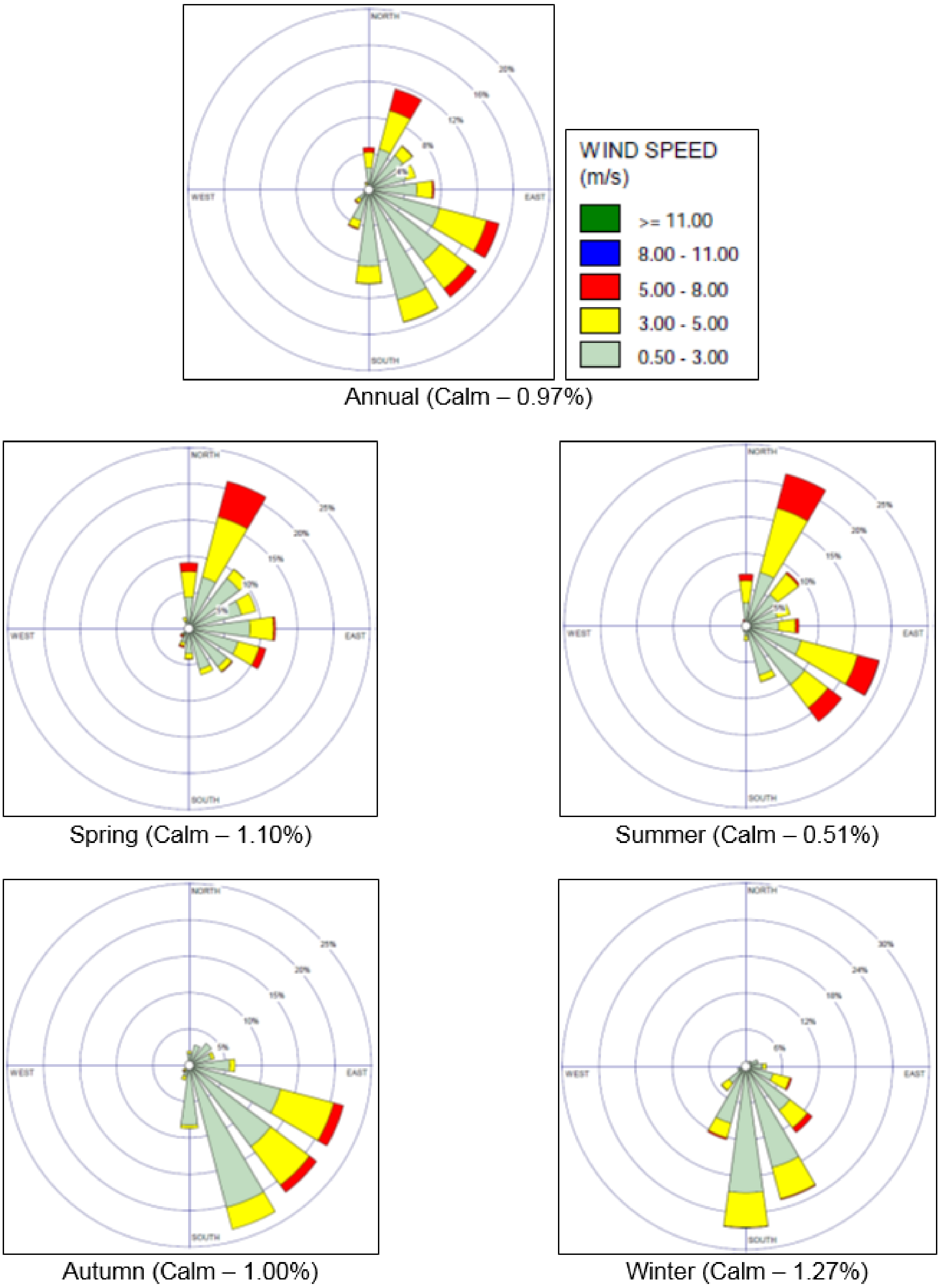


Figure 12-3 Site specific wind roses by season for 2014

12.5.4.4 Atmospheric Stability

Atmospheric stability is an important factor in the dispersion and transport of particulates. It refers to the vertical movement of the atmosphere. 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 Table 12-5.

Table 12-5 Annual stability class distribution predicted

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

12.5.4.5 Mixing Height

The height above ground within which the particulates 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 12-4 . 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.

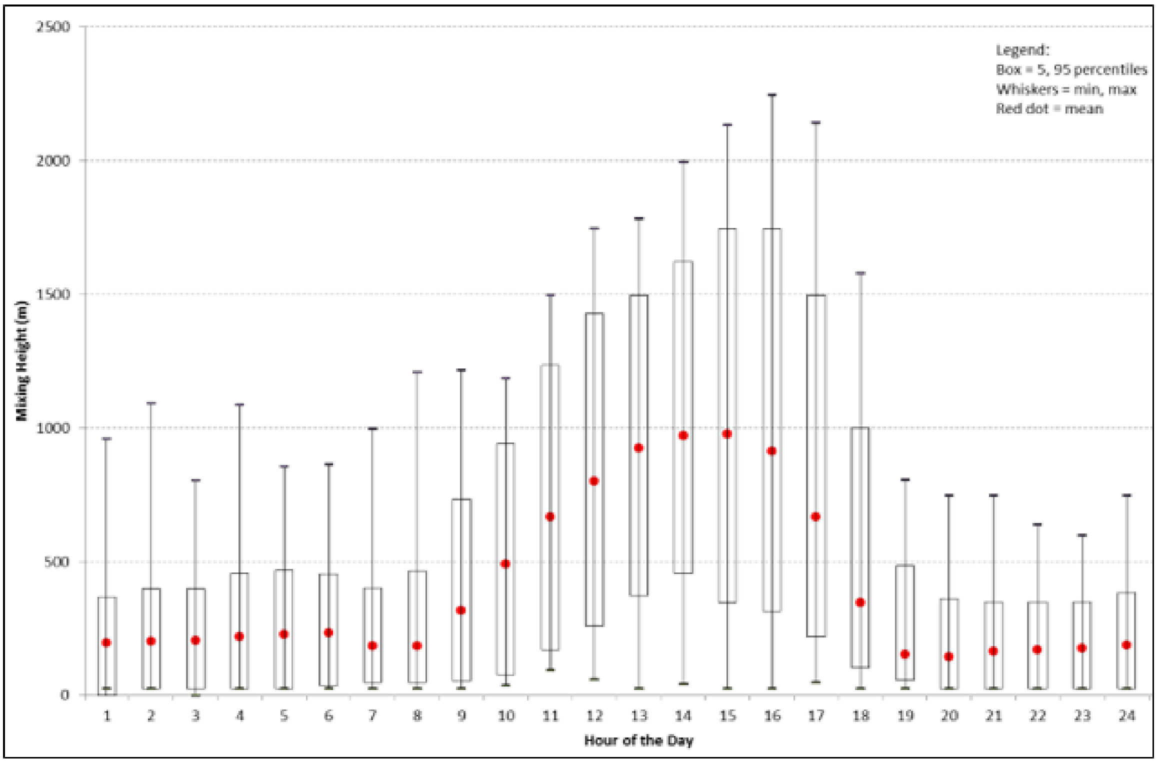


Figure 12-4 Profile of mixing height at the Project

12.5.5 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 will be 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
$PM_{2.5}$	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

12.6 Emissions Estimation

12.6.1 Pollution Causing Activities

The air quality assessment considers dust generating activities from mining activities and disturbed surfaces within the MLs area boundaries. The main emissions to air are dust and particulate matter generated by the onsite construction and mining activities which 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.

12.6.2 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

12.6.3 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 construction phase is discussed in Section 12.8.

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 have been used to provide data to estimate the amount of TSP, PM_{10} and $PM_{2.5}$ emitted from the various mine activities, based on the amount of coal and overburden material mined as provided by CDM Smith (see Appendix A7 – Air Quality and GHG Technical Report).

The annual emission rates 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	0.09	0.04	0.01
Wheel generated dust	4.29	0.99	0.10
Site clearance activities	2.51	0.59	0.27
TOTAL	**6.89**	**1.62**	**0.38**

12.6.4 Emission Estimation for Operational Activities

The assessment has been based on the year 2030 which 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 annual emission rates estimated for the main sources of air emissions from the mining activities during 2030 (Stage 2) is summarised in Table 12-11.

Table 12-11 Operational Stage 2 emission rates

Source	Emission rate (g/s)		
	TSP	PM_{10}	$PM_{2.5}$
CHPP operations	10.75	4.55	1.10
Waste handling	3.28	1.19	0.34
Wind erosion	0.33	0.15	0.05
Wheel generated dust[1]	49.58	14.65	0.84
Mining operations	30.72	10.65	1.64
Blasting/drilling	40.82	21.15	1.23
Diesel combustion	-	-	4.37
Power generation	0.21	0.21	0.21
Train Loadout	7.60	1.52	0.31
TOTAL	143.30	54.07	10.09

1. As outlined in the Air Quality Assessment Technical Report (Appendix B of Appendix 7), The default emission rates in the NPI EET for Mining have been used for this emission factor.

12.6.5 Emission Estimation for Blasting Activities

Gaseous emissions (NO_2, CO and SO_2) from blasting activities have been 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 are based on the following activity data:

- Blasting frequency – one per day;
- Blasting mix – ANFO, Heavy ANFO and Emulsion; and
- MIC – 1,000 kg / 250 kg.

The gaseous emission factors derived for blasting activities were multiplied by two as required in Table 8 of the relevant NPI EET Manual. The emission factors adopted for the amended EIS are therefore:

- 68 kg/t CO;
- 16 kg/t NOx; and
- 0.06 kg/t SO_2.

12.7 Air Quality Modelling

Modelling was undertaken using CALPUFF, an advanced non-steady-state meteorological and air quality modelling system developed by the Atmospheric Studies Group that is used to simulate potential impacts from the proposed mining activities. The model has been adopted by the US EPA as the preferred model for assessing near field applications involving complex meteorological conditions.

To generate the broad scale meteorological inputs to run CALPUFF, TAPM, a three dimensional (3D) prognostic model developed and verified for air pollution studies by the CSIRO, and CALMET were used. 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.

The output from TAPM was used to generate appropriate meteorological data for CALMET as a precursor to the CALPUFF model and the default TAPM databases for terrain, land use and meteorology were used. The 3D wind field data from TAPM was used as the input parameters for CALMET.

Other modelling input parameters included particle size distribution 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; and
- Dust emissions from other sources including wind erosion from ROM stockpiles, haul roads, pit and overburden dump areas were modelled as area sources.

12.7.1.1 Model Scenarios

To generate accurate air quality predictions, CALPUFF was run under two separate Project scenarios, including:

- Construction Phase: includes the site clearance, civil works, structure and plant erection, commissioning and testing of plant and equipment and construction site demobilisation; and
- Operational Phase: includes all activities associated with the typical operation of an open cut mine. 2030 has been modelled as this year is likely to have the highest risk to sensitive receptors given the highest extraction rate and closest location of extraction works to sensitive receptors. Modelling was undertaken to predict TSP, PM_{10}, $PM_{2.5}$, and dust deposition at sensitive receptors during the two Project phases. In addition, the impacts from gaseous emissions generated by blasting activities were modelled.

12.8 Potential Impacts

This section assesses the impacts of the modelled air quality and vibration assessment results on the sensitive receptors shown in Figure 12-1. The results of the original SEIS air quality modelling have been used in the assessment of potential impacts as the results are considered to be a worst case scenario compared with the change in mining schedule to apply a 500 m preliminary buffer to the Bruce Highway. The rationale that the new mine schedule will result in a lesser impact than the modelled mine schedule is:

- The activities will start and end in the same locations of Open Cut 1 and Open Cut 2;
- No changes in the pit depths are proposed;
- The peak amount of overburden required to be placed at the out of pit dumps at the commencement of the Project, prior to establishing a steady state mining process, has significantly reduced. This subsequently means that hauling overburden to the out of pit dump will occur over a much shorter duration in Open Cut 2, which is a principal source of air quality emissions from the heavy mobile plant and equipment;
- The reduction in ex-pit dumping for all three waste rock stockpiles in terms of reduced quantities (reduction of approximately 288 million BCM from the original SEIS mine plan), and timeframes with a significant reduction in the unrehabilitated surface areas that must be rehabilitated in the future;

- There is no material change in regard of the peak emission period at which Open Cut 2 will be operational and Open Cut 1 will be under construction;
- There is no material change in the location of plant and equipment to that modelled under the previous mining schedule; and
- The shorter duration that ex-pit rehabilitation activities will occur given rehabilitation activities can start earlier, and the retained waste rock stockpiles will be significantly smaller than the original SEIS.

A further consideration in respect of modelling emissions generated by the Project is that further geotechnical assessment of the mining pit at the 500 m buffer zone is proposed to be undertaken with six months of Project activities commencing. Depending on the outcome of this analysis, the mine plan may be updated which may require updated noise modelling to assess for impacts to sensitive receptors.

Notwithstanding, Central Queensland Coal commits to undertaking routine dust monitoring from the commencement of construction at potentially impacted sensitive receptors to monitor for air quality impacts. The mitigation measures that will be implemented are described at Sections 12.9.1 and Sections 12.9.2 and the monitoring that will be undertaken is described at Section 12.9.3. The draft Environmental Authority conditions relating to air are at Section 23.1.4 of Chapter 23 – Draft EA conditions.

12.8.1 Assessment of Impacts on Sensitive Receptors

12.8.1.1 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 12.9.

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 12-12 and Table 12-13. Contour plots of the predicted maximum ground-level concentrations are presented in Figure 12-5 to Figure 12-9 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/m^3 criterion at all receptors, with the results just above the background concentration of 40 µg/m^3;
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 27.3 µg/m^3 is predicted to occur at the Tooloombah Creek Service Station (R8), which is well below the 50 µg/m^3 criterion;
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 16. µg/m^3 is predicted to occur at the 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 4.9 µg/m^3, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m^3 criterion; and
- The predicted dust deposition impacts from construction are negligible with the cumulative deposition of 62.2 mg/m^2/day which is approximately half of the 120 mg/m^2/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.

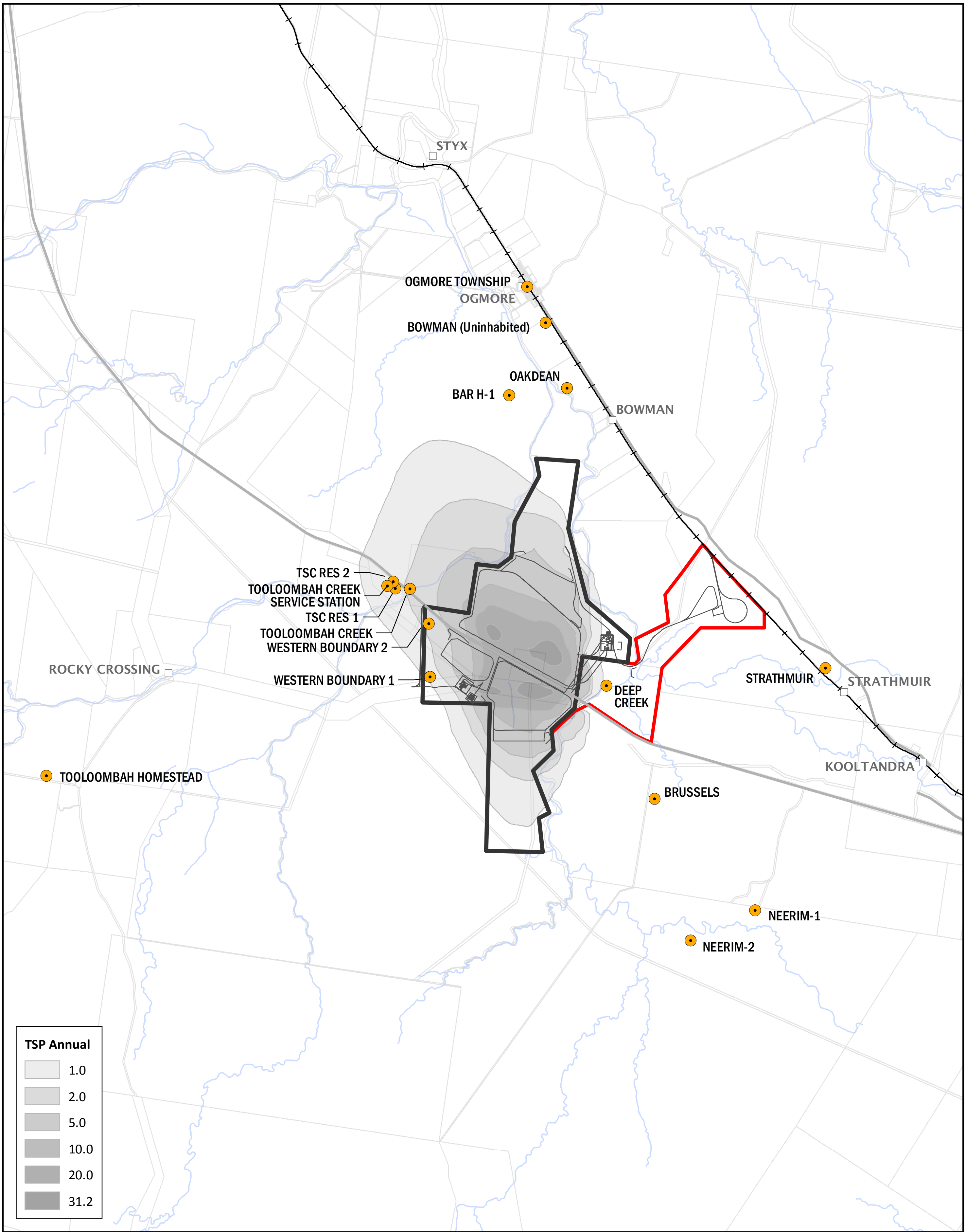
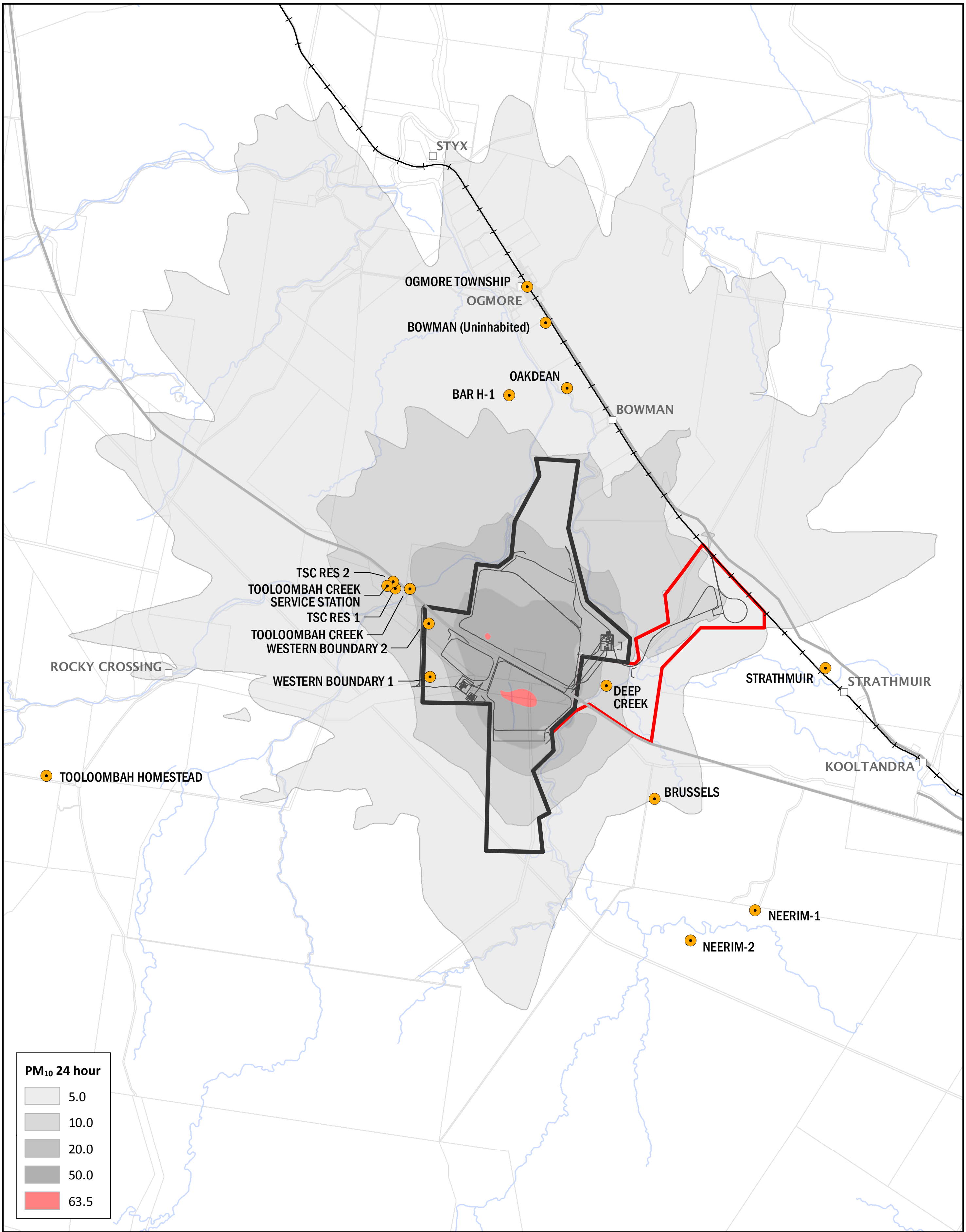


Figure 12-5
Construction stage in isolation
TSP annual

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

BRUGGEMANNGD \\brbsvr1\PRO\Project\1000111 - Styx SEIS Post submission work\7Work\3GIS\DATA\MXD\Chapter 12_Supp_Report_Air Quality\1000111 Construction Stage in Isolation TSP Annual__12-5.mxd 11/13/2018



N

0 1 2 km

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

Figure 12-6
Construction Stage in Isolation
PM_{10} 24 hour

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith

BRUGGEMANNGD \\brbsvr1\PRO\Project\1000111 - Styx SEIS Post submission work\7Work\3GIS\DATA\MXD\Chapter 12_Supp_Report_Air Quality\1000111 Construction Stage in Isolation PM10 25 hour_12-6.mxd 11/13/2018

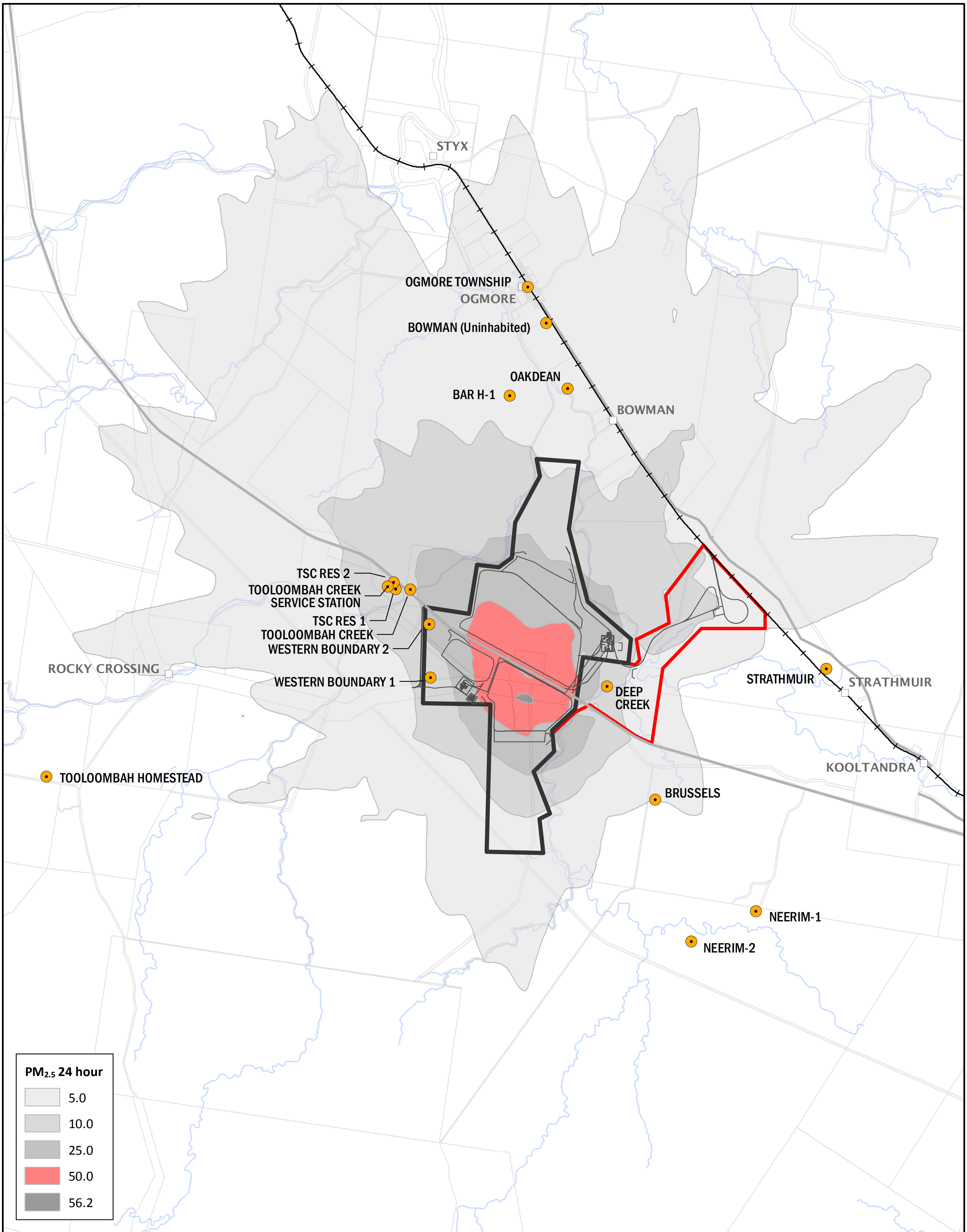


Figure 12-7
Construction Stage in Isolation
$PM_{2.5}$ 24 hour

N

0 1 2 km

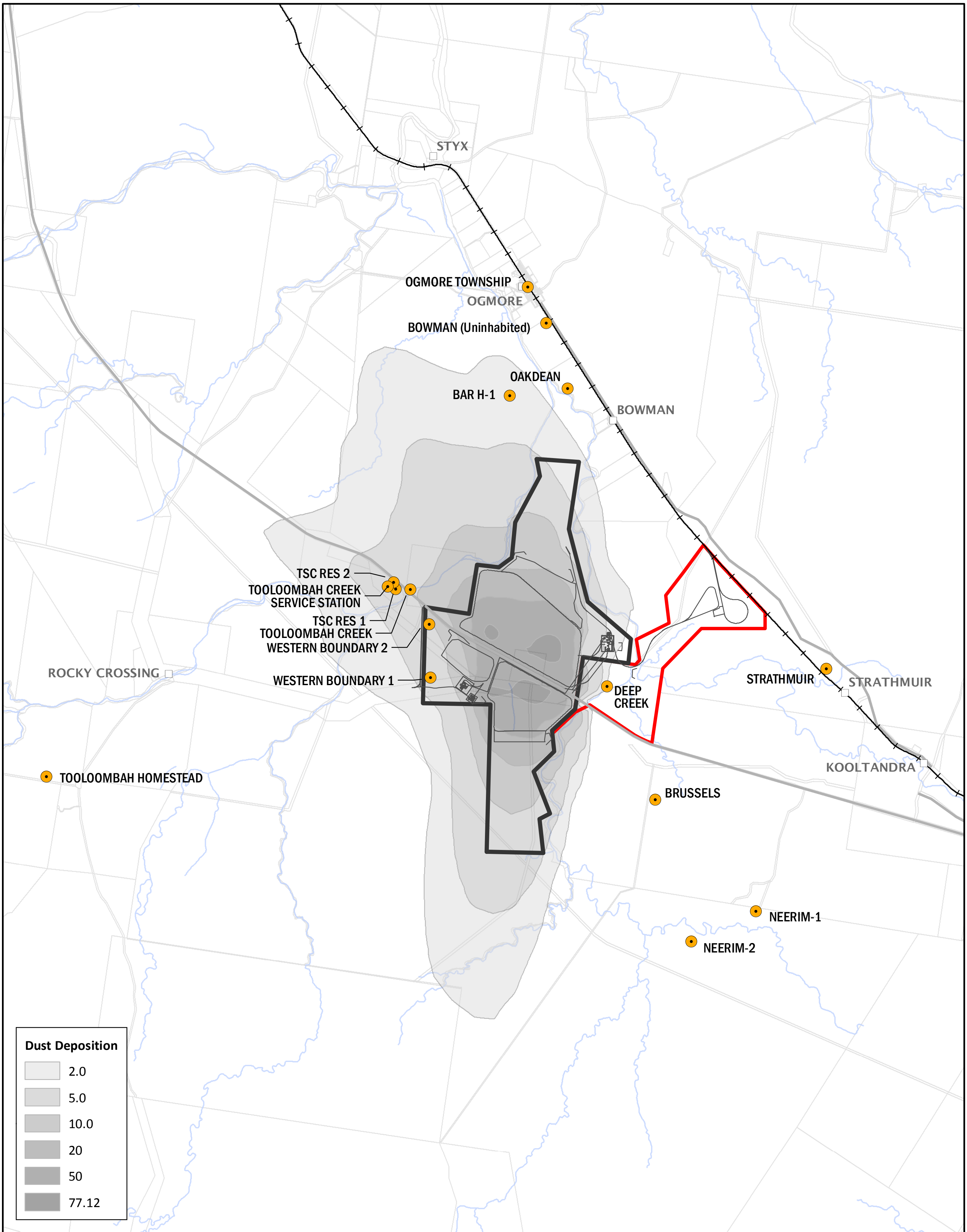
Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith



N

0 1 2 km

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

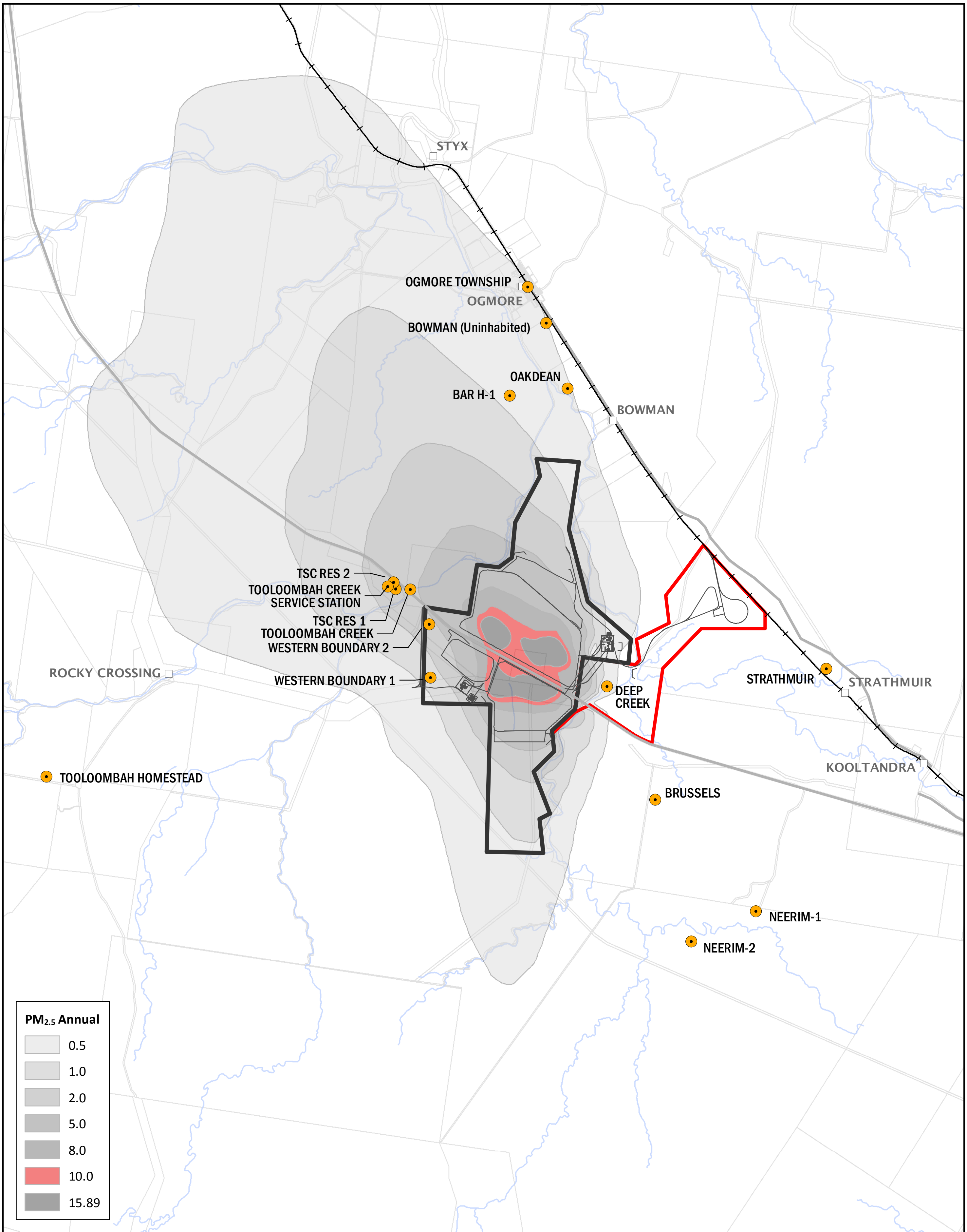
Legend

- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

Figure 12-8
Construction Stage in Isolation
Dust Deposition – 1 Month

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith



Legend

Sensitive receptor	Main Road
ML 80187	North Coast Rail Line
ML 700022	Watercourse
Mine infrastructure	
Cadastral boundary	

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Figure 12-9
Construction Stage in Isolation
$PM_{2.5}$ Annual

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

Table 12-12 Predicted maximum ground-level concentrations for the Project construction – in isolation

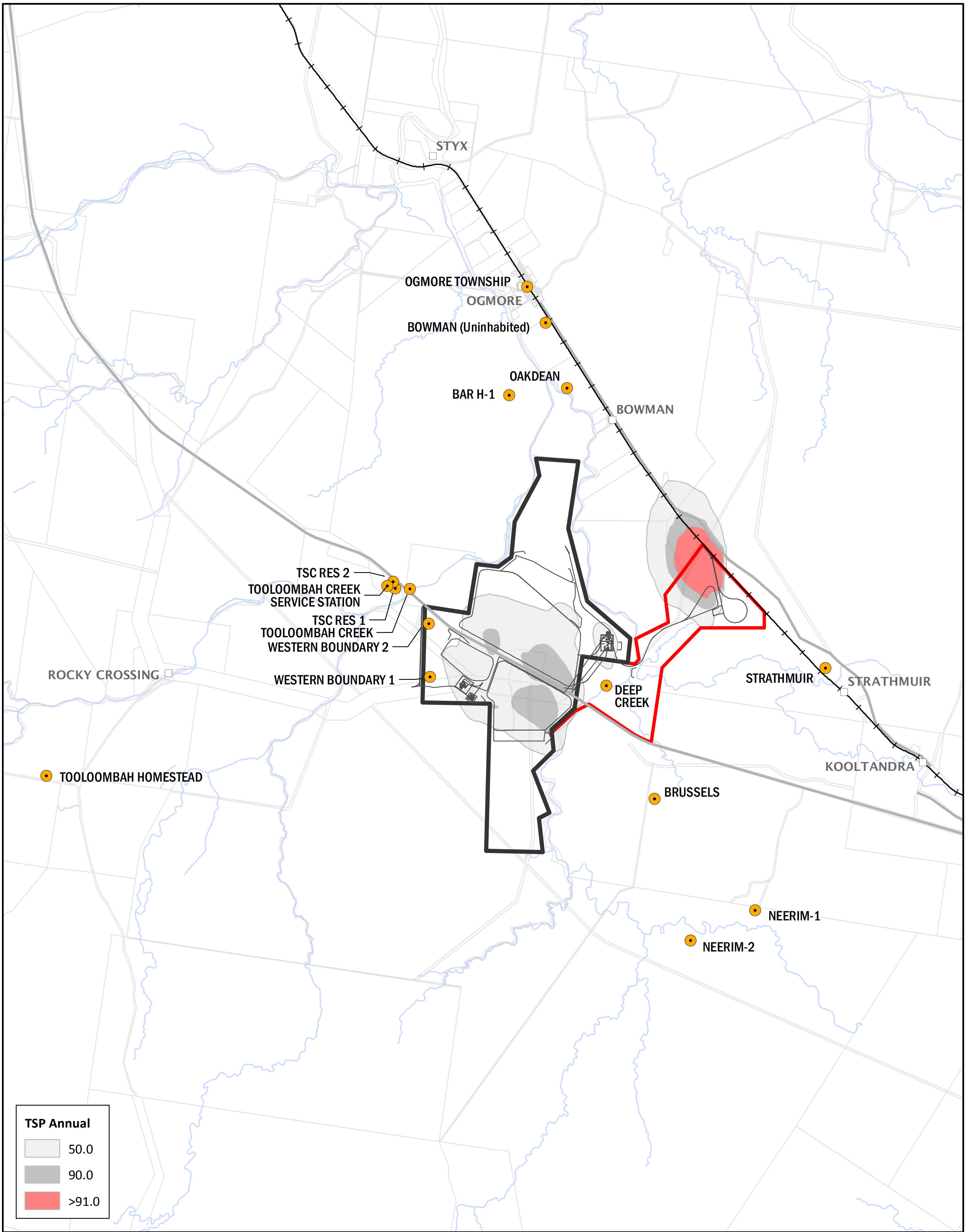
Receptor	In isolation				
	24 Hour $PM_{2.5}$ (µg/m³)	Annual $PM_{2.5}$ (µg/m³)	24 Hour PM_{10} (µg/m³)	Annual TSP (µg/m³)	Daily Dust Deposition (mg/m²/day)
R1	3.82	0.39	4.12	0.19	1.26
R2	1.86	0.04	1.92	0.01	0.06
R3	0.76	0.01	0.78	0.00	0.03
R4	0.44	0.01	0.45	0.01	0.04
R5	3.20	0.18	3.44	0.08	0.67
R6	2.68	0.19	2.94	0.07	0.50
R7	1.22	0.01	1.17	0.00	0.02
R8	6.96	1.27	7.25	0.75	3.18
R9	1.10	0.05	0.81	0.02	0.11
Criteria	**25**	**8**	**50**	**90**	**120**

Table 12-13 Predicted maximum ground-level concentrations for the Project construction – cumulative

Receptor	Cumulative				
	24 Hour $PM_{2.5}$ (µg/m³)	Annual $PM_{2.5}$ (µg/m³)	24 Hour PM_{10} (µg/m³)	Annual TSP (µg/m³)	Daily Dust Deposition (mg/m²/day)
R1	13.52	3.99	24.12	40.19	60.26
R2	11.56	3.64	21.92	40.01	59.06
R3	10.46	3.61	20.78	40.00	59.03
R4	10.14	3.61	20.45	40.01	59.04
R5	12.90	3.78	23.44	40.08	59.67
R6	12.38	3.79	22.94	40.07	59.50
R7	10.92	3.61	21.17	40.00	59.02
R8	16.66	4.87	27.25	40.75	62.18
R9	10.80	3.65	20.81	40.02	59.11
Criteria	**25**	**8**	**50**	**90**	**120**

12.8.1.2 Operation Phase –2030 Worst Case Scenario

The predicted ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition for the operation of the Project at the nearest sensitive receptors in isolation and cumulatively are presented in Table 12-14 and Table 12-15 respectively. Contour plots of the predicted maximum ground-level concentrations are presented in Figure 12-10 to Figure 12-14 and Appendix C of the air quality assessment report at Appendix A7 – Air Quality and GHG Technical Report.



N

0 1 2 km

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

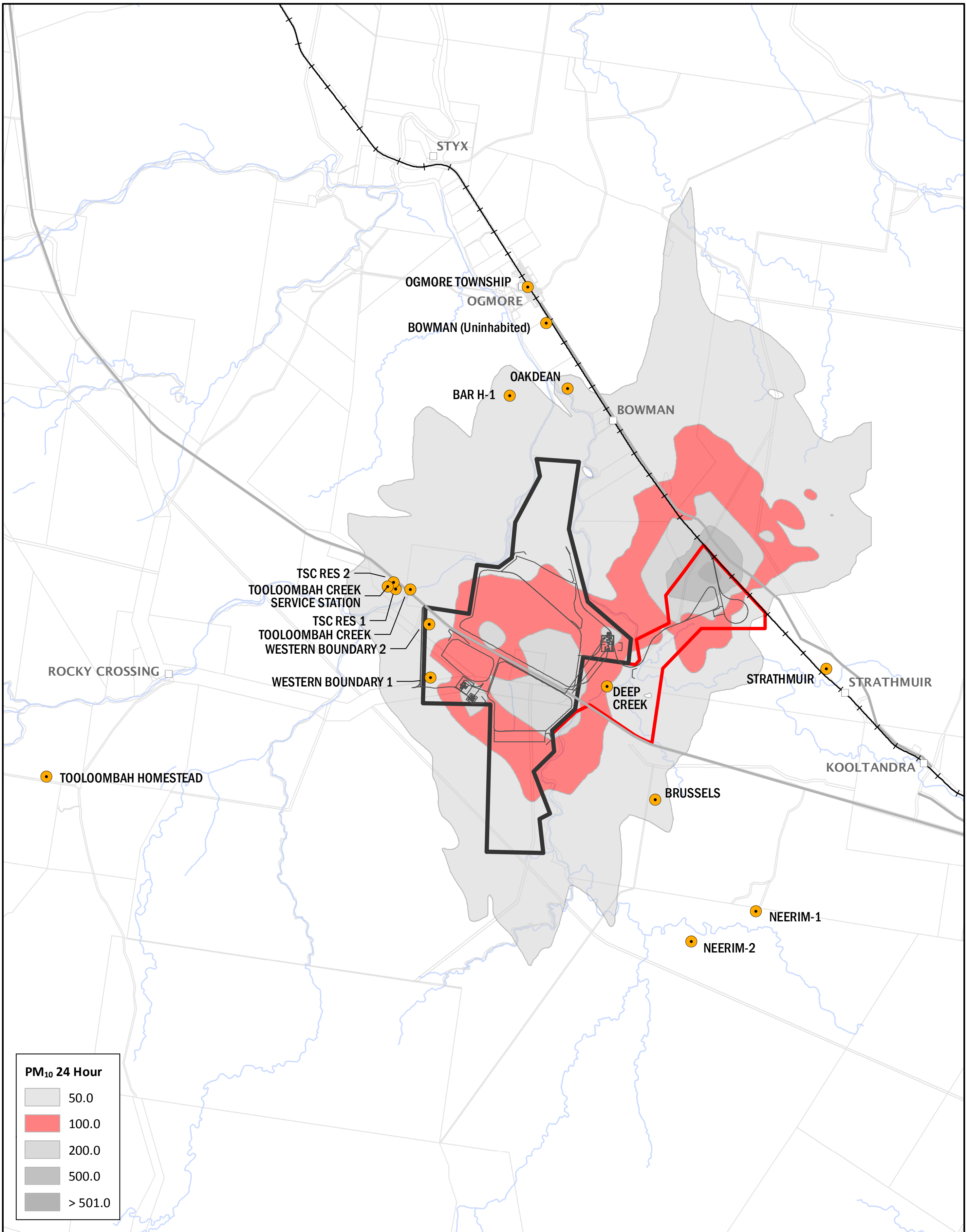
- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

Figure 12-10
2030 - Operations in Isolation
TSP Annual

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith

BRUGGEMANNGD \\brbsvr1\PRO\Project\1000111 - Styx SEIS Post submission work\7Work\3GIS\DATA\MXD\Chapter 12_Supp_Report_Air Quality\1000111 Year 12 Operations in Isolation TSP Annual_12-10.mxd 11/13/2018



N

0 1 2 km

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

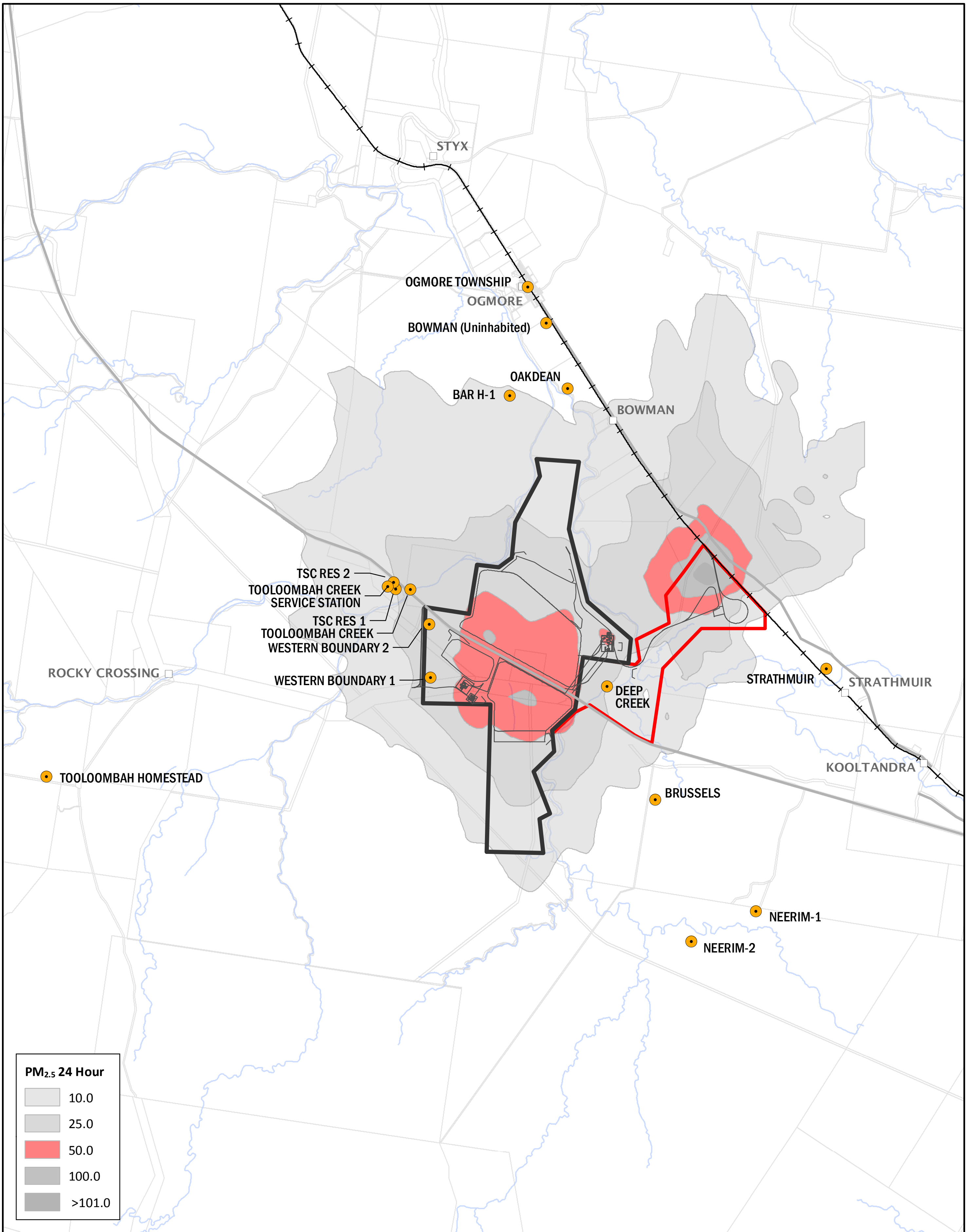
- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

Figure 12-11
2030 - Operations in Isolation
PM_{10} 24 hour

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith

BRUGGEMANNGD \\brbsvr1\PRO\Project\1000111 - Styx SEIS Post submission work\7Work\3GIS\DATA\MXD\Chapter 12_Supp_Report_Air Quality\1000111 Year 12 operations in isolation PM10 24 hour_12-11.mxd 11/13/2018



Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse
- Dam

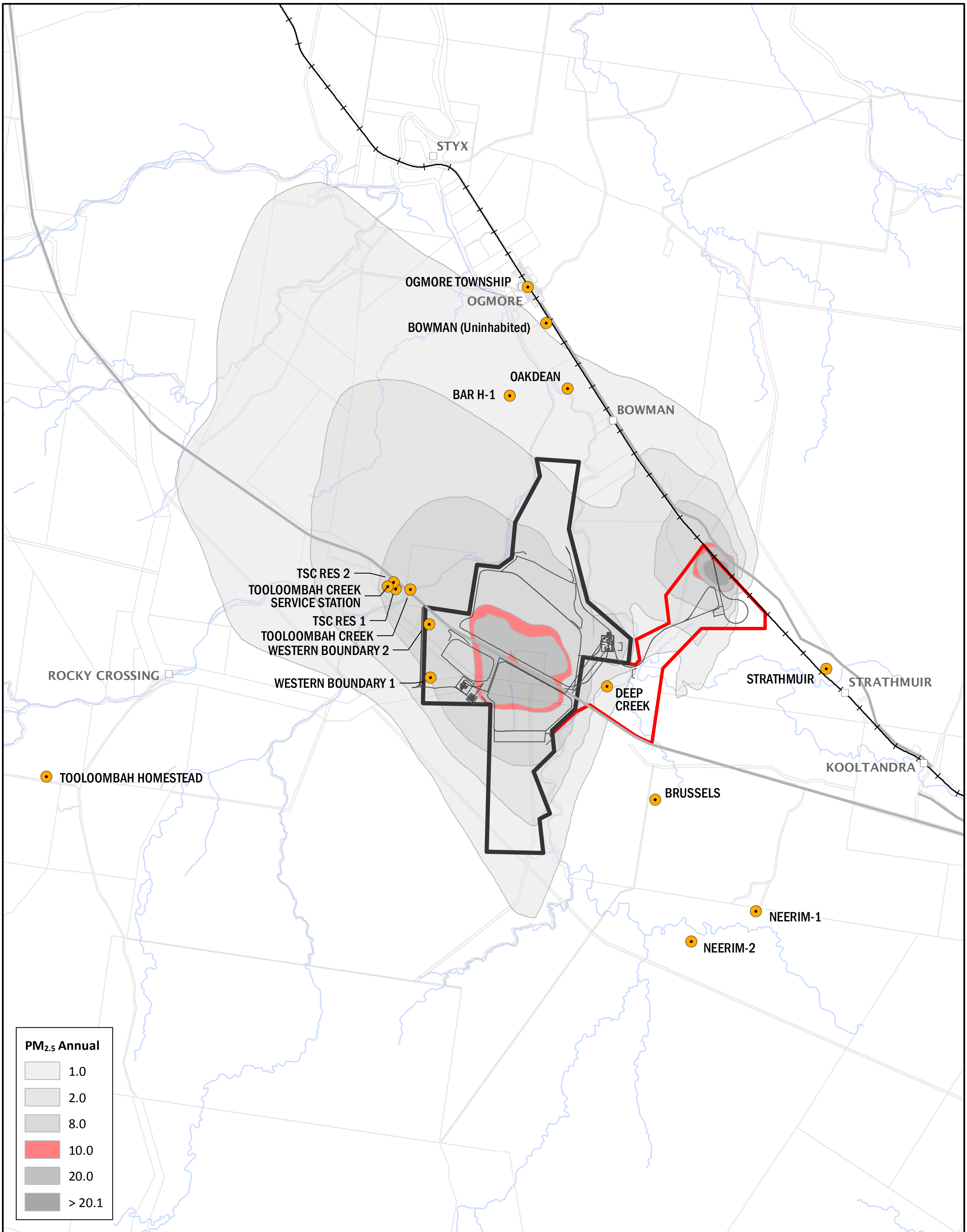
Figure 12-12

2030 - Operations in Isolation

$PM_{2.5}$ 24 hour

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith



N

0 1 2 km

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

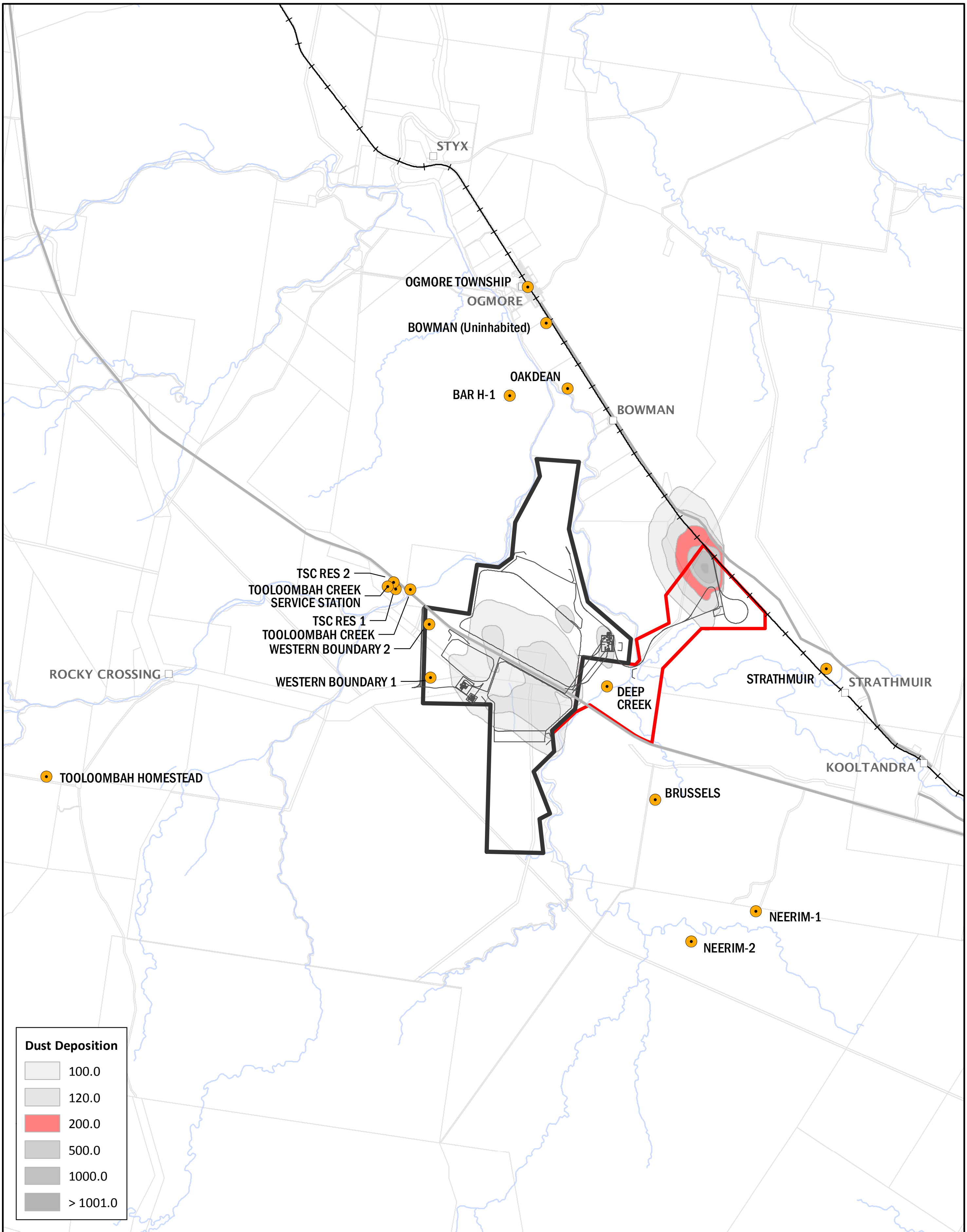
- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

Figure 12-13
2030 - Operations in Isolation
$PM_{2.5}$ Annual

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith

BRUGGEMANNGD \\brbsvr1\PRO\Project\1000111 - Styx SEIS Post submission work\7Work\3GIS\DATA\MXD\Chapter 12_Supp_Report_Air Quality\1000111 Year 12 operations in isolation PM2.5 annual_12-13.mxd 11/13/2018



N

0 1 2 km

Scale @ A4 1:125,000
Date: 13/11/18
Drawn: Gayle B.

Legend

- Sensitive receptor
- ML 80187
- ML 700022
- Mine infrastructure
- Cadastral boundary
- Main Road
- North Coast Rail Line
- Watercourse

Figure 12-14
2030 - Operations in Isolation
dust deposition – 1 month

DATA SOURCE
Waratah Coal, 2018
QLD Open Source Data, 2018

CDM Smith

BRUGGEMANNGD \\brbsvr1\PRO\Project\1000111 - Styx SEIS Post submission work\7Work\3GIS\DATA\MXD\Chapter 12_Supp_Report_Air Quality\1000111 Year 12 operations in isolation dust deposition one month_12-14.mxd 11/13/2018

The model results show:

- The highest annual TSP concentrations are below the 90 µg/m^3 criterion at all receptors, with the maximum concentration of 46 µg/m^3;
- The maximum 24-hour average cumulative ground-level PM_{10} concentration of 45 µg/m^3 is predicted to occur at Oakdean (R5), which is below the 50 µg/m^3 criterion. The maximum predicted incremental increase in PM_{10} due to the operation of the Project is approximately 25 µg/m^3 at the Oakdean receptor;
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 19.1 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 5.7 µg/m^3, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m^3 criterion; and
- The highest daily dust deposition results show that an incremental increase of 22.2 mg/m^2/day will occur at the Tooloombah Creek Service Station receptor, with a total deposition of 81.2 mg/m^2/day which is well below the 120 mg/m^2/day criterion.

Overall, it can clearly be seen that with the Project operating at 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 the Project operation at 2030 – in isolation

Receptor	In isolation				
	24 Hour $PM_{2.5}$ (µg/m^3)	Annual $PM_{2.5}$ (µg/m^3)	24 Hour PM_{10} (µg/m^3)	Annual TSP (µg/m^3)	Daily Dust Deposition (mg/m^2/day)
R1	5.20	0.79	24.42	2.63	2.63
R2	3.47	0.23	23.03	1.67	1.67
R3	1.39	0.03	7.13	0.16	0.16
R4	1.14	0.05	7.00	0.34	0.34
R5	4.67	0.59	25.26	2.79	2.79
R6	3.45	0.45	14.09	1.57	1.57
R7	1.90	0.03	7.47	0.19	0.19
R8	9.37	2.07	24.29	6.22	6.22
R9	2.00	0.10	5.48	0.39	0.39
Criteria	**25**	**8**	**50**	**90**	**120**

Table 12-15 Predicted maximum ground-level concentrations for the Project operation at 2030 – cumulative

Receptor	Cumulative				
	24 Hour $PM_{2.5}$ (µg/m³)	Annual $PM_{2.5}$ (µg/m³)	24 Hour PM_{10} (µg/m³)	Annual TSP (µg/m³)	Daily Dust Deposition (mg/m²/day)
R1	14.90	4.39	44.42	42.63	68.93
R2	13.17	3.83	43.03	41.67	69.62
R3	11.09	3.63	27.13	40.16	59.94
R4	10.84	3.65	27.00	40.34	61.48
R5	14.37	4.19	45.26	42.79	67.92
R6	13.15	4.05	34.09	41.57	65.37
R7	11.60	3.63	27.47	40.19	60.47
R8	19.07	5.67	44.29	46.22	81.22
R9	11.70	3.70	25.48	40.39	60.68
Criteria	**25**	**8**	**50**	**90**	**120**

12.8.2 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 has been assessed.

The operational goal of a 120-day rolling average deposition rate of 200 mg/m²/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 three wetlands

Description	UTM Coordinates (km)		120-day rolling average deposition rate (mg/m²/day)		Criteria
	Easting	Northing	Isolation	Cumulative	
Tooloombah Creek	769.689	7488.548	5.23	64.23	200 mg/m²/day
Deep Creek	775.226	7486.022	12.57	71.57	
Western Boundary Wetland 1	770.787	7486.254	9.64	68.64	
Western Boundary Wetland 2	770.743	7487.605	10.35	69.35	

12.8.3 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 12.5.8.3);

- 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); and
- Dispersion modelling of the pollutant emissions was carried out in accordance with the methodologies outlined in Section 2.5.7 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 QEPP (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 sensitive receptor 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.

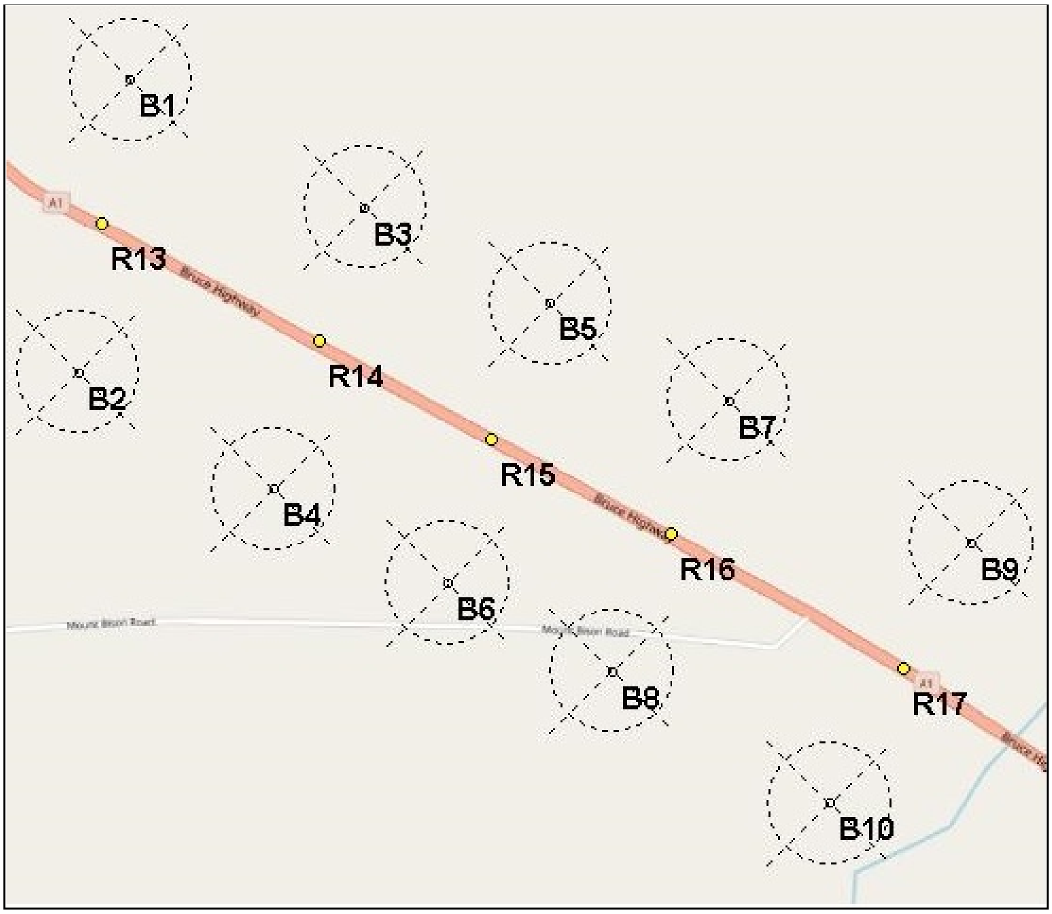


Figure 12-15 Locations of blasting activities and modelled Bruce Highway receptors

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**

12.8.4 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 Queensland Government 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 Environmental Protection (Air) Policy 2008 (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.

12.9 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).

12.9.1 General Mitigation Measures

General mitigation measures will involve:

- Preparation and implementation of an Air Quality Management Plan 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.

12.9.1.1 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.

12.9.1.2 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. The following dust suppression measures will be considered:

- Minimising topsoil and vegetation removal and revegetation of disturbed areas as soon as possible;
- Revegetation of exposed areas to be exposed for more than three months;
- 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;
- Watering of ROM stockpiles using water sprays and 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;
- 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; and
- 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.

12.9.1.3 Rehabilitation of Exposed Surfaces

Rehabilitation of exposed surfaces will be undertaken progressively as mining and stockpiling activities are completed (time from disturbance to rehabilitated estimated at approximately two to five years) and will include the use of fast-growing temporary cover material to accelerate the effectiveness of dust controls.

12.9.1.4 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. 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; and
- Restrict land disturbance to that necessary for the operation and minimise the area of land disturbed at any one time.

12.9.2 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.

Table 12-18 Coal producer sector coal dust mitigation activities

Activity	Description
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	Brushes located at a suitable position to remove excess coal on wagon sills immediately after the coal is loaded minimises parasitic coal the dislodges and falls off the wagon during transit and minimises loss of product coal by allowing dislodged coal to be returned for loading.
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.

12.9.3 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 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.

12.9.3.1 Project Weather Station

In accordance with Draft EA Condition 19 (see Chapter 23) the Project will maintain a weather station on Mamelon Property. Specific siting requirements for the weather station are provided in AS 3580.14. To be representative of the region, the weather station will be located so that shadows will not be cast on the device or near to objects likely to reflect sunlight. The weather station will also be 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; and
- **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.

12.9.4 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.

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;
- A verbal response will be made within seven days and followed up with a written response as required;
- 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.

12.10 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.

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.

12.10.1 Legislative Requirements

12.10.1.1 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 192 Parties to the UNFCC including Australia. Australia's global commitments to climate change is derived from the Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education.

The Kyoto Protocol is an international agreement created under the UNFCCC in Kyoto, Japan in 1997. Australia ratified the Protocol in 2007, and this came into effect in 2008. The Kyoto Protocol aims to reduce global GHG emissions by requiring developed countries to meet internationally agreed emission reduction or limitation targets for the period 2008 to 2012, which has now been extended to 2020.

12.10.1.2 Commonwealth

National Greenhouse Energy Reporting Act 2007

The *National Greenhouse Energy Reporting Act* 2007 (Cth) (NGER Act) establishes a national framework for the reporting of GHG emissions and the production and consumption of energy. It is applicable when a corporation or single facility (including typically mineral and energy companies) exceeds the threshold values as detailed in Section 13 of the NGER Act. The NGER Act is administered by the Clean Energy Regulator with details and allowable calculation methodologies contained in the:

- *National Greenhouse and Energy Reporting Regulations 2008* (NGER Regulation); and
- National Greenhouse and Energy Reporting Determination 2008 (NGER Determination).

Central Queensland Coal as a "controlling corporation" (as defined under the NGER Act) will report to the Greenhouse and Energy Data Officer if threshold values in Table 12-19 are exceeded. If these values are exceeded, Fairway must provide the following information to the relevant Commonwealth authorities:

- GHG emissions;
- Energy production; and
- Energy consumption.

The controlling corporation must provide annual reports to the Greenhouse Energy and Data Officer on its GHG emissions, energy production and consumption. The Technical Guidelines (For the Estimation of Greenhouse Gas Emissions by Facilities in Australia (DotEE 2016a) provides techniques to estimate the emission quantities relevant to coal mining activities and will be used to estimate the emission quantities relevant to coal mining.

Table 12-19 Threshold values of GHG emissions and production

	Threshold values		
	GHG emissions	Energy production	Energy consumption
Controlling corporations	50 kilotonnes per year of carbon dioxide equivalent (CO_2-e)	200 terajoules per year	200 terajoules per year
Single facility	25 kilotonnes per year of CO_2-e	100 terajoules per year	100 terajoules per year

12.10.1.3 State

Climate Q: Toward a Greener Queensland

ClimateQ: toward a greener Queensland presents the next phase in Queensland's response to the challenge of climate change. The revised strategy presents investments and policies to ensure Queensland remains at the forefront of the national climate change response.

ClimateQ outlines a commitment to reduce Queensland's GHG emissions by 60% by 2050, in line with the Australian Government's long term target. This is proposed to be achieved through a variety of short, medium and long term strategies, such as:

- Improving energy efficiency;
- Reducing the emissions intensity of the Queensland energy sector;

- Mode switching and fuel efficiency in the transport sector;
- Reduction of land clearing; and
- Carbon sequestration.

12.10.2 Greenhouse Gas Assessment

12.10.2.1 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.

12.10.2.2 Greenhouse Gas Emissions Estimation

Emission factors used in this assessment have been derived from either 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 NGA Factors Workbook (DotEE, 2016b) as indicated in Table 12-20.

Table 12-20 Emission factors

Scope	Emissions Source	Emission Factor	Source
1	Combustion emissions from ULP (Stationary)	2.38 t CO_2-e / kL	NGA Factors Workbook, 2016
	Combustion emissions from diesel (stationary)	2.68 t CO_2-e / kL	NGA Factors Workbook, 2016
	Combustion for transport (general)	2.69 t CO_2-e / kWh	NGA Factors Workbook, 2016
	Extraction of coal (fugitive) - Queensland	0.02 t CO_2-e / tonnes raw coal	NGA Factors Workbook, 2016

For this assessment Scope 1 and Scope 2 emissions have been calculated in accordance with the NGA Factors Workbook methodology.

12.10.3 Calculated Emissions

Table 12-21 outlines the estimated GHG emissions for the construction and maximum operational phase (2030) 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 Appendix A7 – Air Quality and GHG Technical Report;
- 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 12-21 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 (2030)	
Staff Movements	1 (direct)	4.1	24.9	125
Equipment	1 (direct)	17,574	216,748	1,512,483
Generator	1 (direct)	3.3	3,759	47,324
Haulage	1 (direct)	-	59,282	85,670
Fugitive Coal	1 (direct)	-	200,000	683,523
Total		**17,581**	**479,814**	**2,329,125**

12.10.3.1 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 479,814 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 2,329, 125 tonnes CO_2-e.

12.10.3.2 Comparison to State and National Inventories

These estimated operation phase emissions (479,814 tonnes CO_2-e,) represent approximately 0.09% of Australia's latest GHG inventory estimates of 537 MtCO_2-e (2015).

The total annual GHG emissions for Australia and Queensland as reported in the National Greenhouse Gas Inventory (DotEE, 2015) were 537 Mt CO_2-e (2015) and 152 Mt CO_2-e (2015), respectively. The maximum estimated annual operating emissions is 0.48 Mt CO_2-e which is 0.09% and 0.32% of the national and state inventories, respectively.

12.10.4 Potential Impacts

12.10.4.1 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.

12.10.4.2 Operation

Prior to the implementation of mitigation measures, the operation of the Project will contribute to a maximum emission rate of 479,814 tonnes CO_2-e per annum.

12.10.5 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 will incorporate GHG offsets and ecological offsets into the Offsets Delivery Plan if determined as being required (see Chapter 14 – Terrestrial Ecology for further discussion). The proposed mitigation measures for each phase of the Project are outlined in Table 12-22.

Table 12-22 Mitigation measures

Phase	Mitigation Measure
Planning and Design	▪ Mine layout will use existing cleared land, where practicable, therefore minimising the amount of vegetation removed; and ▪ Where possible, revegetation for carbon sequestration and biodiversity habitat will be integrated in the design.
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 require the selection of energy efficient equipment and vehicles.

Phase	Mitigation Measure
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.

12.10.5.1 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.

12.11 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 utilising the risk assessment framework outlined in Chapter 1 – Introduction.

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 12-23. A summary of the impacts for construction and operation of the Project is provided below.

Table 12-23 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

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 $mg/m^2/day$ (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.	

12.12 Conclusion

An air quality assessment was undertaken to evaluate the potential impacts of air pollutants generated from the construction and operational stages of the Styx Coal Project. 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.

The results of the construction 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 results just above the background concentration of 40 µg/m^3;
- The maximum 24-hour average cumulative ground-level PM10 concentration of 27.3 µg/m^3 is predicted to occur at the Tooloombah Creek Service Station (R8), which is well below the 50 µg/m^3 criterion;
- The highest 24-hour average cumulative ground-level $PM_{2.5}$ concentration of 16. µg/m^3 is predicted to occur at the 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 4.9 µg/m^3, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m^3 criterion; and
- The predicted dust deposition impacts from construction are negligible with the cumulative deposition of 62.2 mg/m^2/day which is approximately half of the 120 mg/m^2/day criterion.

The results of the 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 46 µg/m^3;
- The maximum 24-hour average cumulative ground-level PM10 concentration of 45 µg/m^3 is predicted to occur at Oakdean (R5), which is below the 50 µg/m^3 criterion. The maximum predicted incremental increase in PM_{10} due to the operation of the Project is approximately 25 µg/m^3 at the Oakdean receptor;
- The highest 24-hour average cumulative ground-level PM2.5 concentration of 19.1 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 PM2.5 concentration is 5.7 µg/m^3, predicted to occur at the Tooloombah Creek Service Station (R8), and is below the 8 µg/m^3 criterion; and
- The highest daily dust deposition results show that an incremental increase of 22.2 mg/m^2/day will occur at the Tooloombah Creek Service Station receptor, with a total deposition of 81.2 mg/m^2/day which is well below the 120 mg/m^2/day criterion.

Overall, it can clearly be seen that during the construction phase and with the Project operating at 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 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.

A greenhouse gas assessment has also been undertaken for the Project. This assessment determines the carbon dioxide equivalent (CO_2-e) emissions from the Project according to international and Federal guidelines. The estimated maximum annual operational phase emissions (479,814 tonnes CO_2-e) represent approximately 0.09% of Australia's latest greenhouse inventory estimates of 537 MtCO_2-E (2015).

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.

Maximum annual scope 1 and 2 GHG emissions associated with the Project operations were estimated to be 479 kt Co_2-e. This amounts to 0.09% of Australia's annual GHG emissions. 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, and offsets for carbon sequestration will be evaluated for their cost effectiveness.

The Project will comply with the relevant air quality criteria and will report GHG emissions for all years of operations. Annual greenhouse gas rates are expected to exceed 25,000 t CO_2-e and therefore this Project will trigger NGER reporting requirements.

12.13 Commitments

Central Queensland Coal's commitments, in relation to the protecting the air quality are provided in Table 12-24.

Table 12-24 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.
Greenhouse Gases
Mine layout will use existing cleared land, where practicable, therefore minimising the amount of vegetation removed.
Incorporate GHG offsets and ecological offsets into the Offsets Delivery Plan if determined as being required.
Review predicted emissions during detailed design and actual emissions during construction and operation.
Regular assessment, review and evaluation of GHG reduction opportunities.

12.14 ToR Cross-reference Table

Table 12-25 ToR cross-reference

Terms of Reference	Section of the EIS
8.10 Air	
Describe the existing air environment at the project site and the surrounding region.	Section 12.5.5
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.	Sections 12.6 and 12.8
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.	Sections 12.2, 12.6, 12.8 and 12.9
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).	Sections 12.4, 12.8.1 and 12.8.2
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).	Sections 12.6, 12.8 and 12.9
Describe the proposed mitigation measures and how the proposed activity will be consistent with best practice environmental management.	Sections 12.7 and 12.9

Terms of Reference	Section of the EIS
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 12.5.2
Describe how the achievement of the objectives would be monitored, audited and reported, and how corrective actions would be managed.	Section 12.9
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[1].	Section 12.10.12
Provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO2 equivalent' terms.	Section 12.10
Estimate emissions from upstream activities associated with the proposed project, including the fossil fuel based electricity to be used.	Section 12.6
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 12.10
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	Section 12.10
• an assessment of how the preferred measures minimise emissions and achieve energy efficiency	Section 12.10
• a comparison of the preferred measures for emission controls and energy consumption with best practice environmental management in the relevant sector of industry	Sections 12.7 and 12.10
• a description of any opportunities for further offsetting greenhouse gas emissions through indirect means.	Section 12.10.5

[1] http://www.cleanenergyregulator.gov.au/NGER