SARAJI EAST MINING LEASE PROJECT

Environmental Impact Statement

Chapter 11

Air Quality and Greenhouse Gas

Table of Contents

Table of figures

Table of tables

11.0 Air Quality and Greenhouse Gas

11.1 Introduction

BM Alliance Coal Operations Pty Ltd (BMA) is seeking approval to develop the Saraji East Mining Lease Project (the Project) involving a single-seam underground mine and supporting infrastructure on Mining Lease Application (MLA) 70383 and MLA 70459 adjacent to, and accessed through, the existing open cut mine void within Mining Lease (ML) 1775.

This chapter discusses the potential air quality and greenhouse gas (GHG) impacts resulting from the Project, in support of the Project's Environmental Impact Statement (EIS). The objective of this chapter is to determine if the Project will be operated in a way that protects the environmental values of air. The underpinning air quality impact assessment for the Project was completed by Advanced Environmental Dynamics Pty Ltd (AED), on behalf of BMA. The AED Air Quality Technical Report that details the assessment is provided in **Appendix H-1 Air Quality Technical Report**.

The potential air quality impacts of the Project have been assessed by:

- a review of the relevant air quality legislation and guidelines
- assessment of potential emission sources and the development of an emissions inventory
- describing the environmental values of the Project Site and surrounds
- predicting dust impacts using dispersion modelling software
- proposing mitigation and management measures.

The assessment of potential GHG and climate change impacts of the Project entailed:

- outlining the regulatory framework for GHG management in Australia
- estimating the direct and indirect GHG emissions resulting from activities during the operations phase
- identifying mitigation measures to reduce GHG emissions during the operations phase, including mitigation measures which are inherent for the Project based on commitments included in the BHP Climate Transition Action Plan 2021
- undertaking a preliminary climate change risk assessment for the Project.

11.2 Need for the Project

The Project will mine up to 11 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal and produce up to 8.2 Mtpa of metallurgical product coal over an operating life of approximately 20 years.

Metallurgical coal produced in the Bowen Basin is in high demand for use in steel production in Asia. In addition to the economic benefits and employment opportunities provided by the Project, both directly and indirectly, the Project provides the ability to obtain additional coal resource from an existing mining precinct utilising, where possible, existing infrastructure associated with the adjacent Saraji Mine operated by BMA.

Due to the presence of existing infrastructure, the Project presents an opportunity to obtain additional coal resource in a more resource and emissions efficient manner than a true greenfield project. It is expected that product from the Project will serve the demand for coking coal for steel manufacturing and will aid in the development of renewable and low emission technologies.

11.3 Legislation, policy and guidance

11.3.1 Air quality

Commonwealth legislation

National ambient air quality standards and goals are set by the National Environmental Protection Council (NEPC) and are specified within the Ambient Air Quality National Environmental Protection Measure (Ambient Air Quality NEPM) Variation 2021, effective18 May 2021. The Ambient Air Quality NEPM provides guidance relating to air in the external environment and does not include air inside buildings or structures.

The Ambient Air Quality NEPM outlines monitoring, assessment and reporting procedures for the following pollutants:

- particulate matter with an aerodynamic diameter less than 10 micrometres (µm) (PM_{10})
- particulate matter with an aerodynamic diameter less than 2.5 µm ($PM_{2.5}$)
- nitrogen dioxide (NO_2)
- carbon monoxide (CO)
- ozone (O_3)
- sulphur dioxide (SO_2).

The Ambient Air Quality NEPM standards are intended to be applied to air quality experienced by the general population in a region and not to air quality in areas in the region affected by localised air emissions, such as individual industrial sources. The standards were set at a level intended to adequately protect human health and wellbeing.

The Ambient Air Quality NEPM pollutants applicable to the Project are PM_{10} and $PM_{2.5}$.

Queensland legislation

In Queensland (QLD), air quality is managed under *the Environmental Protection Act 1994* (EP Act), the Environmental Protection Regulation 2019 and the Environmental Protection (Air) Policy 2019 (EPP Air). The EPP Air was prepared by the Queensland Government to enhance or protect the atmospheric environment in Queensland by providing air quality objectives. These objectives are to be achieved in various environments with reference to sensitive receptors. It does not apply to workplaces and the air quality objectives set out in the EPP Air are intended to be progressively achieved over the long term.

The EPP Air recommends different strategies to control emissions for different types of activities, including:

- identifying environmental values to be enhanced or protected
- stating indicators and air quality objectives for enhancing or protecting the environmental values
- providing a framework for making consistent, equitable and informed decisions about the air environment.

Pollutants relevant to the air quality impact assessment are described in Section 11.4.1. The EPP Air pollutants applicable to the Project are Total Suspended Particles (TSP), PM_{10} and $PM_{2.5}$.

In addition to the ambient air objectives for suspended particulates, the Department of Environment and Science (DES) typically adopts a deposited dust guideline of 120 milligrams per square metre per day (mg/m^2/day) derived from a history of dust investigations, subjective observations and establishing nuisance effects.

Project adopted ambient air quality goals

Ambient air quality goals used in the Project's air quality impact assessment have been adopted considering both national and state legislation. The standards in the Ambient Air Quality NEPM for PM_{10} and $PM_{2.5}$ are the same as the EPP Air objectives for these pollutants, with the EPP Air objectives for PM_{10} and $PM_{2.5}$ set for the protection of the environmental value of health and wellbeing. These goals are summarised in Table 11-1.

Table 11-1 Project adopted ambient air quality goals

Pollutant	Averaging period	Project goal	Allowable exceedances	Source
TSP	Annual	90 µg/m^3	None	EPP(Air)
PM_{10}	24 hour	50 µg/m^3	None	Ambient Air Quality NEPM and EPP(Air)
	Annual	25 µg/m^3	None	
$PM_{2.5}$	24 hour	25 µg/m^3	None	Ambient Air Quality NEPM and EPP(Air)
	Annual	8 µg/m^3	None	
Dust deposition	30 day	120 mg/m^2/day	None	QLD DES

11.3.2 Greenhouse gas legislation

International agreements

The Kyoto Protocol was concluded and agreed in 1997 by the United Nations Framework Convention on Climate Change (UNFCCC) and enforced in 2005. Australia ratified the Kyoto Protocol in 2007. The Kyoto Protocol aims to reduce the impact of human-induced climate change by setting nation-specific GHG emissions targets. The Kyoto Protocol sets out three flexible mechanisms for achieving GHG targets:

- The Clean Development Mechanism
- Joint Implementation, and
- International Emissions Trading.

The Protocol designated two commitment periods for emissions targets; the first commitment period started in 2008 and ended in 2012 and the second commitment period (Doha Amendment) began in 2013 and ended in 2020.

Australia has also ratified the Paris Agreement that was finalised and entered into force in 2016, with the objective to build upon the mechanisms and targets put forward by the Kyoto Protocol. The Paris Agreement has been ratified by 189 of the 197 Parties to the UNFCCC. The Paris Agreement demonstrates the Australian Government's commitment to reducing human-induced climate change with a central aim is to strengthen the global response to climate change. The goal of the Paris Agreement is to limit the increase in the global average temperature to below 2°C above pre-industrial levels and reduce GHG emissions by encouraging technological innovation and clean energy.

In November 2021, Australia agreed to the Glasgow Climate Pact decided at CP-26, which reaffirms the Paris Agreement goal, and outlines new commitments for reduction of greenhouse emissions involving forest management, methane emissions, electric vehicles, reduction of coal use, and science-based targets.

International Energy Agency Net Zero by 2050

The International Energy Agency (IEA) has released a special report entitled Net Zero by 2050: A Roadmap for the Global Energy Sector (IEA, 2021), which outlines a global pathway to reducing emissions by 2050 in order to limit global temperatures at 1.5°C.

Net Zero by 2050 has outlined specified priority actions within the report as part of the pathway to net zero. Priority actions from the report are as follows:

- Make the 2020s the decade of massive clean energy expansion
- Prepare for the next phase of the transition by boosting innovation
- Clean energy jobs will grow strongly but must be spread widely
- Set near-term milestones to get on track for long-term targets
- Drive a historic surge in clean energy investment
- Address emerging energy security risks now

- Take international co-operation to new heights.

Net Zero by 2050 also states that "*Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our pathway, and no new coal mines or mine extensions are required. Demand for coking coal falls at a slightly slower rate than for steam coal,… existing sources of production are sufficient to cover demand through to 2050"*.

Net Zero by 2050 does not define "*projects already committed*" and does not provide a list of projects which are considered to be committed.

At the time of the IEA publication (2021), the Project had progressed through the process of assessment and approval for several years. Therefore, it is assumed that the Project is a committed project with respect to the commentary within Net Zero by 2050.

National Greenhouse and Energy Reporting Act 2007

The Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes a national system for reporting corporate GHG emissions, energy consumption and production. The NGER Act requires corporations that exceed certain GHG emission thresholds to publicly report their GHG emissions, energy consumption and production each financial year.

The current GHG reporting thresholds for corporations are as follows:

- emission of more than 50,000 tonnes (t) of carbon dioxide equivalents (CO_2-e), or
- consumption of more than 200 terajoules (TJ) of energy per year.

The current GHG reporting thresholds for individual facilities are as follows:

- emission of more than 25,000 t CO_2-e, or
- consumption of more than 100 TJ of energy per year.

During the construction and operation phases, it is anticipated that the Project will be under the operational control of BMA. BMA is registered as a controlling corporation under the NGER Act. Therefore, the Project's annual GHG emissions, energy consumption and production will be included in BMA's annual NGER report.

National climate change policy

A review of the Australia's climate change policies was completed in 2017 by the former Department of the Environment and Energy (DoEE) (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)). This review found that the Australian Government is committed to addressing climate change, while concurrently ensuring energy security and affordability, and the competitiveness of the energy industry.

National Emissions Reduction Fund

The Emissions Reduction Fund (ERF) provides incentives for Australian businesses, farmers, land holders and citizens to adopt new practices and technologies to reduce Australia's GHG emissions. The DCCEEW and the Clean Energy Regulator are responsible for managing the ERF. The fund has three key elements, as described in Table 11-2.

Table 11-2 Key elements of the emissions reduction fund

Element	Description
Crediting emissions reductions	Crediting involves determining a quantity of emissions avoided/reduced by a project. Projects can claim emissions reductions that go beyond business-as-usual standards. There are specific methods for estimating the quantity of emissions avoided/reduced by a project.
Purchasing emissions reductions	ERF participants can sell their emissions reductions in the form of Australian Carbon Credit Units (ACCUs) to the Government through competitive reverse auctions run by the Clean Energy Regulator.

Element	Description
Safeguarding emissions reductions	The safeguard mechanism complements the ERF by providing a framework for Australia's largest emitters to measure, report and manage their emissions.

Queensland Mineral Resources Act 1989

In QLD, mining and mineral resource industry projects also subject to the *Mineral Resource Act 1989* (MR Act), which aims to:

- encourage and facilitate prospecting and exploring for and mining of minerals
- enhance knowledge of the mineral resources of the State
- minimise land use conflict with respect to prospecting, exploring and mining
- encourage environmental responsibility in prospecting, exploring and mining
- ensure an appropriate financial return to the State from mining
- provide an administrative framework to expedite and regulate prospecting and exploring for and mining of minerals, and
- encourage responsible land care management in prospecting, exploring and mining.

The MR Act provides guidance on restrictions for flaring or venting incidental coal seam gas, as referenced below.

1) *It is a condition of the mining lease that the mining lease holder must not flare or vent incidental coal seam gas mined under section 318CM(1) in the area of the mining lease unless the flaring or venting is authorised under this section.*
2) *Flaring the incidental coal seam gas is authorised if it is not commercially or technically feasible to use it—*
    a. *for a coal mining lease—under section 318CN(2); or*
    b. *for an oil shale mining lease—under section 318CNA(2).*
3) *Venting the incidental coal seam gas is authorised if—*
    a. *it is not safe to use the gas for a purpose mentioned in subsection (2) or to flare it; or*
    b. *flaring it is not technically practicable; or*
    c. *for incidental coal seam gas that is vented as or with mine ventilation air—it is not commercially practicable to use the air.*
4) *Venting the incidental coal seam gas is also authorised if—*
    a. *it is being used, or is proposed to be used, under a greenhouse abatement scheme; and*
    b. *if subsection (1) were to apply, the direct or indirect benefit the mining lease holder would otherwise obtain because of the use of the gas under the scheme would be reduced.*
5) *Subsection (6) applies, despite subsections (2) to (4), if—*
    a. *an oil shale mining lease is over land in an area of a petroleum lease (the overlapping land); and*

   b. *incidental coal seam gas is, under section 318CM(1), mined from the overlapping land.*

6) *Flaring or venting is authorised only if—*

   a. *the mining lease holder has given the petroleum lease holder written notice that the gas is available to the petroleum lease holder; and*

   b. *the petroleum lease holder has either not responded or has refused to accept the gas within 20 business days after receiving the notice.*

7) *In this section greenhouse abatement scheme means a scheme about the abatement of greenhouse gases prescribed by regulation*

Queensland Government policy and initiatives

On 13 July 2017, the Queensland Government signed the international "Under2MOU" agreement, which was developed by a coalition of subnational governments aiming to lead by example to combat climate change. The agreement aims to:

- limit global warming to 2 degrees Celsius (°C)
- by 2050, reduce GHG emissions to between 80 and 95 per cent of 1990 levels, or to less than two tonnes per capita, per year.

To achieve these goals, the Queensland Government's *Climate Transition Strategy* has made three key climate change commitments:

1. power Queensland with 50 per cent renewable energy by 2030
2. achieve net zero emissions by 2050
3. achieve an interim emissions reduction target of at least 30 per cent below 2005 levels by 2030.

11.3.3 BHP Climate Transition Action Plan (2021)

BHP accepts the Intergovernmental Panel on Climate Change's (IPCC) assessment of climate change science and acknowledges the need for significant reductions in human generated GHG emissions. To address this ongoing and global issue, BHP has developed a Climate Transition Action Plan (2021) which "*sets out a strategic approach to reduce greenhouse gas (GHG) emissions to net zero within operations by 2050 and to work with customers and suppliers to support their emissions reductions, consistent with the ambition of pursuing net zero in the value chain"*.

BHP has engaged with governments and stakeholders in the development of the Climate Transition Action Plan (2021), which is intended to be an effective, long-term policy framework that can deliver a measured transition to a lower carbon economy. To display support of the Paris Agreement, BHP became a signatory of the UNFCCC 'Paris Pledge' and set company emission reduction targets.

BHP's emissions reduction target commitments are as follows:

- Short term target:
  - Maintain operational GHG emissions at or below FY2017 levels by FY2022
- Medium term targets:
  - 30 percent reduction in Scope 1 and Scope 2 emissions from FY2020 levels by FY2030
  - Support the development of technologies and pathways capable of 2 per cent emissions intensity reduction in integrated steelmaking for Scope 1 and Scope 2 emissions with widespread adoption expected post 2030
  - Support 40 percent emissions intensity reduction for BHP-chartered shipping of products for Scope 1 and Scope 2 emissions

    - Support industry to develop technologies and pathways capable of 30 per cent emissions intensity reduction in integrated steelmaking for Scope 3 emissions, with widespread adoption expected post 2030
    - Support 40 per cent emissions intensity reduction of BHP-chartered shipping of products for Scope 3 emissions
- Long term targets:
    - Net zero operational emissions by FY2050 for Scope 1 and Scope 2 emissions.

In addition to the medium and long term emissions targets, the Climate Transition Action Plan (2021) includes agreements for:

- 50% renewable energy supply to select Queensland and Western Australia sites
- Establishment of two solar farms and a battery storage system.

As part of the Climate Transition Action Plan (2021), BHP is investing in renewable charging technology and decarbonisation of maritime and steel-working industries. BHP has also developed a carbon offset strategy detailing how voluntary and regulatory carbon offsets from customers will play a role in decarbonising the value chain. Opportunities to invest in high quality offset generating projects and to supply offsets to complement customer decarbonisation strategies will be considered.

As a member of the BHP Group, BMA adhere to BHP's operational and environmental management framework, and therefore BHP's commitments within the Climate Transition Action Plan (2021) apply to the Project.

The commitments within BHP's Climate Transition Action Plan (2021) align with the priority actions form the IEA's Net Zero by 2050 report, as detailed previously in Section 11.3.2.

11.4 Methodology

11.4.1 Air quality

Pollutant emission sources

Underground mines are associated with significantly less dust generation when compared with an open cut mine alternative. Both mining methods may share a number of common dust generating sources, such as ROM stockpiles, breaker stations, conveyors, and stacker/reclaimers as well as windblown dust from waste spoil dumps and pit-related disturbance areas. However, the release of fugitive dust emissions associated with material handling by open cut mining methods are replaced by the release of dust to the atmosphere via ventilation shafts in the underground mine.

For the Project, the extent of the disturbance footprint is established early, i.e. during the construction phase of the Project and remains relatively stable throughout the life of the Project. That part of the disturbance footprint associated with the construction of the accommodation village (for example) can be minimised through the stabilising of at risk surfaces (such as roads, paths, etc.) and the rehabilitation of surfaces as soon as practicable.

As such, the pollutant emissions source for this Project is focused on the construction and operation phases of the Project. Although not identified specifically, the decommissioning and commissioning phases of the Project may be considered conservatively represented by the earliest and latter stages of the mining operations. The potential for substantial quantities of dust to be generated during other stages of the Project (e.g. commissioning, decommissioning, rehabilitation) is considered to be low and where necessary, may be adequately managed through air quality management practices typical of mining operations.

Construction phase

Construction is anticipated to take between one and three years with the majority of the construction work expected to occur between FY2023-2025 (Year 1-3). Emissions of air pollutants may occur in relation to construction activities associated with the development of the mine entry portal, mine industrial area (MIA), coal handling and processing plant (CHPP), rail spur, water storage infrastructure, powerline, access roads, and accommodation village.

The main pollutant of concern during construction will be the generation of dust associated with heavy vehicle movements, land clearing and wind erosion. Small amounts of other pollutants (such as oxides of nitrogen and volatile organic compounds) may be released in association with the combustion of diesel fuel by plant and equipment, although these sources of pollutants are anticipated to be relatively minor.

Operations phase

The Project CHPP will have the capacity to process seven million tonnes per annum (Mtpa) run-of mine (ROM) coal with excess ROM coal trucked from the CHPP to the Saraji Mine CHPP for processing.

The operational phase of the Project will potentially emit a range of pollutants associated with (but not limited to) the following:

- conveying of coal from the mine portal to the CHPP including transfer points and surge bins
- processing of coal including sizing at the breaker stations (Project CHPP and Saraji Mine CHPP)
- stacking/reclaiming of stockpiles (Project CHPP and Saraji Mine CHPP)
- dozer activities on stockpiles (Project CHPP)
- wheel generated dust associated with the transport of coal via haul trucks from the Project CHPP to the Saraji Mine CHPP
- truck dumping of coal at the Saraji Mine CHPP ROM stockpile
- wheel generated dust associated with rejects hauling (Project CHPP and Saraji Mine CHPP)
- exhaust gas associated with the underground ventilation outlets
- flaring and/or venting of off-gases
- combustion of diesel and petrol fuels in mobile and/or fixed plant and equipment.

Pollutants that may be emitted into the airshed as a result of the operation of the Project include:

- dust (as TSP, PM_{10} and $PM_{2.5}$)
- oxides of nitrogen, carbon monoxide and volatile organic compounds (e.g. combustion of fuels)
- methane (venting of incidental mine gas)
- carbon dioxide (e.g. flaring of incidental mine gas).

Pollutant management and mitigation options for the Project are discussed Section 11.7.1.

Although the Project design incorporates a number of significant dust reduction features (e.g. the transport of ROM coal by conveyor from the mine portal to the CHPP), the risk of adverse impacts of dust on the air quality environment associated with material handling is likely to exceed those from other activities. Therefore, the focus of the assessment is the quantification of operation phase Project-related impacts for TSP, PM_{10}, $PM_{2.5}$ and dust deposition.

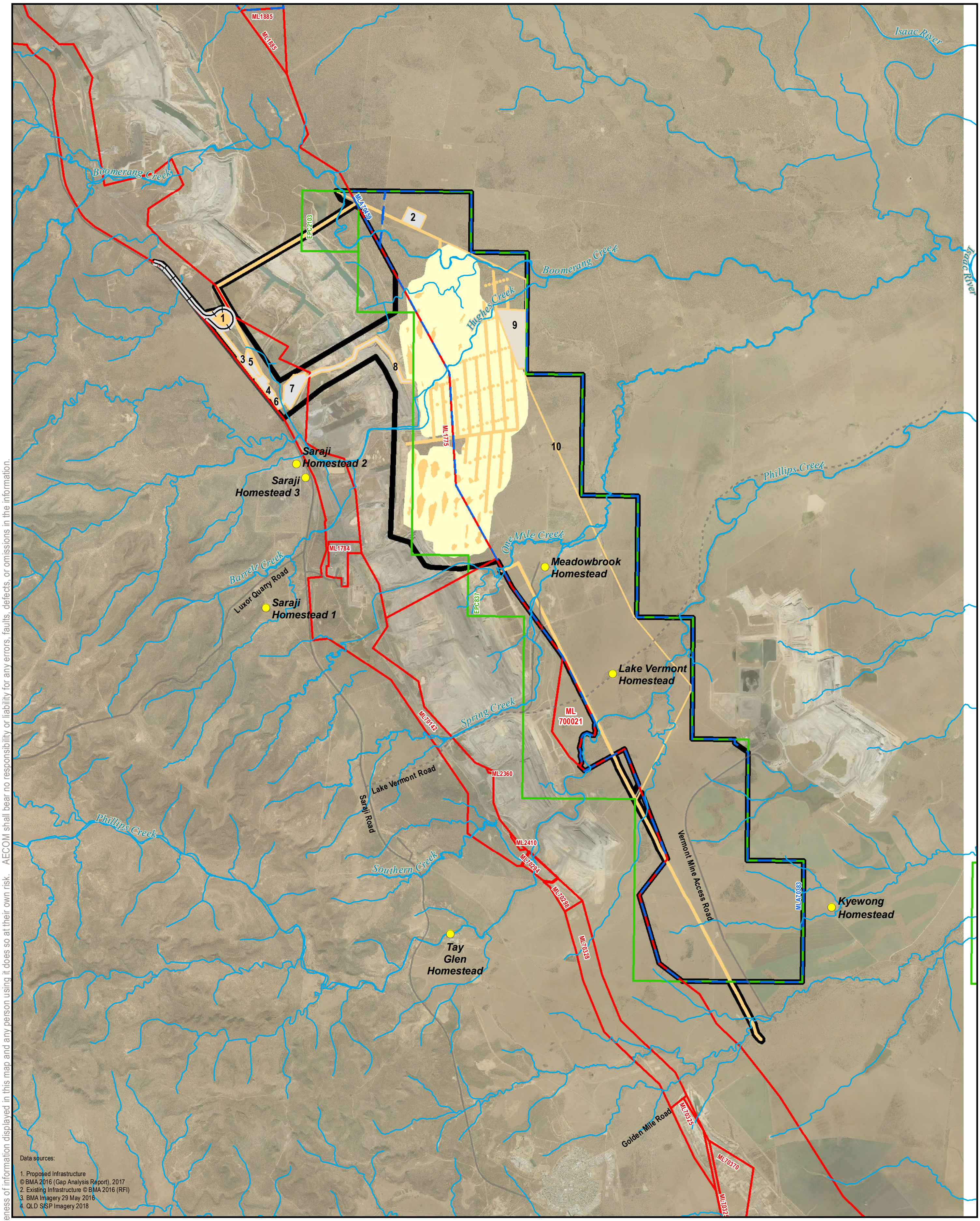
Sensitive receptors

A sensitive receptor is defined as a location that may be sensitive to impacts from the Project, such as residences, commercial or industrial facilities where people are present for an extended period of time. At air sensitive receptors, air quality goals must be met. Therefore, locations considered as part of this assessment are sensitive receptors located in the vicinity of the Project Site Table 11-3 and Figure 11-1.

With the exception of the Lake Vermont Homestead and Meadowbrook Homestead, all assessment locations are privately owned (see Table 11-3). There are currently co-existence agreements in place between BMA and landholders at Saraji Homestead 2 and Saraji Homestead 3. Discussions between BMA and the Saraji Homestead 1 landholder concerning a co-existence agreement have commenced. Despite these agreements in place, all homesteads within the vicinity of the Project have been assessed as sensitive receptors.

Table 11-3 Assessment locations

Location ID	Property reference	Ownership	Location
1	Kyewong Homestead	Private landholder	148.426, -22.511
2	Lake Vermont Homestead	BMA	148.360, -22.448
3	Saraji Homestead 1	Private landholder	148.259, -22.428
4	Saraji Homestead 2	Private landholder	148.268, -22.389
5	Saraji Homestead 3	Private landholder	148.268, -22.396
6	Tay Glen Homestead	Private landholder	148.313, -22.520
7	Meadowbrook Homestead	BMA - Unoccupied	148.339, -22.420



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road
- Rail loop
- Watercourse

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

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Figure 11-1
Project layout and homestead

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 8/07/2024 VERSION: 4

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11.4.2 Emission scenario

Construction Phase

The main pollutant of concern during construction will be the generation of dust associated with heavy vehicle movements, land clearing, and wind erosion. With the construction of the mine entry portal, conveyor, and CHPP occurring at already disturbed areas within the Saraji Mine ML, the generation of dust associated with these activities will be immaterial compared to other localised activities.

The main dust generating activity that will occur at locations off the SRM ML is the clearing of land associated with the construction of the proposed accommodation village.

Operational phase

In order to highlight the impact of dust emissions associated with the Operational Phase of the Project, three dust emission scenarios have been explicitly modelled:

- Project-Only Case (Peak BAU Case): Underground mining at a rate of 11 Mtpa ROM coal. As this is representative of the maximum annual production rate of coal from the Project, this scenario is considered to be conservative and representative of peak as opposed to typical operations. Results from the dispersion modelling for this scenario will be presented in isolation of any other dust emission sources, i.e. results will not include an estimate of current or future dust levels as a result of other dust emission sources that exist within the local airshed
- Project-Only Case (Peak Upset Case): As per the Peak BAU Case but incorporating less dust reduction measures, for example reduced haul road watering capacity. As these conditions are considered atypical, results for this scenario are only presented for the 24-hour average concentration of PM_{10}.
- Cumulative Impacts (Peak Mitigated Case): As per the Peak BAU Case but incorporating additional dust reduction measures, for example reducing heavy vehicle movements on the haul road between the Project CHPP and the SRM CHPP during adverse meteorological conditions.

11.4.3 Production data

The Project will mine a maximum of 11 Mtpa ROM coal. The Project CHPP will have the capacity to process seven Mtpa ROM coal with excess ROM coal trucked from the CHPP to the Saraji Mine CHPP for processing.

For the purposes of this assessment, an hourly peak throughput of 800 tonnes per hour (tph) through the Project CHPP and 500 tph through the Saraji Mine CHPP was assumed.

11.4.4 Dust emission sources

Dust emission sources that were explicitly accounted for in the dispersion modelling include:

- the conveying of coal from the underground mine portal to the Project CHPP
- the sizing of ROM coal
- the stacking and reclaiming of coal
- use of a dozer to assist reclaiming at the Project CHPP
- wind erosion from stockpiles located at the Project CHPP
- the transport of excess ROM coal to the Saraji Mine CHPP
- the dumping of ROM coal at the Saraji Mine CHPP
- stacking/reclaiming and sizing of coal at the Saraji Mine CHPP
- ventilation outlets.

The following potential air emission sources were not included in the dust dispersion model:

- emissions associated with the flaring of off-gases (emissions of greenhouse gases have been addressed in Section 11.5.2)

- emissions of dust associated with the handling of product coal which is considered to be immaterial due to its relatively high moisture content.

11.4.5 Dust management and reduction measures

Dust reduction measures that were adopted into the dispersion model for the Project are:

- watering of haul roads at a rate of more than two litres per metre squared per hour (i.e. level 2 watering)
- water sprays during crushing
- water sprays on stockpiles.

Upset conditions

From an air quality perspective, upset conditions could arise in relation to a failure of dust controls resulting in an increase in the amount of dust released into the atmosphere. As dust reduction measures typically rely on the availability of adequate water supply, any constraints in relation to water availability and/or the ability to deliver the required level of dust suppression (in particular) to haul routes, may lead to dust impacts in excess of that predicted based on typical operating conditions. Upset conditions as a result of water constraints have been considered in this assessment as the Peak Upset Case.

11.4.6 Dust emissions inventory

The National Pollutant Inventory (NPI) has produced a series of Emission Estimation Technique Manuals (EETM) that are intended to provide data on emissions of air pollutants from a wide variety of industries/activities.

For this assessment, the NPI EETM for Mining V3.1 (NPI, 2012) was used to provide data to estimate the amount of dust emitted from the various activities associated with the Project, incorporating site-specific information where available. Emission factors from the NPI EETM for Mining were supplemented with those from the US EPA's AP42 (USEPA, 1995) when required and/or considered appropriate.

A summary of the dust emission estimates for the Project is presented in Table 11-4 and presented in Figure 11-2 for the Peak BAU Case and Table 11-5 and Figure 11-3 for the Peak Upset Case. When developing estimates for $PM_{2.5}$, it was conservatively assumed that 20 per cent of PM_{10} is in the form of $PM_{2.5}$.

Further information regarding the development of the Project emissions inventory is available in **Appendix H-1 Air Quality Technical Report**.

Table 11-4 Project emission estimates (Peak BAU Case)

Emission source	Control	TSP (kg/year)	PM_{10} (kg/year)	$PM_{2.5}$ (kg/year)
Operational Phase (Peak BAU Case)				
Activities at Project CHPP				
Conveying of coal	50% U-shaped	1,659	829	166
Coal processing (breaker station)	50% water spray	139,840	50,589	10,118
Stacking/reclaiming coal	50% water spray	26,192	11,388	2,278
Dozers on coal	No controls	87,554	25,230	5,046
Wind erosion of stockpiles	No controls	2,393	1,197	239
Transport of excess ROM coal to Saraji CHPP	75% Level 2 watering	175,200	43,800	8,760
Activities at Saraji Mine CHPP				
Dumping of coal	50% water spray	21,900	9,198	1,840
Coal processing (breaker station)	50% water spray	33,288	12,045	2,409
Stacking/reclaiming coal	50% water spray	10,074	4,380	876
Underground Ventilation Outlets				
Underground Ventilation Outlets	No controls	49,720	24,860	4,972
Project total (kg/year)		**547,790**	**183,516**	**36,703**

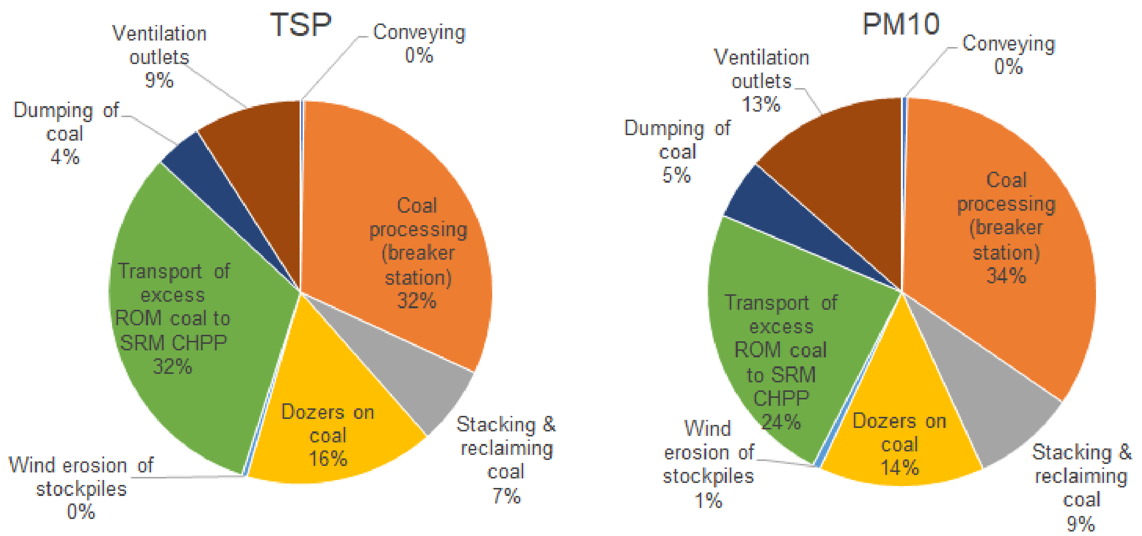


Figure 11-2 Summary of Project emissions inventory (Peak BAU Case)

Table 11-5 Project emission estimates (Peak Upset Case)

Emission source	Control	TSP (kg/year)	PM_{10} (kg/year)	$PM_{2.5}$ (kg/year)
Operational Phase (Upset)				
Activities at Project CHPP				
Conveying of coal	50% U-shaped	1,659	829	166
Coal processing (breaker station)	No controls	279,619	101,178	20,236
Stacking/reclaiming coal	No controls	52,385	22,776	4,555
Dozers on coal	No controls	87,554	25,230	5,046
Wind erosion of stockpiles	No controls	2,393	1,197	239
Transport of excess ROM coal to Saraji CHPP	50% Level 1 watering	350,400	87,600	17,520
Activities at Saraji Mine CHPP				
Dumping of coal	50% water spray	21,900	9,198	1,840
Coal processing (breaker station)	50% water spray	33,288	12,045	2,409
Stacking/reclaiming coal	50% water spray	10,074	4,380	876
Underground Ventilation Outlets				
Underground Ventilation Outlets	No controls	49,720	24,860	4,972
Project total (kg/year)		**888,992**	**289,293**	**57,859**

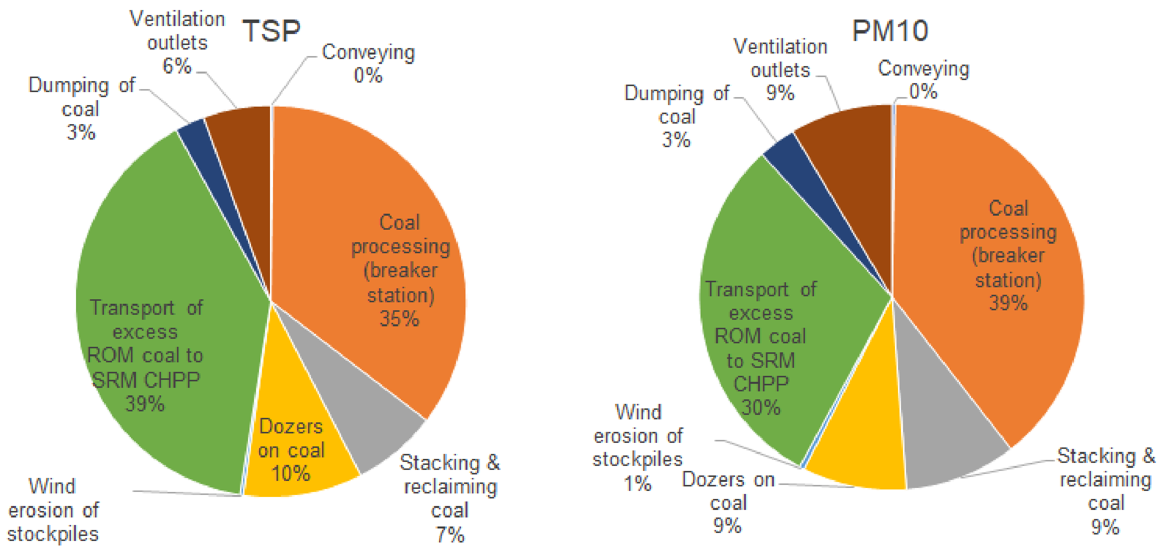


Figure 11-3 Summary of Project emissions inventory (Peak Upset Case)

11.4.7 Dust dispersion model

The dispersion model that was used for this assessment is based on the CALMET/CALPUFF suite of modelling tools (Scire et al., 2000).

Regional, three-dimensional wind fields that are used as input into the dispersion model were prepared using a combination of The Air Pollution Model developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Hurley, 2008), and CALMET, the meteorological pre-processor for CALPUFF (Scire, 2000). Due to the large areal extent of the model domain and the lack of observational data, data assimilation was not undertaken. Numerically simulated, hourly meteorology was developed corresponding to 2019.

Further information about the dispersion modelling assessment methodology, including the development of meteorology for the Project Site is available in **Appendix H-1 Air Quality Technical Report**.

11.5 Description of environmental values

11.5.1 Climate and meteorology

The Project is located in Central Queensland approximately 30 km north of Dysart and 170 km southwest of Mackay. The Central Queensland region generally experiences a warm subtropical climate, with distinct wet and dry seasons.

The nearest Australian Bureau of Meteorology (BoM) operated weather station to the Project with long term climate data available is the Moranbah Water Treatment Plant, located approximately 2.1 km northeast of Moranbah. Long term climatic trends in the vicinity of the Project Site have therefore been described by monitoring data collected at the Moranbah Water Treatment Plant station. A summary of long term average temperature and rainfall is presented in Table 11-6, and long-term wind roses are presented in Figure 11-4 and Figure 11-5.

Monthly mean rainfall values vary greatly, ranging from 9.1 millimetres (mm) (September) to 103.9 mm (December). Rainfall is highest in the months of summer: an average of 103.9 mm in December, 103.8 mm in January and 100.7 mm in February. Approximately 50 per cent of average annual rainfall is recorded during this season. Winter (June, July and August) is the clear dry season, with approximately 11 per cent of total annual average rain occurring in these months.

In summer, the average maximum temperature ranges from 33.1°C (November) to 34.0°C (December) and the average minimum temperature ranges from 21.1°C (December) to 21.9°C (January). In winter, the average maximum temperature ranges from 23.7°C (June and July) to 25.5°C (August) and the average minimum temperature ranges from 9.9°C (July) to 11.2°C (June).

Table 11-6 Long term monthly averages for rainfall and mean max and minimum temperatures recorded at Moranbah Water Treatment Plant BoM station (operational 1972 – 2012)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm)	103.8	100.7	55.4	36.4	34.5	22.1	18.0	25.0	9.1	35.7	69.3	103.9	613.9
Mean maximum temperature (°C)	33.8	33.1	32.1	29.5	26.5	23.7	23.7	25.5	29.2	32.3	33.1	34.0	29.7
Mean minimum temperature (°C)	21.9	21.8	20.2	17.6	14.2	11.2	9.9	11.1	14.1	17.6	19.4	21.1	16.7

The BoM annual 9 am wind rose Figure 11-4 shows that over 40 per cent of winds at this time are from the east and are of low to moderate strength. Winds at 3 pm Figure 11-5 are also most frequently from the east and are also of low to moderate strength.

In addition to the BoM observed data, a site specific numerically simulated dataset was developed using CALMET. Further details on the CALMET dataset are provided in **Appendix H-1 Air Quality Technical Report**.

Rose of Wind direction versus Wind speed in km/h (10 Jan 1986 to 26 Mar 2012)

Custom times selected, refer to attached note for details

MORANBAH WATER TREATMENT PLANT

Site No: 034038 • Opened Jan 1972 • Closed Apr 2012 • Latitude: -21.9947° • Longitude: 148.0308° • Elevation 260m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

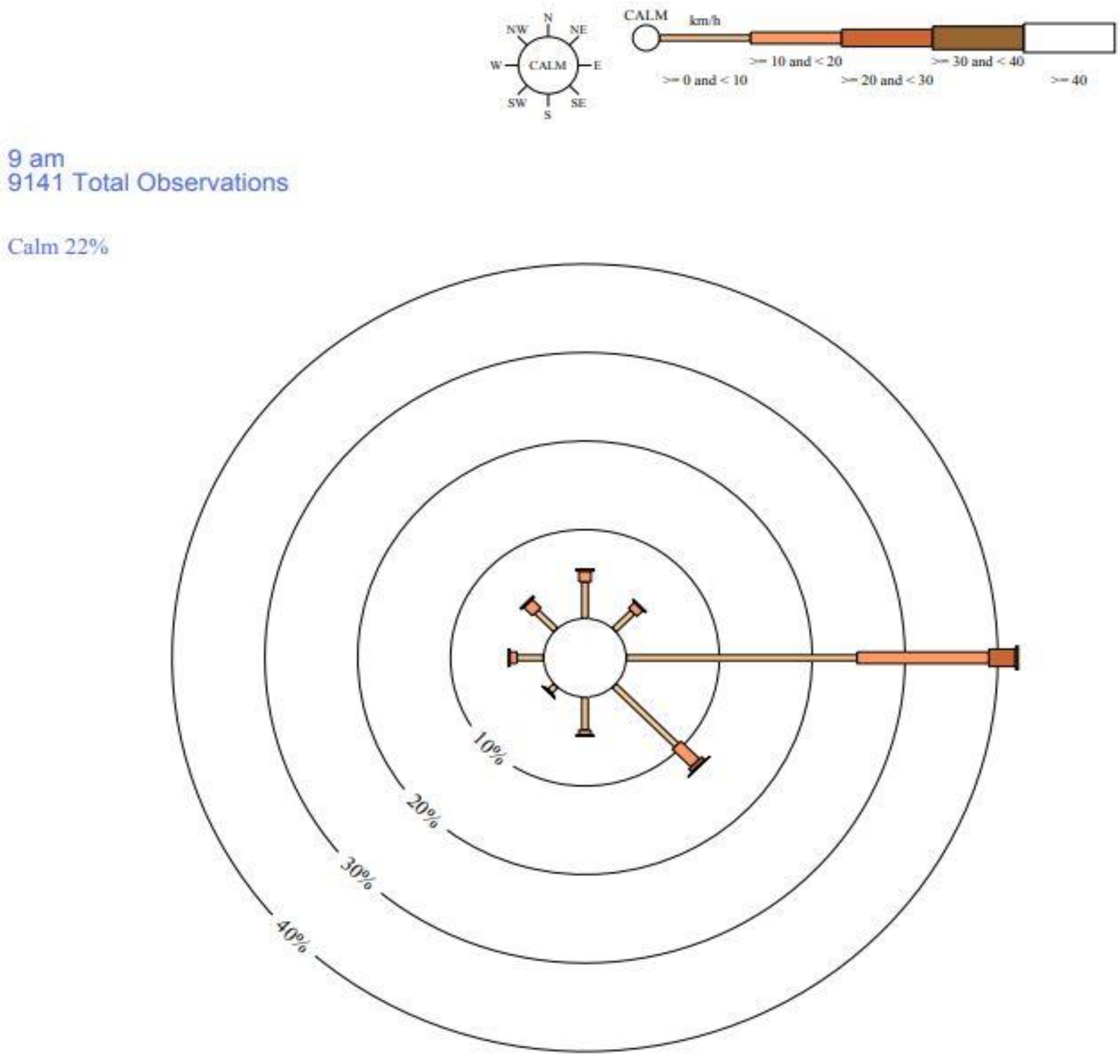
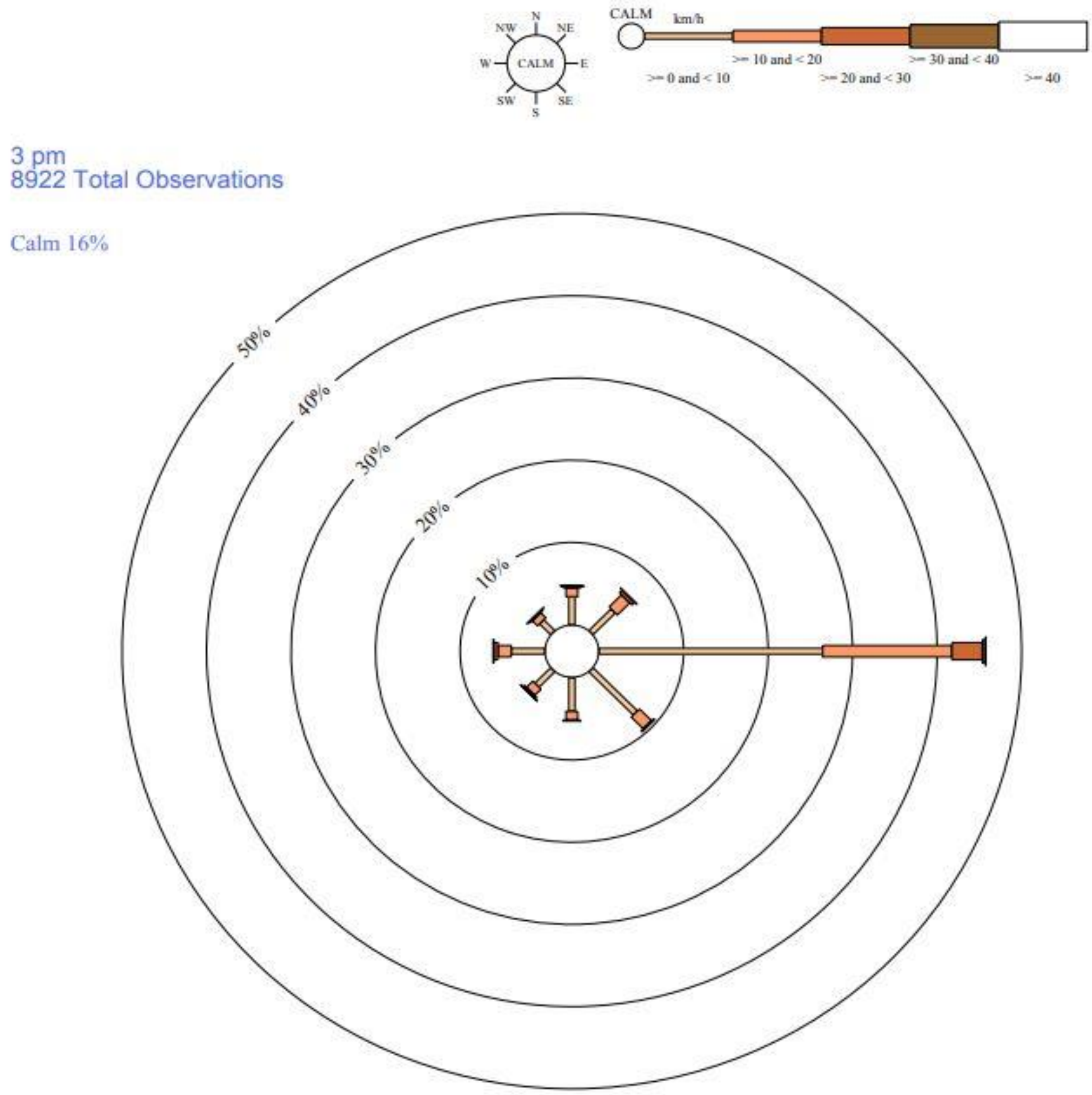


Figure 11-4 BoM Moranbah Water Treatment Plant annual 9 am wind rose

Rose of Wind direction versus Wind speed in km/h (10 Jan 1986 to 26 Mar 2012)
Custom times selected, refer to attached note for details

MORANBAH WATER TREATMENT PLANT
Site No: 034038 • Opened Jan 1972 • Closed Apr 2012 • Latitude: -21.9947° • Longitude: 148.0308° • Elevation 260m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



TCZANNUAL Page 1

Figure 11-5 BoM Moranbah Water Treatment Plant annual 3 pm wind rose

11.5.2 Greenhouse gas inventory methodology

Note: Appendix H-1 Air Quality Report of the EIS references an ‘Appendix J-1 Greenhouse Gas Inventory and Assessment Report’. The reference is in error and the greenhouse gas inventory and assessment has been documented within this Chapter 11.

An inventory of GHG emissions for the Project was prepared in accordance with the Australian Standard (AS) ISO14064.1 (2006): *Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*.

GHG emissions attributable to the Project were considered in terms of three ‘scopes’ of emission categories. These three ‘scopes’ are described below and in Figure 11-6 Overview of scope and emissions across a reporting entity (Source: Greenfleet)

- **Scope 1 emissions -** releases of GHG into the atmosphere as a direct result of a Project activity or series of Project activities (including ancillary activities). For example, fugitive emissions released from the coal seam as coal is extracted during the production process, or emissions from diesel consumed onsite in machinery.
- **Scope 2 emissions -** releases of GHG into the atmosphere as a direct result of one or more Project activities that generate electricity, heating, cooling or steam that is consumed by the Project but that do not form part of the Project. For example, the consumption of electricity by Project infrastructure, where the electricity has been generated outside of the Project Footprint.
- **Scope 3 emissions -** other indirect GHG emissions that occur outside the Project Footprint. For example, third party emissions from transportation of coal and subsequent use of the coal.

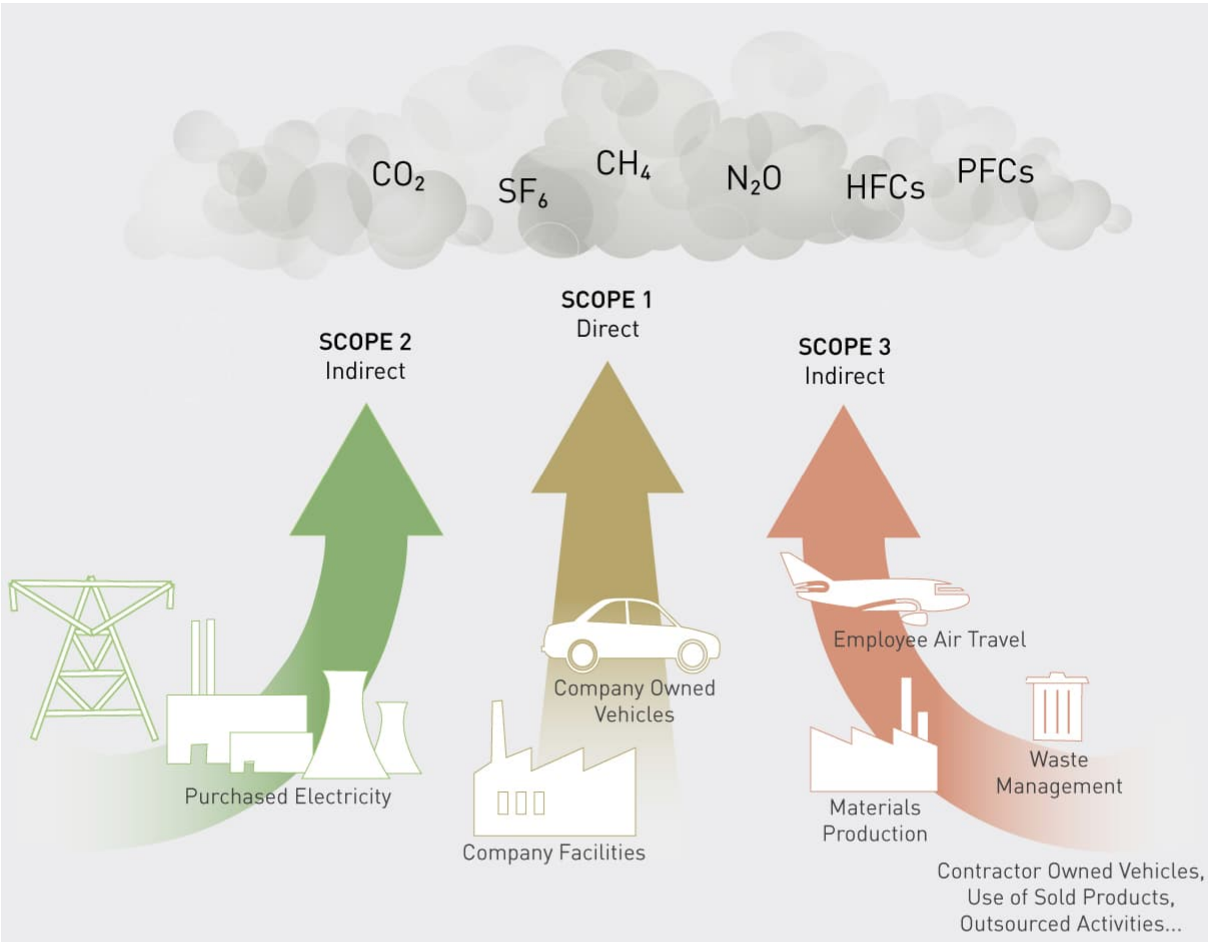


Figure 11-6 Overview of scope and emissions across a reporting entity (Source: Greenfleet)

The purpose of separating different types of emissions into scopes is to avoid the potential for double counting. Double counting occurs when two or more organisations assume responsibility for the same emissions.
Scope 1 and Scope 2 emissions must be reported under the NGER Act; however, reporting Scope 3 emissions is voluntary. The NGER Act states that the following gases must be reported:

- carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)
- hydrofluorocarbons (HFC)
- perfluorocarbons (PFC)
- sulphur hexafluoride (SF_6).

CO_2-e was used to assess GHG emissions from the Project. For a given mixture and amount of GHG, CO_2-e describes the amount of CO_2 that would have the same global warming potential (GWP) when measured over a specified time scale (100 years). The GWP of a GHG is the radiative forcing impact contributing to global warming, relative to one unit of CO_2. Because CO_2 is used as the reference gas, it has a GWP of one.

Inventory principles

The GHG inventory in Table 11-8 was developed to satisfy AS ISO14064.1 (2006): *Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals* as well as The Greenhouse Gas Protocol (WBCSD & WRI, 2004).

The principles behind the GHG inventory, and how/where they have been addressed in the context of the Project, are provided in Table 11-7.

Table 11-7 Principles of the GHG inventory

Principle	Requirements	Addressed
Relevance	Ensure the inventory appropriately reflects the emissions of the Project.	GHG emissions from the Project have been estimated as per Terms of Reference (ToR) for the EIS. Scope 1 and Scope 2 emissions cover emissions from the Mining Lease (ML). Scope 3 emissions cover emissions associated with transporting personnel and the end use(s) of coal from the proposed mine.
Completeness	Account for, and report on, all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.	The GHG inventory covers all Scope 1 and Scope 2 emissions from the Project. GHG emissions from the following sources are relatively minor in terms of the overall emissions and therefore have not been estimated: • land clearing • petrol vehicles • fugitive emissions from wastewater treatment.
Consistency	Use consistent methodologies to allow for meaningful comparisons of emissions over time.	Emissions have been estimated using the published emission factors provided in Table 11-8. Estimating future GHG emissions and reporting emissions under the NGER Act will follow the same methodology.
Transparency	Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies, and data sources used.	Emissions have been estimated using the published emission factors provided in Table 11-8.

Principle	Requirements	Addressed
Accuracy	Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.	Although care was taken when estimating the Project's projected energy usage and coal production rates, a high level of uncertainty surrounds the predicted GHG emissions from the Project. The inherent uncertainty associated with using the latest National Greenhouse Accounts (NGA) emission factors (August 2021) to estimate future emissions, without allowing for futuristic changes to emission factors, is a major source of uncertainty. Currently, the emissions factor of electricity purchased from the Queensland grid is 0.73 t CO_2-e per megawatt hour (MWh). In the future, the emissions factor might decrease as the penetration of renewable energy increases.

Emission factors

The NGA emissions factors (Department of Industry, Science, Energy and Resources, 2021) presented in Table 11-8 were used to prepare the GHG inventory.

Table 11-8 National Greenhouse Accounts emissions factors

Emission source	Energy content	Scope of emissions	GHG emission factor	Units	Source
Coal mine waste gas that is captured for combustion	0.0377 GJ/m^3	1	56.8	kg CO_2-e/GJ of incidental mine gas combusted	National Greenhouse Accounts Factors (August 2021) (DoISER, 2021)
Post-mining activities associated with gassy underground mines	N/A	1	0.019	t CO_2-e per tonne of raw coal mined	
Consumption of diesel fuel	38.6 GJ/kL	1	70.4	kg CO_2-e/GJ of diesel fuel consumed	
Consumption of electricity	-	2	0.73	kg CO_2-e/MWh consumed	
Consumption of coking coal	30 GJ/t	3	92.03	kg CO_2-e/GJ consumed	
Transporting coal by rail	N/A	3	13	Grams of CO_2-e per net tonne of coal, per kilometre travelled	BMA supplied estimation of rail emissions (electric locos)
Handling coal at the terminal	N/A	3	1,174	t CO_2-e per Mt of coal handled	BMA supplied estimation of coal terminal emissions
Diesel consumption by the coal bulk carrier	N/A	3	65.7	kL/Mt coal	Caval Ridge Mine EIS, 2010
Kerosene for use as an aviation fuel (for transporting fly in fly out workers)	36.8 GJ/kL	3	70.21	kg CO_2-e/kGJ	National Greenhouse Accounts Factors (August 2021) (DoISER, 2021)
Electricity purchased	N/A	3	0.12	kg CO_2-e/MWh generated	
Diesel fuel combusted	N/A	3	3.6	kg CO_2-e/GJ	

11.5.3 Background air quality

The Project is to be located within an airshed that includes BMA's Saraji Mine, Peak Downs Mine and Norwich Park Mine, as well as Jellinbah Group's Lake Vermont Mine.

For this assessment (and in the absence of suitable site-specific data from which to calculate background levels of dust) estimates of background dust levels (Table 11-9) were developed using data from the Caval Ridge Mine Site 2 (BMA CVM Site 2) ambient air monitoring station located approximately four kilometres (km) northwest of the Moranbah Airport, 2.5 km south of Moranbah and 38 km north-northwest of the Project Site. This location is considered to be sufficiently representative of the background level of dust that would occur in the vicinity of the Project in the absence of anthropogenic activities.

As recommended by the Victorian Environment Protection Authority (Vic EPA), 70th percentile values were used to estimate background levels for the 24 hour average concentration of PM_{10} and $PM_{2.5}$. Background levels of annual average TSP, PM_{10} and $PM_{2.5}$ were estimated using annual average values. The estimated background level of dust deposition is based on an average of data for the period February 2014 through November 2015. For further information see **Appendix H-1 Air Quality Technical Report**.

Table 11-9 below includes the percentage of the Project goal that is represented by the estimated background level, ranging from 36 per cent for dust deposition to 91 per cent for the annual average concentration of the PM_{10}.

Table 11-9 Estimated background air pollutant levels

Pollutant	Averaging period	Estimated background level	Percentage of goal	Source
TSP	Annual	39.4 µg/m^3	44%	BMA CVM Site 2
PM_{10}	24 hour	24.7 µg/m^3	49%	BMA CVM Site 2
	Annual	22.8 µg/m^3	91%	BMA CVM Site 2
$PM_{2.5}$	24 hour	18.8 µg/m^3	75%	BMA CVM Site 2
	Annual	4.1 µg/m^3	51%	BMA CVM Site 2
Dust deposition	Monthly	43.6 mg/m^2/day	36%	BMA CVM Site 2

11.6 Potential impacts

11.6.1 Project-only air quality impacts

Presented in this section are the results for the annual average concentration of TSP, the 24 hour and annual average concentration of PM_{10} and $PM_{2.5}$, as well as the monthly average dust deposition for the Project-only Peak BAU Case and Peak Upset Case.

Health related criteria

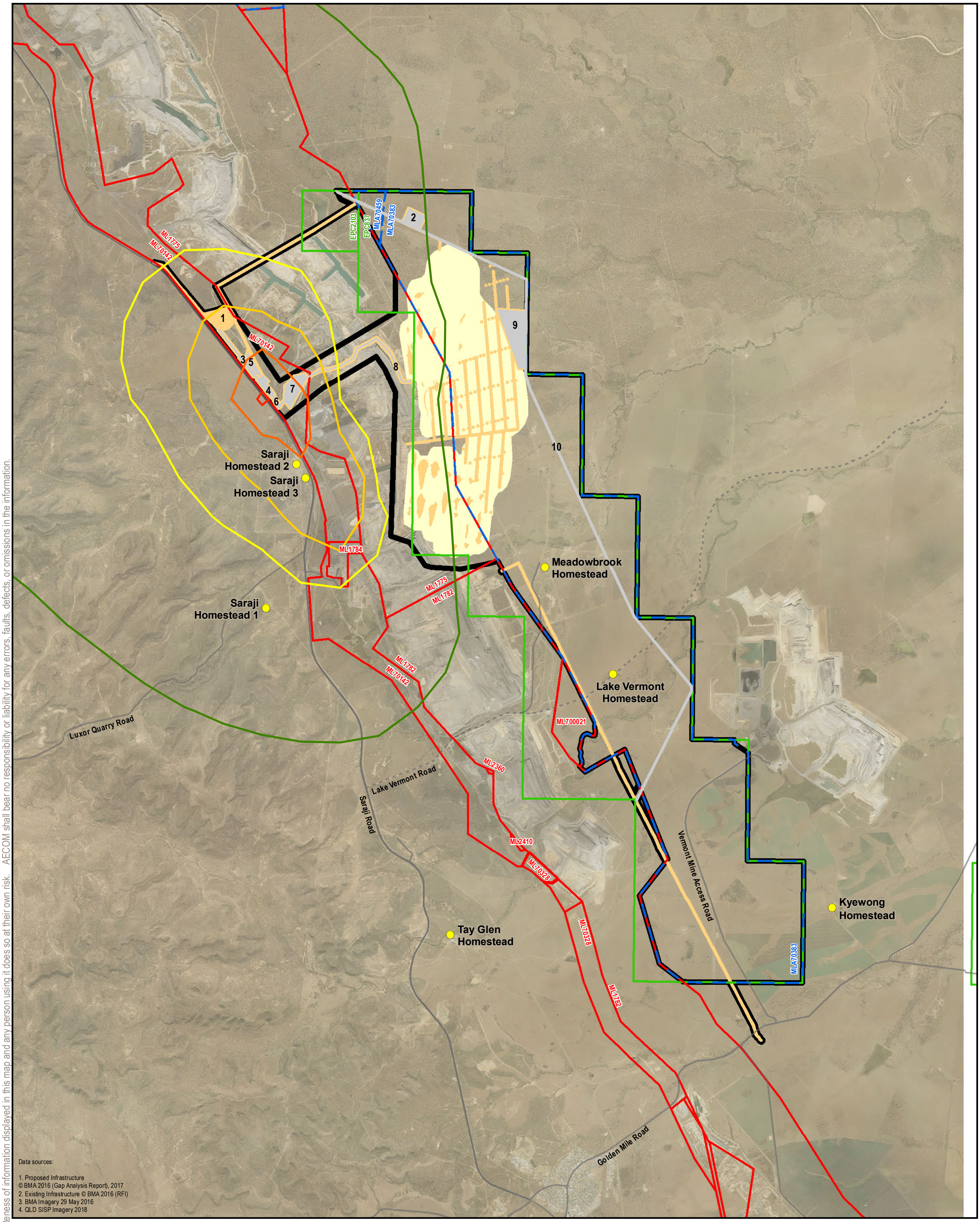
Results for TSP

Presented in Table 11-10 are the predicted annual average concentrations of TSP for the Peak BAU Case. Results of the dispersion modelling do not highlight any significant issues in relation to emission of TSP from the Project (in isolation) with annual concentrations predicted to be less than approximately 28 per cent of the Project goal of 90 microgram per cubic metre (µg/m^3) at receptor locations.

Table 11-10 Project-only Peak BAU Case predicted concentration of TSP at receptor locations

ID	Description	Averaging period	Peak BAU Case (µg/m³)	Percentage of goal
1	Kyewong Homestead	Annual	0.0	0%
2	Lake Vermont Homestead	Annual	0.1	0%
3	Saraji Homestead 1	Annual	3.6	4%
4	Saraji Homestead 2	Annual	25.3	28%
5	Saraji Homestead 3	Annual	20.3	23%
6	Tay Glen Homestead	Annual	0.3	0%
7	Meadowbrook Homestead	Annual	0.4	0%

Presented in Figure 11-7 is a contour plot of the annual average concentration of TSP.



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

Total Suspended Particulate μg/m³

- 1
- 5
- 10
- 25
- 50

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

N

Figure 11-7
Annual average concentration of TSP (Peak BAU Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

BHP Mitsubishi Alliance

DATE: 5/07/2024 VERSION: 6

Results for PM_{10}

Presented in Table 11-11 is the maximum predicted 24 hour average and annual average concentration of PM_{10} at the receptor locations as a result of emissions of dust from the Project (in isolation of other dust emissions sources). Results for both the Peak BAU Case and Peak Upset Case are included in the table. The results presented exclude estimates of background levels of dust.

Under the Peak BAU case, Project-only contributions to the maximum 24 hour average concentration of PM_{10} are predicted to be below the Project goal of 50 µg/m^3 at all assessment locations. Predicted annual average concentrations of PM_{10} are also below the Project goal of 25 µg/m^3 at all assessment locations.

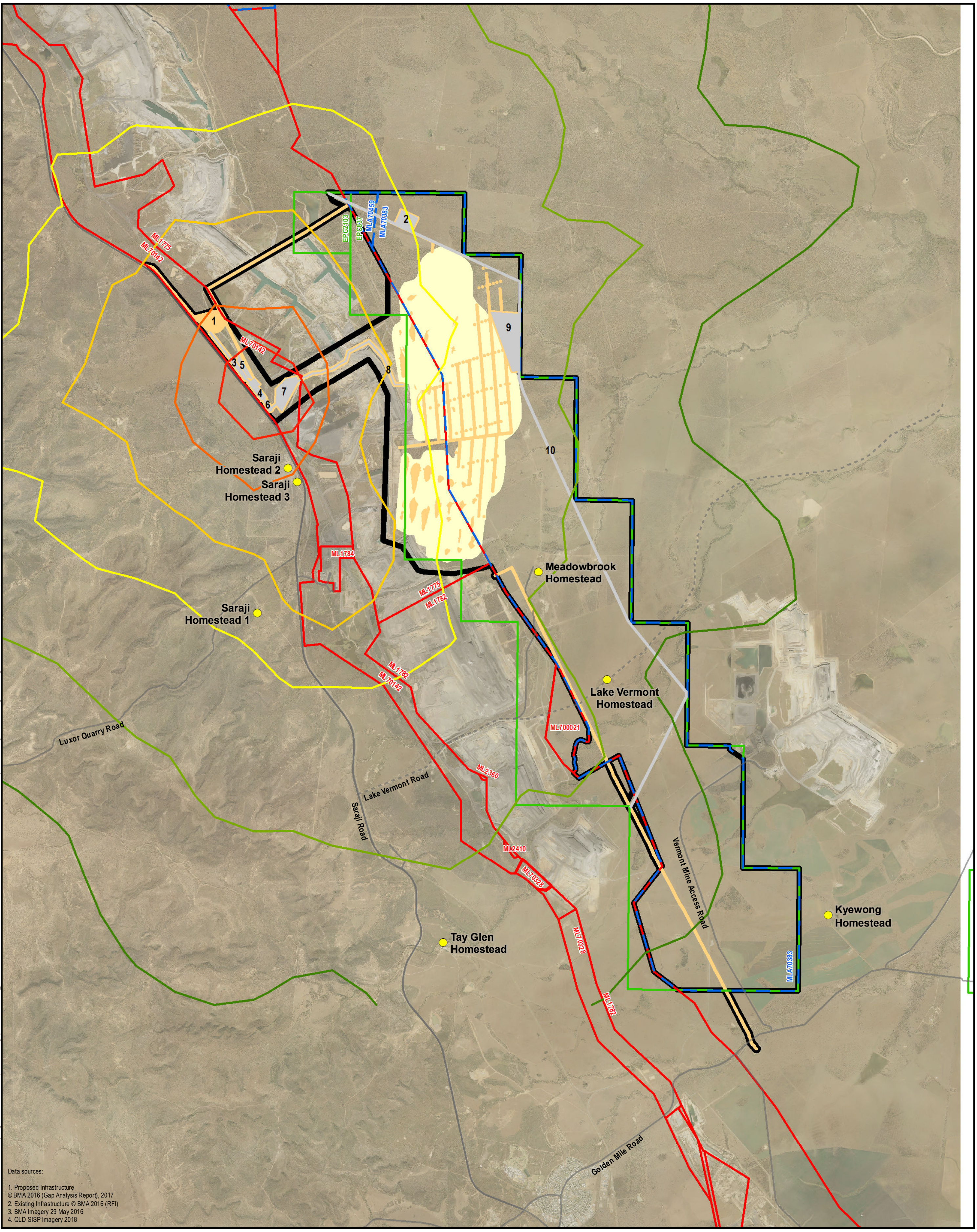
Results of the dispersion modelling based on the Peak Upset Case highlight the potential for adverse impacts of dust at both Saraji Homestead 2 based on Project dust emission sources alone.

Background levels for the 24 hour average concentration of PM_{10} are estimated to be 24.7 µg/m^3 (or 49 per cent of the Project goal) while background levels for the annual average concentration of PM_{10} are estimated to be 22.8 µg/m^3 (or 91 per cent of the Project goal) (Section 11.5.2). Therefore, results of the dispersion modelling suggest that additional dust reduction measures (relative to the Peak BAU Case) may be required to mitigate the risk of exceedances at Saraji Homestead 2 and Saraji Homestead 3. Mitigation measures are discussed in Section 11.7.1.

Table 11-11 Project-only predicted emissions of PM_{10} at receptor locations

ID	Description	Averaging period	Peak BAU Case		Peak Upset Case	
			Project-only (µg/m^3)	Percentage of goal	Project-only (µg/m^3)	Percentage of goal
1	Kyewong Homestead	24 hour	0.5	1%	0.8	2%
		Annual	0.0	0%	-	-
2	Lake Vermont Homestead	24 hour	1.4	3%	2.3	5%
		Annual	0.1	0%	-	-
3	Saraji Homestead 1	24 hour	8.7	17%	12.2	24%
		Annual	1.2	5%	-	-
4	Saraji Homestead 2	24 hour	30.2	60%	**55.8**	**112%**
		Annual	7.0	28%	-	-
5	Saraji Homestead 3	24 hour	21.7	43%	39.5	79%
		Annual	5.6	22%	-	-
6	Tay Glen Homestead	24 hour	1.5	3%	2.4	5%
		Annual	0.1	0%	-	-
7	Meadowbrook Homestead	24 hour	2.1	4%	3.4	7%
		Annual	0.1	0%	-	-

Figure 11-8 is a contour plot of the maximum 24 hour average concentration of PM_{10} for the Peak BAU Case. A contour plot for the Peak Upset Case is included as Figure 11-9. Presented in Figure 11-10 is a contour plot of the maximum annual average concentration of PM_{10} for the Peak BAU Case.



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

PM_{10} µg/m³

- 1
- 2
- 5
- 10
- 25
- 50

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

N

Figure 11-8
Maximum 24 hour average concentration of PM_{10} (Peak BAU Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 5/07/2024 VERSION: 6

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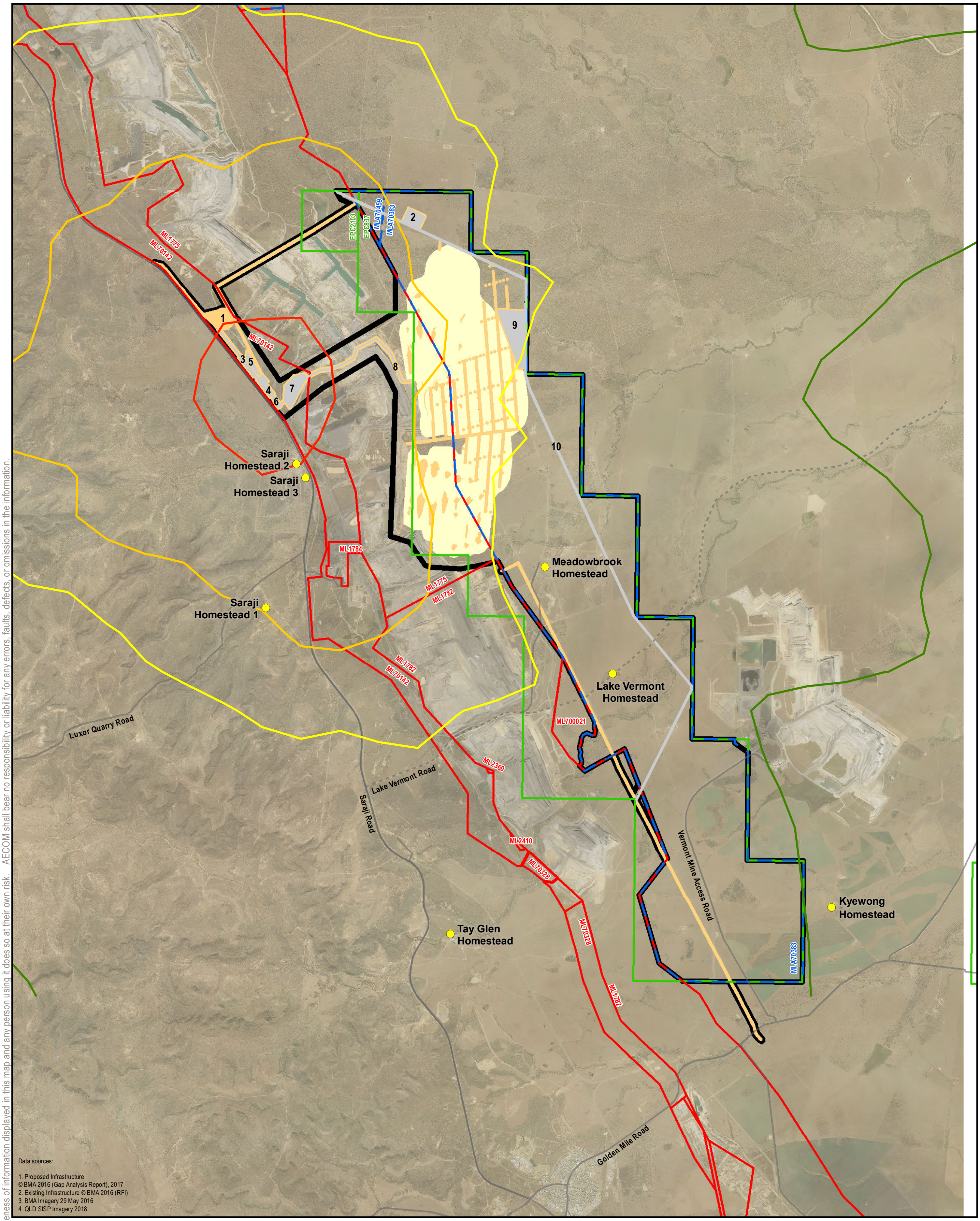

LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

PM_{10} µg/m³

- 1
- 5
- 10
- 50

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

N

Figure 11-9
Maximum 24 hour average concentration of PM_{10} (Peak Upset Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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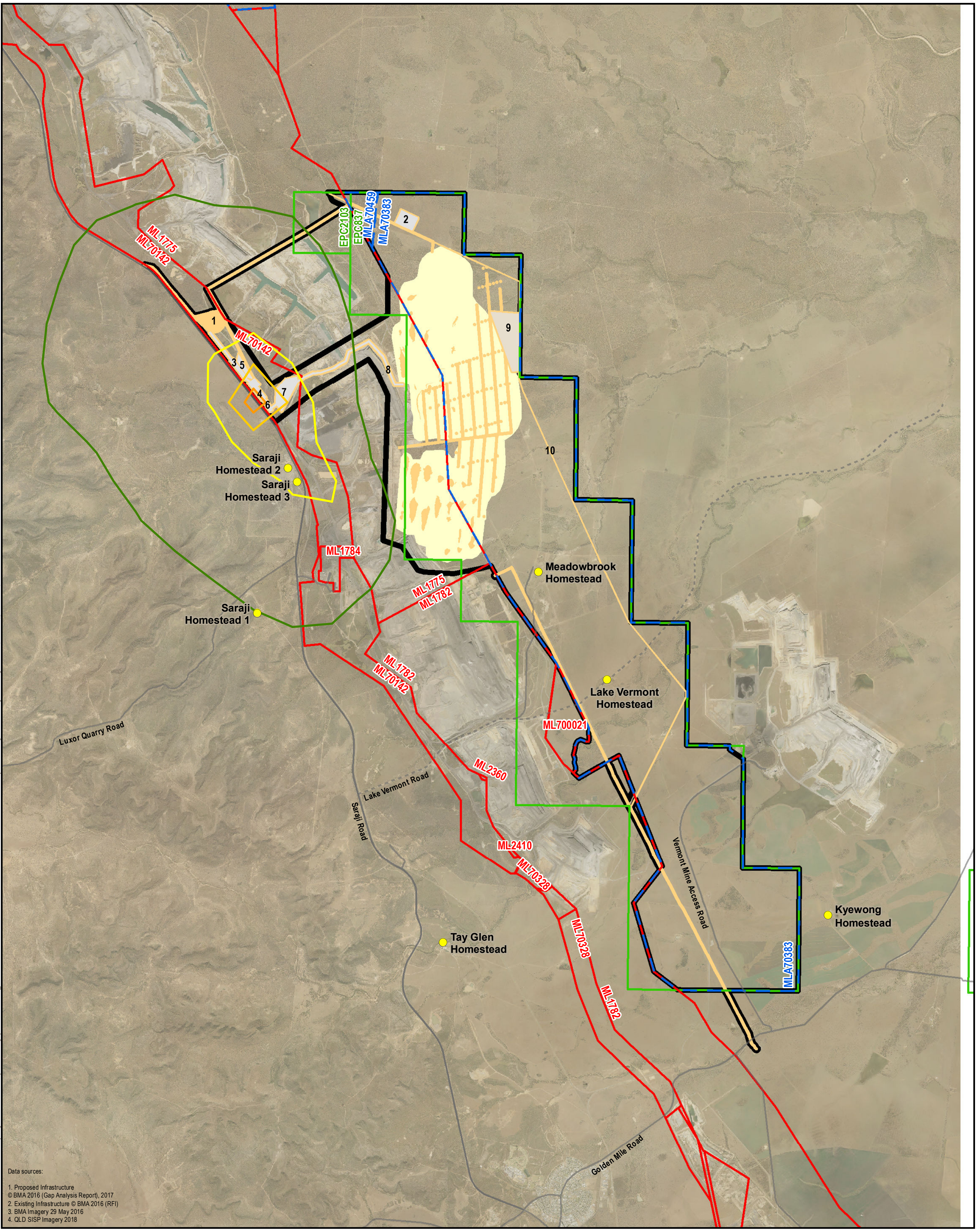
DATE: 5/07/2024 VERSION: 5



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

PM_{10} Annual Average µg/m^3

- 1
- 5
- 10
- 15

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

N

Figure 11-10
Annual average concentration of PM_{10} (Peak BAU Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

BMA
BHP Mitsubishi Alliance

DATE: 5/07/2024 VERSION: 6

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Results for $PM_{2.5}$

Table 11-12 presents the results for the maximum 24-hour average and annual average concentration of $PM_{2.5}$ for the Project-only case at receptor locations. Results for both the Peak BAU Case and Peak Upset Case are included in the table. The results presented exclude estimates of background levels of dust.

Project-only contributions to the 24-hour average concentrations of $PM_{2.5}$ at the Saraji 2 Homestead and Saraji 3 Homestead are predicted to be 24 per cent and 17 per cent of the Project goal of 25 µg/m^3 for $PM_{2.5}$, respectively, for the Peak BAU Case. Project-only contributions to $PM_{2.5}$ impacts at all other receptors are predicted to be minor and well below the Project goal of 25 µg/m^3.

Under the Peak Upset Case, Project-only contributions to the 24-hour average concentrations of $PM_{2.5}$ are predicted to be 45 per cent of the Project goal of 25 µg/m^3 at the Saraji 2 Homestead, and lower at all other receptors.

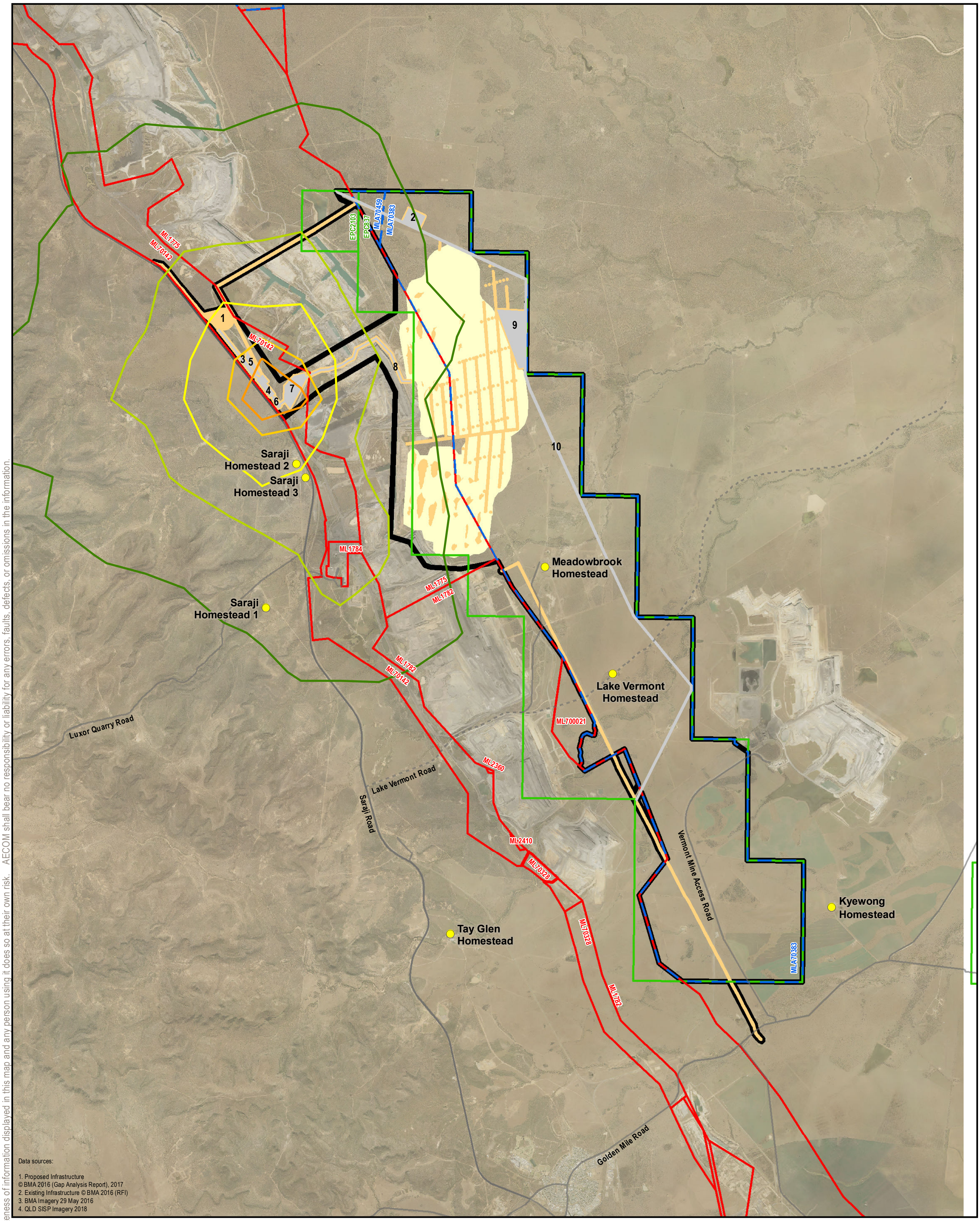
Background levels for the 24-hour average concentration of $PM_{2.5}$ are estimated to be 17.7 µg/m^3 (or 75 per cent of the Project goal, refer Table 11.8). Therefore, results of the dispersion modelling suggest that additional mitigation measures may be required to prevent exceedances of the Project goal for $PM_{2.5}$ occurring at Saraji Homestead 2 during the 24 hour averaging period under the Peak Upset Case. Mitigation measures are discussed in Section 11.7.1.

Figure 11-11 presents the maximum 24 hour average concentration of $PM_{2.5}$ under the Peak BAU Case, while Figure 11-12 presents the same for the Peak Upset Case.

No significant air quality issues attributable to the Project were identified in relation to the annual average concentration of $PM_{2.5}$ with Project-only contributions predicted to be less than 17 per cent of the Project goal of 8 µg/m^3. A contour plot is presented in Figure 11-13 for the annual average concentration of $PM_{2.5}$ under the Peak BAU Case.

Table 11-12 Project-only predicted emissions of $PM_{2.5}$ at receptor locations

ID	Description	Averaging period	Peak BAU Case		Peak Upset Case	
			Project-only (µg/m3)	Percentage of goal	Project-only (µg/m3)	Percentage of goal
1	Kyewong Homestead	24 hour	0.1	0%	0.2	1%
		Annual	0.0	0%	-	-
2	Lake Vermont Homestead	24 hour	0.3	1%	0.5	2%
		Annual	0.0	0%	-	-
3	Saraji Homestead 1	24 hour	1.7	7%	2.4	10%
		Annual	0.2	3%	-	-
4	Saraji Homestead 2	24 hour	6.0	24%	11.2	45%
		Annual	1.4	17%	-	-
5	Saraji Homestead 3	24 hour	4.3	17%	7.9	32%
		Annual	1.1	14%	-	-
6	Tay Glen Homestead	24 hour	0.3	0%	0.5	2%
		Annual	0.0	0%	-	-
7	Meadowbrook Homestead	24 hour	0.4	0%	0.7	3%
		Annual	0.0	0%	-	-



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

$PM_{2.5}$ µg/m³
- 1
- 2.5
- 5
- 10
- 15

Surface Infrastructure
1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

Figure 11-11
Maximum 24 hour average concentration of $PM_{2.5}$ (Peak BAU Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)
Projection: Map Grid of Australia - Zone 55 (GDA94)

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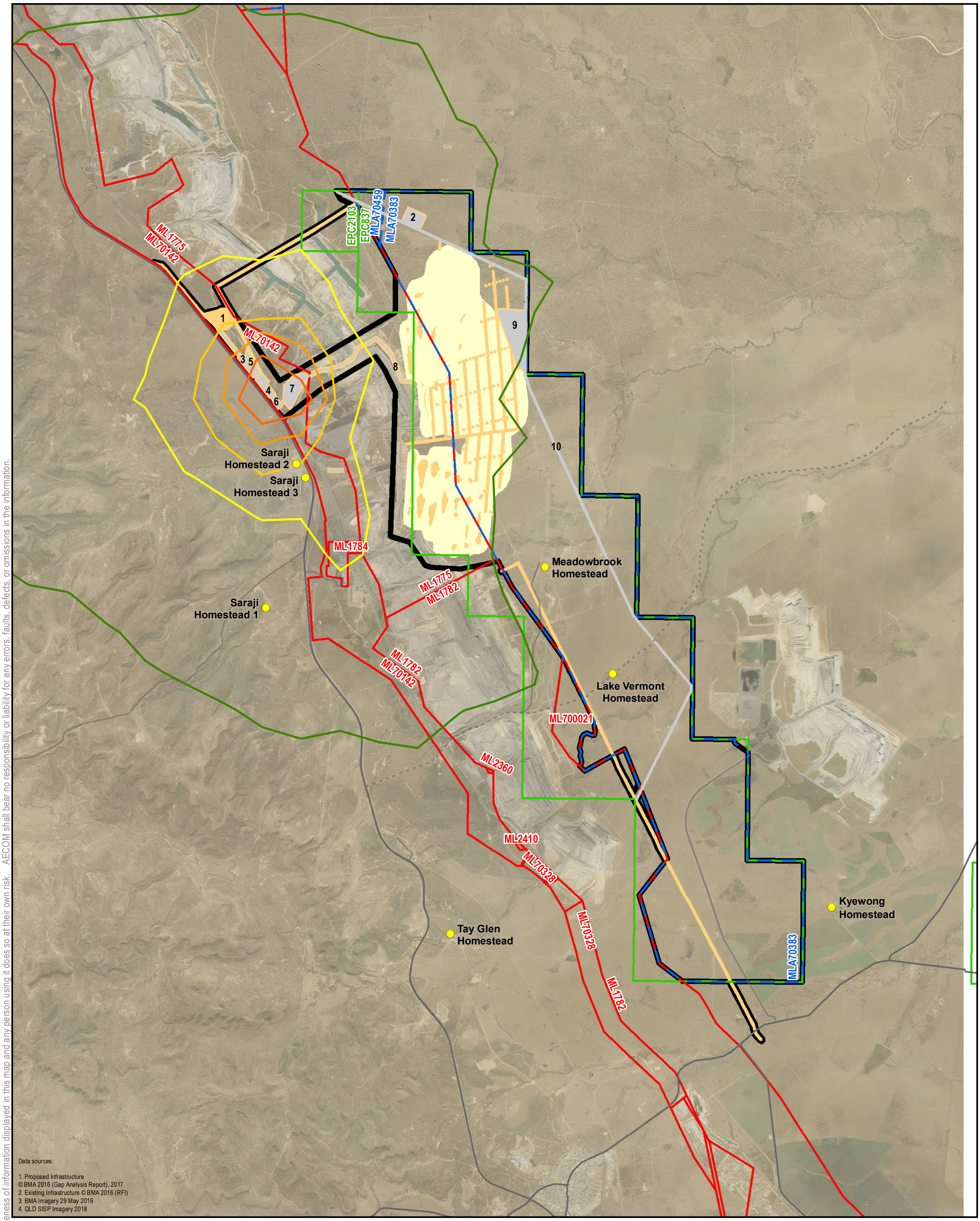

LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

PM2.5 μg/m³

- 1
- 5
- 10
- 15
- 25

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

N

Figure 11-12
Maximum 24 hour average concentration of $PM_{2.5}$ (Peak Upset Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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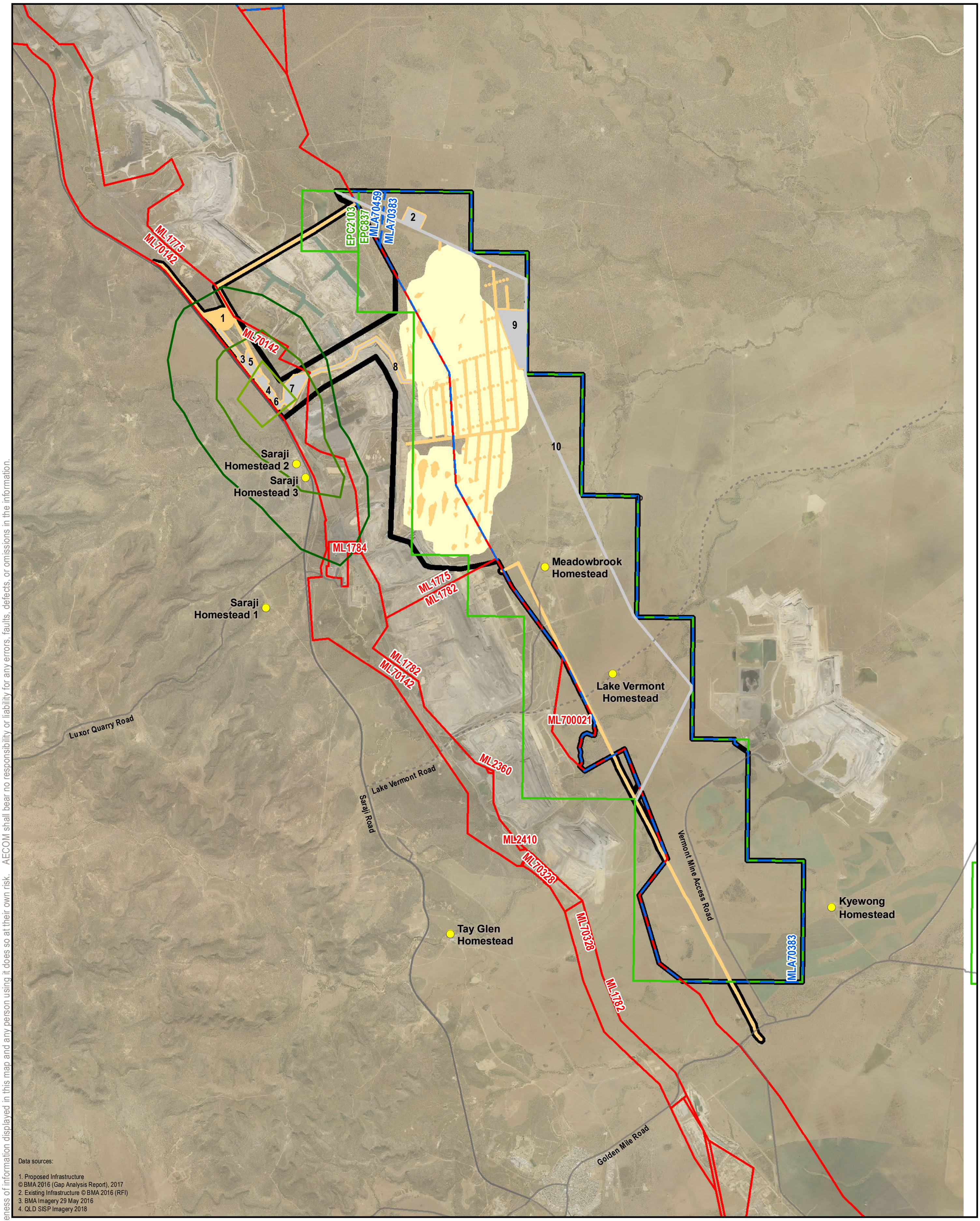

LEGEND

- Project Site
- Exploration Permit Coal (EPC)
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- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Public Road
- Private Access Road

Average Annual $PM_{2.5}$ µg/m³

- 0.5
- 1
- 2

Surface Infrastructure

1 Rail Loading Balloon Loop
2 Process Water Dam
3 Product Stockpiles
4 CHPP
5 Raw Water Dam
6 ROM Pad
7 Future MIA
8 Conveyor
9 Construction Village
10 Transport and Infrastructure Corridor

N

Figure 11-13
Annual average concentration of $PM_{2.5}$ (Peak BAU Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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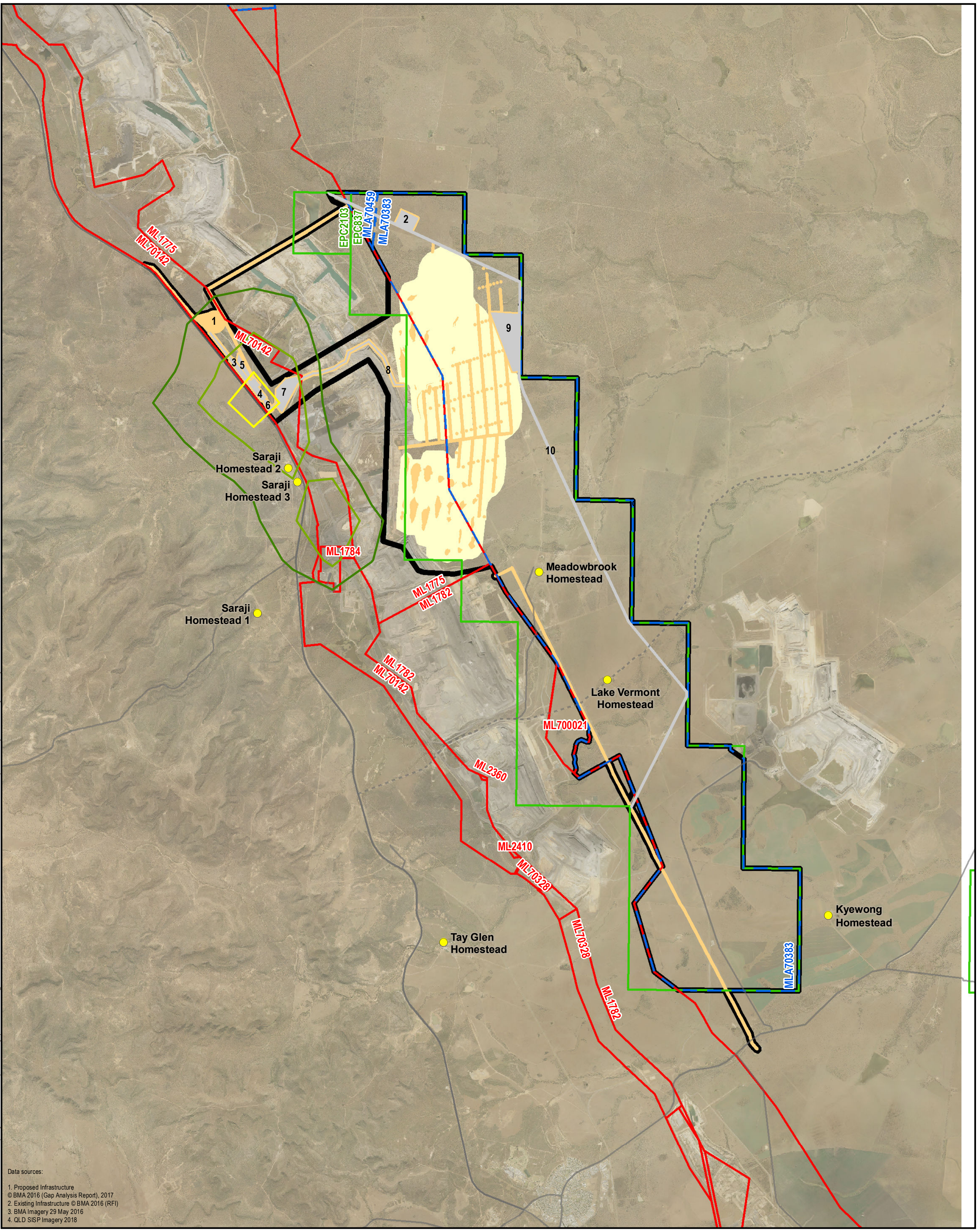
Nuisance related criteria – dust deposition results

Table 11-13 shows the results for dust deposition for the Project-only Peak BAU Case. No air quality issues have been identified, with Project-only contributions predicted to be less than or equal to two per cent of the Project goal at all receptor locations.

A contour plot of the predicted maximum 30-day average dust deposition is included as Figure 11-14.

Table 11-13 Project-only predicted emissions of dust deposition at receptor locations

ID	Description	Averaging period	Project-only ($mg/m^2/day$)	Percentage of goal
1	Kyewong Homestead	30 day	0.0	0%
2	Lake Vermont Homestead	30 day	0.0	0%
3	Saraji Homestead 1	30 day	0.5	0%
4	Saraji Homestead 2	30 day	2.4	2%
5	Saraji Homestead 3	30 day	2.0	2%
6	Tay Glen Homestead	30 day	0.1	0%
7	Meadowbrook Homestead	30 day	0.0	0%



LEGEND

- Project Site
- Exploration Permit Coal (EPC)
- Mining Lease (ML)
- Mining Lease Application (MLA)
- Surface Infrastructure
- Project Footprint - Indirect Impact
- Project Footprint - Direct Impact
- Homestead
- Private Access Road
- Public Road

30 Day Average Dust Deposition mg/m²/day

- 1
- 2
- 5

Surface Infrastructure

1. Rail Loading Balloon Loop
2. Process Water Dam
3. Product Stockpiles
4. CHPP
5. Raw Water Dam
6. ROM Pad
7. Future MIA
8. Conveyor
9. Construction Village
10. Transport and Infrastructure Corridor

N

Figure 11-14
Maximum 30 day average dust deposition (Peak BAU Case)

Environmental Impact Statement
Saraji East Mining Lease Project

0 0.75 1.5 3
Kilometres

Scale: 1:150,000 (when printed at A4)

Projection: Map Grid of Australia - Zone 55 (GDA94)

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11.6.2 Cumulative air quality impacts

Comparison with emissions

Table 11-14 provides a comparison of fugitive emissions of PM_{10} from the Project with those reported by the local mining operations of Saraji Mine, Peak Downs Mine and Lake Vermont Mine to the NPI for FY2022.

Annual emissions of PM_{10} associated with the Project are estimated (Table 11-14) to be less than 2.5 per cent of those released by the neighbouring Saraji Mine and less than 0.6 per cent of the total airshed loading from all four mining operations combined. This assumes that production at the Saraji, Peak Downs and Lake Vermont open cut mines is maintained at their current level. Future increases or decreases in open cut mining production rates may have a significant influence on airshed loading of PM_{10} whilst the Project contribution is anticipated to be relatively consistent throughout the 20-year production schedule of the Project.

Thus, the likely impacts on air quality that are attributable to the Project are considered to be immaterial when compared to those resulting from neighbouring open cut mining operations and the Project will have minimal influence on the future air quality environment of the region.

Table 11-14 Fugitive emissions of PM_{10} from local mining operations

Mine	Mining method	Fugitive PM_{10} emission (tonnes/year)	Source
Saraji Mine	Open cut	7,313	NPI FY2022
Lake Vermont Mine	Open cut	10,561	NPI FY2022
Peak Downs Mine	Open cut	12,205	NPI FY2022
The Project	Underground	184	Table 11-4
Total		**30,079**	

In relation to emissions of TSP and PM_{10}, it is noted that annual reporting to the NPI is not required for emissions of TSP and only combustion-related emissions are required to be reported for $PM_{2.5}$. Thus a similar comparison of Project emissions with other significant dust emissions sources within the local airshed is not able to be undertaken based on NPI data.

However, based on a review of Table 2 of the NPI Emissions Estimation Technique Manual for Mining Version 3.1 (January 2012) (NPI EETM Mining), a ratio of PM_{10} to TSP of 0.4 has been used to estimate TSP emissions from the open cut mining operations listed in Table 11-15.

To estimate emissions of $PM_{2.5}$ from these same open cut mining operations (Table 11-16) an estimate of 20% of PM_{10} is assumed to be in the form of $PM_{2.5}$ has been adopted.

Table 11-15 Fugitive emissions of TSP from local mining operations

Mine	Mining method	Fugitive TSP emission (tonnes/year)	Source
Saraji Mine	Open cut	18,282	NPI EETM Mining
Lake Vermont Mine	Open cut	26,402	NPI EETM Mining
Peak Downs Mine	Open cut	30,512	NPI EETM Mining
The Project	Underground	584	Table 11-4
Total		**75,196**	

Table 11-16 Fugitive emissions of $PM_{2.5}$ from local mining operations

Mine	Mining method	Fugitive $PM_{2.5}$ emission (tonnes/year)	Source
Saraji Mine	Open cut	1,462	Estimate
Lake Vermont Mine	Open cut	2,112	Estimate
Peak Downs Mine	Open cut	2,441	Estimate
The Project	Underground	37	Table 11-4
Total		**6,016**	

Dispersion modelling of cumulative impacts

A dispersion modelling study was conducted to investigate the cumulative impacts associated with the Project and local sources. The study investigated the mitigations required to manage dust impacts at key assessment locations, in addition to BAU. The study is described in more detail in **Appendix H-1 Air Quality Technical Report**.

In addition to emissions from the Project, the cumulative assessment considered:

- Detailed life of mine plan information provided by BMA for Saraji Mine, including responsive mitigation measures
- Detailed life of mine plan information provided by BMA for Peak Downs Mine, including responsive mitigation measures
- ambient background (Table 11-9).

Table 11-17 and Table 11-18 summarise the modelled results for cumulative assessment based on the 24 hour average concentration. These tables show the ground level concentrations (GLC) for PM_{10} and $PM_{2.5}$.

Results presented suggest that Project-related impacts will be immaterial when compared to dust generated by neighbouring mining operations, with less than one additional exceedance day per year (on average) predicted to be attributable to the Project over the life of the mine.

Table 11-17 Ground level concentrations for the 24 hour average concentration of PM_{10}

ID	Description	Average Maximum GLC over the Life of Asset (LOA) (μg/m^3) (All Sources)	Project Dust Sources		Non-Project Dust Sources	
			Case	Additional GLC (μg/m^3)	Case	Average Maximum GLC (over LOA) (μg/m^3)
1	Kyewong Homestead	41.4	BAU	0.2	BAU	41.2
2	Lake Vermont Homestead	53.8	BAU	0.6	mitigated	53.2
3	Saraji Homestead 1	72.4	BAU	1.3	mitigated	71.1
4	Saraji Homestead 2	99.9	Mitigated (haul roads)	4.5	mitigated	95.4
5	Saraji Homestead 3	91.2	Mitigated (haul roads)	3.3	mitigated	87.9
6	Tay Glen Homestead	56.1	BAU	0.2	mitigated	55.9
7	Meadowbrook Homestead	80.2	BAU	0.6	mitigated	79.6
Note: Results include a background level of 24.7 μg/m^3 for the 24 hour average concentration of PM_{10}						

Table 11-18 Ground level concentrations for the 24 hour average concentration of $PM_{2.5}$

ID	Description	Average Maximum GLC over the LOA (µg/m³) (All Sources)	Project Dust Sources		Non-Project Dust Sources	
			Case	Additional GLC (µg/m³)	Case	Average Maximum GLC (over LOA) (µg/m³)
1	Kyewong Homestead	22.1	BAU	0.0	BAU	22.1
2	Lake Vermont Homestead	24.6	BAU	0.1	mitigated	24.5
3	Saraji Homestead 1	28.3	BAU	0.2	mitigated	28.1
4	Saraji Homestead 2	33.8	Mitigated (haul roads)	0.9	mitigated	32.9
5	Saraji Homestead 3	32.1	Mitigated (haul roads)	0.7	mitigated	31.4
6	Tay Glen Homestead	25.1	BAU	0.1	mitigated	25.0
7	Meadowbrook Homestead	29.9	BAU	0.1	mitigated	29.8
Note: Results include a background level of 18.8 µg/m³ for the 24 hour average concentration of $PM_{2.5}$						

The cumulative assessment found that to minimise the additional exceedances (exceedances above those related to ambient background concentrations and the modelled operation of Saraji and Peak Downs Mines), it will be sufficient to reduce the hauling of ROM coal between the Project CHPP and the SRM CHPP during adverse conditions.

11.6.3 Greenhouse gas emissions

Sources of greenhouse gas emissions

The main sources of Scope 1 and Scope 2 GHG emissions from the Project are:

- direct CO_2 emissions from fuel combusted by mining equipment
- direct CO_2 emissions from incidental mine gas captured and flared
- fugitive emissions of CH_4 and CO_2 due to underground air ventilation processes
- fugitive emissions from post-mining activities (including coal stockpiles and conveyors)
- indirect CO_2 emissions from electricity generation
- fugitive emissions of CH_4 from the decommissioned mine for up to 20 years post-closure.

Scope 3 GHG emissions for the Project include:

- transporting coal by rail to the domestic port for export
- coal handling at the domestic port, and transportation by ship to the export destinations
- transporting Project personnel on a fly in fly out (FIFO) basis
- emissions associated with the end use(s) of product coal.

Activity data and key assumptions

Estimates of the annual Project usage of diesel, electricity, incidental mine gas and ventilation air for the lifetime of the Project are presented in Table 11-19.

Table 11-19 Estimates of the annual Project usage of diesel, electricity, mine waste gas and ventilation air

Source	Annual usage	Basis
Diesel	7,102 kilolitres (kL) per year, equating to 142.1 megalitres over 20 years.	Based on proposed mine equipment listed in **Chapter 3 Project Description**.
Electricity	74 gigawatt hours (GWh) per year.	Estimated from 14 MW power demand noted in **Chapter 3 Project Description** with a 60% utilisation rate.
Flaring incidental mine gas	Estimated 3.675 petajoules (PJ) of gas flared per year, equating to 73.5 PJ over 20 years.	BMA estimation of pre-drainage methane and goaf gas.
Venting fugitive emissions of CH_4 and CO_2 from underground ventilation	Total ventilation flow of 320 m^3/s, comprised of: CH_4 concentration of 0.15 % v/v CO_2 concentration of 0.15 % v/v.	Based on proposed mine ventilation rate outlined in **Chapter 3 Project Description**.
Post mining activities associated with gassy underground mines	Production rate at the maximum value of 11 Mtpa of ROM coal, equating to a conservative value of 220 Mt over the 20 year production schedule.	Based on proposed ROM coal rate described in **Chapter 3 Project Description**.
Fugitive emissions from the decommissioned underground mine	Emissions from the mine for the last full year of operation are 0.315 Mt CO2-e (excluding flaring and post mining emissions). Emission factors and the proportion of the mine flooded are based on methods in Sections 3.32, 3.33, 3.34 and 3.4 of the guidelines for a period of 20 years.	Estimated as per the NGER Technical Guidelines (DoISER, 2022)

Greenhouse gas emissions and energy use

Estimates of the Project's diesel usage, electricity consumption, incidental mine gas consumption and fugitive emissions for 20 year production schedule are presented in Table 11-20, based on the activity data in Table 11-19 and emission factors in Table 11-8. Scope 1 and Scope 2 emissions from these activities are also presented in Table 11-20.

Table 11-20 Scope 1 and 2 GHG emissions from the Project over the 20 year mine production schedule

Scope of emissions	Emissions source	Usage	GHG emissions (t CO_2-e)	Energy content (PJ)
1	Diesel	142 ML	386,012	5.5
1	Flaring incidental mine gas	Nil	4,091,304	73.5
1	CH_4 in ventilation air	206 kilotonnes CH_4	5,754,550	NA
1	CO_2 in ventilation air	564 kilotonnes CO_2	563,779	NA
1	Fugitive emissions from post mining activities associated with gassy underground mines	220 Mt	4,180,000	NA
1	Fugitive emissions from the decommissioned underground mine	20 years post mining	1,354,300	NA
2	Electricity consumption	1480 GWh	1,080,400	5.3
-	**TOTAL**		**17,410,346**	**84.3**

The operation phase of the Project is estimated to result in approximately 17.4 Mt CO_2-e of GHG over the 20-year production schedule, equivalent to 0.87 Mt CO_2-e per year.

The most significant sources of GHG emissions from the Project are:

- fugitive emissions associated with underground ventilation air (36 per cent)
- flaring of incidental mine gas (23 per cent)
- fugitive emissions from post-mining activities (24 per cent)
- fugitive emissions from decommissioned underground mine (8 per cent).

A breakdown of Scope 1 and Scope 2 emissions from the Project's operation phase (over 20 years) are presented in Figure 11-15.

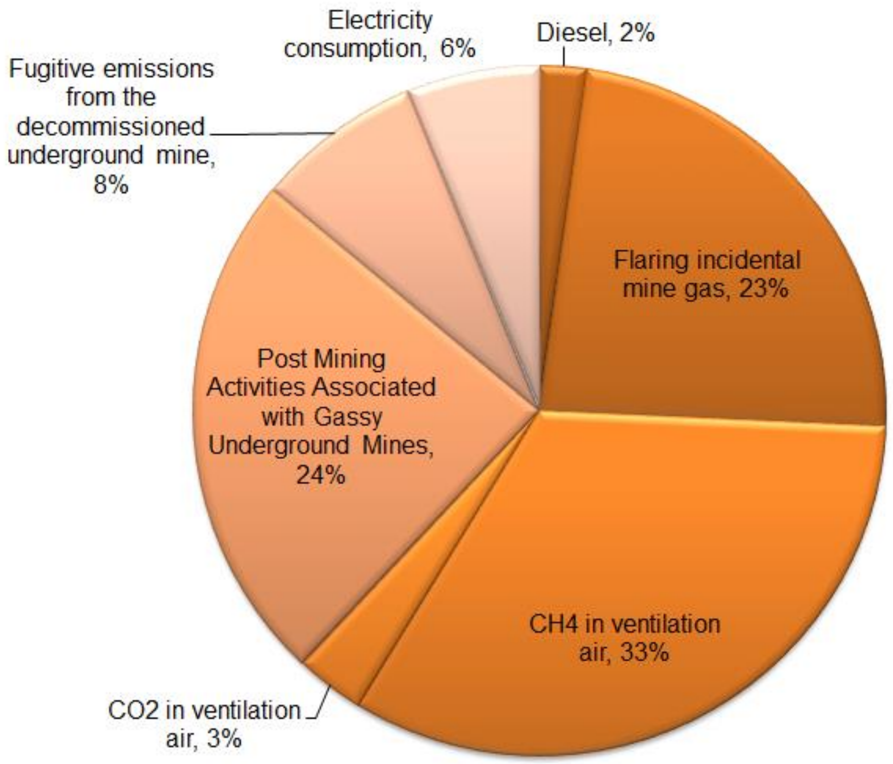

Figure 11-15 Scope 1 and Scope 2 emissions from the Project's operation phase over 20 years

Scope 3 greenhouse gas emissions

Scope 3 GHG emissions are presented in Table 11-21. The estimated Scope 3 emissions over the 20 year production schedule are 451 Mt CO_2-e.

Table 11-21 Scope 3 GHG emissions over the 20 year life of Project

Emissions source	GHG emissions (t CO_2-e)
Product use	441,696,000
Flights for remote workforce	120,918
Rail transport of product coal	416,052
Handling of product coal at domestic port	187,840
Shipping product coal to overseas markets	7,879,812
Embodied emissions in electricity	177,600
Embodied in diesel	19,739
TOTAL	**450,545,962**

The following key assumptions were used to estimate Scope 3 emissions from the Project:

- embodied GHG emission factors for diesel (0.139 t CO_2-e per kL of diesel) and electricity (0.12 t CO_2-e per MWh of electricity), published by DoISER (2021)
- emissions from product use have been estimated using the NGA emission factor for coking coal as per the National Greenhouse Accounts Factors, August 2021
- 15 return flights Brisbane to Moranbah per week over the 20 year operation of the Project, with each flight assumed to consume 3,000 litres of aviation fuel.

Emissions intensity

The GHG emissions intensity of Scope 1 and Scope 2 emissions over the operation of the Project is estimated to be 0.07 CO_2-e/t ROM coal. The GHG intensity for the Project is in line with emissions assessed for similar mining operations in the area such as the Olive Downs Project which is estimated at 0.118 CO_2-e/t ROM coal (Pembroke Olive Downs, 2018).

Comparison with Australian emissions

The DCCEE (2022) publish GHG emissions inventories for Australia from 1990 to 2021. Australia's total GHG emissions (including land use, land use change and forestry activities), was 464.0 Mt CO_2-e in 2021 (DCCEE, 2022). The breakdown of Australia's GHG emissions by state is presented in Figure 11-16.

The annual GHG emissions predicted for the Project (Scope 1 and Scope 2) represent 0.19 per cent of Australia's 2021 GHG emissions and 0.6 per cent of Queensland's 2021 GHG emissions.

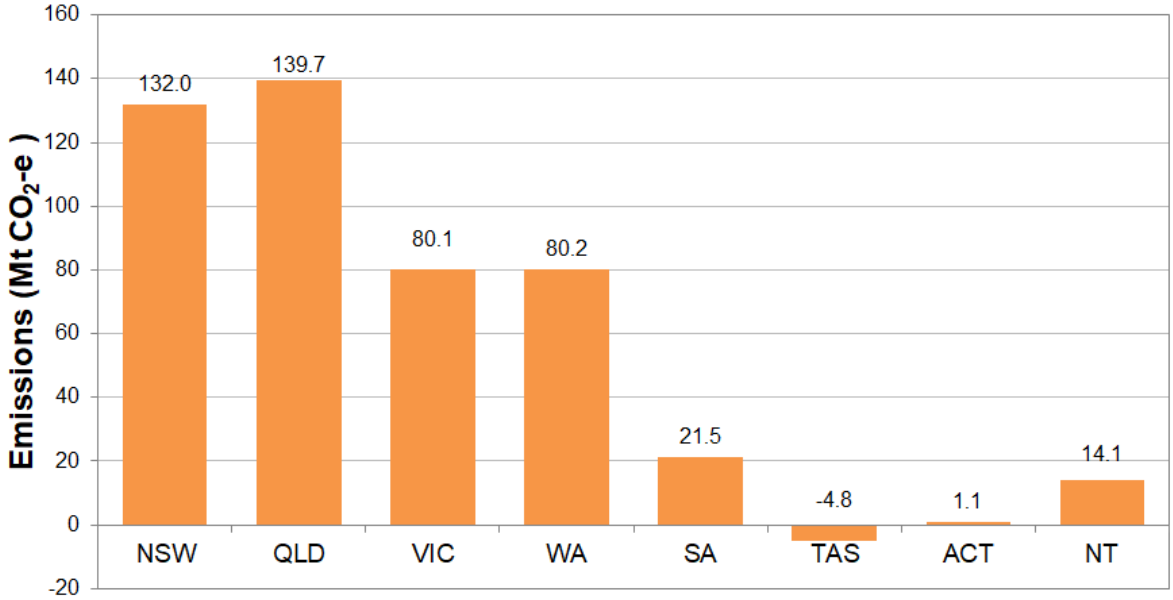

Figure 11-16 Breakdown of Australia's emissions by state in 2021

11.7 Management and mitigation measures

11.7.1 Air quality

The Project is to be located within an airshed that includes BMA's Saraji Mine, Peak Downs Mine and Norwich Park Mine, as well as Jellinbah Group's Lake Vermont Mine. Dispersion modelling indicates that the Project goals for PM_{10} and $PM_{2.5}$ may be exceeded at one or more sensitive receptor locations due to mining activities within the Project's airshed. Given the existing air quality environment, the overall impact on the region's air quality that is attributable to the Project is considered to be immaterial. The Project is anticipated to have a minimal influence on the future air quality environment given the nature and scale of Project activities. Nonetheless, opportunities to minimise the release of dust emissions pollutants during all phases of the Project will be incorporated into an Air Management Plan, to be developed prior to construction.

When requested by the administering authority or as a result of an air quality complaint (which is neither frivolous nor vexatious nor based on mistaken belief in the opinion of the authorised officer), dust and particulate monitoring will be undertaken and the results notified to the administering authority.

The Air Management Plan for the Project will include details of the proposed air quality monitoring program. The air quality monitoring program for the Project will include the use of a continuous dust monitor to monitor PM_{10}, and an automatic weather station to record meteorological conditions at ground level. A temperature inversion tower will also be considered for the Project to allow measurement of meteorological conditions at height.

Construction phase

During construction of the Project, the application of water as/when required to minimise visible dust emissions will be one of the primary mitigation measures available.

General management strategies for the minimisation of pollutant generation during construction may include (but not be limited to):

- minimising the extent of exposed areas. Disturbed areas would be stabilised as soon as practicable to prevent or minimise wind-blown dust
- use of water sprays on haul routes, exposed areas and stockpiles as required to adequately dampen and prevent the emission of dust from the site
- reducing vehicle speed on unsealed roads to reduce dust generation and keep vehicles to well-defined roads
- strict adherence to plant and equipment maintenance programs
- minimising haulage distances between construction sites to spoil stockpiles
- addressing equipment for dust control under performance in a timely manner by keeping it in good operation condition
- ensuring all personnel are familiar with the objectives and requirements of the Project's Air Management Plan
- stockpiles would be maintained in a condition that minimises windblown generated dust
- erosion and sediment control structures would be regularly maintained to ensure silt does not become a source of dust
- unsealed trafficable areas would be kept damp during high wind events to minimise dust generation.

Operational phase

The Project incorporates a number of key dust reduction features, most notably the transport of ROM coal by conveyor from the mine portal to the Project CHPP. Dust mitigation should be considered during the detailed design phase to capitalise on opportunities to minimise overall dust emissions.

Examples of possible engineering options are included in Table 11-22 which, where feasible, may be considered for the Project during the design phase. Engineering solutions incorporated during the design phase of the Project will typically be more cost effective than retrofitting solutions once the Project is constructed.

Table 11-22 Proposed mitigation options

Emission source	Mitigation options
Conveyors	Partial or full enclosure
	Belt scrapers
	Water sprays / foggers
Transfer points	Partial or full enclosure
	Water sprays
	Belt scrapers
Bins	Limit drop height into surge bin
	Enclose chute
Stacking and reclaiming	Water sprays
	Use of low dust-generating techniques such as telescopic stackers with chutes and scraper reclaimers
Sizing stations	Partial or full enclosure

Emission source	Mitigation options
	Water sprays
ROM dump	Partial or full enclosure
	Water sprays
Ventilation outlets	Use of dust collection system
Flares	Ensure use of high destruction efficiency flares
Rail haul to export	Load profiling
	Veneering

Potential impacts during the operation of the Project will be managed through the Air Management Plan, which will consider the following:

- minimising vehicle and plant speed to suit road conditions and around stockpiles
- watering of haul roads and other high risk areas with increased frequency during adverse weather conditions
- optimising the use of water sprays
- strict adherence to plant and equipment maintenance schedules to minimise dust emissions
- address equipment under performance in a timely manner to reduce air pollutant emissions and maximise fuel efficiency
- water spraying would be applied during high wind speed events
- unutilised exposed areas would be progressively sealed and/or revegetated
- revegetation of topsoil stockpiles would be undertaken progressively based on a risk based approach.

It is an Aurizon requirement for all mines transporting coal on the Aurizon coal network to implement dust mitigation measures contained in the Aurizon's Central Queensland Coal Dust Management Plan. As identified in Table 11-22, measures associated with load profiling, coal wagon veneering systems and associated support systems would be implemented during rail-haul of coal to export.

Rehabilitation

Commitments to rehabilitate disturbed areas after the closure of the mine will prevent ongoing wind erosion. Rehabilitation will be undertaken progressively as longwall mining activity has been completed in accordance with the Rehabilitation Management Plan.

A detailed rehabilitation management plan has been outlined in **Appendix K-1 Rehabilitation Management Plan**. The plan provides details of revegetation that will be an effective dust control measure. Improving the effectiveness and time for rehabilitation measures will result in reduced dust emissions from exposed areas, however these benefits cannot be incorporated into modelling until the rehabilitation strategy has been formulated.

11.7.2 Greenhouse gas abatement

BHP

BMA will contribute towards Queensland's emissions reduction and renewable energy targets. As of 2024 the Queensland Government set a target of zero net emissions by 2050 with interim emissions reduction targets of 30 per cent by 2030 and 75 per cent by 2035 from 2005 levels.

This is consistent with the overarching BHP Climate Transition Action Plan (2021) which "*sets out a strategic approach to reduce greenhouse gas (GHG) emissions to net zero within operations by 2050 and to work with customers and suppliers to support their emissions reductions, consistent with the ambition of pursuing net zero in the value chain*". BHP accepts the Intergovernmental Panel on Climate Change's (IPCC) assessment of climate change science and acknowledges the need for significant reductions in human generated GHG emissions.

BHP has engaged with governments and stakeholders in the development of the Climate Transition Action Plan (2021), which is intended to be an effective, long-term policy framework that can deliver a measured transition to a lower carbon economy. To display support of the Paris Agreement, BHP became a signatory of the UNFCCC 'Paris Pledge' and set company emission reduction targets.

BHP's emissions reduction target commitments are as follows:

Operational GHG emissions (scope 1 and Scope 2 from our operated assets):

- Medium term targets - 30 percent reduction in Scope 1 and Scope 2 emissions from FY2020 levels by FY2030. The pathway to our medium-term target, will set us up well for greater GHG emissions reductions after FY2030 through the following actions:
  - procuring renewable and other low to zero GHG emission electricity
  - minimising the increase in operational GHG emissions from organic production growth and new operational sites
  - accelerating and de-risking diesel displacement solutions through testing and sequenced deployment
  - pursuing solutions to abate fugitive methane emissions.
- Long term targets - Net zero operational emissions by FY2050 for Scope 1 and Scope 2 emissions. The pathway to our long-term zero goal beyond FY2030 is primarily to:
  - displace diesel via electric vehicles (e.g. trucks, locomotives) and electric mining equipment (e.g. excavators, shovels)
  - procure additional renewable and other low to zero GHG emission electricity to support the increased amount of electricity required for electric vehicles and mining equipment
  - minimise fugitive methane emissions to the greatest extent technically and commercially viable, through existing or emerging technology.

We are pursuing the long-term goal of net zero Scope 3 emissions by CY2050. Our strategy to support reduction of GHG emissions in our value chain has four primary focus areas:

- support the development and adoption of GHG emission reduction technologies in steelmaking
- enhance the quality of the iron ore and steelmaking coal we produce
- support the development and adoption of GHG emission reduction technologies in shipping
- encourage suppliers to pursue net zero GHG emissions

As part of the Climate Transition Action Plan (2021), BHP is investing in renewable charging technology and decarbonisation of maritime and steel-working industries. BHP has also developed a carbon offset strategy detailing how voluntary and regulatory carbon offsets from customers will play a role in decarbonising the value chain. Opportunities to invest in high quality offset generating projects and to supply offsets to complement customer decarbonisation strategies will be considered.

Our offset strategy focusses on:

- directly investing in offset-generating projects that deliver sustainability co-benefits and that can provide a long-term supply of offsets
- working with others to support the move toward mature international and sub-national carbon market mechanisms
- developing a clear approach to both the voluntary and regulatory use of offsets to meet emission reduction commitments, as well as for structured product offerings to our customer base.

BMA

BMA operates a number of assets across the Bowen Basin (and Hay Point) and as such initiatives and opportunities to contribute to emissions reduction are approached collectively by the business (rather than asset by asset). FY20 is the baseline year for medium- and long-term targets and is being used as a reference point.

When reported in June 2024 the FY20 operational emissions broadly split for BMA were as shown below.

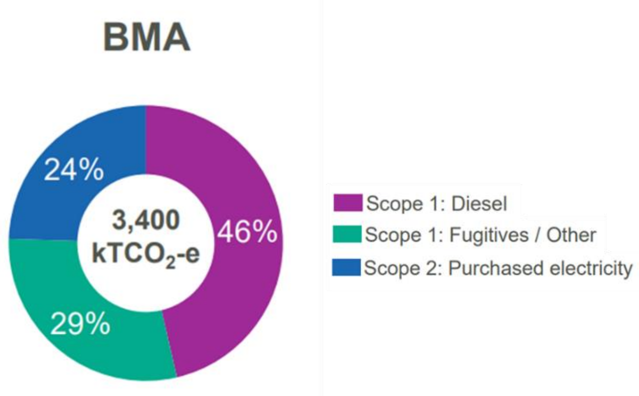

Figure 11-17 BMA FY20 operational emissions split

In the short-medium term Scope 2 purchased electricity emissions are targeted to reduce by 100% by mid-late FY2020s.

In the longer term BMA, as a constituent of BHP in Australia, contributes to, and benefits from, the operational decarbonisation opportunities. In Australia key opportunities in BHP that have been identified relate to:

- Transition from diesel to electricity energy source. Haul trucks and other ancillary equipment are the largest user of diesel and electrification has been identified as an effective pathway to decrease diesel related emissions.
- BHP is collaborating with vendors and industry worldwide to accelerate development of electrification technologies.
- Technical solutions to meet power demand. This includes planning for renewable generation, understanding storage capacity and options for interconnection with grids.
- Addressing methane emissions. Methane accounted for 29 per cent of BMAs reported operational emissions for FY2020. There is an opportunity for methane emissions to be extracted and actively managed with the appropriate technology. BHP is accelerating work to understand the characteristics of the gas and determining optimal use (eg. use for power generation or other industrial purposes). Through exploration of new and innovative technology BMA may be able to substantially reduce these emissions.

Site based greenhouse mitigation measures

The following management measures are considered for the Project to minimise GHG emissions during operation:

- preferencing fuel efficient mining equipment during procurement
- maintaining mining equipment in good working order that so fuel efficiency is maximised
- using appropriately sized equipment.

Further abatement opportunities are associated with drainage of incidental mine gas from the Project. BMA will assess the following initiatives for incidental mine gas from the Project:

- drainage and flaring of incidental mine gas where it is safe and technically feasible to do so
- the beneficial utilisation of incidental mine gas for the purposes of on-site power generation
- the sale/transfer of incidental mine gas to a third-party for use off-site.

Flaring of incidental mine gas (which can have a CH_4 content of >90 per cent) significantly reduces GHG emissions. The oxidation of CH_4, with a GWP of 28 to CO_2 (GWP of 1) reduces CO_2 equivalent emissions by more than nine times on a mass basis.

Based on the Project's estimated annual GHG emissions and energy use (0.87 Mt CO_2-e and 4.22 PJ respectively) the following actions will be undertaken to fulfil legislative and corporate requirements:

- report annual GHG emissions under the National Greenhouse and Energy Reporting System under the NGER Act
- comply with any prevailing regulatory mechanisms for reducing emissions, such as the Federal Government's Safeguard Mechanism and other similar and successor policies
- investigate cost effective opportunities to reduce emissions in accordance with BHP's management standards and contribute if and as required to the delivery of the company's emissions reduction targets.

Table 11-23 Snapshot for Greenhouse Gas Abatement

Aspect	Snapshot
BMA emissions reference point	BMA FY2020 emissions
BMA emission reduction targets	Short-medium term: BMA reduce Scope 2 emissions (purchased renewable electricity) by 100% by mid-late FY2020's Long term: BMA contribute to BHP target net zero operational emissions by FY2050
Emission reduction measures	Project specific design measures: • maintenance strategies in support of fuel efficiency • equipment selection (size, type) to maximise efficiency.
	BMA measures: • progress renewable power purchase agreement (PPA) to reduce Scope emissions.
Abatement opportunities / advancing technologies[1]	Project specific opportunities: • consider gas drainage and abatement of incidental mine gas including options for flaring on-site use or for third-party of-site use. BMA opportunities: • BHP is undertaking operational trials and collaboration with vendors and industry to accelerate development of electrification technologies • BHP is working on alternative solutions to power generation for its operations (to support the electrification).
Reporting	• annual GHG emission reporting in compliance with the NGER Act as mandated by Clean Energy Regulator (federal level).

[1] Where opportunities or technologies advance BMA acknowledge that amendments to approvals may be required

11.7.3 Climate change risk assessment

Changes in local weather patterns resulting from climate change have the potential to affect the operation of the Project in the future. A preliminary climate change risk assessment was undertaken for the operations phase of the Project.

11.7.4 Predicted change in climate

The preliminary climate change risk assessment is based on climate change scenarios for the Whitsunday, Hinterland and Mackay Region outlined in *'ClimateQ: toward a greener Queensland'* (DERM, 2009). The climate change scenarios for 2030 and 2050 are presented in Table 11-24. A projected southward shift in the primary regions of cyclone development may result in a greater cyclone impact for the Whitsunday, Hinterland and Mackay Region, with potential to increase extreme daily rainfall and increase flood peaks.

Table 11-24 Projected climate change scenarios for the Whitsunday, Hinterland and Mackay Region relative to 1990 (Source: OCC 2009)

Variable	Season	2030 – medium emissions	2050 – low emissions	2050 – high emissions
Temperature (°C)	Annual	+0.9	+1.1	+1.9
	Summer	+0.9	+1.1	+1.9
	Autumn	+0.9	+1.1	+1.8
	Winter	+0.9	+1.1	+1.9
	Spring	+0.9	+1.1	+1.9
Rainfall (%)	Annual	-3	-4	-7
	Summer	-2	-3	-4
	Autumn	-4	-5	-8
	Winter	-3	-4	-6
	Spring	-7	-8	-13
Potential evaporation	Annual	+3	+4	+7
	Summer	+3	+3	+6
	Autumn	+4	+4	+8
	Winter	+4	+5	+7
	Spring	+3	+4	+6

The potential risk to the Project posed by each climate change parameter was assessed and mitigation measures have been proposed (where appropriate). This is outlined in Table 11-25.

Table 11-25 Potential impacts of climate change and proposed mitigation measures

Potential climate change impacts	Risk scenario	Risk to Project	Mitigation measures (if required)
Increase in annual average temperature	Potential to affect reliability of mine infrastructure and/or equipment	Low	Not applicable
	Health impacts on mine personnel from increased temperatures (i.e. heat stress)	Medium	Compliance with BHP Safety Our Requirements (BHP, 2018b)
Decrease in annual average rainfall	Reduced yield from on-site water storage systems	Low	Responsive water management system to manage water
Change in seasonal average rainfall	Decrease in rainfall during autumn, winter and spring	Low	Responsive water management system to manage water
Increase in annual average potential evaporation	Reduced yield from on-site water storage systems	Low	Responsive water management system to manage water
	Increased dust emissions due to drier surface conditions, resulting in increased water demand for dust suppression	Low	Dust control measures including watering of haul roads and stockpiles
Increased risk of tropical cyclone impact	Increased impacts from flood events	Medium	Emergency response procedures and flood forecasting will be incorporated into operating procedures

Potential climate change impacts	Risk scenario	Risk to Project	Mitigation measures (if required)
	Increased risk of erosion especially from exposed areas due to increase in rainfall intensity	Medium	Adaptive management as soon as practical to minimise risk

The Project generally has a limited vulnerability to climate change impacts, with the greatest potential impacts an increased risk of flooding, and potential for increased soil erosion due to increase in rainfall intensity.

11.8 Summary

11.8.1 Air quality

AED has undertaken an air quality assessment of the Project, focused on impacts associated with the emission of dust from the Project on the receiving environment. Two dust emissions scenarios were modelled:

- typical operating conditions based on a mining rate of 11 Mtpa ROM coal incorporating typical dust management practices; and
- upset conditions based on a mining rate of 11 Mtpa ROM coal with an assumed reduced dust mitigation capacity.

Results of the dispersion modelling have highlighted the potential for adverse impacts of dust from the Project at the location of the Saraji 2 Homestead and Saraji 3 Homestead during peak operations. It is noted that the Saraji 2 Homestead and the Saraji 3 Homestead are situated in close proximity to the Project CHPP, the haulage route from the Project CHPP and the Saraji Mine CHPP. As discussed in Section 11.4.1 there are currently co-existence agreements in place between BMA and landholders at Saraji Homestead 2 and Saraji Homestead 3.

Risks of adverse impacts on air quality at the Saraji 2 Homestead and the Saraji 3 Homestead are predicted. Thus, the implementation of additional dust mitigation measures may be required when excess ROM coal is transported from the Project CHPP to the Saraji Mine CHPP during adverse meteorological conditions at any time during the operation of the Project.

Results of the dust assessment did not highlight any significant air quality issues attributable to the Project at any of the other assessment locations.

Publicly available information was used to estimate the mass of TSP, PM_{10} and $PM_{2.5}$ annually released into the local airshed from Saraji Mine, Peak Downs Mine and Lake Vermont Mine. Emissions of PM_{10} associated with the Project were estimated be less than 0.6 per cent of the total airshed loading from all four mining operations combined (i.e. Saraji East Mine, Saraji Mine, Peak Downs Mine and Lake Vermont Mine). This comparison assumed that the current levels of production at the neighbouring open cut mines are maintained into the future. Future increases or decreases in open cut mining production rates may have a significant influence on airshed loading of PM_{10} whilst the Project contribution is anticipated to be relatively consistent throughout the 20 year production schedule of the Project.

Therefore, the overall impact on the region's air quality that is attributable to the Project is considered to be immaterial when compared to the air quality environment resulting from neighbouring open cut mining operations and the Project will have minimal influence on the future air quality environment.

The Air Management Plan for the Project will include details of the proposed air quality monitoring program which will include the use of a continuous dust monitor to measure PM_{10} and an automatic weather station to record meteorological conditions The monitoring program will allow conditions to be monitored, allowing Project activities to be adjusted to minimise impacts as far as reasonably practicable.

11.8.2 Greenhouse gas

The operational phase of the Project is estimated to result in approximately 17.4 Mt CO_2-e of GHG (Scope 1 and Scope 2) over the Project's 20 year proposed production schedule. This equates to

0.87 Mt CO_2-e on an annual basis. The annual GHG emissions predicted for the Project represent 0.19 per cent of Australia's 2021 GHG emissions.

The Project is considered to have a low vulnerability to the effects of climate change.