MACHEnergy

Mount Pleasant Operation

A JOINT VENTURE WITH JCDA Japan Coal Development Australia

Appendix S

Greenhouse Gas Assessment

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GRAPHS

LIST OF ATTACHMENTS

1 INTRODUCTION

The Mount Pleasant Operation (MPO) is a major operating open cut coal mine and associated infrastructure, located approximately 3 kilometres (km) north-west of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW).

This Greenhouse Gas Assessment (GHG Assessment) forms part of an Environmental Impact Statement (EIS), which has been prepared to accompany a Development Application for the Mount Pleasant Optimisation Project (the Project) in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

This GHG Assessment has been conducted as part of the EIS to evaluate the likely greenhouse gas emissions of the Project.

1.1 THE MOUNT PLEASANT OPERATION

The MPO Development Consent DA 92/97 was granted on 22 December 1999. The MPO was also approved under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) in 2012 (EPBC 2011/5795).

MACH Energy Australia Pty Ltd (MACH Energy) acquired the MPO from Coal & Allied Operations Pty Ltd on 4 August 2016. MACH Energy commenced construction activities at the MPO in November 2016, and in October 2017 commenced mining operations in accordance with Development Consent DA 92/97 and EPBC 2011/5795.

MACH Mount Pleasant Operations Pty Ltd now manages the MPO as agent for, and on behalf of, the unincorporated Mount Pleasant Joint Venture between MACH Energy (95 per cent [%] owner) and J.C.D. Australia Pty Ltd (5% owner)[1].

The MPO is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Up to approximately nine trains per day of thermal coal products from the MPO are transported by rail to the Port of Newcastle for export, or to domestic customers for use in electricity generation.

[1] Throughout this report, MACH Mount Pleasant Operations Pty Ltd and the unincorporated Mount Pleasant Joint Venture will be referred to as MACH.

1.2 OVERVIEW OF THE PROJECT

The Project would include the following:

- increased open cut coal extraction within MPO Mining Leases (MLs) by mining of additional coal reserves, including lower coal seams in North Pit;
- staged increase in extraction, handling and processing of ROM coal up to 21 Mtpa (i.e. progressive increase in ROM coal mining rate from 10.5 Mtpa over the Project life);
- staged upgrades to the existing Coal Handling and Preparation Plant (CHPP) and coal handling infrastructure to facilitate the handling and processing of additional coal;
- rail transport of up to approximately 17 Mtpa of product coal to domestic and export customers;
- upgrades to workshops, electricity distribution and other ancillary infrastructure;
- existing infrastructure relocations to facilitate mining extensions (e.g. local roads, powerlines and water pipelines);
- construction and operation of new water management and water storage infrastructure in support of the mine;
- additional reject dewatering facilities to allow co-disposal of fine rejects with waste rock as part of ROM waste rock operations;
- development of an integrated waste rock emplacement landform that incorporates geomorphic drainage design principles for hydrological stability, and varying topographic relief to be more natural in exterior appearance;
- construction and operation of new ancillary infrastructure in support of mining;
- extension to the time limit on mining operations to 22 December 2048;
- an average operational workforce of approximately 600 people, with a peak of approximately 830 people;
- ongoing exploration activities; and
- other associated infrastructure, plant, equipment and activities.

A detailed description of the Project is provided in Section 3 of the main text of the EIS.

1.3 GREENHOUSE GASES

1.3.1 Relevant Greenhouse Gases and Global Warming Potential

In the context of the Project, the most relevant greenhouse gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Greenhouse gas emissions are typically standardised by expression as a carbon dioxide equivalent (CO_2-e) based on their Global Warming Potential (GWP). The GWP is determined by the differing periods that greenhouse gases remain in the atmosphere and their relative absorption of outgoing infrared radiation. The GWP of CH_4 is 28 (i.e. one tonne of CH_4 emissions has 28 times the potential to contribute to global warming than one tonne of CO_2 emissions), while the GWP of N_2O is 265 (Department of Industry, Science, Energy and Resources [DISER], 2020).

To simplify greenhouse gas accounting, the emissions of these greenhouse gases (typically estimated in tonnes [t]) are converted to tonnes of carbon dioxide equivalent (t CO_2-e) before being summed to determine total greenhouse gas emissions. This can be expressed as:

$$t\ CO_2\text{-}e = t\ CO_2 \times 1 + t\ CH_4 \times 28 + t\ N_2O \times 265$$

1.3.2 Greenhouse Gas Emission Scopes

The Greenhouse Gas Protocol (GHG Protocol) (World Business Council for Sustainable Development [WBCSD] and World Resources Institute [WRI], 2020) contains methodologies for calculating and assessing greenhouse gas emissions. The GHG Protocol provides guidance and standards for companies and organisations preparing greenhouse gas emission inventories. It covers the accounting and reporting of the six greenhouse gases covered by the *Kyoto Protocol*, including the three greenhouse gases most relevant to the Project as described above.

Under the GHG Protocol, an entity's operational boundaries are established by identifying emissions associated with its operations, categorising them as direct or indirect emissions, and identifying the scope of accounting and reporting for indirect emissions.

Three 'Scopes' of emissions (Scopes 1, 2 and 3) are defined for greenhouse gas accounting and reporting purposes. This is explored further below.

Scope 1 – Direct Greenhouse Gas Emissions

Direct greenhouse gas emissions are defined as emissions that occur from sources that are owned or controlled by the entity (WBCSD and WRI, 2020). Direct greenhouse gas emissions are emissions that are principally the result of the following types of activities undertaken by an entity:

- Generation of electricity, heat or steam – these emissions result from combustion of fuels in stationary sources (e.g. boilers, turbines and furnaces).
- Physical or chemical processing – most of these emissions result from the manufacture or processing of chemicals and materials (e.g. production of cement, ammonia and aluminium, or waste processing).
- Transportation of materials, products, waste, and employees – these emissions result from the combustion of fuels in mobile combustion sources (e.g. trucks, trains, ships, aeroplanes, cars, motorcycles and buses) owned/controlled by the entity.

- Fugitive emissions – these emissions result from intentional or unintentional releases (e.g. equipment leaks from joints, seals, and gaskets; methane emissions from coal mines and venting; hydrofluorocarbon emissions during the use of air conditioning and refrigeration equipment; and methane leakages from gas transport) (WBCSD and WRI, 2020).

Scope 2 – Electricity Indirect Greenhouse Gas Emissions

Scope 2 emissions are a category of indirect emissions that account for greenhouse gas emissions associated with the generation of purchased electricity consumed by the entity.

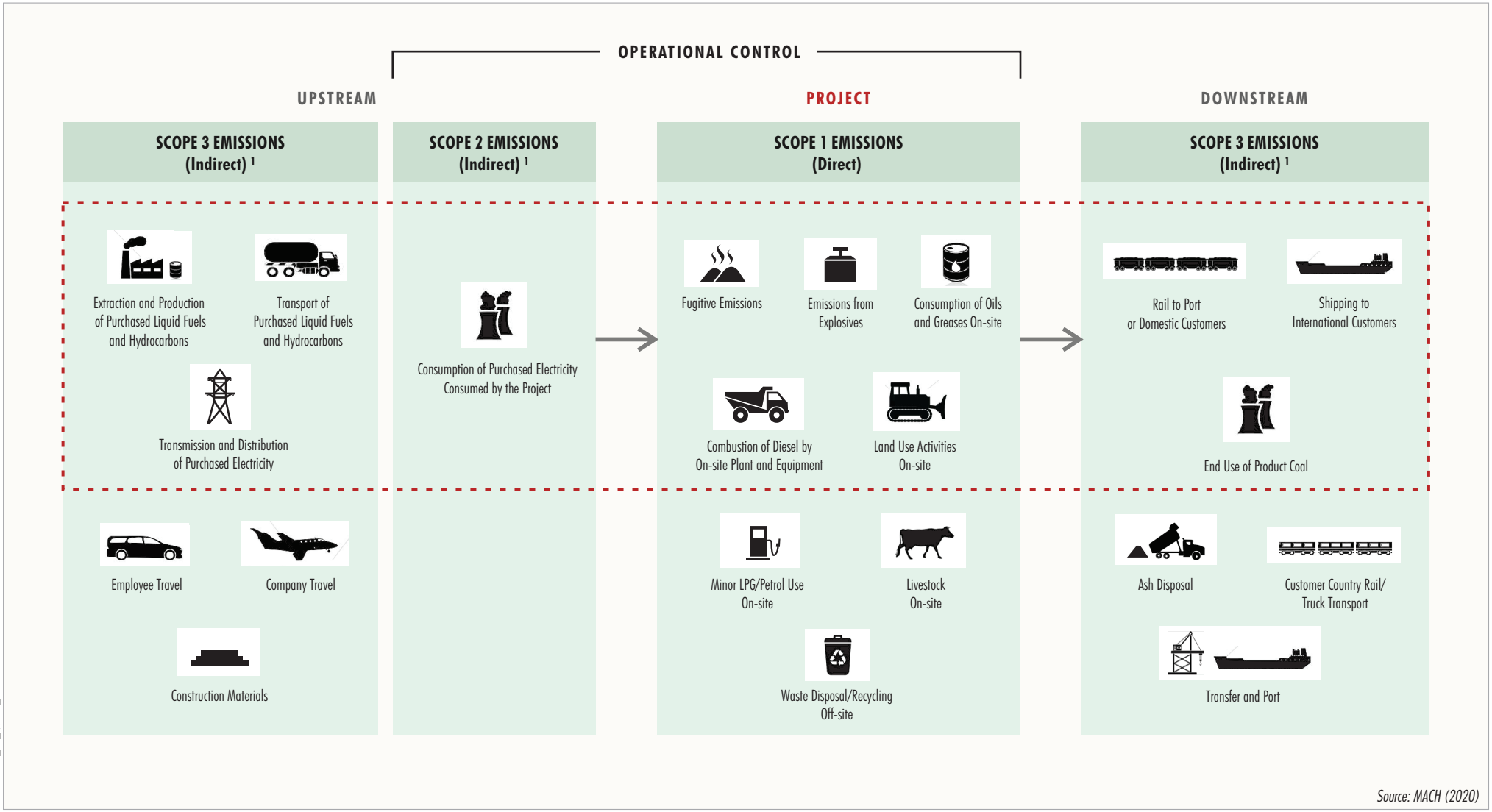
Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (WBCSD and WRI, 2020). Scope 2 emissions physically occur at the facility where the electricity is generated (WBCSD and WRI, 2020). Entities report the emissions associated with the generation of purchased electricity (consumed in equipment or operations owned or controlled by the entity) as Scope 2.

Scope 3 – Other Indirect Greenhouse Gas Emissions

Scope 3 emissions are those indirect emissions that are the consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Some examples of Scope 3 emissions provided in the GHG Protocol are those from the extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services (WBCSD and WRI, 2020).

The GHG Protocol notes that reporting Scope 3 emissions can result in double counting of emissions. For example, greenhouse gas emissions from the burning of coal to produce energy are the Scope 3 emissions of the mines approved to produce the coal, as well as the Scope 1 emissions of the businesses that burn the coal to generate electricity. Those emissions will also be the Scope 2 emissions of the businesses that purchase the electricity.

A diagrammatic representation of the three greenhouse gas emission Scopes and key elements included in this assessment is presented on Figure 1.



Source: MACH (2020)

MAC18-02 SSD_EIS_App GHG_001E

LEGEND
Assessment Boundary

[1] Scope 2 and 3 Emissions are Scope 1 Emissions for the businesses that generate them.

MACHEnergy

MOUNT PLEASANT OPTIMISATION PROJECT
Greenhouse Gas Emission Scopes and Assessment Boundary

Figure 1

2 ASSESSMENT REQUIREMENTS

2.1 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The Secretary's Environmental Assessment Requirements (SEARs) for the Project (issued 17 February 2020) include the following in relation to greenhouse gases:

> *The EIS must address the following key issues:*
>
> - ***Air Quality** – including:*
>
> *…*
>
> - *an assessment of the likely greenhouse gas emissions of the development;*

This GHG Assessment has been prepared to satisfy the above requirement and clause 14 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries), 2007*, and is supported by the *Mount Pleasant Optimisation Project Greenhouse Gas Calculations* report prepared by Todoroski Air Sciences (2021) (Attachment A) and peer reviewed by Katestone Environmental (refer to Attachment 5 of the main text of the EIS).

3 POLICY FRAMEWORK

3.1 GLOBAL

The international framework addressing greenhouse gas emissions, and the global response to climate change, commenced with adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992.

The UNFCCC has close to global membership, with 197 Parties (UNFCCC, 2020a). While a number of negotiating sessions are held each year, the largest is the annual Conference of the Parties (UNFCCC, 2020a). Two of the most important progressions of the UNFCCC were at the third Conference of the Parties (in 1997) and 21st Conference of the Parties (in 2015), with the adoption of the *Kyoto Protocol* and the *Paris Agreement*, respectively.

The *Kyoto Protocol* entered into force in 2005 and imposed limits on the greenhouse gas emissions of developed countries listed in Annex 1 to the UNFCCC, with an initial commitment period of 2008 to 2012 (UNFCCC, 2020b). The UNFCCC requires parties to submit national inventories of greenhouse gas emissions and report on steps taken to implement the *Kyoto Protocol* (UNFCCC, 2020b). The *Doha Amendment* to the *Kyoto Protocol* was adopted at the 18th Conference of the Parties (in 2012), which included a second commitment period of 2013 to 2020 (UNFCCC, 2020b). However, the *Doha Amendment* has not yet entered into force (UNFCCC, 2020b).

The goal of the *Paris Agreement* is to limit global temperature increases to well below 2 degrees Celsius (°C) above pre-industrial levels (UNFCCC, 2020b). In order to achieve that goal, Parties aim to reach peak global emissions as soon as possible, so as to (UNFCCC, 2020c):

> *… achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs[2] in the second half of the century.*

The *Paris Agreement* does not specify how global emission reductions are to be achieved. It requires Parties to prepare, communicate and maintain nationally determined contributions (NDCs) and to pursue domestic measures to achieve them (UNFCCC, 2020c; UNFCCC, 2020d). The NDCs are to be communicated every five years, with each successive NDC to represent a progression beyond the previous NDC. Parties' first NDCs were submitted in 2015. Second or updated NDCs are due to be submitted in 2020.

The greenhouse gas emissions associated with coal produced by the Project that is used domestically will be accounted for and managed in accordance with domestic law that has been adopted to implement Australia's NDCs. Greenhouse gas emissions produced by the end use of Project coal overseas would be accounted for and managed in accordance with the laws that have been adopted to implement the NDCs of the countries to which the coal is exported. The NDCs of key countries to which MACH currently exports coal from the MPO and the key countries to which coal from the Project is expected to be exported (Expected Export Countries) are described in Section 5.4.

At the 24th Conference of the Parties (in 2018), the *Katowice Climate Package* was agreed. The *Katowice Climate Package* contains, among other things, detailed guidance on the features of NDCs and the information each country should provide to improve transparency regarding NDCs, as well as highlighting the need to ensure that double counting of greenhouse gas emissions is avoided (UNFCCC, 2020e).

[2] Greenhouse gases

3.2 NATIONAL

Australia's first NDC under the *Paris Agreement* communicates a greenhouse gas emission reduction target of 26% to 28% below 2005 levels by 2030 (Commonwealth of Australia, 2015).

Australia's first NDC is an unconditional, economy-wide target that represents reductions in emissions per capita by 2030 of approximately 50 to 52% and reductions in emissions per unit of Gross Domestic Product (GDP) by 2030 of approximately 64 to 65% (Commonwealth of Australia, 2015).

3.2.1 Assessment

Australia's National Greenhouse Accounts are prepared by the Commonwealth DISER. The DISER publishes the greenhouse gas emission factors used in preparing the National Greenhouse Accounts. The *National Greenhouse Accounts Factors Australian National Greenhouse Accounts October 2020* (NGA Factors) (DISER, 2020) is the latest such publication.

3.2.2 Reporting

The Commonwealth *National Greenhouse and Energy Reporting Act, 2007* (NGER Act) is a national framework for reporting greenhouse gas emissions, energy production and energy consumption by corporations. The greenhouse gas emissions and energy data reported under the NGER Act is used by the Commonwealth Government in compiling Australia's national greenhouse gas emission inventory to meet its reporting obligations under the UNFCCC.

Under the NGER Act, corporations that have operational control of facilities must report their greenhouse gas emissions and energy data if they meet the thresholds for reporting. The thresholds are:

a) emitting 25,000 t CO_2-e of greenhouse gas emissions or producing or consuming 100 terajoules (TJ) of energy (for an individual facility); or

b) emitting 50,000 t CO_2-e of greenhouse gas emissions or producing or consuming 200 TJ of energy (cumulatively for all facilities under the operational control of the corporation).

Reporting requirements of the NGER Act include both Scope 1 and Scope 2 emissions. To avoid the potential double counting of emissions, the NGER Act does not cover Scope 3 emissions.

The MPO has triggered reporting under the NGER Act, and the following emissions and energy data were reported to the Clean Energy Regulator for the 2018 to 2019 reporting period:

- Scope 1 emissions – 185,921 t CO_2-e.
- Scope 2 – 2,124 t CO_2-e.
- Energy consumed – 623,350 gigajoules.

MACH would continue to comply with its obligations under the NGER Act for the Project.

3.2.3 Mitigation

The Emissions Reduction Fund is the centrepiece of a suite of Commonwealth Government policies designed to incentivise business and other entities to adopt better technologies and practices to reduce greenhouse gas emissions (Commonwealth of Australia, 2017). The Emissions Reduction Fund is a $2.55 billion fund that purchases emission reductions and abatement through a Commonwealth Government procurement process. The Emissions Reduction Fund is underpinned by the Commonwealth *Carbon Credits (Carbon Farming) Act, 2011*, which provides a framework for developing offset projects and the creation of Australian carbon credit units.

In February 2019 the Australian Government announced the Climate Solutions Package, which is a $3.5 billion plan to deliver Australia's 2030 emissions reduction target. As part of the package, a Climate Solutions Fund has been established to continue the work of the Emissions Reduction Fund with an additional $2 billion investment over 10 years. Approximately $200 million per year over ten years is expected to be allocated to abatement purchases through the Emissions Reduction Fund.

In addition, a range of policies including the Safeguard Mechanism, the Renewable Energy Target and the National Energy Productivity Plan have been implemented to help Australia meet its greenhouse gas commitments (Commonwealth of Australia, 2017).

The Safeguard Mechanism, which was established through the NGER Act, aims to ensure that greenhouse gas emission reductions purchased through the Emissions Reduction Fund are not undermined by increases in greenhouse gas emissions in other sectors. The Safeguard Mechanism sets a baseline level of emissions for facilities that emit over 100,000 t CO_2-e per year. If a facility exceeds its baseline level, it is generally required to surrender Australian carbon credit units, equivalent to the exceedance, to the Clean Energy Regulator. There are other mechanisms by which a facility can manage baseline exceedance, including applying for multi-year monitoring periods and exemptions for exceptional circumstances (i.e. natural disasters or criminal activity unrelated to the liable entity).

The baseline currently set for the MPO is 663,971 t CO_2-e (Clean Energy Regulator, 2020a).

3.3 STATE

The NSW Government has released the *NSW Climate Change Policy Framework* (Office of Environment and Heritage, 2016), which commits NSW to the ‘aspirational long-term objective’ of achieving net-zero emissions by 2050. The NSW Climate Change Policy Framework endorses the *Paris Agreement* and includes as one of its aspirational objectives the implementation of policies consistent with the Commonwealth Government’s plans for long-term greenhouse gas emission reductions. It also includes an objective for NSW to be more resilient to climate change impacts (Office of Environment and Heritage, 2016).

3.3.1 Assessment

Estimates of NSW’ greenhouse gas emissions are prepared as part of Australia’s National Greenhouse Accounts by the DISER. The NGA Factors published by the DISER includes NSW-specific emission factors used in preparing the National Greenhouse Accounts.

3.3.2 Reporting

In addition to the reporting of greenhouse gas emissions and energy consumption/production of individual facilities in NSW through reporting under the NGER Act (Section 3.2), and Commonwealth Government's reporting of the State's greenhouse gas emissions via the National Greenhouse Accounts, the NSW Government has committed to additional reporting as part of the Net Zero Plan Stage 1: 2020 – 2030, including (Department of Planning, Industry and Environment [DPIE], 2020a):

- State of the Environment Reports, which will describe the greenhouse gas emissions reductions achieved, greenhouse gas emissions forecasts and economic impact analyses.
- Annual recommendations from the NSW Climate Change Council, focused on potential improvements to the programs described in the Net Zero Plan Stage 1: 2020 – 2030, opportunities for further greenhouse gas emissions reductions and reducing the cost of living in NSW.
- Reports from the NSW Chief Scientist and Engineer every second year on emerging technologies that can reduce greenhouse gas emissions and are commercially competitive.

3.3.3 Mitigation

The NSW Climate Change Policy Framework is being implemented in part through the Climate Change Fund, through which the NSW Government is investing $1.4 billion for the period 2017 to 2022 to improve energy affordability and reliability, help households and businesses save money and improve climate change resilience in communities across NSW (DPIE, 2020b).

The DPIE published the Net Zero Plan Stage 1: 2020-2030 in March 2020, which describes how, over the next decade, the NSW Government intends to work towards its objective of achieving net zero emissions by 2050 (DPIE, 2020a). The Net Zero Plan Stage 1: 2020-2030 sets out greenhouse gas emissions mitigation measures relevant to electricity generation, transport, agriculture, stationary energy (excluding electricity generation), fugitive emissions, industrial processes, waste and land use (DPIE, 2020a).

The NSW Government outlines a number of greenhouse gas mitigation strategies in the Net Zero Plan Stage 1: 2020-2030, including (DPIE, 2020a):

- A $450 million Emissions Intensity Reduction Program to support businesses in transitioning their process, plant and equipment to low greenhouse gas emissions alternatives.
- A further $450 million from the Commonwealth's Climate Solutions Fund to support land managers, farms and other businesses to implement low-cost greenhouse gas emissions reduction actions.
- Development of Renewable Energy Zones to connect investors with communities who wish to diversify their electricity supply with renewable energy.
- Establishment of an Energy Security Safeguard and expansion of the Energy Efficiency Program to improve energy efficiency.
- Development of an Electric Vehicle Infrastructure and Model Availability Program to increase the uptake of electric vehicles in NSW.
- Development of a Primary Industries Productivity and Abatement Program to support landowners and primary producers in commercialising low-emissions technologies and maximising their revenue from carbon offset programs.
- Investment in a Coal Innovation Program focused on providing incentives for capturing and reusing methane released from underground mines, and commercialising emerging technologies that can reduce fugitive emissions from hard-to-mitigate mines.

- Establishment of policies regarding organic waste management and development of waste to energy facilities to reduce the amount of methane generated from decomposing organic material.
- Development of a Green Investment Strategy to facilitate growth in the environmental goods and services sector and attract new investors.

Notably, the Net Zero Plan Stage 1: 2020-2030 (DPIE, 2020a) states the following:

> *New South Wales' $36 billion mining sector is one of our biggest economic contributors, supplying both domestic and export markets with high quality, competitive resources. Mining will continue to be an important part of the economy into the future and it is important that the State's action on climate change does not undermine those businesses and the jobs and communities they support.*

This illustrates that the State of NSW is adopting an approach to emissions reduction that balances both socio-economic factors and emission reduction opportunities for the long-term benefit of the State.

3.3.4 Adaptation

The NSW Government acknowledges that changes to climate due to global greenhouse gas emissions are unavoidable and NSW must adapt to these climatic changes by building resilience (DPIE, 2020c).

It is further acknowledged that responsibility for adapting to climate change and building resilience is shared between private entities and governments (DPIE, 2020d), consistent with the roles and responsibilities of governments, businesses and the community in regard to climate change adaptation in Australia agreed by the Council of Australian Governments (COAG) in 2012 (COAG, 2012).

Role of Government

The NSW Government (DPIE, 2020d) states the following basic principle of climate change risk management for governments, consistent with the *Select Council on Climate Change Meeting Communique 16 November 2012* (COAG, 2012):

> *Governments (on behalf of the community) should be responsible primarily for managing risks to public goods and assets (including the natural environment) and to government service delivery, and for creating an institutional, market and regulatory environment that supports and promotes private adaptation.*

COAG (2012) describes that one of the key roles of government in climate change adaptation is to set the right conditions to facilitate adaptation by private entities. This means governments must ensure that policies and regulatory arrangements that facilitate climate change adaptation do not distort market signals and incentives for private entities (COAG, 2012). This is reinforced in the 'Guiding principles for the management and allocation of climate change risks' (COAG, 2012), which states:

> *Public actions and policies should be carefully targeted and should not undermine the incentives for, or capacity of, the private sector to individually manage risk.*

Governments should also ensure climate change risk is appropriately recognised by private entities and the responsibility for management of such risks is apportioned and communicated effectively (COAG, 2012).

The NSW *Climate Change Policy Framework* (Office of Environment and Heritage, 2016) (Section 3.3) outlines the NSW Government's commitments regarding reducing greenhouse gas emissions and building resilience in NSW. In line with the above, the *Climate Change Policy Framework* and the subsequent Net Zero Plan Stage 1: 2020 – 2030 (DPIE, 2020a) (Section 3.3.3) are focused on programs and strategies that incentivise participation by businesses, rather than requiring participation.

COAG (2012) notes that local governments have a critical role in ensuring local circumstances are adequately considered in the overall adaptation response by the State, and in involving communities directly in facilitating change.

Role of Business

The NSW Government (DPIE, 2020d) states the following basic principle of climate change risk management for private entities, consistent with the *Select Council on Climate Change Meeting Communique 16 November 2012* (COAG, 2012):

> *Private parties should be responsible for managing risks to private assets and incomes.*

COAG (2012) expands on the above basic principle, noting that to manage risks from climate change impacts, private entities should:

- *be aware of the risks and their responsibility for managing them;*
- *take steps to understand the magnitude and nature of the specific risks to their assets and activities; and*
- *develop and implement strategies and actions to manage the risks.*

4 ESTIMATED PROJECT GREENHOUSE GAS EMISSIONS

4.1 GREENHOUSE GAS EMISSIONS ESTIMATION METHODOLOGY

Project direct and indirect greenhouse gas emissions have been estimated by Todoroski Air Sciences (2021) (Attachment A) using published emission factors from the NGA Factors (DISER, 2020), where possible.

Where NGA Factors were not available (e.g. for rail and ship transport), greenhouse gas emissions have been estimated based on emissions projections for the same activities for similar projects. Fugitive emissions have been calculated using site-specific emissions data.

The energy contents, emission factors and activity data used to estimate the Project's greenhouse gas emissions are summarised in Attachment A.

4.2 PROJECT GREENHOUSE GAS EMISSIONS

A summary of key potential Project greenhouse gas emissions sources considered is provided in Table 1. The Project greenhouse gas emissions estimated by Todoroski Air Sciences (2021) are summarised in Table 2.

Table 1
Summary of Key Potential Project Greenhouse Gas Emissions

Component	Direct Emissions	Indirect Emissions	
	Scope 1	Scope 2	Scope 3
Electricity consumption for the processing of ROM coal and other on-site uses	N/A	Emissions from the consumption of purchased electricity used at the Project.	Upstream emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed, and the electricity lost in delivery in the transmission and distribution network.
Diesel consumption (including during decommissioning)	Emissions from the combustion of diesel at the Project.	N/A	Upstream emissions attributable to the extraction, production and transport of diesel consumed at the Project.
Oil and grease consumption (including during decommissioning)	Emissions from the consumption of oil and grease at the Project.	N/A	Upstream emissions attributable to the extraction, production and transport of oil and grease consumed at the Project.
Land (vegetation) clearing	Release of stored carbon in vegetation	N/A	N/A
Explosives	Emissions from the use of explosives.	N/A	N/A[1]
Fugitive	Fugitive emissions resulting from the extraction of coal.	N/A	N/A
Product coal transport	N/A	N/A	Downstream emissions from the combustion of diesel used during domestic rail transport and shipping.
Combustion of product coal	N/A	N/A	Downstream third-party emissions from the combustion of product coal from the Project.

After: Todoroski Air Sciences (2021).

[1] The contribution of Scope 3 emissions from the use of explosives (i.e. upstream emissions from the production and transport of explosives) is not material in the context of overall emissions.

Table 2
Summary of Greenhouse Gas Emission Estimates

Period	Estimated Greenhouse Emissions (Mt CO_2-e)		
	Scope 1	Scope 2	Scope 3
Annual average*	0.45	0.08	33.1
Maximum annual value	0.61	0.11	45.1
Total over life of Project*	12.0	2.17	860

After: Todoroski Air Sciences (2021).

Note: Mt CO_2-e = Million tonnes of carbon dioxide equivalent.

* The annual average values exclude the decommissioning phase, but the total values include the decommissioning phase.

The estimated annual average and maximum annual Scope 1 greenhouse gas emissions of the Project are within the MPO's current Safeguard Mechanism baseline of approximately 0.664 Mt CO_2-e.

It is acknowledged that the MPO's Safeguard Mechanism baseline value may change over time in accordance with the provisions of the NGER Act and the applicable rules and regulations (Clean Energy Regulator, 2020b). Notwithstanding, it is anticipated that MACH's implementation of various mitigation measures to minimise the overall generation of greenhouse gas emissions from the Project (Section 4.2.2) would result in greenhouse gas emissions being maintained within any varied Safeguard Mechanism baseline emissions value. Otherwise, MACH would be required to purchase Australian carbon credit units for any exceedance of the baseline.

The estimated Project greenhouse gas emissions, disaggregated by key greenhouse gas emissions source (e.g. diesel combustion, end use of coal, etc.), is provided in section 2.3 of Attachment A.

Discussion of the greenhouse gas emission intensity of the Project is provided in Section 4.2.1, and details of the Project's relative greenhouse gas contribution at a global, national and state level is provided in Sections 4.2.4 and 5.4.

4.2.1 Greenhouse Gas Emissions Intensity

The estimated Scope 1 and 2 greenhouse gas emissions intensity of the Project is estimated to be approximately 0.03 Mt CO_2-e/Mt ROM coal (Attachment A). This compares favourably with other coal mining operations in the Hunter Valley, which have estimated greenhouse gas emissions intensities ranging from 0.03 to 0.07 Mt CO_2-e/Mt ROM coal (Attachment A). The low greenhouse gas emissions intensity is related to the relatively low strip ratios at the MPO, which also lower the cost of coal production.

4.2.2 Mitigation and Management Measures

Existing greenhouse gas mitigation and management measures implemented at the MPO would continue for the Project.

As diesel fuel consumption represents more than half of estimated direct emissions, the existing measures are generally focused on minimising greenhouse gas emissions through the efficient use of diesel, by:

- optimising the design of haul roads to minimise the distance travelled;
- minimising the re-handling of material (i.e. coal, overburden and topsoil); and
- maintaining the mobile fleet in good operating order.

As part of the Project, MACH would review and update existing direct (Scope 1) greenhouse gas minimisation measures at the MPO, including consideration of the fuel efficiency in mobile fleet items. In addition, MACH would investigate whether it is reasonable and feasible to also reduce Scope 2 greenhouse gas emissions associated with on-site electricity use (e.g. evaluation of sourcing a proportion of site electricity from renewable sources).

Greenhouse gas emissions from the MPO would also continue to be monitored, and where relevant reported annually, in accordance with MACH's obligations under the NGER Act.

4.2.3 Future Demand for Coal and Potential for Coal Market Substitution

As described in the NSW Government's *Strategic Statement on Coal Exploration and Mining in NSW* (NSW Government, 2020), while many countries are transitioning from fossil fuels to low-carbon sources of energy, the long-term global seaborne thermal coal demand is not expected to decrease significantly in the next three decades. The NSW Government notes that (NSW Government, 2020):

> *Ending or reducing NSW thermal coal exports while there is still strong long-term global demand would likely have little or no impact on global carbon emissions. Most coal consumers would be likely to source their coal from elsewhere, and much of this coal would be lower quality compared to NSW coal.*

In consideration of this, the NSW Government is committed to supporting responsible coal production in areas deemed suitable for mining in NSW. Notably, this includes considering the extension of existing coal mines (NSW Government, 2020), such as the MPO. The Project would involve the extraction of approximately 247 million tonnes (Mt) of additional ROM coal in comparison to the approved MPO, without significantly increasing the approved mine disturbance footprint, providing various high-quality thermal coal products.

In addition, the coal produced by the Project would not necessarily result in, or coincide with, a net increase in coal production globally, or in the Hunter Valley, compared to current levels of production. Graph 1 provides a summary of the approved and proposed coal extraction in the Hunter Valley for the period 2010 to 2050 based on currently approved and proposed projects. Graph 1 illustrates that the Project's coal would be expected to replace some of the production from other coal mines that will cease once their coal reserves have depleted.

4.2.4 The Project's Relative Greenhouse Gas Emissions Contribution

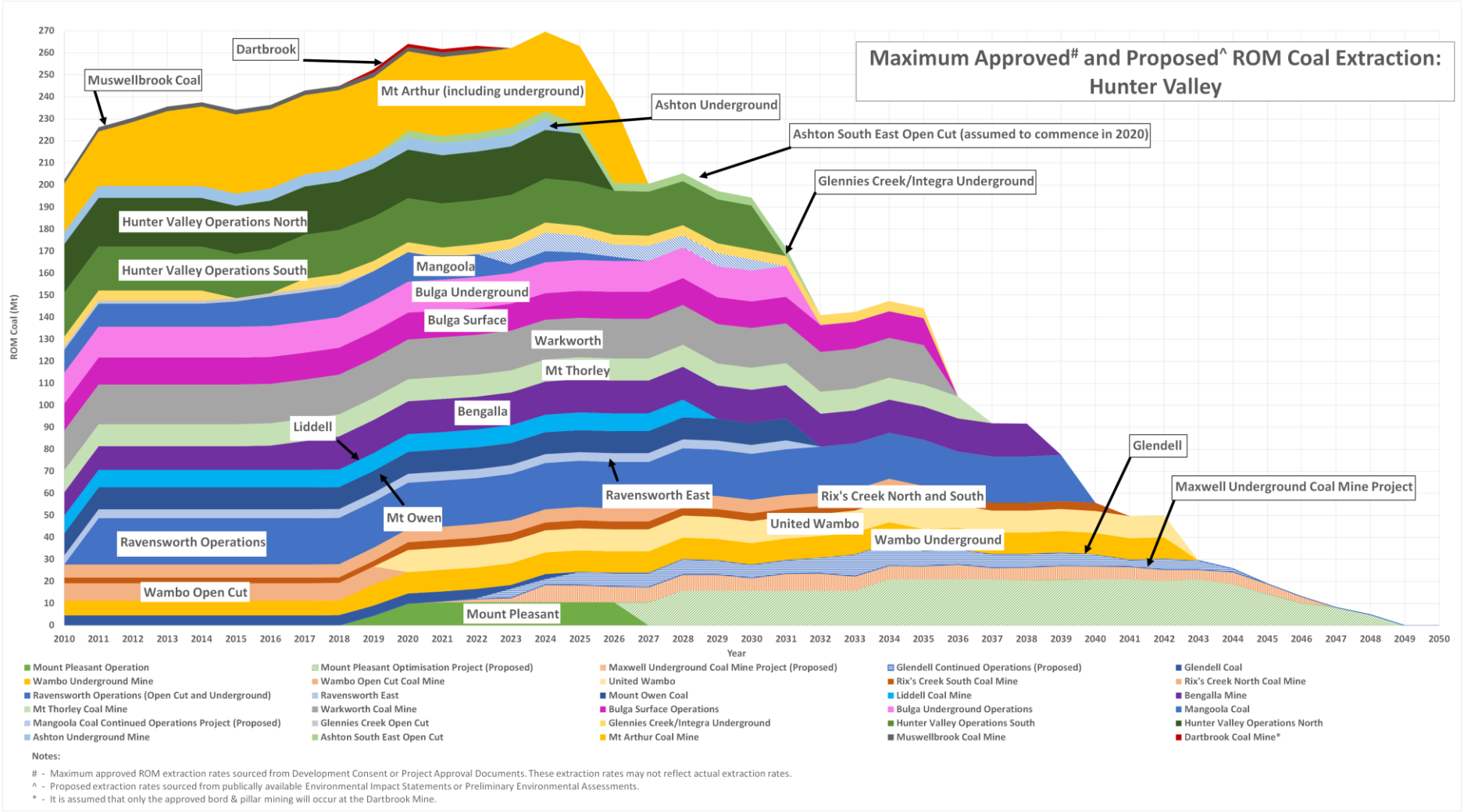
The estimated greenhouse gas emissions of the Project should also be considered in the context of global greenhouse gas emissions associated with anthropogenic sources. Emissions from power generation (including the combustion of coal and gas), transport (e.g. automobiles, aeroplanes and ships), agriculture for food production and industrial processes all contribute to global emissions.

To gain an understanding of the Project in the context of the global coal market and global greenhouse gas emissions, the Project's annual coal production volume can be compared to the current global coal demand and the Project's greenhouse gas emissions can be compared to total estimated anthropogenic greenhouse gas emissions. The International Energy Agency estimates the current global coal demand to be in the order of 5,000 Mt of coal per annum (International Energy Agency, 2020). The proposed peak production rate of the Project of 21 Mt represents approximately 0.4% of the current estimated global coal demand. Consistent with the NSW Government's *Strategic Statement on Coal Exploration and Mining in NSW* (Section 4.2.3), should the Project be rejected, global coal demand would be satisfied by alternative sources of coal of lower quality that would otherwise be consumed.

Comparison of the Project's annual average Scope 1 and 2 emissions during the operational phase (approximately 0.54 Mt CO_2-e) to the total anthropogenic greenhouse gas emissions globally (excluding land use change) in 2017 of approximately 50 gigatonnes of carbon dioxide equivalent (Gt CO_2-e) (United Nations Environment Program, 2018) indicates the Project's Scope 1 and 2 emissions would contribute approximately 0.001% in the context of cumulative global emissions.

Further, comparison of the annual average Scope 3 emissions of customer entities combusting coal produced by the Project (approximately 32.4 Mt CO_2-e) (Attachment A) to the total anthropogenic greenhouse gas emissions globally (excluding land use change) in 2017 suggests these emissions would be approximately 0.065% of global anthropogenic emissions.

Further discussion of the Project's relative greenhouse gas emissions contribution, in the context of NSW and Australian greenhouse gas emissions, is provided in Section 5.4.



Graph 1
Approved and Proposed Coal Extraction in the Hunter Valley

5 POTENTIAL IMPACTS OF CLIMATE CHANGE

Consideration of the potential implications of climate change involves complex interactions between climatic, biophysical, social, economic, institutional and technological processes.

Although scientific understanding of climate change has improved, projections are still subject to a wide range of uncertainties such as (Commonwealth Scientific and Industrial Research Organisation [CSIRO] and Bureau of Meteorology [BoM], 2015):

> *…scenario uncertainty, due to the uncertain future emissions and concentrations of greenhouse gases and aerosols; response uncertainty, resulting from limitations in our understanding of the climate system and its representation in climate models; and natural variability, the uncertainty stemming from unperturbed variability in the climate system.*

The sources for climate change projections considered for the Project include:

- The *Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC) (Kirtman *et al.*, 2013; Collins *et al.*, 2013) and the *Global Warming of 1.5°C* Special Report of the IPCC (IPCC, 2018).
- Climate Change in Australia, produced by CSIRO and BoM (Dowdy *et al.*, 2015).
- The NSW and Australian Capital Territory (ACT) Regional Climate Modelling (NARCliM) Project, a research partnership between the NSW and ACT Governments and the Climate Change Research Centre at the University of NSW (NARCliM, 2015).

The Climate Change in Australia report presents climate change projections for Australia. The NARCliM Project presents climate change projections for NSW and ACT only.

5.1 CLIMATE CHANGE PROJECTIONS GLOBALLY

The IPCC has completed a number of comprehensive assessments of potential climate change, which include projections for both the 'near-term', focused on the period 2016 to 2035, and 'long-term', focused on the period 2081 to 2100. Summaries of relevant climate projections from the *Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Kirtman *et al.*, 2013; Collins *et al.*, 2013) are provided below.

While the Sixth Assessment Report of the IPCC is due to be completed in 2022, a special report was published in 2018 that described the potential impacts of global warming of 1.5°C above pre-industrial levels (IPCC, 2018). A summary of the key potential impacts described in the special report are provided below.

***Fifth Assessment Report* – 'near-term' climate projections**

Projections indicated global mean surface temperatures are likely to increase by 0.3 to 0.7°C relative to the reference period of 1986 to 2005, though they may increase to between 1 and 1.5°C (Kirtman *et al.*, 2013).

In regard to temperature extremes, it is likely that warm days and nights will be more frequent, while cold days and nights will be less frequent (Kirtman *et al.*, 2013).

Heavy rainfall events are anticipated to become more frequent over land (Kirtman *et al.*, 2013).

***Fifth Assessment Report* – 'long-term' climate projections**

Global mean surface temperatures are projected to increase by 1.1 to 2.6°C under the RCP4.5[3] climate scenario and 2.6 to 4.8°C under the RCP8.5[4] climate scenario (Collins *et al.*, 2013).

Climate projections suggest it is virtually certain that, in most places, there will be fewer cold but more hot temperature extremes as global mean temperatures increase (Collins *et al.*, 2013).

Global rainfall is anticipated to increase with increased global mean temperatures. Further, the contrast between annual mean rainfall in wet and dry regions, and between wet and dry seasons, will increase over most of the globe (Collins *et al.*, 2013).

***Global Warming of 1.5°C Special Report* – key potential impacts**

The IPCC (2018) projects that, between 2030 and 2052, global warming is likely to reach 1.5°C above pre-industrial levels (i.e. the mean temperature over the period 1850 to 1900) if it continues to increase at its current rate.

Extreme climatic events (e.g. hot extremes, heavy rainfall events and droughts) are projected to be more frequent if global warming reaches 1.5°C above pre-industrial levels, and even more frequent if global temperatures are raised to 2°C above pre-industrial levels (IPCC, 2018).

5.2 CLIMATE CHANGE PROJECTIONS FOR AUSTRALIA

In Australia, the climate is generally projected to become warmer and drier. Climate change may result in changes to rainfall patterns, runoff patterns and river flow.

Two greenhouse gas global emission scenario projections for annual average rainfall in the East Coast South sub-cluster of 'Eastern Australia' for 2030 and 2090 (relative to 1995) are presented in Table 3 based on Climate Change in Australia, produced by CSIRO and BoM (Dowdy *et al.*, 2015).

It is noted that the RCP8.5 scenario illustrated in Table 3 is a scenario where minimal greenhouse gas emissions controls are introduced, and hence does not reflect the measures currently being pursued by Parties to the *Paris Agreement*.

Table 3
Climate Change Projections for the East Coast South Sub-cluster, Eastern Australia – Percentage Change in Rainfall (relative to 1995)

Period	2030	2090	
	RCP4.5	RCP4.5	RCP8.5
Summer	+1	0	+11
Autumn	-3	-1	-2
Winter	-5	-8	-17
Spring	-1	-6	-8
Annual	-3	-2	-3

Source: After Dowdy *et al.* (2015).
RCP4.5: Emissions scenario assuming a slow reduction in emissions that stabilises CO_2 concentration at about 540 ppm by 2100.
RCP8.5: Emissions scenario assuming an increase in emissions leading to a CO_2 concentration of about 940 ppm by 2100.

[3] Emissions scenario assuming a slow reduction in emissions that stabilises CO_2 concentration at about 540 parts per million (ppm) by 2100.
[4] Emissions scenario assuming an increase in emissions leading to a CO_2 concentration of about 940 ppm by 2100.

5.3 CLIMATE CHANGE PROJECTIONS FOR NEW SOUTH WALES

The Project is located within the Hunter Region of the NARCliM Project domain. NARCliM projections are generated with the Weather Research and Forecasting Model, which has been demonstrated to be effective in simulating temperature and rainfall in NSW and provides a good representation of local topography and coastal processes (Evans and McCabe, 2010).

Mean temperatures in the Hunter Region are projected to rise by 0.7°C by 2030 and 2°C by 2070 (NARCliM, 2015). Summer and spring will experience the greatest changes in temperatures, with maximum temperatures increasing by 2.3°C by 2079. These increases are projected to occur across the region, with a slightly greater increase in the Upper Hunter (NARCliM, 2015).

Changes to annual rainfall are predicted to vary across the Hunter Region, with rainfall projected to increase in autumn and decrease in winter (NARCliM, 2015) (Table 4).

Table 4
Climate Change Projections for the Hunter Region, NSW – Percentage Change in Rainfall

Period	2020-2039	2060-2079
Summer	-2.9	+9.6
Autumn	+12.7	+13.1
Winter	-1.3	-2.8
Spring	-0.1	+2.4
Annual	+1.8	+7.2

Source: After NARCliM (2015).

Note: Projections based on IPCC high emissions A2 scenario and relative to 1990-2009 baseline period.

The NARCliM (2015) and Dowdy *et al.* (2015) rainfall projections are quite variable, particularly for the 2079/2090 forecast. As shown in Table 3, Dowdy *et al*. (2015) project a generally drier climate, whereas Table 4 indicates that NARCliM (2015) projects a wetter climate.

NARCliM projections are based on the IPCC high emissions A2 scenario, which projects an increase in global warming by approximately 3.4°C by 2100. The A2 scenario is similar to the RCP8.5 scenario modelled by Dowdy *et al*. (2015), in terms of changes in global mean temperature, and hence does not reflect the measures currently being pursued by Parties to the *Paris Agreement*.

The potential implications of climate change on local groundwater and surface water resources are considered in the Project Groundwater Assessment (Australasian Groundwater and Environmental Consultants, 2020) and the Project Surface Water Assessment (Hydro Engineering Consulting, 2020), respectively.

Over the life of the Project, it is anticipated that such climatic modelling for Australia, NSW and various regions will be updated many times as international greenhouse gas emissions mitigation measures are adjusted based on the uptake of less carbon-intensive technology and as climate science continues to evolve.

The potential contributions of Project greenhouse gas emissions to national and international emissions are considered in the following sub-sections.

5.4 POTENTIAL IMPACTS OF THE PROJECT

Biological diversity, or 'biodiversity', is considered to be the number, relative abundance, and genetic diversity of organisms from all habitats (including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part) and includes diversity within species and between species as well as diversity of ecosystems (Lindenmayer and Burgman, 2005).

Many natural ecosystems are considered to be vulnerable to climate change. Patterns of temperature and rainfall are key factors affecting the distribution and abundance of species (Preston and Jones, 2006). Projected changes in climate will have diverse ecological implications. Habitat for some species will expand, contract and/or shift with the changing climate, resulting in habitat losses or gains, which could prove challenging, particularly for species that are threatened.

Anthropogenic Climate Change is listed as a key threatening process under the NSW *Biodiversity Conservation Act, 2016*, and *Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases* is listed as a key threatening process under the EPBC Act.

It is acknowledged that (subject to the efficacy of national and international greenhouse gas abatement measures) all sources of greenhouse gas emissions will contribute in some way towards the potential global, national, state and regional effects of climate change.

5.4.1 Project Scope 1 and 2 Emissions

The Project's contribution to Australian emissions would be relatively small, as estimated annual average Scope 1 and 2 emissions from the Project during operations represent approximately 0.4% of the estimated total greenhouse gas emissions in NSW from 2017 (131.5 Mt CO_2-e) and approximately 0.1% of Australia's annual greenhouse gas emissions from 2017 (534.7 Mt CO_2-e) (Attachment A).

The Project's contribution to global climate change effects would be proportional to its contribution to global greenhouse gas emissions. Greenhouse gases directly generated at the Project (i.e. Scope 1 emissions) and indirect emissions associated with the on-site use of electricity (i.e. Scope 2 emissions) have together been estimated at approximately 0.54 Mt CO_2-e per year during operations (Table 2). These emissions would be small in the context of global greenhouse gas emissions (Section 4.2.4).

MACH would continue to report on its contribution to Australian greenhouse gas emissions inventories through its obligations for reporting under the NGER Act, and would comply with other applicable laws and policies implemented by the government to manage emissions under Australia's progressive NDCs, including under the Safeguard Mechanism as set out above.

5.4.2 Project Scope 3 Emissions

The Project's Scope 1 and 2 emissions would be significantly less than the Scope 3 emissions produced by customers using Project product coal. It is anticipated that a significant majority of the Scope 3 emissions from the use of Project coal would occur overseas. The estimated Scope 3 emissions associated with the combustion of coal produced by the Project by customer entities would represent approximately 0.065% of the total anthropogenic greenhouse gas emissions globally (excluding land use change) in 2017 (Section 4.2.4).

Under the *Paris Agreement*, each Party is required to prepare, communicate and maintain NDCs that will contribute to the long-term goals of the *Paris Agreement* (UNFCCC, 2020d).

It is important to note that, under the *Paris Agreement*, each NDC reflects the country's ambition for reducing emissions, taking into account its domestic circumstances and capabilities (UNFCCC, 2020d). Each country will have its own range of opportunities and priorities to trade off various alternative emission reduction (and carbon sink) options having regard to the economic priorities and physical attributes of the country.

Table 5 provides a high-level summary of the NDCs under the *Paris Agreement* of the Expected Export Countries for Project product coal. It should be noted that, under the *Paris Agreement*, these NDCs are successive and are to be updated every five years, with the next round of NDCs due by the end of 2020 (UNFCCC, 2020d). The review mechanisms under the *Paris Agreement*, therefore, provide for increasing the stringency of emission control measures as required over time to achieve the goals of the *Paris Agreement*.

Any small quantities of Project product coal sold on the domestic market (e.g. to AGL's Bayswater Power Station) would likely be substituting or augmenting supply from existing coal sources (i.e. it is anticipated greenhouse gas emissions associated with domestic power generation would not increase materially).

Table 5
Key Potential Customer Country Current Nationally Determined Contributions

Destination Country/State	Summary of First NDC [1]
Japan	A 26% reduction in greenhouse gas emissions compared to 2013 emissions by 2030, or a total of approximately 1,042 Mt CO_2-e in 2030.
India	A 33-35% reduction in greenhouse gas emissions per unit of GDP from the 2005 level by 2030.
South Korea	A 37% reduction in greenhouse gas emissions compared to the business-as-usual projection for 2030 by 2030, or a total of approximately 536 Mt CO_2-e in 2030.
China	Achieve peak greenhouse gas emissions in 2030, with a 60% to 65% reduction in greenhouse gas emissions per unit of GDP from the 2005 level in 2030.
Taiwan (Republic of China)	Taiwan is not recognised as an independent sovereign nation and therefore is not a member of the United Nations and consequently cannot be a party to the *Paris Agreement*. Nonetheless it has put forward an Intended NDC. Taiwan has committed to a 50% reduction in greenhouse gas emissions compared to the business-as-usual projection for 2030 by 2030, or a total of approximately 214 Mt CO_2-e in 2030.
Vietnam	A 9% reduction in greenhouse gas emissions compared to the business-as-usual projection for 2030 by 2030, or a total of approximately 845 Mt CO_2-e in 2030 (unconditional with domestic resources). A 27% reduction in greenhouse gas emissions compared to the business-as-usual projection for 2030 by 2030, or a total of approximately 677 Mt CO_2-e in 2030 (conditional with international support).
Malaysia	A 35% reduction in greenhouse gas emissions per unit of GDP from the 2005 level in 2030 (unconditional with domestic resources), and a 45% reduction in greenhouse gas emissions per unit of GDP from the 2005 level in 2030 (conditional with international support).
Thailand	A 20% reduction in greenhouse gas emissions compared to the business-as-usual projection for 2030 by 2030 (unconditional with domestic resources), and a 25% reduction in greenhouse gas emissions compared to the business-as-usual projection for 2030 by 2030 (conditional with international support).

After: Government of Japan (2020), Government of India (2016), Government of South Korea (2015), Department of Climate Change, National Development & Reform Commission of China (2015), Government of Taiwan (2015), Government of Vietnam (2020), Government of Indonesia (2016), Government of Malaysia (2015) and Government of Thailand (2020).

[1] At the time of writing, the second NDC of each potential customer country had not been submitted to the UNFCCC.

5.5 POTENTIAL IMPACTS ON THE PROJECT

Due to the inherent uncertainties associated with the climate change projections described in Sections 5.1 to 5.3, the potential impacts of climate change on the Project cannot be determined with a high degree of confidence.

Notwithstanding, the projections presented in Sections 5.1 to 5.3 indicate average temperatures are likely to rise in the Project area, and extreme temperature events may increase in frequency. This suggests that bushfire activity may become more prevalent in the region.

In addition, rainfall has the potential to both increase and decrease, particularly seasonally, with heavier rainfall events likely to become more frequent.

5.5.1 Key Risks and Mitigations

The potential for increased bushfire activity in the region poses risks to both the Project workforce and Project infrastructure. The Project's Preliminary Hazard Analysis (MACH, 2020) assesses a number of fire-related hazards (including those related to bushfires) and describes the relevant existing and proposed preventative measures.

MACH's Bushfire Management Plan (Narla Environmental, 2020) includes a range of measures to reduce the potential for the ignition of bushfires, as well as minimising potential impacts of bushfires on the MPO. Key mitigation measures include the prohibition of smoking on-site, and the management of fuel loads in a number of bushfire management zones (Narla Environmental, 2020).

Significant variations in rainfall patterns also have the potential to affect the Project in regard to water storage overtopping (e.g. during storm surges) and water reliability risks.

The potential implications of climate change have been considered in the Project Groundwater Assessment (Australasian Groundwater and Environmental Consultants, 2020) and the Project Surface Water Assessment (Hydro Engineering Consulting, 2020). Preliminary water storage designs and water reliability estimates have been determined in consideration of a wide range of potential climate scenarios, including prolonged dry periods and long periods of heavy rainfall. In addition, a post-mining extreme rainfall event (storm surge) has been evaluated for the final void and determined that no final void overtopping would occur (Hydro Engineering Consulting, 2020).

It is recognised that international measures to 'decarbonise' global economies may alter the future demand for and/or supply of coal. Expected global trends are factored into coal price forecasts considered in the Project Economic Assessment (AnalytEcon, 2021). The Economic Assessment also includes sensitivity analysis for variations in export coal prices and the social cost per tonne of carbon emissions. The sensitivity analysis shows that the Project would still generate a substantial net benefit to NSW under the scenarios considered (AnalytEcon, 2021).

5.5.2 Adaptive Management

MACH would implement an adaptive management approach to climate change impacts throughout the life of the Project.

This would include conducting climate change risk assessments in consideration of the DPIE's *Guide to Climate Change Risk Assessment for NSW Local Government* (DPIE, 2019) and implementing appropriate risk treatment strategies. Potential climate change risks to be assessed would include the example risks published by the NSW Office of Environment and Heritage (Office of Environment and Heritage, 2011).

6 EVALUATION AND SUMMARY

The Project's contribution to global climate change effects would be proportional to its contribution to global greenhouse gas emissions.

The Project's Scope 1 and Scope 2 emissions have together been estimated at approximately 0.54 Mt CO_2-e per year during operations, which represents approximately 0.4% of the estimated total greenhouse gas emissions in NSW from 2017 and approximately 0.1% of Australia's annual greenhouse gas emissions from 2017.

The estimated annual average Scope 3 emissions due to the combustion of coal produced by the Project by its customers would be approximately 0.065% of the total anthropogenic greenhouse gas emissions globally (excluding land use change) in 2017.

If the Project does not proceed, global demand for coal could be satisfied by other sources and, therefore, there would not be a corresponding reduction in global greenhouse emissions in the atmosphere. The Project's relatively low greenhouse gas emissions intensity and low cost of production (due to relatively low strip ratios) means that it would remain competitive in the global coal market. The Project's high-quality thermal coal means that if the Project does not proceed, the existing and future demand for coal is likely to be satisfied by lower-quality (and thus more emissions-intensive) coal which means that more coal would need to be burned to meet the same energy needs, resulting in higher greenhouse gas emissions.

In evaluating the Development Application for the Project under section 4.15(1) of the EP&A Act, the consent authority is required to take into consideration a range of matters, including, but not limited to, the provisions of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries), 2007,* the likely impacts of the Project, and the public interest.

The Project's greenhouse gas emissions and contribution to climate change are not the only factors that can inform the consent authority's consideration of the public interest. The public interest is broad and captures not only environmental considerations, but also the social and economic benefits associated with the Project for the wider community and the State. An evaluation of the merits of the Project is provided in Section 8 of the main text of the EIS.

In relation to greenhouse gas emissions, climate change and the principles of ecologically sustainable development, it is noted that:

- Greenhouse gas emissions estimates for the Project (Scopes 1, 2 and 3) have accounted for uncertainty by adopting conservative assumptions (Attachment A).
- The assessment of greenhouse gas emissions of the Project allows the effective integration of social, economic and environmental considerations in the decision-making process for the Project.
- MACH would implement a suite of mitigation measures to minimise the Project's Scope 1 and Scope 2 greenhouse gas emissions (as described in Section 4.2.2).
- Valuation of potential impacts of Project Scope 1 and Scope 2 greenhouse gas emissions has been incorporated into the Economic Assessment (AnalytEcon, 2021) for the Project.
- The Project would benefit current and future generations through:
    - approximately $856 million (net present value) in royalties and NSW' share of company income tax – noting a range of uncertainty analyses (e.g. variations in discount rate, coal price and exchange rate) indicate benefits would still be delivered to NSW under numerous economic scenarios (AnalytEcon, 2021);

  - the continuation and expansion of MPO employment to 2048 (up to approximately 830 full-time equivalent operational personnel); and
  - a range of positive flow-on effects of the Project, including continuation and expansion of local spend by the Project workforce and continuation and expansion of community contributions (i.e. under an updated Voluntary Planning Agreement for the Project) (AnalytEcon, 2021).

- The greenhouse gas emissions associated with the combustion of Project product coal will be primarily addressed and regulated by the Expected Export Countries, under their NDCs. Those NDC's reflect national priorities, including in respect of sustainable development and considering the potential benefits of providing reliable, affordable and efficient energy and electricity to different populations.

In relation to Australian and NSW laws and policies, it is noted that:

- There is nothing in existing climate change laws and policies which prohibits the approval of new coal mining development (including 'brownfield' expansions, such as the Project).
- None of the mechanisms or measures that Australia has adopted for the purpose of meeting its NDC under the *Paris Agreement* include restrictions on coal mine expansions.
- MACH would continue to comply with its obligations to report greenhouse gas emissions and energy consumption/production under the NGER Act.
- MACH would continue to comply with the Federal Government's Safeguard Mechanism by remaining below its baseline set by the Clean Energy Regulator, offsetting its emissions above its baseline, or otherwise managing compliance.
- The life of the Project would be completed before 2050, which is the target date for NSW achieving net zero emissions.
- It is the NSW Government's policy[5] that coal in NSW continues to be developed in recognition of the significant social and economic benefits to NSW that result from the efficient development of mineral resources.

MACH has considered the key potential climate change risks to the Project (namely increased frequency of bushfires, water reliability during dry periods and storm surges) in the design of the Project, and would continue to assess climate change risks on an ongoing basis via implementation of an adaptive management approach.

[5] As embodied in the NSW *Mining Act, 1992*, the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*, *Net Zero Plan Stage 1: 2020 – 2030* (DPIE, 2020a) and the *Strategic Statement on Coal Exploration and Mining in NSW* (NSW Government, 2020).

7 REFERENCES

AnalytEcon (2021) *Mount Pleasant Optimisation Project Economic Assessment*.

Australasian Groundwater and Environmental Consultants Pty Ltd (2020) *Mount Pleasant Optimisation Project Groundwater Assessment*.

Clean Energy Regulator (2020a) *Safeguard baselines table*.
Website:
http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/Safeguard-baselines-table#Safeguard-baselines-table
Date accessed: October 2020.

Clean Energy Regulator (2020b) *Baselines*.
Website: http://www.cleanenergyregulator.gov.au/NGER/The-safeguard-mechanism/Baselines
Date accessed: October 2020.

Coalition of Australian Governments (2012) *Select Council on Climate Change Meeting Communique 16 November 2012*.

Collins, M., R. Knutti, J. Arblaster, J.-L. Dufresne, T. Fichefet, P. Friedlingstein, X. Gao, W.J. Gutowski, T. Johns, G. Krinner, M. Shongwe, C. Tebaldi, A.J. Weaver and M. Wehner, 2013: Long-term Climate Change: Projections, Commitments and Irreversibility. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Commonwealth of Australia (2015) *Australia's Intended Nationally Determined Contribution to a new Climate Change Agreement – August 2015*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Australia%20First/Australias%20Intended%20Nationally%20Determined%20Contribution%20to%20a%20new%20Climate%20Change%20Agreement%20-%20August%202015.pdf
Date accessed: September 2020.

Commonwealth of Australia (2017) *Review of Climate Change Policies: Discussion Paper*.

Commonwealth Scientific and Industrial Research Organisation and Australian Bureau of Meteorology (2015) *Climate Change in Australia Information for Australia's Natural Resource Management Regions: Technical Report*.

Department of Climate Change, National Development & Reform Commission of China (2015) *Enhance Actions on Climate Change: China's Intended Nationally Determined Contributions*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/China%20First/China%27s%20First%20NDC%20Submission.pdf
Date accessed: October 2020.

Department of Industry, Science, Energy and Resources (2020) *National Greenhouse Accounts Factors Australian National Greenhouse Accounts October 2020*.

Department of Planning, Industry and Environment (2019) *Guide to Climate Change Risk Assessment for NSW Local Government – 2019 Revision*.

Department of Planning, Industry and Environment (2020a) *Net Zero Plan Stage 1: 2020 – 2030*.

Department of Planning, Industry and Environment (2020b) *NSW Climate Change Fund*.
Website: https://www.environment.nsw.gov.au/topics/climate-change/nsw-climate-change-fund#:~:text=Through%20the%20Climate%20Change%20Fund,across%20NSW%20to%20climate%20change.&text=increasing%20resilience%20to%20a%20changing%20climate.
Date accessed: October 2020.

Department of Planning, Industry and Environment (2020c) *NSW Government action on climate change*.
Website: https://climatechange.environment.nsw.gov.au/About-climate-change-in-NSW/NSW-Government-action-on-climate-change
Date accessed: October 2020.

Department of Planning, Industry and Environment (2020d) *What is Adaptation?*
Website: https://climatechange.environment.nsw.gov.au/Adapting-to-climate-change/What-is-Adaptation
Date accessed: October 2020.

Dowdy, A. et al. (2015) *East Coast Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions: Cluster Reports.* Elström, M. et al., CSIRO and Bureau of Meteorology (eds).

Evans, J.P. and McCabe, M.F. (2010) *Regional climate simulation over Australia's Murray-Darling Basin: A multi-temporal assessment*.

Government of India (2016) *India's Intended Nationally Determined Contribution: Working Towards Climate Justice*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf
Date accessed: September 2020.

Government of Indonesia (2016) *First Nationally Determined Contribution Republic of Indonesia*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Indonesia%20First/First%20NDC%20Indonesia_submitted%20to%20UNFCCC%20Set_November%20%202016.pdf
Date accessed: September 2020.

Government of Japan (2020) *Submission of Japan's Nationally Determined Contribution (NDC)*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Japan%20First/SUBMISSION%20OF%20JAPAN%27S%20NATIONALLY%20DETERMINED%20CONTRIBUTION%20(NDC).PDF
Date accessed: November 2020.

Government of Malaysia (2015) *Intended Nationally Determined Contribution of the Government of Malaysia*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Malaysia%20First/INDC%20Malaysia%20Final%2027%20November%202015%20Revised%20Final%20UNFCCC.pdf
Date accessed: September 2020.

Government of South Korea (2015) *Submission by the Republic of Korea – Intended Nationally Determined Contribution*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Republic%20of%20Korea%20First/INDC%20Submission%20by%20the%20Republic%20of%20Korea%20on%20June%2030.pdf
Date accessed: September 2020.

Government of Taiwan (2015) *Submission by Republic of China (Taiwan) Intended Nationally Determined Contribution*.
Website:
https://ghg.tgpf.org.tw/files/team/Submissiom_by_Republic_of_China_(Taiwan)INDC.pdf
Date accessed: September 2020.

Government of Thailand (2020) *Thailand's Updated Nationally Determined Contribution*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Thailand%20First/Thailand%20Updated%20NDC.pdf
Date accessed: November 2020.

Government of Vietnam (2020) *Updated Nationally Determined Contribution (NDC)*.
Website:
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Viet%20Nam%20First/Viet%20Nam_NDC_2020_Eng.pdf
Date accessed: November 2020.

Hydro Engineering Consulting Pty Ltd (2020) *Mount Pleasant Optimisation Project Surface Water Assessment*.

Intergovernmental Panel on Climate Change (2018) Summary for Policymakers. In: *Global Warming of 1.5°C*. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

International Energy Agency (2020) *Global coal demand by scenario, 2010 – 2040*.
Website: https://www.iea.org/data-and-statistics/charts/global-coal-demand-by-scenario-2010-2040
Date accessed: October 2020.

Kirtman, B., S.B. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang, 2013: Near-term Climate Change: Projections and Predictability. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Lindenmayer, D. and Burgman, M. (2005) *Practical Conservation Biology*.

MACH Energy Australia Pty Ltd (2020) *Mount Pleasant Operation Preliminary Hazard Analysis*.

Narla Environmental (2020) *Bushfire Management Plan – Mount Pleasant Operation*.

New South Wales and Australian Capital Territory Regional Climate Modelling Project (2015) *NSW Climate projections map for 2060-2079*.
Website: https://climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/Interactive-map
Date accessed: September 2020.

New South Wales Government (2020) *Strategic Statement on Coal Exploration and Mining in NSW*.

Office of Environment and Heritage (2011) *Guide to Climate Change Risk Assessment for NSW Local Government*.

Office of Environment and Heritage (2016) *NSW Climate Change Policy Framework*.

Preston, B. and Jones, R. (2006) *Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions*.

Todoroski Air Sciences (2021) *Mount Pleasant Optimisation Project Greenhouse Gas Calculations*.

United Nations Environment Program (2018) *Emissions Gap Report 2018*.

United Nations Framework Convention on Climate Change (2020a) *About the Secretariat*.
Website: https://unfccc.int/about-us/about-the-secretariat
Date accessed: October 2020.

United Nations Framework Convention on Climate Change (2020b) *What is the Kyoto Protocol?*
Website: https://unfccc.int/kyoto_protocol
Date accessed: October 2020.

United Nations Framework Convention on Climate Change (2020c) *What is the Paris Agreement?*
Website: https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement
Date accessed: October 2020.

United Nations Framework Convention on Climate Change (2020d) *Nationally Determined Contributions (NDCs)*.
Website: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/nationally-determined-contributions-ndcs
Date accessed: October 2020.

United Nations Framework Convention on Climate Change (2020e) *The Katowice climate package: Making the Paris Agreement Work For All*.
Website: https://unfccc.int/process-and-meetings/the-paris-agreement/katowice-climate-package#eq-1
Date accessed: October 2020.

World Business Council for Sustainable Development and World Resources Institute (2020) *Greenhouse Gas Protocol*.
Website: https://ghgprotocol.org/standards
Date accessed: November 2020.

ATTACHMENT A

GREENHOUSE GAS CALCULATIONS REPORT

MOUNT PLEASANT OPTMISATION PROJECT

GREENHOUSE GAS CALCULATIONS

MACH Energy Australia

11 January 2021

Job Number 19060984

Prepared by
Todoroski Air Sciences Pty Ltd
Suite 2B, 14 Glen Street
Eastwood, NSW 2122
Phone: (02) 9874 2123
Fax: (02) 9874 2125
Email: info@airsciences.com.au

Mount Pleasant Optimisation Project

Greenhouse Gas Calculations

DOCUMENT CONTROL

Report Version	Date	Prepared by	Reviewed by
DRAFT - 001	23/04/2020	P Henschke	D Kjellberg
FINAL – 001	16/12/2020	P Henschke	D Kjellberg
FINAL – 002	11/01/2021	P Henschke	

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Todoroski Air Sciences has prepared this report for MACH Energy Australia Pty Ltd (MACH Energy). It provides an assessment of the potential greenhouse gas (GHG) emissions associated with the proposed Mount Pleasant Optimisation Project (the Project).

This assessment aims to estimate the predicted emissions of GHGs to the atmosphere due to the Project and to provide a comparison of the direct emissions from the Project at the state and national level.

1.1 Overview of the Mount Pleasant Operation

The Mount Pleasant Operation Development Consent DA 92/97 was granted on 22 December 1999. The Mount Pleasant Operation was also approved under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) in 2012 (EPBC 2011/5795).

MACH Energy acquired the Mount Pleasant Operation from Coal and Allied Operations Pty Ltd on 4 August 2016. MACH Energy commenced construction activities at the Mount Pleasant Operation in November 2016 and commenced mining operations in October 2017, in accordance with Development Consent DA 92/97 and EPBC 2011/5795.

MACH Mount Pleasant Operations Pty Ltd manages the Mount Pleasant Operation as agent for and on behalf of the unincorporated Mount Pleasant Joint Venture between MACH Energy (95 per cent [%] owner) and J.C.D. Australia Pty Ltd (5% owner)[1].

The approved Mount Pleasant Operation includes the construction and operation of an open cut coal mine and associated rail spur and product coal loading infrastructure located approximately three kilometres (km) north-west of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW) (**Figure 1-1** and **Figure 1-2**).

The mine is approved to produce up to 10.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. Up to approximately nine trains per day of thermal coal products from the Mount Pleasant Operation are transported by rail to the Port of Newcastle for export, or to domestic customers for use in electricity generation.

[1] Throughout this report, MACH Mount Pleasant Operations Pty Ltd and the unincorporated Mount Pleasant Joint Venture will be referred to as MACH.

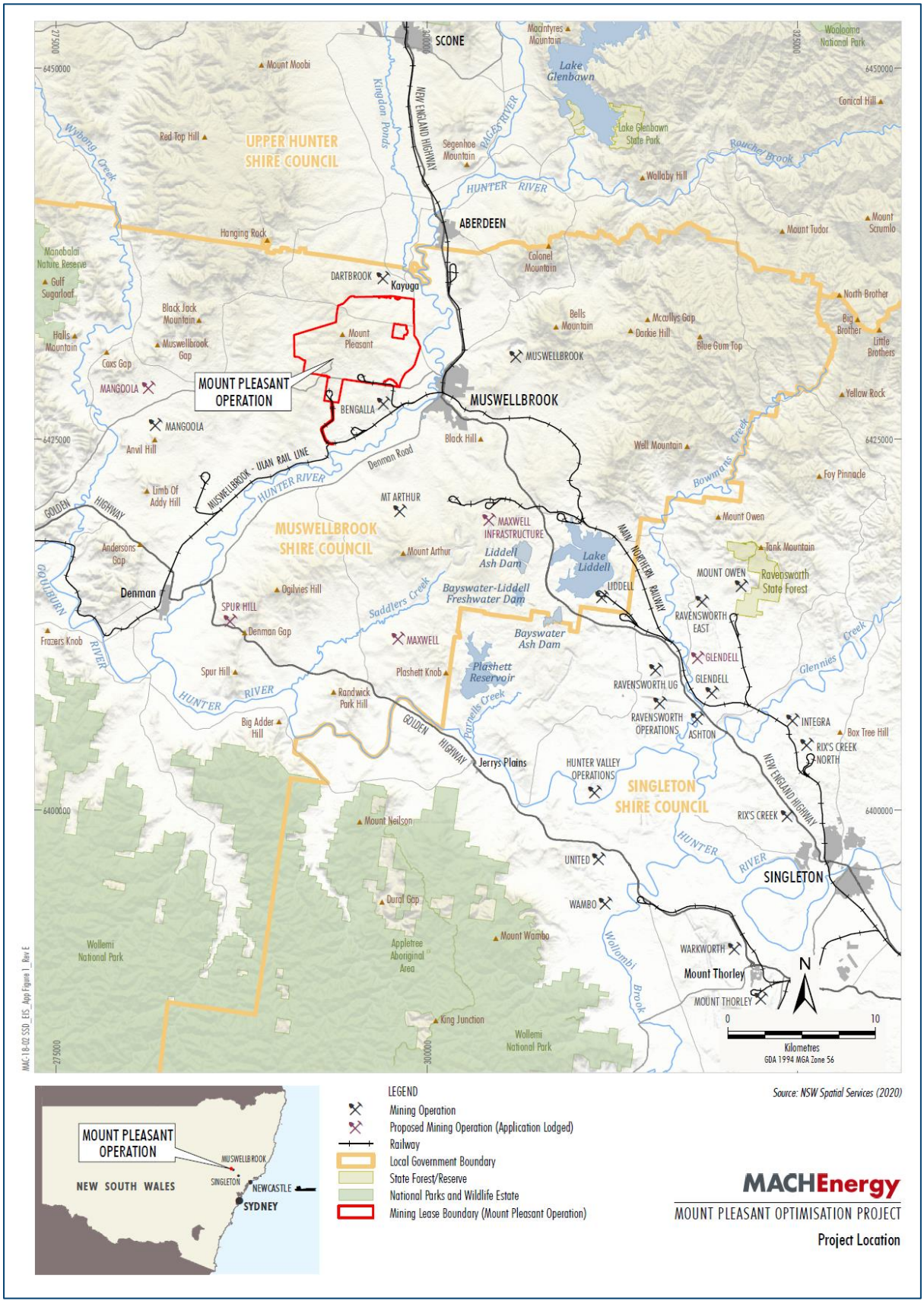


Figure 1-1: Project Location

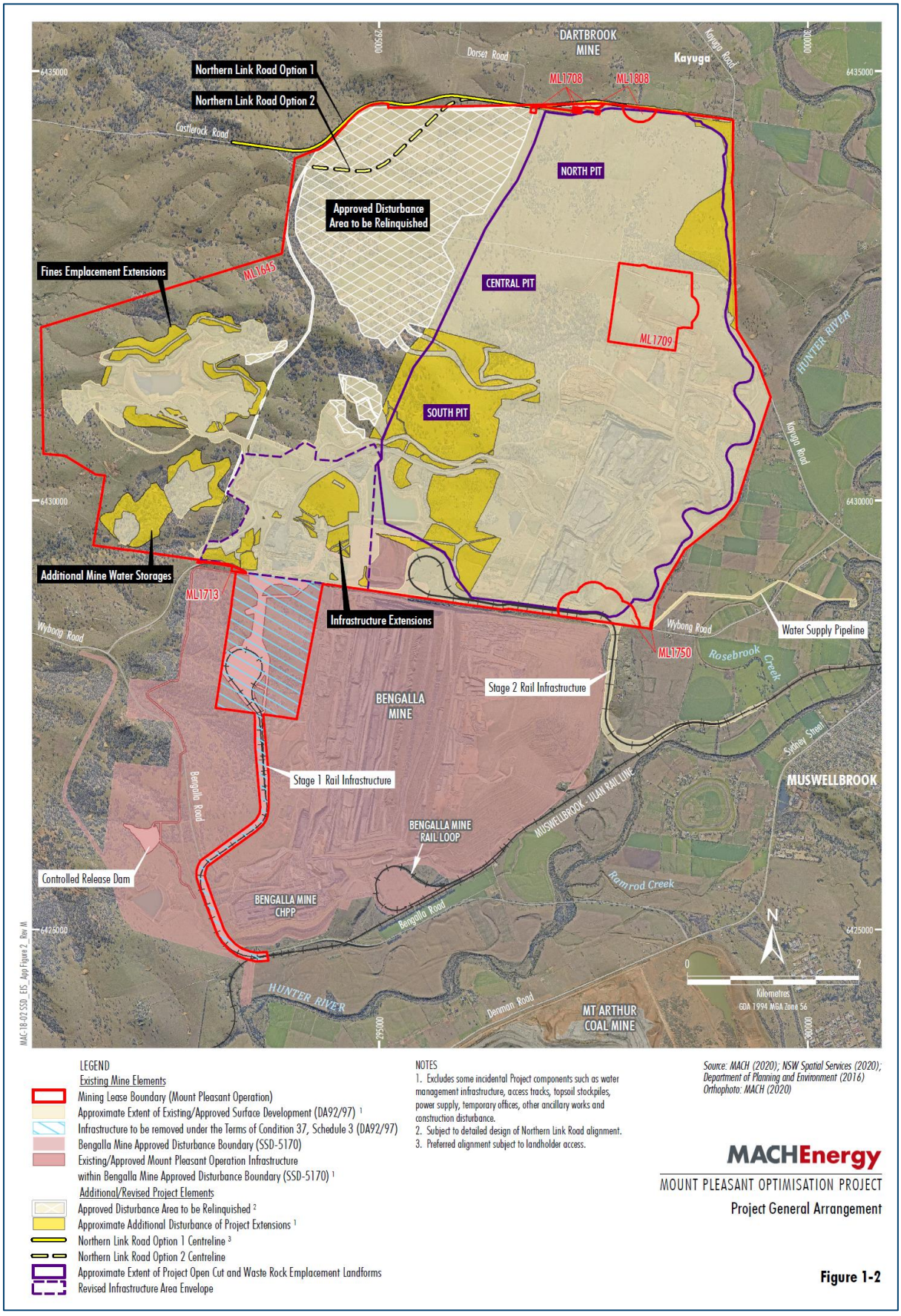


Figure 1-2: Project General Arrangement

1.2 Overview of the Project

The Project would include the following development:

- increased open cut coal extraction within Mount Pleasant Operation Mining Leases by mining of additional coal reserves, including lower coal seams in North Pit;
- staged increase in extraction, handling and processing of ROM coal up to 21 Mtpa (i.e. progressive increase in ROM coal mining rate from 10.5 Mtpa over the Project life);
- staged upgrades to the existing Coal Handling and Preparation Plant (CHPP) and coal handling infrastructure to facilitate the handling and processing of additional coal;
- rail transport of up to approximately 17 Mtpa of product coal to domestic and export customers;
- upgrades to workshops, electricity distribution and other ancillary infrastructure;
- existing infrastructure relocations to facilitate mining extensions (e.g. local roads, powerlines and water pipelines);
- construction and operation of new water management and water storage infrastructure in support of the mine;
- additional reject dewatering facilities to allow co-disposal of fine rejects with waste rock as part of ROM waste rock operations;
- development of an integrated waste rock emplacement landform that incorporates geomorphic drainage design principles for hydrological stability, and varying topographic relief to be more natural in exterior appearance;
- construction and operation of new ancillary infrastructure in support of mining;
- extension to the time limit on mining operations to 22 December 2048;
- an average operational workforce of approximately 600 people, with a peak of approximately 830 people;
- ongoing exploration activities; and
- other associated infrastructure, plant, equipment and activities.

2 GREENHOUSE GAS INVENTORY

The National Greenhouse Accounts (NGA) Factors document published by the Department of the Environment and Energy defines three scopes (Scope 1, 2 and 3) for different emission categories based on whether the emissions generated are from "direct" or "indirect" sources.

Scope 1 emissions encompass the direct sources from the Project defined as:

> "*...from sources within the boundary of an organisation as a result of that organisation's activities*" (**Department of Industry, Science, Energy and Resources, 2020**).

Scope 2 and 3 emissions occur due to the indirect sources from the Project as:

> "*...emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation*" (**Department of Industry, Science, Energy and Resources, 2020**).

For the purpose of this assessment, emissions generated in all three scopes defined above provide a suitable approximation of the total GHG emissions generated from the Project.

Scope 3 emissions can be a significant component of the total emissions inventory; however, these emissions are often not directly controlled by the operation. These emissions are understood to be considered in the Scope 1 emissions from other various organisations related to the Project.

Scope 3 emissions also arise from a number of various other sources indirectly associated with the operation of the Project such as emissions generated by employees travelling to and from the site. The relatively minor individual contributions that are difficult to accurately quantify due to the diversity and nature of the sources, have not been considered further in this assessment.

2.1 Emission sources

Scope 1 and 2 GHG emission sources identified from the operation of the Project are the on-site combustion of diesel fuel, fuel oil combustion, explosives usage, emissions of methane (CH_4) from the exposed coal seams, and on-site consumption of electricity.

Scope 3 emissions have been identified as resulting from the purchase of diesel, electricity for use on-site and the transport of and final use of product coal.

Estimated quantities of materials that have the potential to emit GHG emissions associated with Scope 1 and 2 emissions for the Project have been summarised in **Table 2-1**. These estimates are based on a conservative upper limit of the assumed maximum production throughout the life of the Project. The assessment provides a reasonable worst case approximation of the potential GHG emissions for the purpose of this assessment.

Table 2-1: Summary of quantities of materials estimated for the Project

Period	ROM coal (Mt)	Diesel (ML)	Oil (kL)	Grease (t)	Explosives (kt)	Electricity (GWh)
2023	10.5	68	836	59	20	69
2024	10.5	70	872	60	19	69
2025	10.5	75	931	62	20	69
2026	10.5	93	1,162	76	26	69
2027	10.5	69	668	61	27	69
2028	15.8	85	828	67	26	104
2029	15.8	84	822	67	27	104
2030	15.8	87	852	67	26	104
2031	15.8	79	759	62	25	104
2032	15.8	90	864	78	30	104
2033	15.8	87	785	86	36	104
2034	21.0	95	848	97	37	138
2035	21.0	112	1,000	104	44	138
2036	21.0	110	987	103	38	138
2037	21.0	103	937	104	44	138
2038	20.4	112	1,034	110	47	134
2039	20.6	121	1,107	108	46	135
2040	20.6	121	1,090	113	49	135
2041	21.0	123	1,105	114	46	138
2042	21.0	118	1,039	112	47	138
2043	20.8	119	1,042	112	46	137
2044	18.6	110	962	96	45	122
2045	13.8	91	812	73	30	91
2046	9.3	68	622	55	25	61
2047	8.7	61	510	49	24	57
2048	0.9	11	96	9	0.3	6

Note: Mt = million tonnes, ML = megalitres, kL = kilolitres, t = tonne, kt = kilotonnes and GWh = gigawatt hour-

Scope 3 emissions for the transport and final use of the coal may have the potential to vary in the future depending on the market situation at the time. These assumptions include emission factors for the transport modes of rail and shipping and the associated average weighted distance travelled for the export coal.

During the progression of the mining operation some land clearing will take place, however as waste emplacement landforms are rehabilitated this would act to offset any previous GHG emissions associated with land clearing. The carbon storage of the rehabilitated land would continue beyond the life of the Project. The likely GHG emissions associated with vegetation clearing during construction have been calculated using a conservative estimation approach described in the Greenhouse Gas Assessment Workbook for Road Projects (**TAGHGG, 2013**). This approach conservatively assumes all carbon pools are removed with the vegetation clearing, all carbon removed is converted to CO_2 and sequestration from revegetation is not included. The assumed annual land clearing is approximately 40 hectares (ha) for the life of the Project.

The construction phase of the Project has not been considered separately, as the mine is already operational and any additional construction requirements have been factored into the early years of the Project. During decommissioning, there would be diesel use associated with plant and equipment required for the rehabilitation of the site. The decommissioning phase is expected to occur over approximately 5 years of time and the amount of diesel, oil and grease required is estimated from the ratio of personnel during a peak operating year to the anticipated personnel required for the decommissioning phase.

2.2 Emission factors

To quantify the amount of carbon dioxide equivalent (CO_2-e) material generated from the Project, emission factors obtained from the NGA Factors (**Department of Industry, Science, Energy and Resources, 2020**), site specific fugitive emission sampling applying Method 2 (Rio Tinto, 2012) (i.e. the site specific fugitive emission factor used for previous assessments of the site), emission factors for Scope 3 transport used for other similar coal mining operations in the Hunter Valley and emission factors for land clearing (**TAGHGG, 2013**) are summarised in **Table 2-2**.

Table 2-2: Summary of emission factors

Type	Energy content factor (GJ/kL)	Emission factor			Units	Scope
		CO_2	CH_4	N_2O		
Diesel	38.6	69.9	0.1	0.2	kg CO_2-e/GJ	1
		3.6	-	-		3
Fuel oil	39.7	73.6	0.04	0.2	kg CO_2-e/GJ	1
		3.6	-	-		3
Petroleum based greases	38.8	3.5	-	-	kg CO_2-e/GJ	1
		3.6	-	-		3
Electricity	-	0.81	-	-	kg CO_2-e/kWh	2
		0.09	-	-		3
Explosives	-	0.18	-	-	t CO_2-e/t explosive	1
Fugitive emissions	-	-	0.012	-	t CO_2-e/t ROM	1
Rail transport	-	16.6	-	-	t CO_2-e/Mt-km	3
Ship transport	-	3.7	-	-	t CO_2-e/Mt-km	3
Thermal coal*	29.0	90	0.04	0.2	kg CO_2-e/GJ	3
Land clearing – woodland/ forest	-	521	-	-	t CO_2-e/ha	1
Land clearing - grassland	-	110	-	-	t CO_2-e/ha	1

*Assumes type of coal is anthracite

Note: GJ = gigajoule, GJ/kL = gigajoule per kilolitre, kg CO_2-e = kilograms of carbon dioxide equivalent, t CO_2-e = tonnes of carbon dioxide equivalent, kWh = kilowatt hour, t = tonnes, Mt-km = million tonne-kilometres, CO_2 = Carbon Dioxide, CH_4 = Methane and N_2O = Nitrous Oxide

Product coal is transported to the Port of Newcastle by rail and then transferred to coal loaders before being shipped to its final destination. The approximate rail distance is taken to be 300km (return distance). The approximate shipping distance of 13,000km (return distance) is based predominately on destinations in the Asian market.

The emissions generated from the end use of coal produced by the Project have been assumed to be used in power generation and would be equivalent to those generated in NSW. The type of thermal coal consumed is conservatively assumed to be anthracite. The Project would produce coal of varying specification, anthracite generates the most emissions when consumed based on the different coal types described in the NGA Factors and hence provides a conservative estimate of the emissions generated.

It is also noted that some of the coal produced by the Project may be consumed in Australia. For this assessment, the total Scope 3 emissions assume all of the product coal is transported overseas and hence these estimates are conservative as there would be no emissions generated from the shipping for the coal consumed in Australia.

2.3 Summary of greenhouse gas emissions

Table 2-3 summarises the estimated annual CO_2-e emissions due to the Project.

Table 2-3: Summary of CO_2-e emissions for the Project (kt CO_2-e)

Year	Fugitive emissions	Diesel		Oil		Grease		Explosives	Land clearing	Decom. phase		Electricity		Rail transport	Ship transport	Thermal coal
	Scope															
	1	1	3	1	3	1	3	1	1	1	3	2	3	3	3	3
2023	126	184	9	2	0.1	0.01	0.01	3	11	-	-	56	6	39	371	20,412
2024	126	191	10	3	0.1	0.01	0.01	3	11	-	-	56	6	38	361	19,889
2025	126	202	10	3	0.1	0.01	0.01	3	11	-	-	56	6	38	366	20,151
2026	126	251	13	3	0.2	0.01	0.02	4	11	-	-	56	6	39	371	20,412
2027	126	188	10	2	0.1	0.01	0.01	4	11	-	-	56	6	39	376	20,674
2028	190	230	12	2	0.1	0.01	0.01	4	11	-	-	84	9	64	613	33,759
2029	190	227	12	2	0.1	0.01	0.01	4	11	-	-	84	9	62	594	32,712
2030	190	236	12	2	0.1	0.01	0.01	4	11	-	-	84	9	62	594	32,712
2031	190	213	11	2	0.1	0.01	0.01	4	11	-	-	84	9	62	594	32,712
2032	190	244	12	3	0.1	0.02	0.02	5	11	-	-	84	9	63	599	32,974
2033	190	236	12	2	0.1	0.02	0.02	6	11	-	-	84	9	63	599	32,974
2034	252	258	13	2	0.1	0.02	0.02	6	11	-	-	112	12	83	789	43,442
2035	252	303	16	3	0.1	0.02	0.02	7	11	-	-	112	12	83	789	43,442
2036	252	298	15	3	0.1	0.02	0.02	6	11	-	-	112	12	84	803	44,227
2037	252	278	14	3	0.1	0.02	0.02	7	11	-	-	112	12	83	794	43,703
2038	245	302	16	3	0.1	0.02	0.02	8	11	-	-	109	12	82	780	42,918
2039	247	328	17	3	0.2	0.02	0.02	7	11	-	-	110	12	83	789	43,442
2040	247	327	17	3	0.2	0.02	0.02	8	11	-	-	110	12	83	789	43,442
2041	252	334	17	3	0.2	0.02	0.02	7	11	-	-	112	12	84	799	43,965
2042	252	321	16	3	0.1	0.02	0.02	8	11	-	-	112	12	84	799	43,965
2043	250	323	17	3	0.1	0.02	0.02	7	11	-	-	111	12	82	780	42,918
2044	223	299	15	3	0.1	0.02	0.02	7	11	-	-	99	11	74	708	38,993
2045	166	245	13	2	0.1	0.01	0.01	5	11	-	-	73	8	54	518	28,525
2046	112	185	9	2	0.1	0.01	0.01	4	11	-	-	49	5	37	352	19,366
2047	104	164	8	1	0.1	0.01	0.01	4	11	-	-	46	5	35	333	18,319
2048	11	29	1	0.3	0.01	0.002	0.002	0.05	11	-	-	5	1	5	48	2,617
2049*	-	-	-	-	-	-	-	-	-	52	3	-	-	-	-	-
2050*	-	-	-	-	-	-	-	-	-	52	3	-	-	-	-	-
2051*	-	-	-	-	-	-	-	-	-	52	3	-	-	-	-	-
2052*	-	-	-	-	-	-	-	-	-	52	3	-	-	-	-	-
2053*	-	-	-	-	-	-	-	-	-	52	3	-	-	-	-	-

*Decommissioning phase

2.4 Contribution of greenhouse gas emissions

Table 2-4 summarises the emissions associated with the Project based on Scopes 1, 2 and 3.

Table 2-4: Summary of CO_2-e emissions per scope (kt CO_2-e)

Period	Scope 1	Scope 2	Scope 3
Average Annual*	452	83	33,083
Total*	12,020	2,165	860,158

*The annual average values exclude the decommissioning phase, but the total values include the decommissioning phase.

The estimated annual GHG emissions for Australia during 2017 was 534.7 million tonnes of carbon dioxide equivalent (Mt CO_2-e) (**Department of the Environment and Energy, 2019a**). In comparison, the estimated annual average GHG emission for the Project is 0.54Mt CO_2-e (Scope 1 and 2 excluding the decommissioning phase). Therefore, the annual contribution of GHG emissions from the Project in comparison to the Australian GHG emissions for the 2017 period is estimated to be approximately 0.1%.

At a state level, the estimated GHG emissions for NSW in the 2017 period were 131.5Mt CO_2-e (**Department of the Environment and Energy, 2019b**). The annual contribution of GHG emissions from the Project (Scopes 1 and 2) in comparison to the NSW GHG emissions for the 2017 period is estimated to be approximately 0.4%.

The estimated GHG emissions generated in all three scopes are based on approximated quantities of materials and where applicable generic emission factors. Therefore, the estimated emissions for the Project are considered conservative.

It is important to note that a portion of the Project's emissions would occur as a result of the approved operations of the Mount Pleasant Operation (i.e. early in the Project life, during the approved life of the Mount Pleasant Operation). The approved operations of the Mount Pleasant Operation are estimated to contribute approximately 7%, 11% and 13% of the Project's total Scope 1, Scope 2 and Scope 3 emissions, respectively, based on the predictions described in the Mount Pleasant Operation Mine Optimisation Modification Air Quality and Greenhouse Gas Assessment (**Todoroski Air Sciences, 2017**).

A comparison of the annual ROM coal production and estimated CO_2-e emissions (Scope 1 and 2) from various mining operations in the Hunter Valley is presented in **Table 2-5**. The comparison indicates that in terms of the megatonnes (Mt) of CO_2-e generated per Mt of ROM coal produced, the Project is one of the most efficient mining operations, producing approximately 0.03Mt CO_2-e/Mt ROM coal.

Table 2-5: Comparison of CO_2-e emissions

Mine	Annual ROM extraction (Mt)	Annual average GHG emissions (Scope 1 and 2) (Mt)	Mt CO_2-e/Mt ROM coal
Project	15.8	0.54	0.03
Mangoola Coal[(1)]	13.5	0.46	0.03
Mount Thorley Warkworth[(2)]	10	0.47	0.05
Bengalla Mine[(3)]	15	0.77	0.05
Mt Arthur Coal Mine[(4)]	32	2.2	0.07

[(1)] Umwelt (2019) [(2)]Todoroski Air Sciences (2014) [(3)]Todoroski Air Sciences (2013) [(4)]PAEHolmes (2013)

3 GREENHOUSE GAS MANAGEMENT

The Mount Pleasant Operation utilises various mitigation measures to minimise the overall generation of GHG emissions. Some examples of GHG mitigation and management practices that would continue to be applied for the Project include:

- investigating ways to reduce energy consumption during project planning phases and reviewing energy efficient alternatives;
- regular maintenance of equipment and plant;
- monitoring the consumption of fuel and regularly maintaining diesel powered equipment to ensure operational efficiency; and
- monitoring the total site electricity consumption and investigating avenues to minimise this requirement.

4 GREENHOUSE GAS POLICY CONSIDERATIONS

4.1 International Policy

The United Nations Framework Convention on Climate Change (UNFCCC) is the main global forum for climate change negotiations which aims to stabilise GHG concentrations in the atmosphere to prevent dangerous climate impacts.

The Kyoto Protocol is an international agreement under the UNFCCC that commits developed countries to setting internationally binding GHG reduction targets. The first commitment period of the Kyoto Protocol started in 2008 and ended in 2012 and saw a number of countries commit to reduce GHG emissions to an average of 5% of 1990 levels of GHG emissions to the atmosphere. The second commitment period started in 2013 which extends to 2020, and saw countries commit to reduce GHG emissions by at least 18% below the 1990 level of GHG emissions to the atmosphere.

A historical global climate agreement (the Paris Agreement) was signed at the UNFCCC 21st Conference of the Parties (COP21) in Paris in November and December 2015. The Paris Agreement sets in place a framework for all countries to take climate action from 2020, building on existing international efforts in the period up to 2020. The key aspects of the Paris Agreement include:

- A global goal to hold average temperature increase to well below 2 degrees Celsius (ºC) and pursue efforts to keep warming below 1.5ºC above pre-industrial levels.
- All countries to set mitigation targets from 2020 and review targets every five years to build ambition over time, informed by a global stocktake.
- Robust transparency and accountability rules to provide confidence in countries' actions and track progress towards targets.
- Promoting action to adapt and build resilience to climate impacts.
- Financial, technological and capacity building support to help developing countries implement the Paris Agreement.

4.2 Australian Policy

Australia has an active role in global action for GHG emission reduction and adaptation to the impacts of climate change in the context of coordinated global action. Australia is a party to the UNFCCC, is a signatory to the Kyoto Protocol and the Paris Agreement and has committed to reduce GHG emissions to 26-28% of 2005 levels by 2030.

The Australian Government is implementing national policies to reduce emissions and adapt to the impacts of climate change in the context of coordinated global action. The Direct Action Plan as announced by the Government outlines the framework to achieve the reduction targets with the Emissions Reduction Fund as the primary means.

The Emissions Reduction Fund commits to reduce GHG emissions to 5% below 2000 levels by 2020. The fund offers incentives for businesses that seek out actions to reduce GHG emissions. This approach applies a carbon credit scheme which allows businesses to create credited emissions reductions which can then be exchanged between other businesses. A safeguard mechanism of the Emissions Reduction Fund includes establishing an emissions baseline for large emissions facilities to ensure that emissions reductions are not overtaken by a rise in emissions elsewhere in the country.

4.3 New South Wales Policy

The NSW Climate Change Policy Framework (NCCPF) contains an aspirational long-term objective to achieve net-zero emissions by 2050 and outlines a range of policy, government operations and advocacy roles to achieve emissions savings and to reduce impacts and promote greater understanding for climate change adaptation.

The NCCPF outlines that to save emissions and enable climate change adaptation, NSW will develop policy to achieve emissions savings, consistent with Commonwealth action and to enable adaptation to climate change. The NCCPF outlines that the NSW Government, as a major purchaser, will lead by example in delivering government services and managing assets, and in advocacy consistent with the Paris agreement.

Advocacy at a national level would include support for reforms of the national energy market, building standards and climate modelling.

The NCCPF outlines general policy directions to:

- create a stable policy environment supportive of private investment in emerging energy, transport, carbon farming and environmental services;
- boost energy productivity and reduce (rising) energy costs;
- capture benefits and manage unintended impacts of external policies;
- take advantage of opportunities to grow new industries in NSW;
- reduce risks of extreme weather on assets, and impacts on health and wellbeing; and
- manage impacts and resilience of natural resources, ecosystems and communities.

The NCCPF would be delivered via the Climate Change Fund Strategic Plan, developing a value for emissions savings for use in economic appraisals, embedding climate change considerations into government decision making, developing actions and strategies encompassing advanced energy, efficiency and adaptation, and review mechanisms.

The policy framework is to be reviewed in 2020.

4.4 National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting Act 2007 (NGER Act) introduced a single national framework for reporting and disseminating company information about GHG emissions via the NGER scheme. The main objectives of the NGER scheme is to inform government policy and the general public and to help meet Australia's international reporting obligations.

The NGA Factors have been designed for use by companies and individuals to estimate GHG emissions for their operations. The NGA Factors apply default emission factors and promote consistency between the GHG inventories at a facility and company level, and those presented in the NGA. The factors are determined simultaneously with the production of the NGA. In effect the NGA Factors are calculated based on the performance of facilities operating in Australia and reporting via the NGER scheme, and subject to international expert review each year.

4.5 Discussion

The Paris Agreement that Australia has adopted affects National policy, which in turn affects NSW policy on GHG emissions, as set out in the NCCPF. The Paris Agreement requires government actions to take effect from 2020, as such it is reasonable to expect that the Mount Pleasant Operation would monitor any changes in State and National government policy and accordingly adjust its GHG emission calculations for reporting per any new policy, and potentially adjust operations if required by any new policy.

Management of GHG at the Project would be undertaken in accordance with MACH's Air Quality and Greenhouse Gas Management Plan (**MACH, 2019**). In addition, the Mount Pleasant Operation would continue to account for and report GHG emissions and energy data in accordance with the National Greenhouse Gas and Energy Reporting Scheme.

The Scope 3 emissions from the Project include the use of coal by other parties. These Scope 3 emissions are accounted for in the Scope 1 and 2 emissions of customer entities in Australia or in other countries. The Project does not materially alter the estimated quantity of coal to be used in NSW/Australia and are not expected to affect the ability of NSW or Australia to meet emissions reduction targets.

It is reasonable to expect that there may be future policy changes in the countries which receive Australian coal due to the Paris Agreement or other influencing factors. As such it is also reasonable to expect that the Project would monitor such changes and adjust according to any new policy, guidelines, carbon pricing, coal demand and trade contracts.

5 SUMMARY AND CONCLUSIONS

This study has assessed the potential GHG emissions associated with the Project.

A contemporary and conservative GHG assessment of the Project has been completed. The estimated annual average GHG emission is 0.54Mt CO_2-e material (Scope 1 and 2), which is calculated to be approximately 0.1% of the Australian GHG emissions and approximately 0.4% of the NSW GHG emissions for the 2017 period.

A comparison of the Mt of CO_2-e generated per Mt of ROM coal produced for various coal mines in the Hunter Valley indicates the Project is one of the more efficient mining operations, producing approximately 0.03Mt CO_2-e/Mt ROM coal.

The Scope 3 emissions from the Project include the use of coal by other parties. It is reasonable to expect that there may be future policy changes in the countries which receive Australian coal due to the Paris agreement or other influencing factors. As such it is also reasonable to expect that Project would monitor such changes and adjust accordingly to any new policy, guidelines, carbon pricing, coal demand and trade contracts.

6 REFERENCES

Department of the Environment and Energy (2019a)

"National Inventory Report 2017 Volume 1", Department of the Environment and Energy, May 2019.

Department of the Environment and Energy (2019b)

"State and Territory Greenhouse Gas Inventories 2017", Department of the Environment and Energy, June 2019.

Department of Industry, Science, Energy and Resources (2020)

"National Greenhouse Accounts Factors - Australian National Greenhouse Accounts", Department of Industry, Science, Energy and Resources, October 2020.

MACH Energy Australia Pty Ltd (2019)

"Mount Pleasant Operation Air Quality and Greenhouse Gas Management Plan", MACH Energy, May 2019

PAEHolmes (2013)

"Air Quality and Greenhouse Gas Assessment Mt Arthur Coal Open Cut Modification", prepared by PAEHolmes for Hunter Valley Energy Coal Pty Ltd, January 2013.

Rio Tinto (2012)

"Mt Pleasant Fugitive Emissions Evaluation", Internal memo, Rio Tinto, August 2012.

Todoroski Air Sciences (2013)

"Air Quality Impact and Greenhouse Gas Assessment Continuation of Bengalla Mine", prepared by Todoroski Air Sciences for Hansen Bailey, July 2013.

Todoroski Air Sciences (2014)

"Air Quality and Greenhouse Gas Assessment Warkworth Continuation 2014", prepared for EMGA Mitchell McLennan by Todoroski Air Sciences, June 2014.

Todoroski Air Sciences (2017)

"Mount Pleasant Operation Mine Optimisation Modification Air Quality and Greenhouse Gas Assessment", prepared for MACH Energy Australia by Todoroski Air Sciences, May 2017.

Umwelt (2019)

"Greenhouse Gas and Energy Assessment Mangoola Coal Continued Operations Project", prepared by Umwelt, May 2019