Appendix 13

Greenhouse Gas Assessment

prepared by

Northstar Air Quality Pty Ltd

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Copi Mineral Sands Project

Greenhouse Gas Assessment

Addressee(s):	**R.W. Corkery & Co Pty Limited**
Site Address:	**Exploration Licence Areas 8385, 8865, 8312 & 8769**
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Martin Doyle **9 July 2025**

EXECUTIVE SUMMARY

This greenhouse gas assessment has been prepared by Northstar Air Quality Pty Ltd on behalf of RZ Resources Limited to quantify the potential greenhouse gas impacts of the Copi Mineral Sands Project.

The GHGA has been prepared in accordance with the New South Wales Environment Protection Authority 'Guide for Large Emitters' and presents an assessment of the impacts of activities associated with the site establishment, operational, and rehabilitation phases of the Project.

Greenhouse gas emissions for the 26 years of the Project lifetime have been calculated, with the emissions intensity shown to be comparable to other mineral sands projects. The emissions reduction trajectories required by the New South Wales Government to meet net zero commitments have been examined, and mitigation measures provided to ensure that the Project emissions trajectory does not compromise those net zero goals.

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1. INTRODUCTION

This greenhouse gas assessment (GHGA) has been prepared by Northstar Air Quality Pty Ltd (Northstar) on behalf of RZ Resources Limited (the Applicant) to quantify the potential greenhouse gas (GHG) impacts of the Copi Mineral Sands Project (the Project).

The Applicant is proposing to develop and operate an open-cut mineral sands mine operation approximately 75 kilometres (km) northwest of Wentworth NSW, to extract and process heavy mineral ore and produce a heavy mineral concentrate (HMC).

The Project-life would be up to approximately 26 years and would comprise:

- A site establishment and construction period of approximately three years;
- A mining operations period of up to 18 years; and
- An approximately five-year post-mining rehabilitation period.

The GHGA presents an assessment of the impacts of activities associated with the site establishment and subsequent construction, operational, and rehabilitation phases of the Project. The GHGA has been performed in general accordance with the NSW Environment Protection Authority (EPA) 'NSW Guide for Large Emitters' (NSW EPA, 2025), hereafter 'the GHG Guide' (refer Section 1.1).

1.1. Large Emitter Triggers

Section 2.1 of the GHG Guide outlines the assessment requirements which apply to a project if it meets all of the following three criteria:

1. The project requires development assessments and approval, or a change to an approval under the *Environmental Planning and Assessment Act 1979*, and
2. The project involves one or more schedule activities under Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act) and/or will be carried out at an existing licensed premises; and
3. The project is likely to emit 25 000 tonnes (t) or more of scope 1 and 2 emissions carbon dioxide equivalent (CO_2-e) in any financial year during the operational life of the project (based on planned operational throughput and as designed).

In relation to the Project, the calculations presented in this GHGA indicate that all of the criteria are met, with the maximum scope 1 and scope 2 CO_2-e emissions in any year of the Project lifetime calculated to be greater than 25 000 t CO_2-e.

A detailed description of the Project is provided in Section 1.3. The Project would be a new development.

As required by the GHG Guide, the Intergovernmental Panel on Climate Change (IPCC) sectors/subsectors of relevance to the Project are presented in Table 1 (as taken from Appendix A of the GHG Guide). Also presented in Table 1 are the associated sectors as presented in the NSW Net Zero Emissions Dashboard[1], with emissions associated with the Project compared to those sector totals in Section 4.7.

Table 1 Relevant IPCC sectors and subsectors

IPCC Sector	IPCC Subsector	NSW EPA Net Zero Sector
Fugitive emissions	Open cut mines	Fugitive emissions / open cut mines
Electricity generation	Other	Electricity generation
Stationary energy (excluding electricity)	Mining	Stationary energy (excluding electricity generation)
Transport	Articulated trucks Rigid trucks	Transport / heavy duty vehicles

A detailed assessment of GHG emissions is provided in Section 3 and includes further information regarding the data sources and assumptions adopted.

1.2. Assessment Requirements

This GHGA forms part of the Environmental Impact Statement (EIS) prepared to accompany the development application for the Project under Part 4 of the *Environmental Planning and Assessment Act 1979*.

Planning Secretary's Environmental Assessment Requirements (SEARs) have been provided for the Project by the NSW Department of Planning and Environment (DPE, now the Department of Planning, Housing and Industry [DPHI]) on 19 May 2022. The SEARs included input from NSW Environment Protection Authority (NSW EPA) in May 2022, although no requirements related to GHG were provided at that time. Table 2 provides a summary of the SEARs relevant to this GHGA.

[1] https://www.seed.nsw.gov.au/net-zero-emissions-dashboard

Table 2 Coverage of SEARs and other Agency requirements relevant to greenhouse gas

Authority	Requirement	Relevant section(s)
SEARs (DPE)	an assessment of the likely greenhouse gas emissions of the development including measures to minimise emissions having regard to the targets set in *Climate Change (Net Zero Future) Act 2023* and the EPA's Climate Change Policy and Climate Action Plan, and Commonwealth Safeguard Mechanism reforms.	This report
	a description of the air pollution control techniques from any air emission sources of the development that would be implemented to manage and monitor efficiency and performance (including fugitive dust, particulates, emissions from vehicle movements and greenhouse gases).	

1.3. Project Overview

The Applicant is proposing to develop and operate an open cut mineral sands mine operation approximately 75 km northwest of Wentworth NSW, to extract and process heavy mineral ore and produce a heavy mineral concentrate (HMC) (refer Figure 1).

The Copi Mineral Sands deposit occupies land within the following Exploration Licenses (EL) held by the Applicant (refer Figure 1):

- EL8385;
- EL8865;
- EL8312;
- EL9496; and
- EL8769.

The Project would comprise progressive development of an extraction area with capacity to extract up to approximately 27.1 million tonnes per year ($Mt \cdot yr^{-1}$) of ore, and an infrastructure area including:

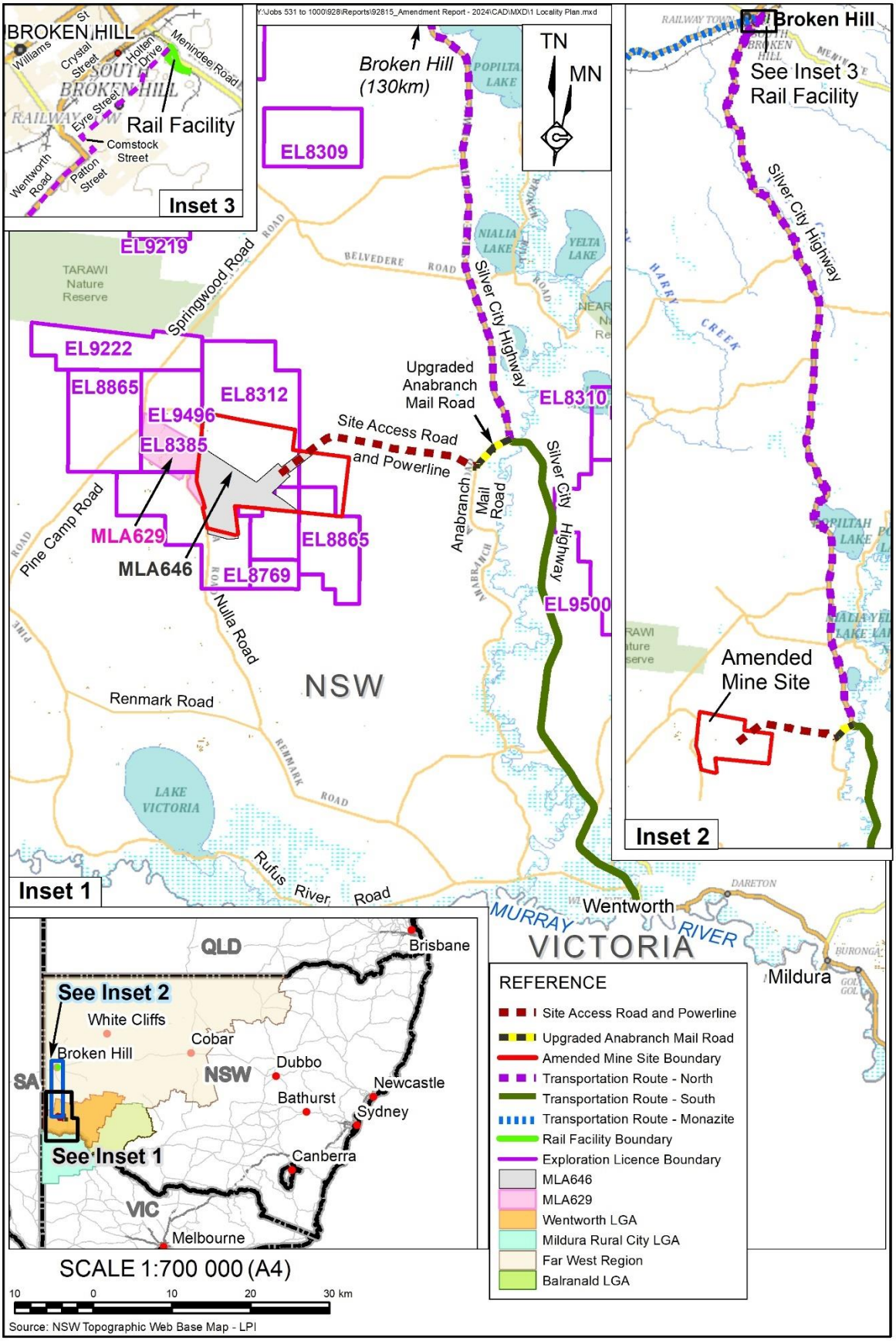
- Mine Camp and associated infrastructure for up to 480 personnel during construction, 240 personnel during operation, and 40 personnel during the rehabilitation phase;
- Offices and Administration Area;
- Workshops, Stores and Laydown Areas;
- A Water Storage Dam and Off-path Storage Facility;
- Stockpile areas; and
- A site access road (approximately 27 km) would be constructed from Anabranch Mail Road to the Infrastructure Area.

Power for the Mine Site would be provided by a combination of diesel generators during construction, and mains power sourced via a 66 kilovolt (kV) powerline. A minimum 30 % of the Project's power would be sourced from renewable sources, including externally contracted and certified renewable sources.

An indicative layout of the Mine Site is illustrated in Figure 2. Mining operations associated with the Project are anticipated to comprise the following:

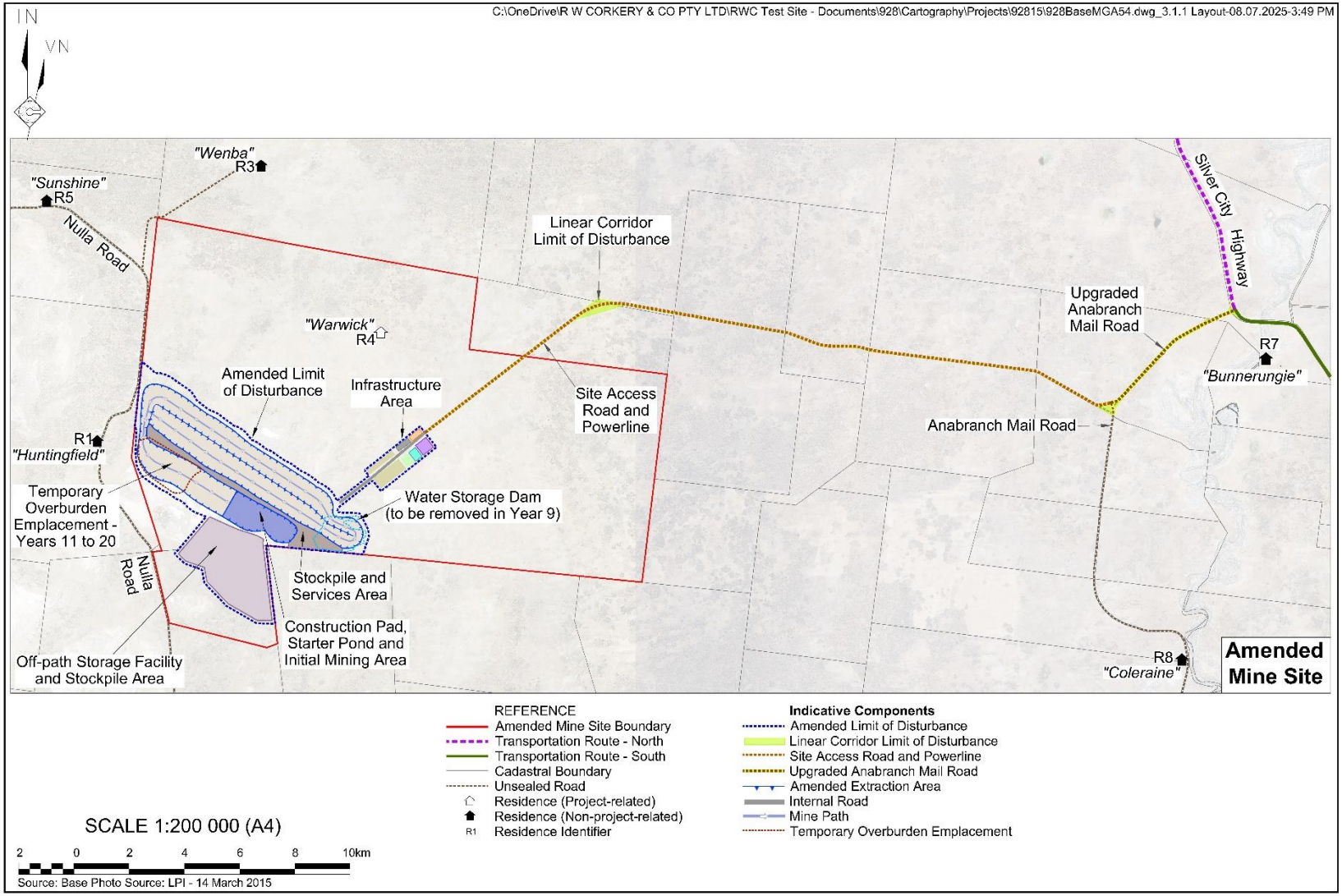
- Dredge mining from an Extraction Area approximately 9.5 km long and up to approximately 3.0 km wide.
- Mining would commence with a starter pond at the at the southern extent of the deposit. The starter pond would be extracted using conventional free dig, load and haul mining techniques. Extracted overburden, namely material located above the water table with no heavy mineral, would be used to construct infrastructure within the Mine Site or stockpiled for later use during rehabilitation operations.
- Following establishment of the starter pond, the dredges would be installed, followed by the floating Wet Concentration Plant.
- Interburden, namely material located below the water table with uneconomic heavy mineral content, would be extracted using floating dredges. Interburden would initially be transferred to the Off Path Storage Facility. Once the dredge pond has achieved its full operational size, extracted interburden would be used to backfill completed sections of the Extraction Area.
- Ore, namely material with economically viable heavy mineral content, would be extracted using a floating dredge. The ore would be transferred to the floating Wet Concentration Plant for processing.
- Reject from the Wet Concentration Plant would initially be transferred to the Off Path Storage Facility. Once the dredge pond has achieved its full operational size, reject would be combined with the extracted interburden to backfill completed sections of the Extraction Area.
- The placed reject and interburden would be covered by overburden and soil before being rehabilitated.
- Product would be transported from the Mine Site to a Rail Facility in Broken Hill for onward transport to markets.

Figure 1 Locality plan



Source: RWC

Figure 2 Indicative Mine layout



Source: RWC

The Project is proposed to be staged as outlined in Table 3.

Table 3 Project staging

Stage	Duration (approx.)
Site establishment and construction	3 years
Mining and processing operations	18 years
Post-mining rehabilitation	5 years
Total	**26 years**

1.4. Assessment Structure

This GHGA has been performed in general accordance with the GHG Guide (NSW EPA, 2025). The GHGA includes the stages of assessment as outlined in Table 4.

Table 4 Outline of greenhouse gas assessment

Description	Addressed
Description of the assessment boundary and scenarios	Section 4.1 and Section 4.2
Identification and prioritisation of GHG emissions	Section 4.3
Selection of measures to avoid and reduce GHG emissions	Section 4.5
Emissions estimates with mitigation measures included	Section 4.6
Emissions benchmarking and goal setting	Section 4.7
Offset strategy	Section 4.8

2. LEGISLATIVE AND POLICY CONTEXT

2.1. Climate Change (Net Zero Future) Act 2023

The *Climate Change (Net Zero Future) Act 2023* seeks to legislate Australia's GHG emissions reduction target of:

- 50 % reduction on 2005 levels by 2030;
- 70 % reduction on 2005 levels by 2035; and
- Net zero emissions by 2050.

The Act also provides for the introduction of regulations to prescribe interim targets for 2040 and 2045.

The Project would contribute to these targets by including mitigation measures outlined in Section 4.5 and targets for the Project as outlined in Section 4.7.2.

2.2. Net Zero Plan Stage 1: 2020 – 2030

The 'Net Zero Plan Stage 1: 2020-30' (NSW DPIE, 2020) lays the foundations for the NSW's action on climate change in this decade to reach its goal of net zero emissions by 2050 in accordance with the *Climate Change (Net Zero Future) Act 2023.* The Plan sets out four priorities:

- Drive the uptake of emissions reduction technologies that also support economic growth, or reduce cost of living or doing business;
- Empower consumers and businesses to make sustainable choices;
- Invest in the next wave of emissions reduction innovation to ensure economic prosperity from decarbonisation beyond 2030; and
- Ensure the NSW Government leads by example.

The Project would support these priorities to reach the goals set out by the NSW government by mitigation measures outlined in Section 4.5.

2.3. Protection of the Environmental Administration Act 1991

Section 6 of the *Protection of the Environmental Administration (POEA) Act 1991* outlines the NSW EPA's statutory objectives to protect the environment and human health. They key elements are:

- to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development; and
- to reduce the risks to human health and prevent the degradation of the environment.

These objectives extend to protecting the environment and human health from climate change. NSW EPA is required to consider the statutory objectives when exercising licensing functions under the POEO Act.

2.4. Protection of the Environment Operations Act 1997

Section 45 of the POEO Act sets out a range of matters that NSW EPA must consider, where relevant, when exercising its licensing functions under Chapter 3 of the POEO Act. Among other matters, this section requires NSW EPA to consider:

- The objectives of NSW EPA;
- The pollution caused (or likely to be caused) and the likely environmental impact;
- Practical measures for preventing, controlling, abating or mitigating pollution; and
- Practical measures for protecting the environment from harm as a result of that pollution.

NSW EPA's obligation to consider matters listed under section 45 extends to regulatory decisions relating to climate change.

2.5. National Greenhouse and Energy Reporting and the Safeguard Mechanism

The National Greenhouse and Energy Reporting (NGER) scheme and the Safeguard Mechanism are established by the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and related legislation. The Commonwealth Clean Energy Regulator (CER) administers the NGER Act, its legislative instruments, and related policies and processes.

The NGER scheme is a national framework for reporting and disseminating company information about GHG emissions, energy production, energy consumption, and other information specified under NGER legislation. The NGER Act applies to corporations that meet reporting thresholds.

There are two types of thresholds under section 1.3 of the NGER Act that determine which companies have an obligation to report: the facility threshold; and, the corporate group thresholds. The current facility threshold is:

- 25 000 $t \cdot yr^{-1}$ or more of GHG emissions (as CO_2-e), including both scope 1 and scope 2 emissions (refer to Section 3.2), and
- Production of 100 terajoules per year ($TJ \cdot yr^{-1}$) or more of energy; or
- Consumption of 100 $TJ \cdot yr^{-1}$ or more of energy.

The Safeguard Mechanism is the Australian Government's policy for reducing emissions at Australia's largest industrial facilities. It sets legislated limits, known as baselines, on the GHG emissions of these facilities. These

baselines will decline, predictably and gradually, on a trajectory consistent with achieving Australia's emission reduction targets of 43 % below 2005 levels by 2030 and net zero by 2050.

The Safeguard Mechanism applies to industrial facilities emitting more than 100 000 $t \cdot yr^{-1}$ CO_2-e, including mining, oil and gas production, manufacturing, transport and waste facilities. The Safeguard Mechanism applies to the electricity sector in a different way by applying a single 'sectoral' baseline across all electricity generators connected to one of Australia's main electricity grids. Individual grid-connected electricity generators are not covered as long as total emissions from grid-connected electricity generators do not exceed the sectoral baseline.

The Safeguard Mechanism also applies to project assessments conducted under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It relates primarily to projects likely to produce 100 000 $t \cdot yr^{-1}$ CO_2-e each financial year.

The Safeguard Mechanism provides a minimum standard for the highest-emitting facilities. However, that does not preclude the need for the EPA and the consent authority to:

- Properly understand the potential GHG impacts of proposed new or significantly modified developments within NSW; and
- Ensure all proponents are adequately avoiding, minimising and managing their emissions over all stages of the development.

3. GREENHOUSE GASES AND SCOPES

3.1. Greenhouse Gases

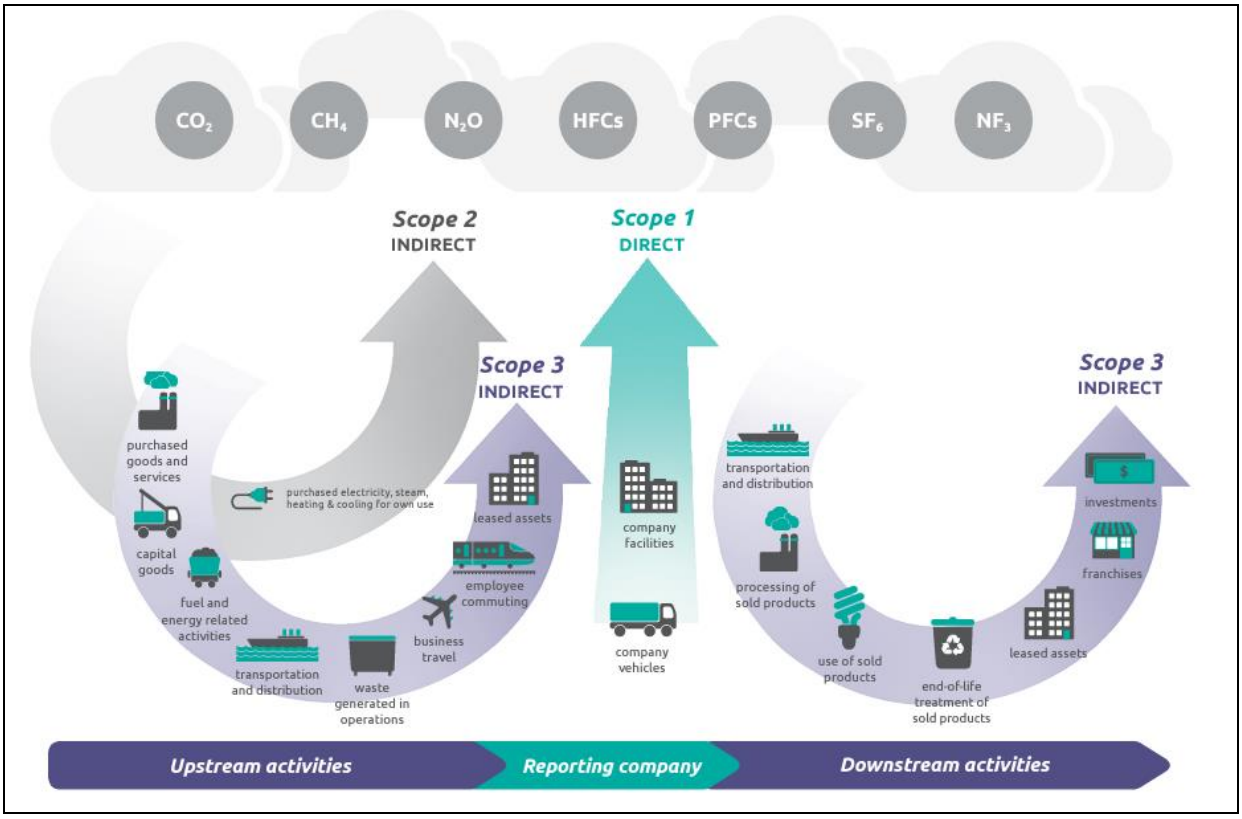
This GHGA considers GHG addressed under the NGER Act and includes the following gases and categories of gases:

- carbon dioxide (CO_2);
- methane (CH_4);
- nitrous oxide (N_2O);
- sulphur hexafluoride (SF_6);
- hydrofluorocarbons (HFCs); and
- perfluorocarbons (PFCs).

3.2. GHG Emission Scopes

This GHGA considers emissions of GHG associated with scope 1, scope 2, and scope 3 emissions. Figure 3 provides an overview of how the three scopes of emissions are related, with the following sections providing additional description, taken from the National Greenhouse Accounts Factors workbook (DCCEEW, 2024a).

Figure 3 Overview of scope 1, scope 2, and scope 3 emissions



Source: (GHG Protocol, 2013)

3.2.1. Direct Emissions (Scope 1)

Direct (or scope 1) emissions are produced from sources within the boundary of an organisation and as a result of that organisation's activities. They are calculated at the point of emission release. These emissions include those from the following activities:

- Generation of energy, heat, steam and electricity, such as fuel combustion in generators;
- Manufacturing processes which produce emissions such as cement, aluminium and ammonia production;
- Transportation of materials, products, waste and people; such as the use of vehicles owned and operated by the reporting organisation;
- Intentional or unintentional GHG releases (fugitive emissions) such as methane emissions from coal mines, natural gas leaks from joints and seals; and
- Solid waste disposal and wastewater treatment including on-site waste management.

3.2.2. Indirect Emissions (Scope 2 and Scope 3)

Indirect emissions are emissions generated in the wider economy as a consequence of an organisation's activities, but which are physically produced by the activities of another organisation. There are two classes of indirect emissions; electricity and other.

3.2.2.1. Electricity (Scope 2)

Scope 2 emissions are indirect emissions which occur as a result of activities that generate electricity, heating, cooling or steam that is consumed by an organisation, but which is generated outside that organisation's boundaries. They are physically produced by the burning of fossil fuels by the generator of the electricity.

3.2.2.2. Other Indirect Emissions (Scope 3)

Scope 3 emissions are indirect emissions, other than electricity (scope 2), which occur outside of the boundary of an organisation as a result of actions by the organisation. Scope 3 emissions may occur:

- Upstream, such as the emissions generated in the extraction and production of fossil fuels; or
- Downstream, such as the emissions from transport of an organisation's product to customers, or the emissions from outsourced activities.

The majority of a company's value chain GHG emissions may lie outside their own operations. Emissions from a company's value chain occurring externally to their operations within Australia may be estimated using the scope 3 emission factors published in (DCCEEW, 2024a). Scope 3 emissions occurring outside of Australia can be calculated using relevant resources, such as the IPCC Emission Factor database.

Table 5 outlines the scope 3 categories as presented in (GHG Protocol, 2013) as adopted in the GHG Guide.

Table 5 Upstream and downstream scope 3 GHG emissions

Stream	Scope 3 categories	
Upstream scope 3 emissions	1	Purchased goods and services
	2	Capital goods
	3	Fuel- and energy- related activities (not included in scope 1 or scope 2)
	4	Upstream transportation and distribution
	5	Waste generated in operations
	6	Business travel
	7	Employee commuting
	8	Upstream leased assets
Downstream scope 3 emissions	9	Downstream transportation and distribution
	10	Processing of sold products
	11	Use of sold products
	12	End-of-life treatment of sold products
	13	Downstream leased assets
	14	Franchises
	15	Investments

3.3. GHG Emission Factors

GHG emission factors are published in the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) document 'Australian National Greenhouse Accounts Factors 2024' (NGA Factors) (DCCEEW, 2024a). This is the most up to date version of the NGA Factors at the time of writing. Emission factors relating to scope 2 and scope 3 electricity emissions are also provided in the 'Australia's Emission Projections 2024' report (DCCEEW, 2024b).

The relevant emission factors associated with the anticipated emissions sources associated with the Project are presented in Table 6.

Table 6 Emission factors adopted for assessment

Emission source	Scope	Emission factor	Units	Source
Grid supplied electricity consumption	2	Varies by year	t CO_2-e·MWh^{-1}	Table 47 (DCCEEW, 2024b)
	3	Varies by year	t CO_2-e·MWh^{-1}	Table 48 (DCCEEW, 2024b)
Diesel combustion in generators during construction	1	2 709.7	kg CO_2-e·kL^{-1}	Table 8 (DCCEEW, 2024a)
	3	667.8	kg CO_2-e·kL^{-1}	Table 8 (DCCEEW, 2024a)
Diesel combustion in plant and equipment during construction, operation, and rehabilitation	1	2 716.3	kg CO_2-e·kL^{-1}	Table 9 (DCCEEW, 2024a)
	3	667.8	kg CO_2-e·kL^{-1}	Table 9 (DCCEEW, 2024a)
Product transport from Project Site during operations	1	2 716.3	kg CO_2-e·kL^{-1}	Table 9 (DCCEEW, 2024a)
	3	667.8	kg CO_2-e·kL^{-1}	Table 9 (DCCEEW, 2024a)
Liquefied Natural Gas (LNG) combustion in driers	1	51.53	kg CO_2-e·kL^{-1}	Table 5 (DCCEEW, 2024a)
	3	No scope 3 emission factor for LNG		
	3	667.78	kg CO_2-e·kL^{-1}	Table 9 (DCCEEW, 2024a)
LNG deliveries to Project Site	3	667.78	kg CO_2-e·kL^{-1}	Table 9 (DCCEEW, 2024a)
Air conditioning at Project Site	1	0.024	t CO_2-e·$unit^{-1}$	Table 10 (DCCEEW, 2024a) Table 11 (DCCEEW, 2024a) Table 3 (Dreepaul, 2017)
Waste generation at Project Site - solid	3	0.864	t CO_2-e·$person^{-1}$ (MSW)	Table 16 (DCCEEW, 2024a) Figure 6 (NSW EPA, 2024)
Waste generation at Project Site - liquid	1	0.0	t CO_2-e·$person^{-1}$ (managed aerobic treatment)	Table 17 (DCCEEW, 2024a)

Note: Some emission factors presented as kg CO_2-e·kL^{-1} including the relevant energy content of the fuel as provided in (DCCEEW, 2024a)

4. GREENHOUSE GAS EMISSIONS ASSESSMENT

The purpose of the GHGA is to examine the potential impacts of the construction, operation, and rehabilitation of the Project relating to emissions of GHG.

4.1. Assessment Boundary

The geographical boundary set for this GHG assessment covers the Project Site (refer Figure 2) and includes activities being performed at the Mine Site (including the Mine Camp) and also includes the transport of product from the Mine Site to Broken Hill. GHG emissions have been considered for all stages of the Project including construction, operation, and rehabilitation.

All scope 1, scope 2 and scope 3 emissions within the defined boundary have been identified and reported as far as possible in Section 4.3.

Scope 3 emissions associated with purchased good and services, processing of sold products, use of sold products, and end-of-life of sold products have not been included in this GHGA.

4.2. Emission Scenario

The emission scenario assessed within this GHGA is for 'project only' as the Project is a new development.

4.3. Emission Sources

Emissions sources within the Project assessment boundary include:

- Construction
  - Consumption of diesel fuel;
    - Vegetation and topsoil removal;
    - Excavation of starter ponds;
    - Construction and installation of Wet Concentration Plant;
    - Construction and installation of the Heavy Mineral Concentrate Washing, Stockpiling Circuit, and associated infrastructure;
    - Construction of Mine Camp and associated infrastructure; and
    - Ancillary works (access tracks, small pads etc.).
  - Consumption of diesel in diesel generators (electricity generation);
  - Consumption of grid supplied electricity (final nine months of construction phase only);
  - Transport of people and materials;

        - Diesel deliveries by truck; and
        - Bus to/from the Mine Camp.
    - Ancillary emissions
        - Solid and liquid waste generation at the Mine Site and Mine Camp; and
        - Leakage of refrigerant from air conditioning units.
- Operation
    - Consumption of diesel fuel;
        - Vegetation and topsoil removal;
        - Excavation of interburden and overburden;
        - Material extraction and haulage;
        - Management of waste;
        - Road maintenance; and
        - Handling of product material at the Processing Plant);
    - Consumption of grid supplied electricity;
    - Consumption of Liquefied Natural Gas (LNG) in driers at the Processing Plant;
    - Transport of people and materials;
        - Product transport from Mine Site to Broken Hill;
        - LNG deliveries by truck;
        - Diesel deliveries by truck; and
        - Bus to/from Mine Camp;
    - Ancillary emissions
        - Solid and liquid waste generation at the Mine Site and Mine Camp; and
        - Leakage of refrigerant from air conditioning units.
- Rehabilitation
    - Limited information on the likely sources of GHG emissions during the rehabilitation phase of the Project is available. However, for the purposes of this assessment it has been assumed that:
        - Diesel fuel consumption would be 50 % of the operational phase requirement in the rehabilitation phase, although is likely to be significantly less.

A summary of the GHG emission sources associated with the various phases of the Project are presented in Table 7.

Table 7 Greenhouse gas emission sources

Scope	GHG emission source	Project phase		
		Site establishment	Operations	Rehabilitation
1	Diesel combustion in plant and equipment	✓	✓	✓
	Diesel combustion in generators	✓	×	×
	LNG use in driers	×	✓	×
	Diesel combustion in product trucks	×	✓	×
	Leakage from air conditioning	✓	✓	✓
2	Electricity consumption (from grid)	✓ (1)	✓	✓
3	Diesel combustion in plant and equipment	✓	✓	✓
	Diesel combustion in generators	✓	×	×
	Diesel combustion in product trucks	×	✓	×
	Transport of consumables (LNG, diesel) to Mine Site	✓	✓	✓
	Electricity consumption (from grid)	✓ (1)	✓	✓
	Solid waste generation	✓	✓	✓

Note: (1) Electricity connection from grid in last 9 months of final year of construction

4.4. Emission Assumptions

Data has been provided by the Applicant. In addition to that data, several assumptions have been required to be adopted to allow assessment of certain emissions sources during certain phases of the Project.

Presented in Table 9 is a summary of the assumptions adopted for each emissions source during each phase of the Project. Table 8 presents the categorisation of adopted assumptions.

A full outline of the activity data adopted is presented in Appendix B.

Table 8 Categorisation of adopted assumptions

Assumption	Category
Data provided by Applicant	1
Data adjusted from Applicant provided data, based on assumptions	2
Assumptions applied by consultant to information provided by Applicant	3
Reasonable (conservative) assumption adopted	4
No assumption required	-

Table 9 Assumptions adopted in activity data calculations

Emission source	Phase	Assumption	Data source (refer Table 8)
Diesel combustion (plant and equipment)	Construction	Diesel fuel estimates provided by Applicant.	1
	Operation	Diesel fuel estimates provided by Applicant.	1
	Rehabilitation	Diesel fuel estimates provided by Applicant.	2
Diesel combustion (generators)	Construction	Power demand (kW) during construction phase provided by Applicant. Assumed diesel combustion of 0.4 $L \cdot kWh^{-1}$. Grid electricity connected after 3 months of third (final) year of construction phase, so diesel only required for first 3 months of final construction year.	3
	Operation	Not required.	-
	Rehabilitation	Not required.	-
Electricity	Construction	Power demand (kW) during construction phase provided by Applicant. Grid electricity connected after 3 months of third (final) year of construction phase, so electricity consumption from grid for last 9 months of final construction year. 30 % of electricity requirement provided by certified renewable sources.	3
	Operation	Power demand (kW) during operational phase provided by Applicant. Assumed power demand 24 hours per day, 7 days per week 30 % of electricity requirement provided by certified renewable sources.	2
	Rehabilitation	Power demand (kW) during year 1 of rehabilitation phase, same as final year of operations. 30 % of electricity requirement provided by certified renewable sources.	2
Liquified Natural Gas (LNG) use in driers	Construction	Not required.	-
	Operation	LNG use provided by Applicant.	1
	Rehabilitation	Not required.	-
LNG and diesel delivery by truck	Construction	Not required.	-
	Operation	Diesel fuel estimates provided by Applicant	1
	Rehabilitation	Not required.	-

Emission source	Phase	Assumption	Data source (refer Table 8)
Product transport from Mine Site	Construction	Not required.	-
	Operation	Diesel fuel estimates provided by Applicant.	1
	Rehabilitation	Not required.	-
Air conditioning	Construction	Assumed 480 full time equivalent (FTE) employees. Assumed 1 air conditioning unit operational for every 2 employees (Mine Camp, Administration, Mine Site). Assumed refrigerant charge of 1 kg per unit. Assumed leakage rate of 3.5 % (per DCCEEW). Assumed R32 refrigerant	4
	Operation	Assumed 240 FTE employees. Other assumptions as per Construction phase.	4
	Rehabilitation	Assumed 40 FTE employees. Other assumptions as per Construction phase.	4
Solid waste generation	Construction	FTE assumptions as outlined above. Assumed 0.54 t municipal solid waste generation per employee, per year.	4
	Operation		
	Rehabilitation		

Note: Whilst liquid waste generation would occur at the Project Site, it is assumed that it would be managed through aerobic treatment on-site, which has an emission factor of 0 t CO_2-e per person.

4.5. Mitigation Measures

The following GHG mitigation measures are included in the design of the Project and reference the GHG mitigation hierarchy as outlined in section 3.1 of the GHG Guide.

4.5.1. Avoided Emissions

The Applicant would seek to purchase 30 % of electricity from externally contracted and certified renewable sources.

4.5.2. Operational Measures

The measures outlined in Table 10 would also be implemented during the life of the Project to avoid, reduce, and substitute, to minimise GHG emissions. These measures are also outlined in the 'Summary of Environmental Management and Monitoring Measures' (Appendix 4 of the EIS). It is noted that these measures are also considered to be best practice as outlined in the 'Best Practice Checklist for Greenhouse Gas Abatement by NSW Coal Mines' (NSW DPE, 2023), noting that no specific guidance currently exists for other mining operations in NSW.

Table 10 Measures to avoid, reduce, and/or substitute GHG emissions

Description	Hierarchy
GHG Management and Energy Efficiency Plan	Avoid / Reduce
Driver training to educate fuel efficient operation of vehicles.	Reduce
Planning and scheduling to minimise material handling and double handling.	Reduce
Turn off all vehicles, plant and equipment when not in use.	Reduce
Ensure that all vehicles, plant and equipment are regularly serviced (including optimisation of tyre pressures) to ensure efficient operation.	Reduce
Clearly mark all haul roads and other roads and tracks and ensure that signposted speed limits are complied with.	Reduce
Ensure that internal haul roads and the Site Access Road are maintained in good condition to facilitate efficient travel and transportation of materials.	Reduce
Reduce gradients around the site where feasible.	Reduce
Utilise renewable fuel/blends fuel in plant and equipment (where practicable).	Substitute
Planning and scheduling of operations and the use of the most efficient vehicles and routes to minimise the number of trips required and minimise greenhouse gas (and particulate) emissions per tonne of material transported. This may include the use of the largest class of vehicle possible to transport overburden within the Mine Site, the use of Type 2 road trains for transportation of heavy mineral concentrate from the Mine Site to the Rail Facility and transporting project personnel at the Mine Camp to and from site by bus.	Reduce
Procure the highest efficiency and most cost-effective vehicles/equipment for the required task.	Reduce
Investigate the use of battery electric vehicles (BEV), fuel cell electric vehicles (FCEV) and diesel-electric hybrid vehicles (HV) which represent emerging best practice in the mining industry. The Applicant would keep up to date with ongoing trials in this area (e.g. Fortescue BEV/HV trial in open cut mines).	Avoid/Reduce

Whilst biodiesel (B100), biodiesel blends (e.g. B5, B20), and renewable diesel would be investigated for use as part of the Project operation, and the use encouraged in B-double truck transport of product from the Mine Site to Broken Hill (and in all other supplier vehicles), the availability and cost may be a limiting factor throughout the lifetime of the Project.

Although a total of 85 000 L of diesel fuel storage would be located at the Project Site (1 × 75 000 L and 2 × 5 000 L tanks), based on the fuel usage provided by the Applicant, this supply would last for approximately 10.1 days during construction (not including the requirement for power generation), 2.5 days during the operational phase, and 6.9 days during the rehabilitation phase of the Project. Additional storage could be included as part of the Project without the requirement for further approval, should this be required. Whilst diesel is likely to be readily available, biodiesel and blends may be less available, although the Applicant would investigate the availability of a suitable bulk fuel supplier (e.g. in Adelaide or Melbourne).

In addition, the cost differential of diesel and B20 (as of 16 April 2024) was approximately $0.61 ($ 1.86 for diesel, $2.47 for B20). Furthermore, the energy content of biodiesel is lower than diesel, which would require a higher quantity to be consumed for equivalent activity. Additional costs may also be incurred due to increased maintenance/servicing requirements of vehicles and equipment when utilising biodiesel.

However, there may be financial benefits to switching to biodiesel and blends, even considering the limitations above. Considering the lower energy content of biodiesel (34.6 $GJ \cdot kL^{-1}$) compared to diesel (38.6 $GJ \cdot kL^{-1}$), and the cost difference as outlined above, the Applicant would see an increased fuel bill of approximately 48 % during any stage of the Project, but a reduction of scope 1 GHG emissions of 99.6%. However, and related, the cost to offset all the scope 1 emissions from the combustion of biodiesel (B100) would be approximately 99.6 % less than offsetting the emissions generated using diesel fuel alone. This would be investigated further by the Applicant and is discussed further in Section 4.7.2.

4.6. Emissions Estimates

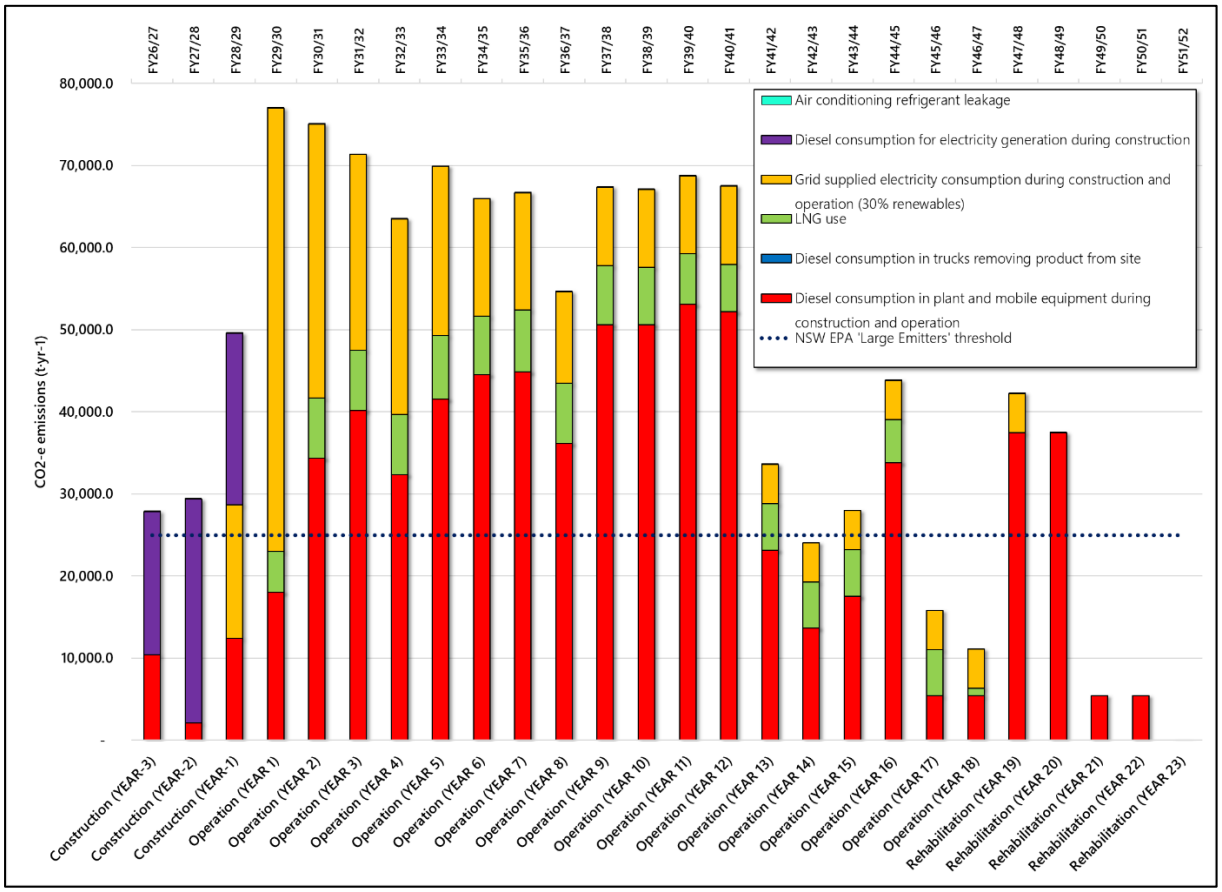
Table 11 provides a summary of the total scope 1, scope 2, and scope 3 emissions calculated during each stage of development, over the Project lifetime. A summary of the scope 1 and scope 2 emissions is presented in Figure 4.

A full outline of all emissions calculated for each individual source are presented in Appendix B.

Table 11 Summary of scope 1, scope 2, and scope 3 GHG emissions

Financial year	Project phase	Scope 1 emissions	Scope 2 emissions	Scope 1 + Scope 2 emissions	Scope 3 emissions
		t CO_2-e·yr^{-1}			
FY26/27	Construction	27 875	0	27 875	7 298
FY27/28	Construction	29 394	0	29 394	7 665
FY28/29	Construction	33 379	16 224	49 603	10 395
FY29/30	Operation	23 035	53 979	77 014	9 227
FY30/31	Operation	41 718	33 340	75 058	13 277
FY31/32	Operation	47 532	23 815	71 347	12 446
FY32/33	Operation	39 697	23 815	63 512	10 516
FY33/34	Operation	49 276	20 639	69 916	12 782
FY34/35	Operation	51 691	14 289	65 979	11 249
FY35/36	Operation	52 416	14 289	66 704	11 348
FY36/37	Operation	43 526	11 113	54 639	11 450
FY37/38	Operation	57 839	9 526	67 365	15 029
FY38/39	Operation	57 595	9 526	67 121	12 753
FY39/40	Operation	59 236	9 526	68 761	13 372
FY40/41	Operation	57 980	9 526	67 506	13 152
FY41/42	Operation	28 842	4 763	33 604	5 964
FY42/43	Operation	19 267	4 763	24 030	3 611
FY43/44	Operation	23 199	4 763	27 962	4 576
FY44/45	Operation	39 084	4 763	43 847	8 594
FY45/46	Operation	11 020	4 763	15 783	1 541
FY46/47	Operation	6 320	4 763	11 083	1 608
FY47/48	Rehabilitation	37 488	4 763	42 251	9 320
FY48/49	Rehabilitation	37 488	0	37 488	9 251
FY49/50	Rehabilitation	5 405	0	5 405	1 364
FY50/51	Rehabilitation	5 405	0	5 405	1 364
FY51/52	Rehabilitation	0	0	0	35
	Total	**885 707**	**282 947**	**1 168 654**	**219 186**

Figure 4 Summary of scope 1 and scope 2 emissions



4.7. Emissions Benchmarking and Goal Setting

Section 4.7.1 provides a benchmarking exercise of the Project against similar developments. Section 4.7.2 provides GHG emission targets for the Project, considering the NSW government Net Zero Plan.

4.7.1. Emissions Benchmarking

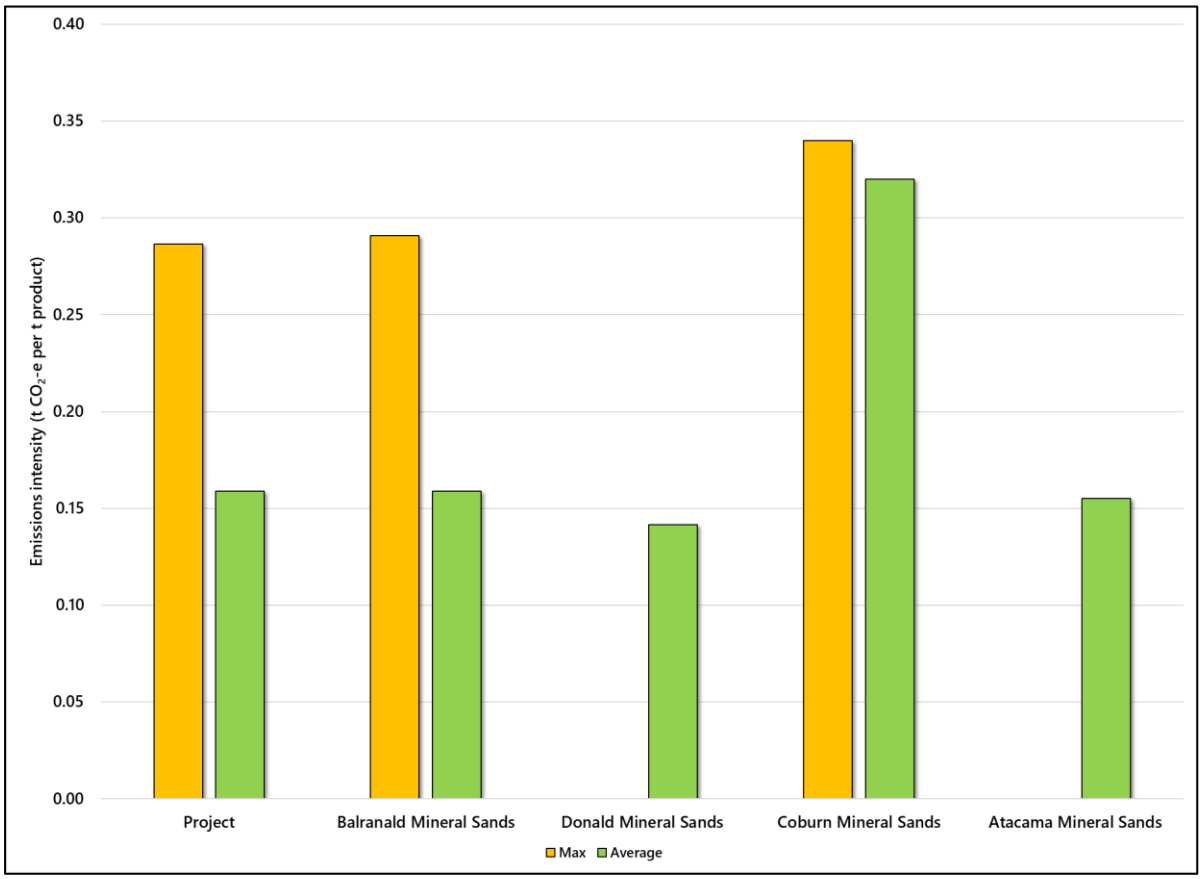
A review of environmental assessments for minerals sands projects across Australia has been performed, with the GHG assessments reviewed, and the emissions intensity expressed as t CO_2-e·t (product)$^{-1}$ of each calculated, for both the project average, and maximum in any year (where information is available). The results of that analysis are presented in Table 12 and Figure 5. Note that scope 1 and 2 emissions have been adopted for this exercise.

The Project is shown to have comparable emissions intensity to other similar projects.

Table 12 Benchmarking of GHG emissions intensity from mineral sands projects

Project	Assessment date	Location	Emissions intensity t CO_2-e·t product^{-1}	
Balranald Mineral Sands[2]	2015	Murray Basin, NSW	Maximum	0.29
			Average	0.16
Donald Mineral Sands[3]	2008	Western Victoria	Maximum	nd
			Average	0.14
Coburn Mineral Sands[4]	2005	NW Western Australia	Maximum	0.34
			Average	0.32
Atacama Mineral Sands[5]	2023	NW of Ceduna, South Australia	Maximum	nd
			Average	0.16
Project	2025	Wentworth, NSW	Maximum	0.29
			Average	0.16

Figure 5 Emissions intensity comparison of Project and other mineral sands projects



[2] https://www.iluka.com/media/srhlbeh3/volume-2_balranald-mineral-sands-project-eis_appendix-e-air-quality-and-greenhouse-gas-assessment.pdf

[3] https://www.planning.vic.gov.au/__data/assets/pdf_file/0034/687085/Donald_Mineral_Sands_EES_Panel_Report.pdf

[4] https://www.epa.wa.gov.au/sites/default/files/PER_documentation/1491-Coburn-PER.pdf

[5] https://www.iluka.com/media/hh5j0j1k/20409_atacama-mlp_v1_-final.pdf

4.7.2. Goal Setting

4.7.2.1. Requirements for Goal Setting

The GHG Guide provides the requirements to outline the Applicants long-term and interim GHG emissions goal for the Project. As outlined in the GHG Guide:

> *"Proponents are required to set an overarching long-term scope-1 GHG emission reduction goal for the project that represents a meaningful contribution to the emissions reduction objectives of the State.*
>
> *Emissions reduction goals should include material efforts to reduce emissions leading towards net zero by 2050. When developing goals, the proponent must consider NSW legislated interim emission reduction targets. Goals for facilities covered by the Safeguard Mechanism should start with the Safeguard Mechanism baseline and then consider setting more ambitious reduction goals as practicable.*
>
> *Proponents must also set interim scope 1 emission goals that will lead to achieving their long-term scope 1 goal. Interim goals are to be set for intervals of five years or less. Scope 1 goals must be described in absolute terms (e.g. tonnes of CO2-e for a given year). Emission intensity goals should also be developed where appropriate.*
>
> *Proponents are also required to specify goals for scope 2 emissions. Scope 3 goals are not required.*
>
> *We expect emissions reduction trajectories to be broadly consistent with the NSW or industry specific emissions reduction trajectory. If the project emissions trajectory, accounting for emission goals, does not align with the overall NSW net zero emissions trajectory, the proponent must explain why the emission reduction trajectory still represents a meaningful contribution to NSW's emission reduction targets and/or supports NSW to decarbonise. We recognise that emissions reduction trajectories may be 'lumpy' and may depend on the implementation of different technologies or processes at different stages of a project."*

As outlined in Section 2.1, the *Climate Change (Net Zero Future) Act* 2023 seeks to legislate Australia's GHG emissions reduction target of:

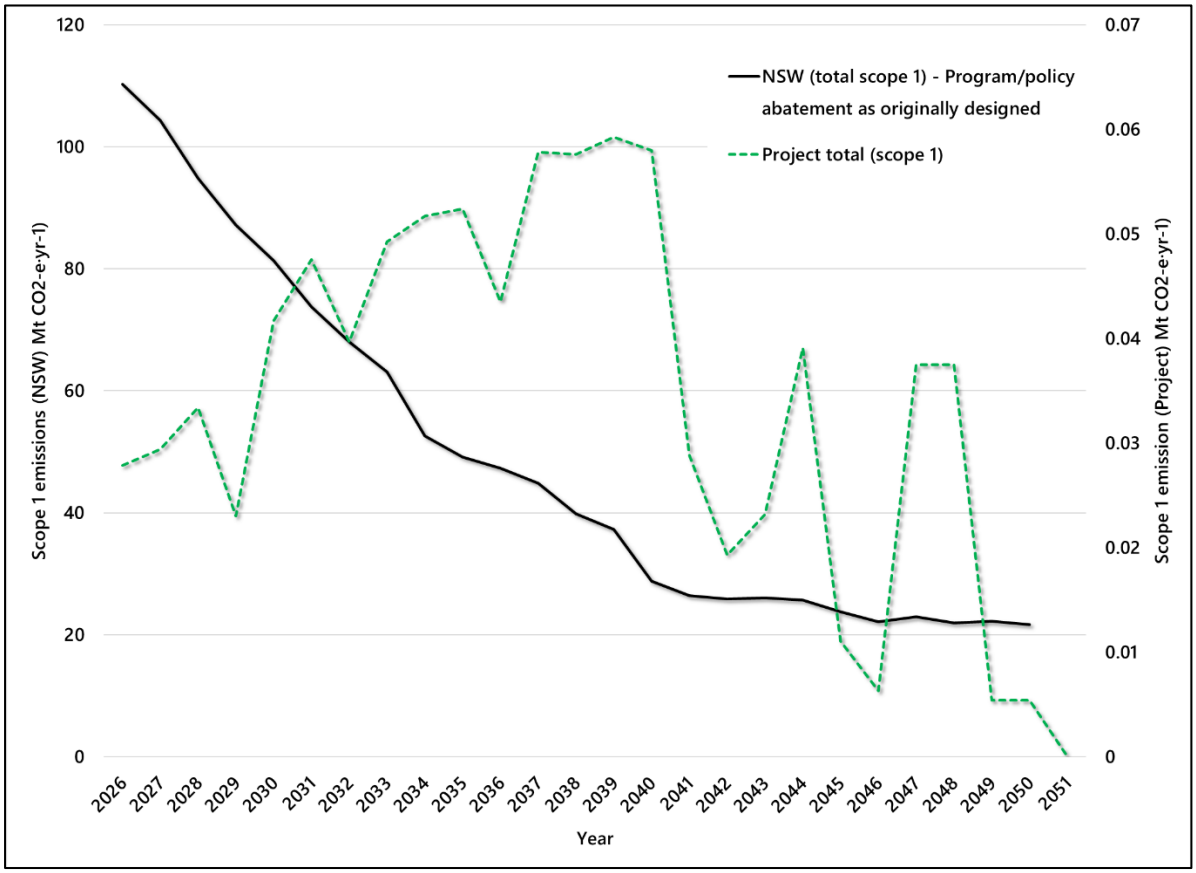
- 50 % reduction on 2005 levels by 2030;
- 70 % reduction on 2005 levels by 2035; and
- Net zero emissions by 2050.

4.7.2.2. Emissions Trajectory

For context, presented in Figure 6 are the anticipated scope 1 emission trajectories for NSW (total emissions), from 2026 to 2050, under the program/policy abatement as originally designed, and for the Project. Emissions from the Project are anticipated to account for a maximum of 0.2 % and an average of 0.09 % of NSW scope 1 emissions in any year along that trajectory.

The Project scope 1 emissions trajectory is non-linear as scope 1 emissions are shown in Figure 4 to be dominated by diesel usage, which is broadly a function of the requirement for material movements at the Project Site which is variable over the lifespan of the Project. However, scope 1 emissions are shown to increase during the first 15 years (3 years of construction and 12 years of operation), with a general downward trend over the remaining 13 years (6 years of operation and 5 years of rehabilitation).

Figure 6 Comparison of NSW net zero and Project Scope 1 emission trajectories (no abatement)



4.7.2.3. Emissions Reductions by Total and IPCC Category

The following section outlines the anticipated/required scope 1 emissions reductions in NSW by total (Table 13) and IPCC category (Table 14 to Table 17) as relevant to the Project (refer Table 1), to meet NSW Government net zero commitments.

The reductions are provided and compared against the 2005 baseline (as per the *Climate Change (Net Zero Future) Act 2023*) and against a 2026 baseline, being the anticipated commencement date of the Proposal.

Table 13 Targets and goals of net zero policy, and comparison to policy abatement as originally designed

Year	NSW Government targets and goals c.f. 2005 emissions	As originally designed c.f. 2005 emissions	As originally designed c.f. 2026 emissions
2030	50 % reduction	49.5 % reduction	26.3 % reduction
2035	70 % reduction	69.5 % reduction	55.4 % reduction
2050	Net zero	86.6 % reduction	80.4 % reduction

Figure 7 NSW EPA scope 1 GHG emissions and targets 2005 to 2050

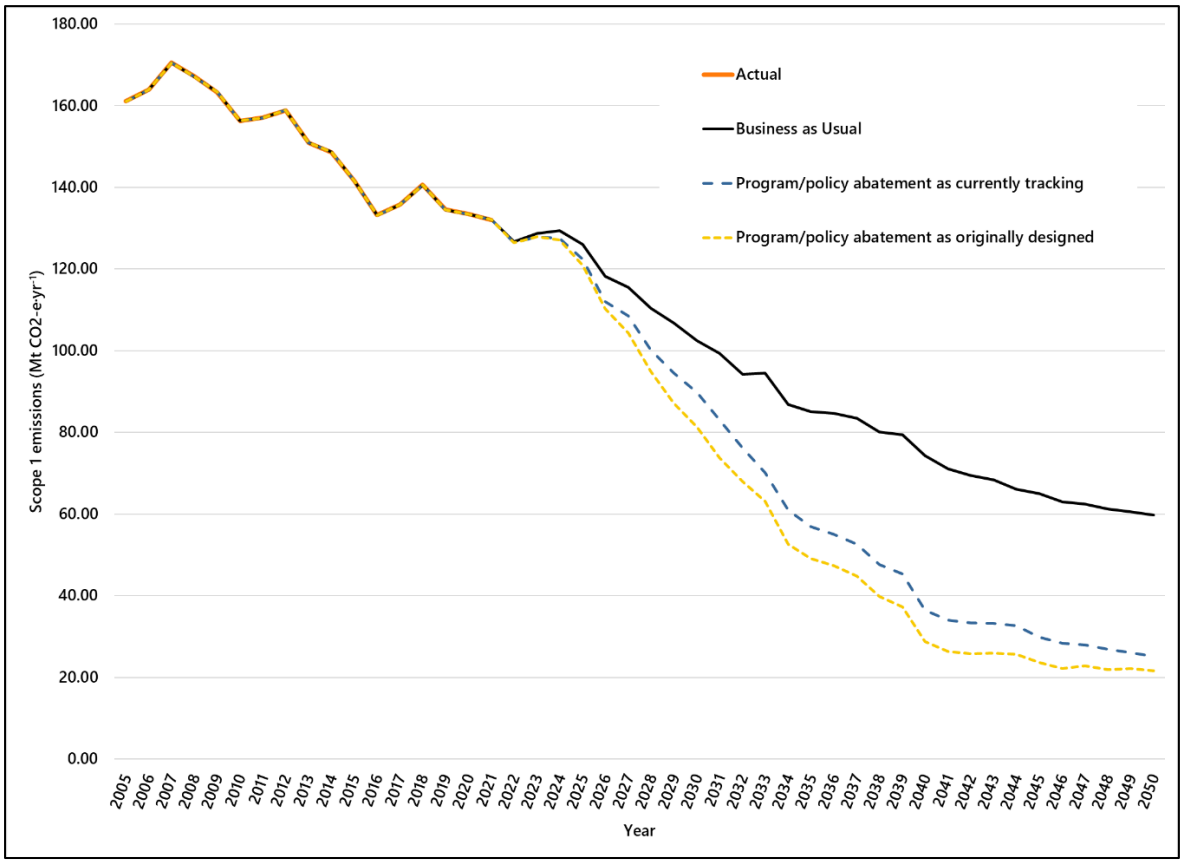


Table 14 Fugitive emissions - comparison to policy abatement as originally designed

Year	As originally designed c.f. 2005 emissions	As originally designed c.f. 2026 emissions
2030	30.6 % reduction	0.9 % reduction
2035	65.5 % reduction	50.7 % reduction
2050	92.0 % reduction	88.5 % reduction

Figure 8 NSW EPA fugitive (open cut mining) GHG emissions and targets 2005 to 2050

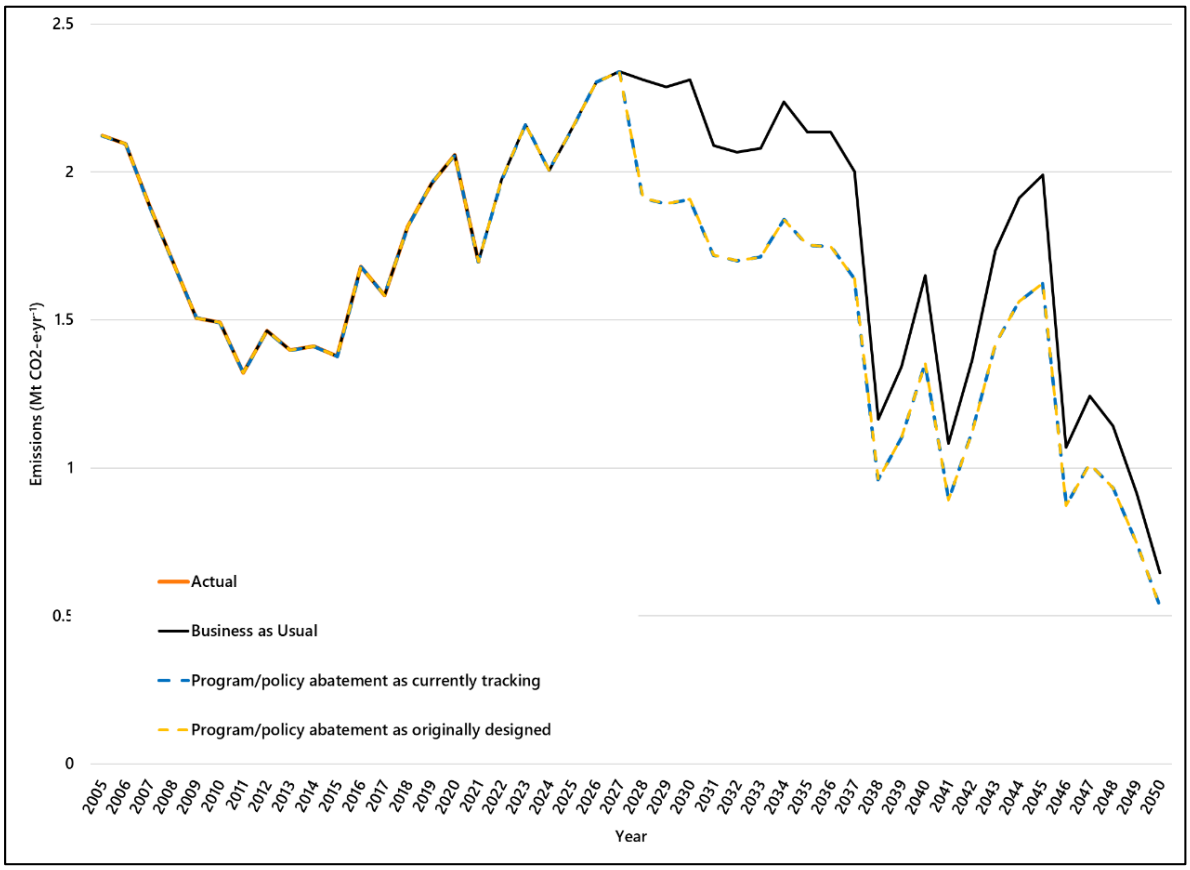


Table 15 Transport - comparison to policy abatement as originally designed

Year	As originally designed c.f. 2005 emissions	As originally designed c.f. 2026 emissions
2030	5.3 % reduction	10.7 % reduction
2035	32.4 % reduction	36.2 % reduction
2050	80.3 % reduction	81.4 % reduction

Figure 9 NSW EPA transport GHG emissions and targets 2005 to 2050

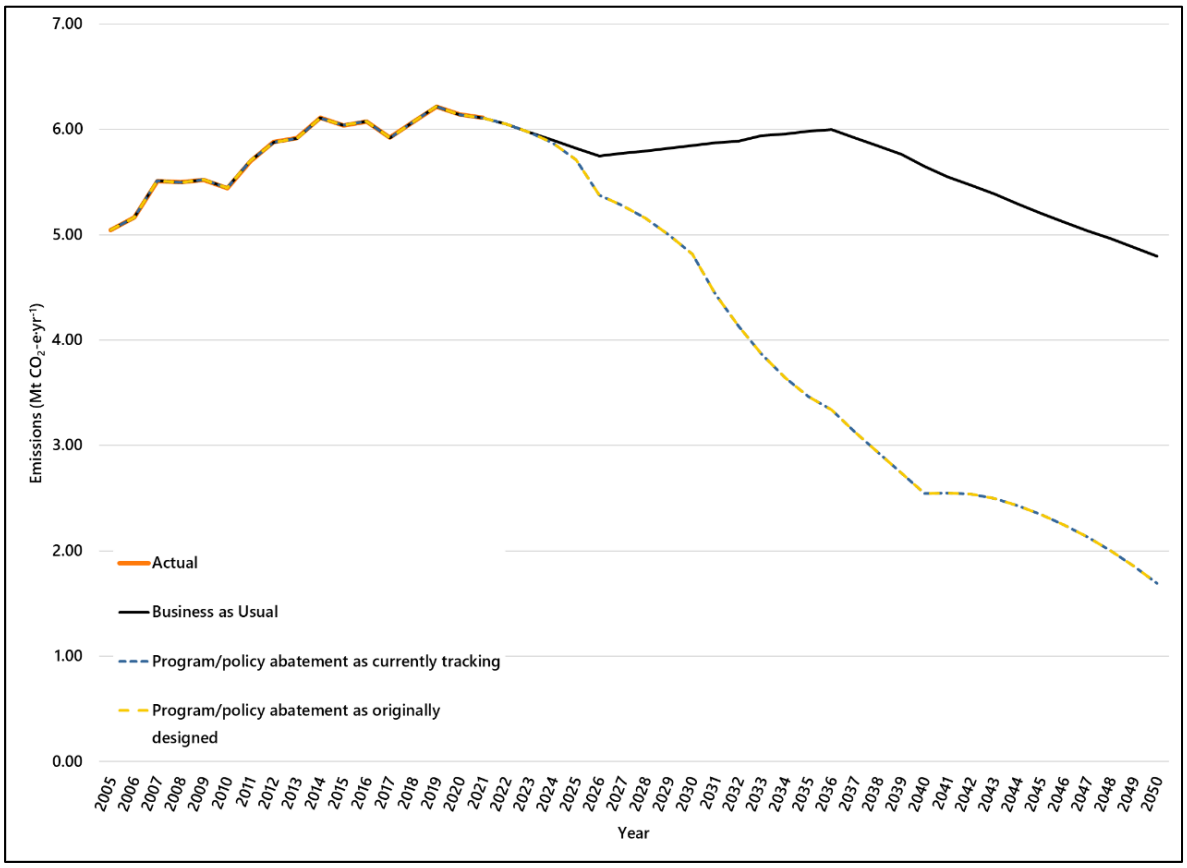


Table 16 Stationary energy - comparison to policy abatement as originally designed

Year	As originally designed c.f. 2005 emissions	As originally designed c.f. 2026 emissions
2030	36.1 % reduction	18.3 % reduction
2035	54.4 % reduction	41.7 % reduction
2050	72.1 % reduction	64.3 % reduction

Figure 10 NSW EPA stationary energy (excl. electricity) GHG emissions and targets 2005 to 2050

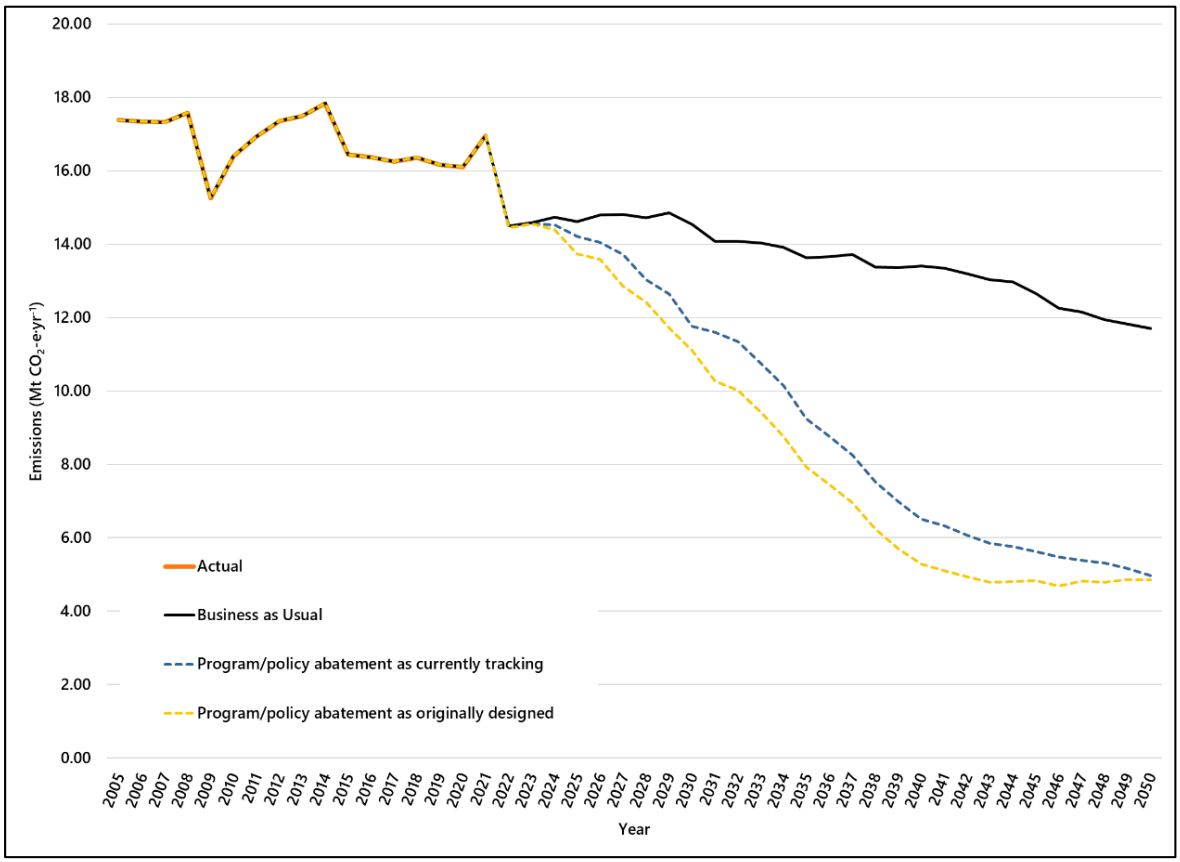
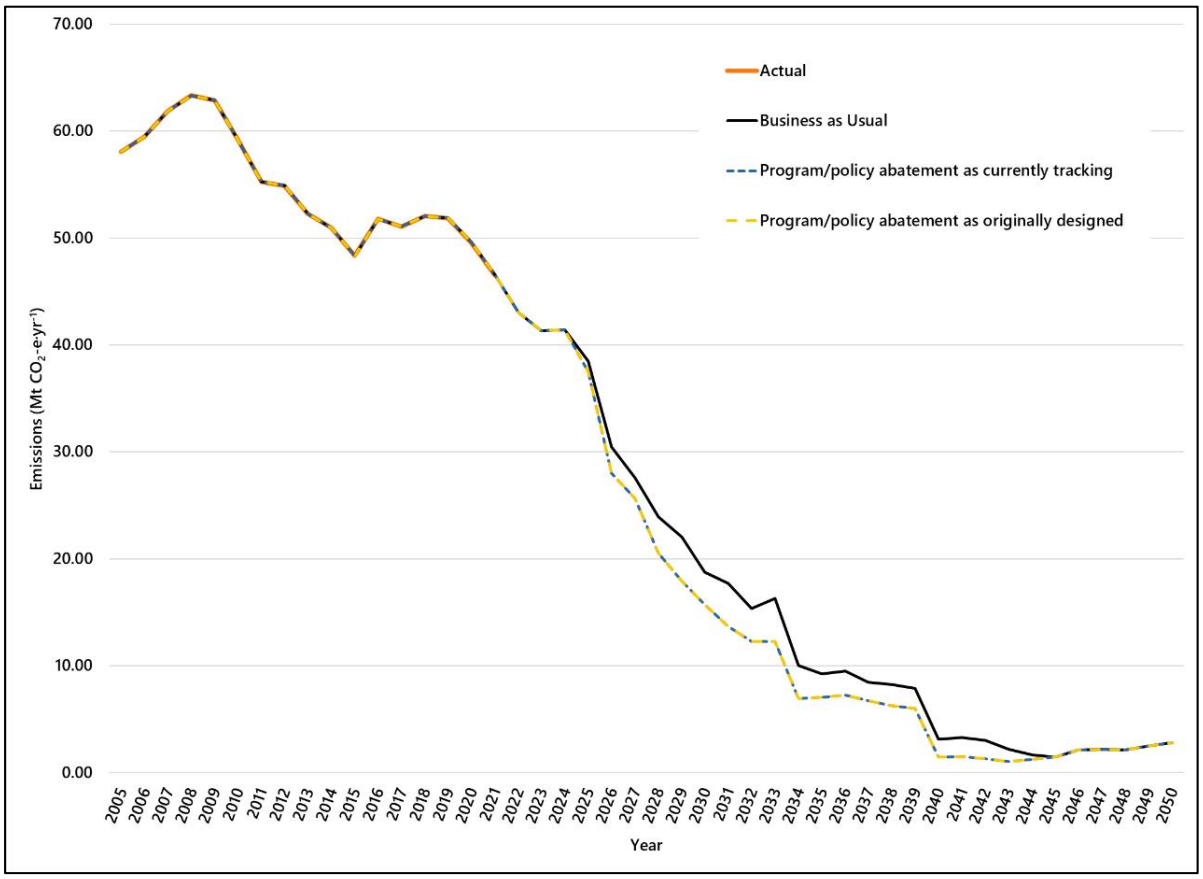


Table 17 Electricity generation - comparison to policy abatement as originally designed

Year	As originally designed c.f. 2005 emissions	As originally designed c.f. 2026 emissions
2030	72.9 % reduction	43.9 % reduction
2035	87.9 % reduction	74.9 % reduction
2050	95.2 % reduction	90.0 % reduction

Note: Electricity generation only proposed during construction phase of Project

Figure 11 NSW EPA electricity generation GHG emissions and targets 2005 to 2050



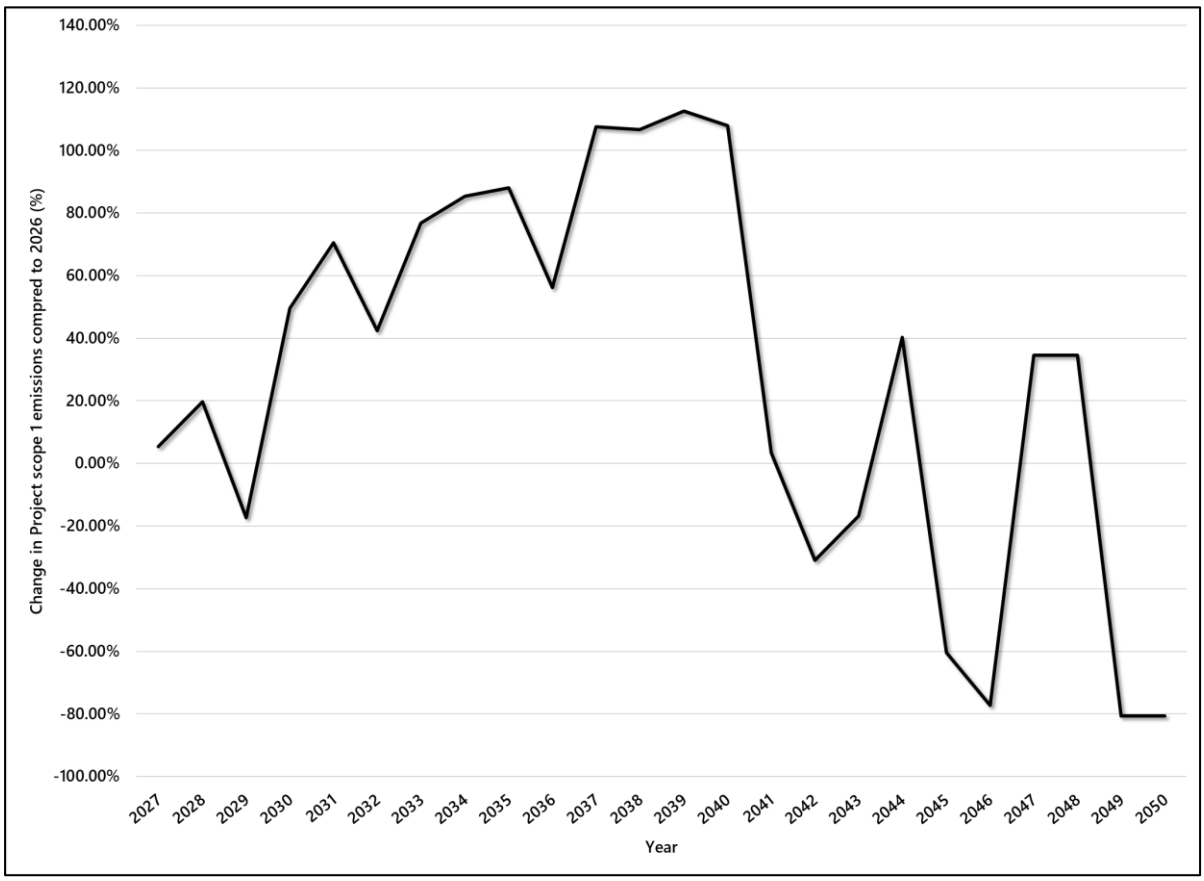
Presented in Table 18 are the calculated changes in Project emissions compared to a 2026 baseline and compared against the NSW Government Net Zero targets and goals. These data are also presented in Figure 12.

Whilst emissions over the Project lifetime are shown to reduce as would be expected, additional actions are likely to be required to ensure that the Project and NSW Government emissions trajectories are more aligned in the short and medium term.

Table 18 Comparison of Project scope 1 emissions and NSW Government goals and targets

Year	NSW Government targets and goals c.f. 2005 emissions	NSW Government targets and goals As originally designed c.f. 2026 emissions	Project c.f. 2026 Project baseline
2030	50 % reduction	26.3 % reduction	49.7 % increase
2035	70 % reduction	55.4 % reduction	56.1 % increase
2050	Net zero	80.4 % reduction	80.6 % reduction

Figure 12 Percentage change in Project scope 1 emissions compared to 2026



4.7.2.4. Specific Project Goals

The following outlines specific goals for the Project:

Scope 1 emissions:

- Aim for a 25 % reduction in scope 1 emissions by 2030 when compared to the Project baseline;
- Aim for a 55 % reduction in scope 1 emissions by 2035 when compared to the Project baseline;
    - Targeting the above emissions reductions would ensure that the Project emissions trajectory matches the NSW Net Zero targets and goals.
    - The above emissions reductions would be targeted primarily through the adoption of the measures outlined in Section 4.5, which includes a GHG Management and Energy Efficiency Plan.
    - Detailed activity data would be collated with GHG emissions calculated at the end of each financial year and compared to the targets above. The effectiveness of the GHG management measures would be reviewed annually.
    - A review of the potential for use of biodiesel/blends in site equipment would be performed prior to the operational phase of the development. It is likely that to meet a scope 1 emissions reduction of 25 % by 2030 would require approximately 30 % of diesel fuel in plant and mobile equipment to be B100 biodiesel. To achieve the 55 % reduction in scope 1 emissions by 2035 would require approximately switching to 70 % biodiesel.

Scope 2 emissions:

- Whilst not examined in detail in this report, scope 2 emissions are anticipated to reduce over time, as the NSW electricity grid is decarbonised. Towards the end of the operational phase of the Project, calculated scope 2 emissions are approximately 9 % of the peak in year 1 of operation.
- The Applicant has committed to purchasing a minimum of 30 % of the required electricity from renewable sources, including externally contracted and certified renewable sources.

4.8. Offset Strategy

Should the measures outlined in Section 4.7.2.4 not deliver the anticipated emissions reductions, the Applicant would investigate options for offsetting emissions to those levels, and would use an accredited and regulated offsetting agent.

5. CONCLUSION

This GHGA has been prepared by Northstar on behalf of the Applicant to quantify the potential GHG impacts of the Project.

The GHGA presents an assessment of the impacts of activities associated with the site establishment, operational, and rehabilitation phases of the Project. The GHGA has been performed in general accordance with the GHG Guide.

GHG emissions for the 26 years of the Project lifetime have been calculated, with the emissions intensity shown to be comparable to other mineral sands projects. The emissions reduction trajectories required by the NSW Government to meet net zero commitments have been examined, and mitigation measures provided to ensure that the Project emissions trajectory does not compromise those net zero goals.

6. REFERENCES

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APPENDIX A

Commonly used units and abbreviations

Units Used in the Report

Units presented in the report follow the International System of Units (SI) conventions unless derived from references using non-SI units.

Commonly used SI units

The following units are commonly used in Northstar reports.

Symbol	Name	Quantity
SI base units		
K	Kelvin	thermodynamic temperature
kg	kilogram	mass
m	metre	length
mol	mole	amount of substance
s	seconds	time
Non-SI units mentioned in the SI or accepted for use		
°	degree	plane angle
d	day	time
h	hour	time
ha	hectare	area
J	joule	energy
L	litre	volume
min	minute	time
N	newton	force or weight
t	tonne	mass
V	volt	electrical potential
W	watt	power

Multiples of SI and non-SI units

The following prefixes are added to unit names to produce multiples and sub-multiples of units:

Prefix	Symbol	Factor
T	tera-	10^{12}
G	giga-	10^{9}
M	mega-	10^{6}
k	kilo-	10^{3}
h	hector-	10^{2}
da	deca-	10^{1}

Prefix	Symbol	Factor
p	pico-	10^{-12}
n	nano-	10^{-9}
μ	micro-	10^{-6}
m	milli-	10^{-3}
c	centi-	10^{-2}
d	deci-	10^{-1}

In this report units formed by the division of SI and non-SI units are expressed as a negative exponent and do not use the solidus (/) symbol. For example:

- 50 micrograms per cubic metre would be presented as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$; and
- 0.2 kilograms per hectare per hour would be presented as 0.2 $kg \cdot ha^{-1} \cdot hr^{-1}$ and not 0.2 kg/ha/hr.

Commonly used SI-derived and non-SI units

Symbol	Name	Quantum
$g \cdot m^{-2} \cdot s^{-1}$	gram per square metre per second	rate of mass deposition per unit area
$g \cdot s^{-1}$	gram per second	rate of mass emission
$kg \cdot ha^{-1} \cdot hr^{-1}$	kilogram per hectare per hour	rate of mass deposition per unit area
$kg \cdot m^{-3}$	kilogram per cubic metre	density
$L \cdot s^{-1}$	litres per second	volumetric rate
m^2	square metre	area
m^3	cubic metre	volume
$m \cdot s^{-1}$	metre per second	speed and velocity
$mg \cdot m^{-3}$	milligram per cubic metre	mass concentration per unit volume
$mg \cdot Nm^{-3}$	milligram per normalised cubic metre (of air)	mass concentration per unit volume
$\mu g \cdot m^{-3}$	microgram per cubic metre	mass concentration per unit volume
$mg \cdot m^{-3}$	milligram per cubic metre	mass concentration per unit volume
Pa	pascal	pressure
ppb	parts per billion ($1x10^{-9}$)	volumetric concentration
pphm	parts per hundred million (1×10^{-5})	volumetric concentration
ppm	parts per million ($1x10^{-6}$)	volumetric concentration

Commonly used abbreviations

Abbreviation	Term
ABS	Australian Bureau of Statistics
ACT	Australian Commonwealth Territory
AGL	above ground level
AHD	Australian height datum
APC	air pollution control
AQI	air quality index
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AQRA	air quality risk assessment
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS/NZS	Australian Standard / New Zealand Standard
AWS	automatic weather station

Abbreviation	Term
BCA	Building Code of Australia
BGL	below ground level
BOM	Bureau of Meteorology
CEMP	construction environment management plan
CCAP	climate change adoption plan
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEM	digital elevation model
EETM	emission estimation technique manual
EPA VIC	Environmental Protection Authority Victoria
EPBC	Environment Protection and Biodiversity Conservation Act
FIBC	flexible intermediate bulk container
GHG	greenhouse gas
GHGA	greenhouse gas assessment
GIS	geographical information system
IAQM	UK Institute of Air Quality Management
IBC	intermediate bulk container
ID	internal diameter
LLV	low level waste
LoM	life of mine
MSDS	Material Safety Data Sheet
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
NH_3	ammonia
NO	nitric oxide
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
NORM	naturally occurring radioactive material
NSW	New South Wales
NSW DCCEEW	New South Wales Department of Climate Change Energy the Environment and Water
NSW EPA	New South Wales Environment Protection Authority
NT	Northern Territory
OEMP	operational environmental management plan
O_3	ozone
OU	odour unit
$OU \cdot m^3 \cdot s^{-1}$	odour units times metres cubed per second
$OU \cdot s^{-1}$	odour units per second
Pb	lead

Abbreviation	Term
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 µm or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 µm or less
ROM	run of mine
SA	South Australia
SEPP	State Environmental Protection Policy
SO_X	oxides of sulphur
SO_2	sulphur dioxide
SRTM3	Shuttle Radar Topography Mission
SVOC	semi-volatile organic compound
TAPM	The Air Pollution Model
TAS	Tasmania
TEU	twenty-foot equivalent unit
TSP	total suspended particulates
TVOC	total volatile organic compounds
TWA	time weighted average
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VIC	Victoria
VLLW	very low level waste
VOC	volatile organic compound

APPENDIX B

Greenhouse Gas Calculations

Activity Data

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Construction (YEAR-3)	Construction (YEAR-2)	Construction (YEAR-1)	Operation (YEAR 1)	Operation (YEAR 2)	Operation (YEAR 3)	Operation (YEAR 4)	Operation (YEAR 5)	Operation (YEAR 6)	Operation (YEAR 7)	Operation (YEAR 8)	Operation (YEAR 9)	Operation (YEAR 10)	Operation (YEAR 11)
Activity data		FY26/27	FY27/28	FY28/29	FY29/30	FY30/31	FY31/32	FY32/33	FY33/34	FY34/35	FY35/36	FY36/37	FY37/38	FY38/39	FY39/40
Electricity	MWh	16,127	25,179	77,257	226,803	226,806	226,806	226,806	226,806	226,806	226,806	226,806	226,806	226,806	226,806
LNG	GJ	-	-	-	97,015	142,546	142,616	142,023	150,263	139,230	145,690	143,026	140,027	135,826	118,788
Diesel (stationary energy)	kL	6,451	10,072	7,726	-	-	-	-	-	-	-	-	-	-	-
Diesel (plant and mobile equipment)	kL	3,825	772	4,579	6,638	12,651	14,790	11,917	15,288	16,386	16,530	13,308	18,634	18,624	19,552
Diesel (concentrate transport)	kL	-	-	-	5.0	7.5	7.5	7.5	8.0	7.0	7.5	7.5	7.5	7.0	6.0
Fuel to transport LNG from BH	kL	23.9	4.8	28.6	66.9	115.8	129.1	111.2	134.3	138.4	140.8	120.1	152.7	151.4	152.9
Employees	# (FTE)	480	480	480	240	240	240	240	240	240	240	240	240	240	240

		14	15	16	17	18	19	20	21	22	23	24	25	26
		Operation (YEAR 11)	Operation (YEAR 12)	Operation (YEAR 13)	Operation (YEAR 14)	Operation (YEAR 15)	Operation (YEAR 16)	Operation (YEAR 17)	Operation (YEAR 18)	Rehabilitation (YEAR 19)	Rehabilitation (YEAR 20)	Rehabilitation (YEAR 21)	Rehabilitation (YEAR 22)	Rehabilitation (YEAR 23)
Activity data		FY39/40	FY40/41	FY41/42	FY42/43	FY43/44	FY44/45	FY45/46	FY46/47	FY47/48	FY48/49	FY49/50	FY50/51	FY51/52
Electricity	MWh	226,806	226,806	226,806	226,806	226,806	226,806	226,806	226,806	226,806	-	-	-	-
LNG	GJ	118,788	111,605	110,040	108,757	109,380	102,364	108,773	17,715	-	-	-	-	-
Diesel (stationary energy)	kL	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel (plant and mobile equipment)	kL	19,552	19,226	8,528	5,028	6,463	12,444	1,992	1,990	13,801	13,801	1,990	1,990	-
Diesel (concentrate transport)	kL	6	6	6	6	6	6	-	-	-	-	-	-	-
Fuel to transport LNG from BH	kL	153	149	82	60	69	104	-	104	104	-	-	-	-
Employees	# (FTE)	240	240	240	240	240	240	240	240	40	40	40	40	40

Scope 1 Emissions

		1	2	3	4	5	6	7	8	9	10	11	12	13
		Construction (YEAR-3)	Construction (YEAR-2)	Construction (YEAR-1)	Operation (YEAR 1)	Operation (YEAR 2)	Operation (YEAR 3)	Operation (YEAR 4)	Operation (YEAR 5)	Operation (YEAR 6)	Operation (YEAR 7)	Operation (YEAR 8)	Operation (YEAR 9)	Operation (YEAR 10)
Scope 1 emissions		**FY26/27**	**FY27/28**	**FY28/29**	**FY29/30**	**FY30/31**	**FY31/32**	**FY32/33**	**FY33/34**	**FY34/35**	**FY35/36**	**FY36/37**	**FY37/38**	**FY38/39**
Diesel consumption for electricity generation during construction	t CO2-e	17,480	27,291	20,935	-	-	-	-	-	-	-	-	-	-
Diesel consumption in plant and mobile equipment during construction and operation	t CO2-e	10,389	2,098	12,439	18,030	34,364	40,175	32,371	41,525	44,509	44,900	36,148	50,616	50,588
Diesel consumption in trucks removing product from site	t CO2-e	-	-	-	3	5	5	5	5	5	5	5	5	5
LNG use	t CO2-e	-	-	-	4,999	7,345	7,349	7,318	7,743	7,175	7,507	7,370	7,216	6,999
Air conditioning refrigerant leakage	t CO2-e	6	6	6	3	3	3	3	3	3	3	3	3	3

		14	15	16	17	18	19	20	21	22	23	24	25	26
		Operation (YEAR 11)	Operation (YEAR 12)	Operation (YEAR 13)	Operation (YEAR 14)	Operation (YEAR 15)	Operation (YEAR 16)	Operation (YEAR 17)	Operation (YEAR 18)	Rehabilitation (YEAR 19)	Rehabilitation (YEAR 20)	Rehabilitation (YEAR 21)	Rehabilitation (YEAR 22)	Rehabilitation (YEAR 23)
Scope 1 emissions		**FY39/40**	**FY40/41**	**FY41/42**	**FY42/43**	**FY43/44**	**FY44/45**	**FY45/46**	**FY46/47**	**FY47/48**	**FY48/49**	**FY49/50**	**FY50/51**	**FY51/52**
Diesel consumption for electricity generation during construction	t CO2-e	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel consumption in plant and mobile equipment during construction and operation	t CO2-e	53,107.6	52,222.6	23,164.3	13,656.3	17,556.5	33,802.7	5,412.1	5,404.6	37,487.4	37,487.4	5,404.6	5,404.6	-
Diesel consumption in trucks removing product from site	t CO2-e	4.0	4.0	4.0	3.7	3.7	3.7	-	-	-	-	-	-	-
LNG use	t CO2-e	6,121.2	5,751.0	5,670.4	5,604.2	5,636.3	5,274.8	5,605.1	912.9	-	-	-	-	-
Air conditioning refrigerant leakage	t CO2-e	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	0.5	0.5	0.5	0.5	0.5

Scope 2 Emissions

		1	2	3	4	5	6	7	8	9	10	11	12	13
		Construction (YEAR-3)	Construction (YEAR-2)	Construction (YEAR-1)	Operation (YEAR 1)	Operation (YEAR 2)	Operation (YEAR 3)	Operation (YEAR 4)	Operation (YEAR 5)	Operation (YEAR 6)	Operation (YEAR 7)	Operation (YEAR 8)	Operation (YEAR 9)	Operation (YEAR 10)
Scope 2 emissions		**FY26/27**	**FY27/28**	**FY28/29**	**FY29/30**	**FY30/31**	**FY31/32**	**FY32/33**	**FY33/34**	**FY34/35**	**FY35/36**	**FY36/37**	**FY37/38**	**FY38/39**
Grid supplied electricity consumption during construction and operation	t CO2-e	-	-	23,177.2	77,112.9	47,629.2	34,020.8	34,020.8	29,484.7	20,412.5	20,412.5	15,876.4	13,608.3	13,608.3

		14	15	16	17	18	19	20	21	22	23	24	25	26
		Operation (YEAR 11)	Operation (YEAR 12)	Operation (YEAR 13)	Operation (YEAR 14)	Operation (YEAR 15)	Operation (YEAR 16)	Operation (YEAR 17)	Operation (YEAR 18)	Rehabilitation (YEAR 19)	Rehabilitation (YEAR 20)	Rehabilitation (YEAR 21)	Rehabilitation (YEAR 22)	Rehabilitation (YEAR 23)
Scope 2 emissions		**FY39/40**	**FY40/41**	**FY41/42**	**FY42/43**	**FY43/44**	**FY44/45**	**FY45/46**	**FY46/47**	**FY47/48**	**FY48/49**	**FY49/50**	**FY50/51**	**FY51/52**
Grid supplied electricity consumption during construction and operation	t CO2-e	13,608.3	13,608.3	6,804.2	6,804.2	6,804.2	6,804.2	6,804.2	6,804.2	6,804.2	-	-	-	-

Scope 3 Emissions

		1	2	3	4	5	6	7	8	9	10	11	12	13
		Construction (YEAR-3)	Construction (YEAR-2)	Construction (YEAR-1)	Operation (YEAR 1)	Operation (YEAR 2)	Operation (YEAR 3)	Operation (YEAR 4)	Operation (YEAR 5)	Operation (YEAR 6)	Operation (YEAR 7)	Operation (YEAR 8)	Operation (YEAR 9)	Operation (YEAR 10)
Scope 3 emissions		**FY26/27**	**FY27/28**	**FY28/29**	**FY29/30**	**FY30/31**	**FY31/32**	**FY32/33**	**FY33/34**	**FY34/35**	**FY35/36**	**FY36/37**	**FY37/38**	**FY38/39**
Diesel consumption for electricity generation during construction	t CO2-e	4,307.76	6,725.58	5,159.09	-	-	-	-	-	-	-	-	-	-
Diesel consumption in plant and mobile equipment during construction and operation	t CO2-e	2,554.09	515.66	3,058.04	4,432.52	8,448.23	9,876.79	7,958.17	10,208.69	10,942.15	11,038.46	8,886.65	12,443.52	12,436.85
Diesel consumption in trucks removing product from site	t CO2-e	-	-	-	3.34	5.01	5.01	5.01	5.34	4.67	5.01	5.01	5.01	4.67
LNG deliveries	t CO2-e	15.96	3.22	19.11	44.69	77.32	86.24	74.25	89.66	92.40	94.00	80.22	101.95	101.07
Grid supplied electricity consumption during construction and operation	t CO2-e	-	-	1,738.29	4,536.05	4,536.11	2,268.06	2,268.06	2,268.06	-	-	2,268.06	2,268.06	-
Solid waste	t CO2-e	414.72	414.72	414.72	207.36	207.36	207.36	207.36	207.36	207.36	207.36	207.36	207.36	207.36
Air conditioning refrigerant leakage	t CO2-e	5.69	5.69	5.69	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.84

		14	15	16	17	18	19	20	21	22	23	24	25	26
		Operation (YEAR 11)	Operation (YEAR 12)	Operation (YEAR 13)	Operation (YEAR 14)	Operation (YEAR 15)	Operation (YEAR 16)	Operation (YEAR 17)	Operation (YEAR 18)	Rehabilitation (YEAR 19)	Rehabilitation (YEAR 20)	Rehabilitation (YEAR 21)	Rehabilitation (YEAR 22)	Rehabilitation (YEAR 23)
Scope 3 emissions		**FY39/40**	**FY40/41**	**FY41/42**	**FY42/43**	**FY43/44**	**FY44/45**	**FY45/46**	**FY46/47**	**FY47/48**	**FY48/49**	**FY49/50**	**FY50/51**	**FY51/52**
Diesel consumption for electricity generation during construction	t CO2-e	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel consumption in plant and mobile equipment during construction and operation	t CO2-e	13,056.2	12,838.6	5,694.8	3,357.3	4,316.1	8,310.2	1,330.5	1,328.7	9,216.0	9,216.0	1,328.7	1,328.7	-
Diesel consumption in trucks removing product from site	t CO2-e	4.0	4.0	4.0	3.7	3.7	3.7	-	-	-	-	-	-	-
LNG deliveries	t CO2-e	102.1	99.6	54.8	39.8	46.0	69.8	-	69.2	69.2	-	-	-	-
Grid supplied electricity consumption during construction and operation	t CO2-e	-	-	-	-	-	-	-	-	-	-	-	-	-
Solid waste	t CO2-e	207.4	207.4	207.4	207.4	207.4	207.4	207.4	207.4	34.6	34.6	34.6	34.6	34.6
Air conditioning refrigerant leakage	t CO2-e	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	0.5	0.5	0.5	0.5	0.5

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air quality	Northstar specialises in all aspects of air quality, dust, and odour management, covering monitoring, modelling and assessment, due diligence and process specification, licencing and regulatory advice, peer review and expert witness.
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