

Appendix V

Greenhouse Gas Assessment



Marulan Quarry

Greenhouse Gas assessment

Global Quarries Australia Pty Ltd

November 2024

→ The Power of Commitment



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Executive summary

This Greenhouse gas assessment (GHG) was prepared for the proposed Marulan Quarry being developed by Global Quarries Australia Pty Ltd (Global Quarries). It forms part of the environmental impact statement (EIS) for the project. The GHG assessment has been undertaken to assess greenhouse gas emissions during construction and operation phases of the project. It is based on data and information developed as part of the EIS and reasonable assumptions regarding the project. This assessment covers scope 1 and scope 2 emission sources only.

Construction emissions were estimated to be 7,308 tCO₂-e scope 1 emissions and 0 tCO₂-e scope 2. These emissions are negligible compared to annual emissions in NSW and Australia. Most of the scope 1 emissions are attributed to vegetation clearing which accounts for 97.6% of scope 1 construction emissions from the loss of a carbon sink. The remaining construction emissions are from diesel consumption from construction equipment and vehicles.

Operational emissions were estimated to be 9,861 tCO₂-e per annum scope 1 emissions and 0 tCO₂-e Scope 2 emissions for annual operational activities, except for the 9th year in which emissions will be 10,578 tonne tCO₂-e for the year due to clearing of vegetation for stage 2 of the quarry. These emissions are negligible compared to the annual emissions in NSW and Australia. The most significant emission source was the consumption of diesel from the transport of material to and from the quarry and made up 86.8% of annual emissions. Diesel consumption from plant equipment was the second largest emission source comprising 12.3% of the total emission sources. The remaining activities such as diesel consumption from blasting, power generation and the vegetation lost are not significant in comparison.

Scope 1 and 2 emissions associated with the construction and operation of the project are below the threshold of 25,000 t CO₂-e per annum for the facility level reporting under the National Greenhouse and Energy Reporting (NGER) act. Therefore the facility will not require annual reporting under the NGER scheme as a separate facility.

Stage	Duration	GHG emissions		Total (t CO ₂ -e)
		Scope 1 (t CO ₂ -e)	Scope 2 (t CO ₂ -e)	
Construction phase total	5 months	7,308	0	7,308
Operation phase	Annual	9,861	0	9,861
Operation phase (Year 9 only)	1 Year (Year 9 of operations)	10,578	0	10,578
Operation phase total	18 years	178,207	0	178,207

Mitigation measures to reduced GHG emissions are:

- Use of mains electricity or renewable energy generation on site (e.g. solar panels with battery storage) to replace diesel generators during both construction and operation
- Minimise the removal of vegetation where possible and investigate the possibility of beneficial reuse to reduce the loss of carbon sink
- Optimise equipment use during operations and construction to minimise diesel consumption
- Regular maintenance of equipment to maintain energy efficiency
- Investigate the use of electric light vehicles and equipment on site during both construction and operation
- Switch from diesel to alternative fuel.

Abbreviations

Abbreviations	Description
ABS	Australian Bureau of Statistics
ANFO	Ammonium Nitrate Fuel Oil
CH ₄	Methane
CO ₂	Carbon dioxide
EF	Emission factors
EIS	Environmental Impact Statement
ENM	Excavated natural material
GHD	GHD Pty Ltd
GHG	Greenhouse Gas
Global Quarries	Global Quarries Australia Pty Ltd
GWP	global warming potential
ha	Hectares
IPCC	Intergovernmental Panel on Climate Change
kL	Kilo litres
N ₂ O	Nitrous oxide
NGER	National greenhouse and energy reporting
NGER ACT	National Greenhouse and Energy Reporting Act 2007
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
t CO ₂ -e	Tonnes Carbon Dioxide Equivalent
TAGG	Transport Authorities Greenhouse Group
The Project	Quarrying operation on Lots 3 and 4 of DP 247199 and Lot 7001 of DP 1025585 in Marulan in the Southern Tablelands of NSW
VENM	Virgin excavated natural material

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1. Introduction

1.1 Project overview

Global Quarries Australia Pty Ltd (Global Quarries) is seeking develop consent to build and operate a quarry on Lots 3 and 4 of DP 247199 and Lot 7001 of DP 1025585, in Marulan in the Southern Tablelands of NSW (the project). The project involves establishment of a hard rock quarry and progressive rehabilitation of the pits with virgin excavated natural material (VENM), excavated natural material (ENM) and other comparable fill material sourced from construction projects from the local region and Sydney basin. The project will involve the extraction of up to 500,000 tonnes (t) per year of hard rock from a target resource estimated at approximately 7.7 million tonnes (Mt) of saleable products from the site. The target resource comprises approximately 4.4 Mt of hard rock or tuffaceous ignimbrite suitable as high-quality feedstock to the construction and concrete industry and a further 3.3 Mt of weathered soft rock products suitable for road and pad construction within the quarry site and for sale as a lower value product to regional markets.

This report has been prepared by GHD Pty Ltd (GHD) to provide an assessment of greenhouse gas emissions associated with the project as an input to the Environmental Impact Statement (EIS). The report addresses the requirements of the Secretary of the NSW Department of Planning, Industry and Environment (the Secretary's Environmental Assessment Requirements (SSD 65146459)) (SEARs) dated 21 December 2023.

1.2 Purpose of this report

The purpose of this report is to assess the potential Scope 1 and scope 2 greenhouse gas (GHG) emissions from the construction and operation of the proposed facility. This report:

- Addresses the SEARs and agency requirements
- Assesses the impacts of quarry construction and operations on scope 1 and 2 GHG emissions
- Recommends measures to mitigate and manage the impacts identified.

The specific SEARS and agency requirements addressed in this report are summarised in section 3.1.

1.3 Scope and limitations

This report: has been prepared by GHD for Global Quarries Australia Pty Ltd and may only be used and relied on by Global Quarries Australia Pty Ltd for the purpose agreed between GHD and Global Quarries Australia Pty Ltd as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Global Quarries Australia Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 3.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

2. Project description

The project involves the establishment of a hard rock quarry including stockpiles, weighbridge, site office, internal roads and road works to allow trucks to safely join the Hume Highway. It also includes transport of the quarried material from the site to the Sydney Basin and surrounding regional areas as well as transport of VENM, ENM and other clean construction material to progressively rehabilitate the site. A project site overview is provided in Figure 2.1.

2.1 Construction Activities

2.1.1 Construction program

An indicative construction program, including anticipated duration of each activity, has been provided in Table 2.1. Some activities may be undertaken concurrently to reduce the overall timeframe.

Table 2.1 Construction tasks and durations

Task	Duration
Construct new intersection on the Hume Highway	12 weeks
Enabling works for the extraction area, internal road network	4 weeks
Earthworks for stockpile storage area and site facilities	4 weeks
Install weighbridge and site offices	4 weeks

2.1.2 Construction equipment

A dozer, excavator and haul trucks are the main items of equipment likely to be required during construction. Other equipment may include:

- Haul trucks
- Roller
- Grader
- Water cart
- Compactor
- Light vehicles
- Hand tools.

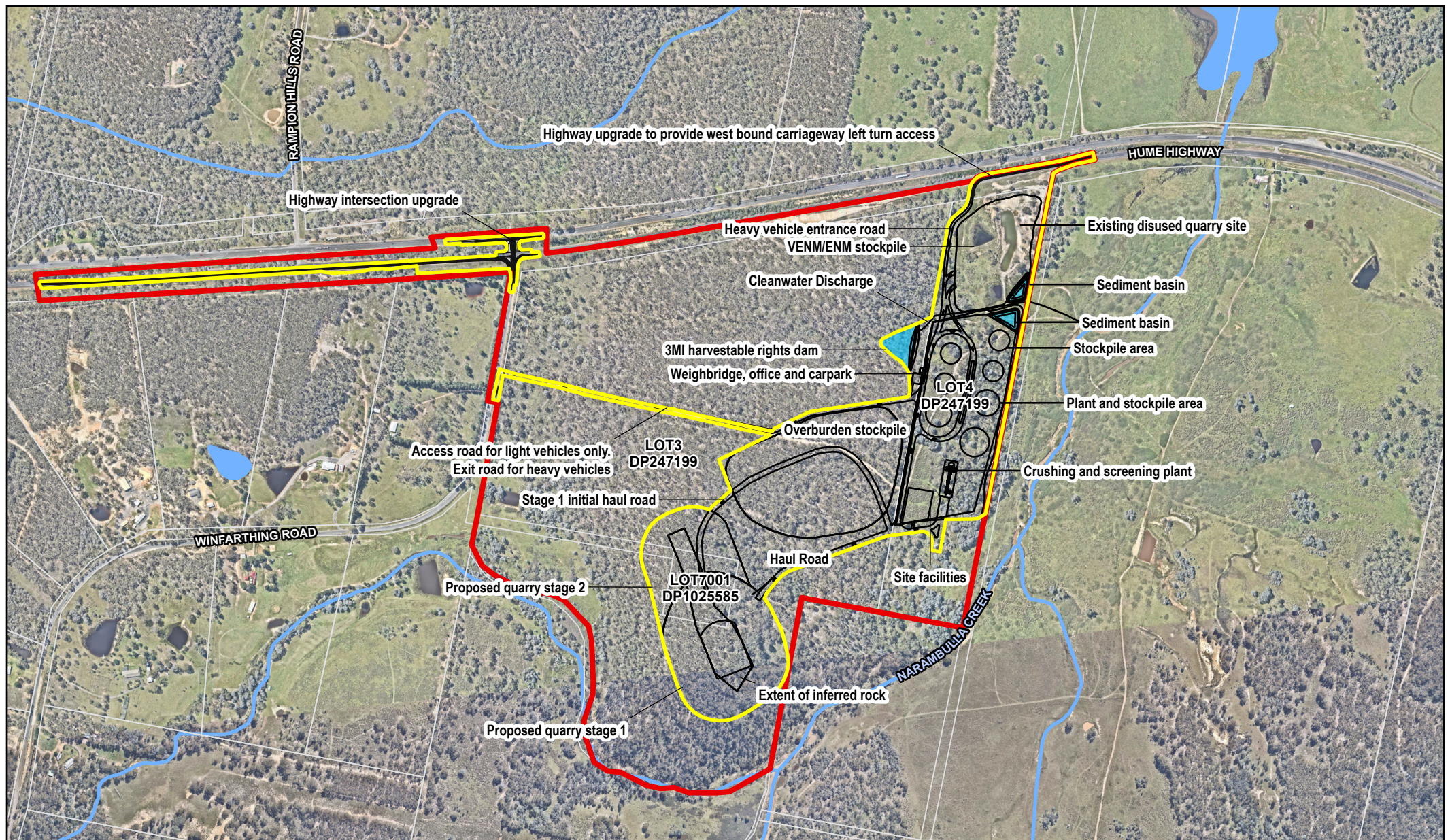
2.1.3 Construction hours

The construction works are proposed to take place over a period of approximately five months.

The majority of works would be undertaken during recommended standard hours defined as:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- Sundays and public holidays: no work.

It is anticipated the peak workforce during construction would be around 30 full time equivalent (FTE) employees.



Legend

- Project Application Area
- Basins and water storage areas
- Disturbance Area
- Waterways
- Design
- Cadastre

Paper Size ISO A4
0 50 100 150 200
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Global Quarries
Marulan quarry EIS

Project No. 2127708
Revision No. 0
Date 30/10/2024

Project site

FIGURE 2.1

2.1.4 Impacted vegetation

A total of 31.1 hectares (ha) of existing vegetation would be cleared to establish project areas, including road corridors and the quarry extraction area of stage 1 and stage 2.

It is assumed that clearing of all significant vegetation, including the quarry extraction and overburden stockpile areas will be undertaken during the construction period of the quarry. Cleared vegetation will be stockpiled on site for use during quarry rehabilitation.

2.2 Operational Activities

2.2.1 Extraction

The Tuffaceous ignimbrite hard rock resource will be progressively drilled and blasted, with material extracted between each blasting event removed using excavators, bulldozers and haul trucks. It is assumed that blasting activities will use a bulk emulsion explosive such as Ammonium Nitrate Fuel Oil (ANFO). It is anticipated that blasting would be undertaken in 20-30,000 tonne shots with up to two blasts per month.

2.2.2 Operational Plant and equipment

Equipment use at the quarry would depend on levels of activity which vary from time to time. A description of the plant and equipment to be used is provided in Table 2.2. The frequency of use is dependent on the activity. For example, the crusher is estimated to operate 70% of the time because it only operates at full capacity while there is rock to crush after a blast.

Table 2.2 *Proposed quarry plant and equipment*

Plant / equipment type	Approximate number	Typical frequency of use during operation	Description of works
Dozer	1	25%	Clearing and grubbing of vegetation and stripping of topsoil Construction of processing area Rehabilitation
Excavators	2	100%	Excavating material and stockpiling Clearing and grubbing of vegetation and stripping of topsoil
Crusher	1	70%	Crushing rock
Screen	1	70%	Aggregate/gravel production and screening
Front-end Loader	2	100%	Loading material onto the haul trucks and stockpiling material
Haul Trucks	Up to 50/day	100%	Moving material from the extraction area to the processing area and overburden stockpile. Delivery of materials to customers.
Water Cart	1	60%	To water haul roads and stockpiles
Water Pump	2	40%	To dewater excavation/basin and to fill watercart from standpipe To water stockpiles and put moisture in products
Hand tools	5	5%	General activities maintaining plant
Light vehicles	Up to 5	20%	Transporting staff to, from and around site

2.2.3 Traffic movements

Up to 50 laden (articulated) trucks will enter and leave the project site per day which equates to 50 trips or 100 heavy vehicle movements per day Monday to Saturday, and no vehicle movements on Sundays and public holidays.

Truck and dog combinations will be used to haul material to major construction projects within the greater Sydney region and other regional markets. Returning trucks will bring VENM, ENM and other comparable fill material to be stockpiled for rehabilitation.

2.2.4 Operating hours

As the demand for product from the site will vary, it is not possible to put firm durations on each stage of activity. However, the quarry is expected to commence operation in 2025 (subject to planning approvals) and be in operation for 18 years.

Operations would generally be limited to the following times:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 6pm
- No work on Sundays or Public Holidays.

Staff may arrive and leave site before and after these times to 'start-up' and 'shut-down' the quarry but excavation, crushing or loading would not occur outside the times specified above. Blasting would only occur on weekdays between the hours of 10:00 am and 3:00 pm.

3. Greenhouse Gas Assessment

3.1 Secretary's Environmental Assessment Requirements

The SEARs require an assessment of the greenhouse gas emissions from the construction and operation of the project for the life of infrastructure. Table 3.1 sets out where the requirements have been addressed in this report.

Table 3.1 Environmental assessment requirements

Requirement	Where addressed in this report
Air Quality including: a greenhouse gas assessment of the operation of the development and details of proposed mitigation, management and monitoring measures	Section 3-4 Section 5

3.2 Legislative Context

Legislation and guidelines applicable to this GHG assessment include:

- *National Greenhouse and Energy Reporting Act 2007* (NGER Act)
- National Greenhouse and Energy Reporting (Measurement) Determination 2008
- National Greenhouse and Energy Reporting Regulations 2008
- National Greenhouse Accounts Factors 2021
- AS ISO 14064-1:2006 Greenhouse gases - Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
- *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (GHG Protocol) (World Business Council for Sustainable Development and World Resources Institute, 2015)
- Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (2014)
- NSW Climate Change Policy Framework
- The Net Zero Plan Stage 1: 2020 – 2030, NSW government
- The Climate Change (Net Zero Future) Act 2023.

These guidelines are considered representative of good practice GHG accounting in Australia and are applicable to the project.

A summary of what is covered by the legislation is given below.

Table 3.2 Key Legislation summary

Act/ Scheme	Description
<i>IPCC Fifth Assessment Report</i>	Report adopted by the Commonwealth government to assess scientific, technical, and socio-economic information concerning climate change, its potential effects, and options for adaptation and mitigation
<i>NGER Act and Regulations</i>	Provides for data accounting in relation to greenhouse gas emissions and energy consumption and production.
<i>National Greenhouse and Energy Reporting (Measurement) Determination 2008</i>	Provides methods and criteria for calculating greenhouse gas emissions and energy data under the NGER Act.
<i>National Greenhouse Accounts</i>	Provides methods and criteria for calculating greenhouse gas emissions, including Scope 3 emissions.

Act/ Scheme	Description
<i>NSW Climate Change Policy Framework</i>	The NSW Climate Change Policy Framework (OEH, 2016) aims to maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate and current and emerging international and national policy settings and actions to address climate change. The Framework includes an aspirational objective to achieve net-zero emissions by 2050.
<i>The Net Zero Plan Stage 1: 2020 – 2030</i>	The Net Zero Plan Stage 1: 2020 – 2030 is the foundation of NSW's action on climate change. The Plan outlines how NSW will fast-track climate action through energy and emissions reductions initiatives. The Plan aims to allow the State to deliver 35% cut in emissions by 2030 compared to 2005 levels.
<i>The Climate Change (Net Zero Future) Act 2023</i>	The Act sets a clear path to 2050 with emissions reduction targets. It also ensures NSW follows a comprehensive guiding principles while continuing to improve resilience and accountability. The act commits the NSW government to effective action and emissions reduction targets of: – 50% reduction on 2005 levels by 2030 – 70% reduction on 2005 levels by 2035 – Net zero by 2050.

3.3 Methodology

This assessment has been undertaken in accordance with the principles of ISO 14064-2 and the general principles for estimating emissions in the National Greenhouse and Energy Reporting (NGER) (Measurement) Determination 2008. Relevant sections of the following documents were used for the purposes of defining appropriate methods for the quantification of emissions from individual sources:

- NGER (Measurement) Determination 2008 (as amended) and NGER Act 2007, Commonwealth Department of Industry, Science, Energy and Resources; and
- National Greenhouse Accounts (NGA) Factors, Commonwealth Department of Industry, Science, Energy and Resources, 2020.

These guidelines are considered representative of good practice GHG accounting in Australia and are applicable to the Project.

3.3.1 Greenhouse Gases and Global warming potential

The GHG considered in this assessment and the corresponding global warming potential (GWP) for each GHG are listed in Table 3.3. GWP is a metric used to quantify and communicate the relative contributions of different substances to climate change over a given time horizon. GWP accounts for the radiative efficiencies of various gases and their lifetimes in the atmosphere, allowing for the impacts of individual gases on global climate change to be compared relative to those for the reference gas carbon dioxide.

The GWPs from the IPCC Fifth Assessment report and section 2.02 of the National Greenhouse and Energy Reporting (NGER) Regulations 2008, updated July 2020, were used in this assessment.

Table 3.3 Greenhouse gases and 100-year global warming potentials

Greenhouse gas	Global warming potential
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	28
Nitrous oxide (N ₂ O)	265

3.3.2 Emission factors and calculation tools

Unless otherwise specified, Scope 1 emission factors (EF) were sourced from the NGER (Measurement) Determination. Emissions associated with vegetation clearing were calculated using the Transport Authorities Greenhouse Group (TAGG) Greenhouse gas assessment calculator.

3.4 Assessment Boundary

3.4.1 Construction emission source

The emission sources within the construction emission boundary include:

- Scope 1 emissions:
 - fuel consumption from construction activity on site
 - vegetation clearing
 - loss carbon sink from the vegetation cleared.

No scope 2 emission sources were identified.

Exclusions

The following activities were excluded from this assessment:

- Scope 3 emission sources are excluded from this assessment such as:
 - emissions associated with embodied energy of major construction materials
 - disposal of waste generated (where the waste is transported for disposal outside the project area)
 - extraction, production, and transport of purchased fuels consumed
 - extraction, production and transport of other purchased materials or goods
 - transportation of products, materials, and equipment to the site
 - transportation of wastes from the site
 - workforce transportation
- Emissions which are likely to be negligible compared with other emissions from the project.

Assumptions

The assumptions used to estimate construction emissions are discussed in Table 3.4.

Activity data used for the GHG assessment was provided by other studies conducted as part of the EIS for the project.

Table 3.4 Construction assumptions summary

Parameter	Assumption
General	The construction hours and program accounts for public holidays such that if any public holidays occur during the construction period it will extend the construction timeline. The total hours of construction works are therefore not affected. The assessment was based on EFs available at the time of the assessment and future changes in EFs or GWP were not considered.
Diesel consumption	The diesel consumption for the construction phase was estimated from the construction equipment list and activity list. The types of equipment, equipment size, frequency of use during a day and hours of operation for each type of equipment were estimated based on project team experience from similar projects. Fuel consumption per hour of use was taken from: – Caterpillar performance handbook, Edition 49 – Ezyquip, 12,500 Rigid Water truck product specification sheet – Compaction-DV210 Specification sheet.
Vegetation Removal	The vegetation clearing for all project areas (including within the highway corridor, quarry extraction zone and overburden zones), would be conducted during the construction phase of the project. The cleared vegetation would be stockpiled at the site within the overburden area. The site is in a class B Biomass area with open woodlands.

Parameter	Assumption
	The area of vegetation to be removed was determined as total area impacted by the quarrying operations (31.1 ha, including the 5.3 ha of stage 1 activity and access road through Stage 2 extraction area) minus already cleared areas on site (approximately 5.9 ha associated with the existing disused quarry and existing cleared areas as part of the Hume highway corridor). The final vegetation clearing area would be 22.9 ha. Negligible vegetation clearing would be required from existing cleared areas.
Vegetation loss – Loss carbon sink	Carbon sink loss is the loss of carbon capturing sources (vegetation) from the project. The recovered carbon sink following the rehabilitation of vegetation is beyond the boundary of this assessment.

3.4.2 Operations emission sources

The emission sources for the operational phase of the project included:

- Scope 1 emissions associated with fuel consumption for:
 - operational activities on site
 - the generation of electricity on site
 - the transport of material to and from the site
 - blasting activities using ANFO
 - loss carbon sink from the vegetation cleared (for Stage 2 extraction zone).

No scope 2 emission sources were identified.

Exclusions

The following activities were excluded from this assessment:

- Emissions which are likely to be negligible compared with other emissions from the project.
- Scope 3 emission sources such as:
 - emissions associated with the extraction of virgin excavated natural material and other comparable fill material
 - disposal of waste generated
 - extraction, production, and transport of purchased fuels consumed
 - extraction, production and transport of other purchased materials or goods
 - transportation of wastes from the site.

Assumptions

The assumptions used for the estimation of emissions for the operation of the project are set out in Table 3.5. The assessment of operational emissions was undertaken on an annual basis and the emission profile represents the yearly average emissions profile for the lifespan of the quarry (18 years).

Activity data used for the GHG assessment was provided by other studies conducted as part of the Environmental Impact Statement (EIS) for the project.

Unless otherwise specified, Scope 1 EFs used were as per the NGER (Measurement) Determination.

Table 3.5 *Operation assumptions summary*

Parameter	Assumption
General	Operations would cover 50 working weeks per year to account for public holidays. The assessment was based on EFs available at the time of the assessment and future changes in EFs or GWP were not considered.
Diesel consumption – Operation activity on site	The diesel consumption for the operational phase was estimated from the equipment list and activity list. The types of equipment, equipment size, frequency of use during a day and hours of operation for each type of equipment were estimated based on project team experience from similar projects. Fuel consumption per hour of use was taken from: – Caterpillar performance handbook, Edition 49 – Ezyquip, 12,500 Rigid Water truck product specification sheet – Powerscreen, Premiertrak 400X Jaw crusher processing application summary. Vegetation clearance for Stage 2 extraction area is undertaken by existing equipment used in irregular operations of the site.
Diesel consumption – Electricity generation on site	Electricity to be generated on site using diesel generators. Diesel consumption for generators was estimated based on demand from the onsite facilities and amenities including the weighbridge and use/charging of hand tools on site. Fuel consumption based on generator specifications (1.49 L/h for 50% load prime for a 6kW rated diesel generator). Electricity would only be generated during operating hours.
Diesel consumption – Transportation vehicles	Articulated trucks would be used to transport material to and from the site. 50 vehicle movements per day to and from the greater Sydney area. Assumed similar distance travelled to deliver material to regional areas from the site. Inbound and outbound truck movements are included. Inbound trucks would take a direct route of approximately 182 kilometres to the site from the greater western Sydney area. Outbound trucks would go west from site to Goulburn where they would safely redirect to go east towards the greater western Sydney area, this route would be approximately 215 kilometres. Fuel consumption rate was determined from the Australian Bureau of Statistics (ABS) Survey of Motor Vehicle Use for articulated trucks.
Diesel consumption – ANFO	Approximately two blasting events would be undertaken per month. Each event would achieve a 20,000 – 30,000 tonne yield of hard rock material. A maximum of 40kg would be used per blast hole over 210 holes per blast. Diesel content in ANFO assumed to be 6% by weight. All diesel used in ANFO would be completely combusted.
Vegetation Removal	Vegetation clearing for stage 2 is included in operations and covers an area of 2.3 ha. Clearing works are scheduled to occur in the 9th year of operation.
Vegetation loss – Loss carbon sink	Carbon sink loss is the loss of carbon capturing sources (vegetation) from the project. The recovered carbon sink following the rehabilitation of vegetation is beyond the boundary of this assessment.

4. Impact assessment

4.1 Construction emissions

A summary of the scope 1 GHG emissions from construction activities is presented in Table 4.1.

Scope 1 emissions were estimated at **7,308 tCO₂-e** for the entire construction period. The majority of the scope 1 emissions are attributed to vegetation removal which account for 97.6% of scope 1 construction emissions and relate to loss of a carbon sink. The remaining emissions are from diesel consumption in construction equipment and vehicles.

No scope 2 emission sources were identified for the construction phase.

Table 4.1 Summary of construction emissions

Activity	Activity Data	Units	GHG Emissions (t CO ₂ -e)			Emission %
			Scope 1	Scope 2	Total	
Enabling works and site establishment including environmental controls, vegetation removal, topsoil stripping and earthworks.	18.8	kL	50.9	0	50.9	0.7%
Construction of new intersection and site access.	21.7	kL	58.8	0	58.8	0.8%
Construction of site offices and processing plant.	15.6	kL	42.3	0	42.3	0.6%
Vegetation clearance for quarry extraction area.	9.7	kL	26.4	0	26.4	0.4%
Vegetation lost carbon sink	22.9	ha	7,130	0	7,130	97.6%
Total			7,308	0	7,308	

4.2 Operation emissions

A summary of the annual scope 1 GHG emissions resulting from operational activities are presented in Table 4.2. It represents the estimated average annual emissions profile associated with the typical operation as detailed in the project description.

Scope 1 emissions were estimated at **9,861 tCO₂-e per annum** for all years except Year 9 in which emissions were estimated to be 10,578 tCO₂-e due to vegetation clearing for stage 2 of the quarry. In all years, the most significant emission source is the consumption of diesel to transport material to and from the quarry and makes up 87.1% of annual emissions in most years. Diesel consumption from plant equipment is the second most significant emission source comprising 12.3% of the total emissions sources.

No scope 2 emission sources were identified for the operational phase.

A total of **177,490 tCO₂-e of Scope 1** and **0 tCO₂-e scope 2** GHG emissions would be emitted over the 18 year life of the quarry. This is assuming no significant change of operation conditions across the operation period (Table 4.2).

Table 4.2 Summary of annual operational emissions – all years except Year 9

Activity	Activity Data	Units	GHG Emissions (t CO ₂ -e)			Emission %
			Scope 1	Scope 2	Total	
Plant equipment operation	449	kL	1,216	0	1,216	12.3%
Site power generation	5	kL	13	0	13	0.1%
Truck Transportation	3162	kL	8,593	0	8,593	87.1%
Explosions activity – Diesel amount	14	kL	39	0	39	0.4%
Annual operational emissions (all years except Year 9)			9,861	0	9,861	

For the 9th year of operations, additional emissions from vegetation clearing for stage 2 of the quarry operation occur (Table 4.3). After year 9, the scope 1 emissions profile returns to its original form (Table 4.2).

Table 4.3 Year 9 operational emissions only

Activity	Activity Data	Units	GHG Emissions (t CO ₂ -e)			Emission %
			Scope 1	Scope 2	Total	
Plant equipment operation	449	kL	1,216	0	1,216	11.5%
Site power generation	5	kL	13	0	13	0.1%
Truck Transportation	3162	kL	8,593	0	8,593	81.2%
Explosions activity – Diesel amount	14	kL	39	0	39	0.4%
Vegetation lost carbon sink	2.3	ha	717	0	717	6.8%
Annual operational emissions			10,578	0	10,578	

As results, over the 18-year operation lifetime of the project the total operation emission profile is shown in Table 4.4.

Table 4.4 Total operational emissions profile

Activity Name	Timing	Activity Data	Units	GHG Emissions (t CO ₂ -e)			Emission %
				Scope 1	Scope 2	Total	
Plant equipment operation	18 years	8,078	kL	21,888	0	21,888	12.3%
Site power generation	18 years	87	kL	236	0	236	0.1%
Truck Transportation	18 years	56,918	kL	154,671	0	154,671	86.8%
Explosions activity – Diesel amount	18 years	256	kL	695	0	695	0.4%
Vegetation lost carbon sink	1 year (Year 9 of operation)	2.3	ha	717	0	717	0.4%
Total operational emissions				178,207	0	178,207	

4.3 Impact of emissions

Annual reporting

Scope 1 emissions associated with the construction¹ and operation of the project are below the threshold of 25,000 tCO₂-e per annum for facility level reporting under the NGER Act. Reporting under the NGER scheme is not required.

Comparison with NSW and Australian annual emissions

The scope 1 emissions estimated from the construction and operational phases of the project will contribute a negligible amount to the Australian and NSW annual emissions (Table 4.5). The construction phase activities represent a possible 0.006% of the NSW annual emissions and 0.002% of the Australian national emissions annually. Similarly, the annual operation emissions will represent 0.007% of NSW emissions and 0.002% of Australia's national emissions.

Table 4.5 Comparison of emissions with Australian and NSW annual emissions.

Australian Emissions ² (MtCO ₂ -e)	% of emissions	NSW Emissions ³ (MtCO ₂ -e)	% of emissions
432.9	0.002% for construction 0.002% for operation	132.05	0.006% for construction 0.007% for operation

¹ Excluding emissions from vegetation removal, which are not reportable under NGER.

² 2023 Net greenhouse gas emissions, DCCEEW, *National Greenhouse Gas Inventory Quarterly Update – December 2023*

³ 2021 Net greenhouse gas emissions, NSW Government, *NSW Net Zero Emissions Dashboard*

5. Greenhouse gas reduction measures

Potential GHG reduction and mitigation measures that could be adopted for either the construction or operation phases of the quarry are set out in Table 5.1.

Table 5.1 GHG reduction measure summary

Opportunity area	Measure	Timing
Diesel consumption – electricity generation	Establish either a connection to the electricity grid to replace diesel generation or establish renewable energy source on site such as solar/ wind energy generation with battery storage.	Operation
Vegetation management	Ensure vegetation removed is beneficially reused on site. Review opportunities for beneficial reuse of removed vegetation in construction management plans where feasible, i.e. use as a mulch on rehabilitated sites. Optimise and deliver vegetation rehabilitation program for cleared areas to return loss carbon sink. Minimise vegetation removal beyond necessary areas.	Construction
Diesel consumption – equipment uses	Ensure equipment is properly maintained to ensure optimum operational efficiency. When available select energy efficient equipment. Consider use of electric vehicles or switch to bio-diesel.	Construction and operation
Diesel consumption – equipment use	Investigate the use of electric light vehicles and equipment, where feasible if a renewable or mains electricity energy supply can be established.	Operation
Diesel consumption – transport	Investigate the use of alternate fuels or alternate transport methods to replace diesel trucks. Minimise transport distance, when possible, such as sourcing VENM, ENM from local areas. Minimise truck movements per day.	Operation

6. Conclusions

Construction

The quantity of emissions estimated to occur during construction are approximately 7,308 tCO₂-e scope 1 emissions and 0 tCO₂-e scope 2 over the entire construction period. These emissions are negligible compared to annual emissions in NSW and Australia and does not meet the scope 1 reporting thresholds under NGER.

Operations

Scope 1 emissions estimated to occur during operations is approximately 9,861 tCO₂-e per annum, comprising of 9,861 tCO₂-e Scope 1 emissions and 0 tCO₂-e Scope 2 emissions except for Year 9 in which emissions are estimated to 10,578 tCO₂-e Scope 1 due to one off vegetation clearing to prepare for stage 2 of the quarry. These emissions are negligible compared to the annual emission in NSW and Australia and does not meet the scope 1 reporting thresholds under NGER.

The resulting net GHG emissions from the total operation period, 18 years, will result in 178,207 t CO₂-e scope 1 emissions.

Table 6.1 *Summary of emissions.*

Stage	Duration	GHG emissions		Total (t CO ₂ -e)
		Scope 1 (t CO ₂ -e)	Scope 2 (t CO ₂ -e)	
Construction phase total	5 months	7,308	0	7,308
Operation phase	Annual	9,861	0	9,861
Operation phase (Year 9 only)	1 Year (Year 9 of operations)	10,578	0	10,578
Operation phase total	18 years	178,207	0	178,207

The total emissions for the construction and operation of Marulan Quarry activities is assessed to be **185,515 tCO₂-e**.

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