NSW Quarry Services Pty Ltd

Proposed Expanded Quarry, Crescent Head Road, Kempsey

Greenhouse Assessment

July 2014

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Appendix A – Greenhouse Gas Inventory

1. Introduction

1.1 Purpose of this report

NSW Quarry Services Pty Ltd (NSW Quarry Services) proposes to re-establish a hard rock quarry at Lot 1 DP 914805, Lots 14 and 16, DP 1157615 and Lots 186, 187, 189 DP 754400, Crescent Head Road, Kempsey, known as Church Hill Quarry. This Quarry is within the Kempsey Local Government Area (LGA). The quarry would be operated under a 'profit a prende" (royalty) arrangement with the owner of the property – Kempsey Shire Council (KSC). This report has been prepared by GHD Pty Ltd to provide an assessment of greenhouse gas emissions associated with the proposal as an input to the environmental impact statement. NSW Quarry Services is the proponent of the proposal and the environmental impact statement is being prepared by GHD in accordance with the requirements of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (the EP&A Act).

The report addresses the requirements of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

1.2 Proposal overview

The proposal is for re-establishment of the quarry with a rate of extraction up to 450,000 tonnes per annum. The extraction rate is primarily required to meet the demands of the Roads and Maritime Services (RMS) Pacific Highway upgrade program. The quarry is well located to service the upgrade works between Port Macquarie and Nambucca Heads which is to take place over a timeframe of approximately 5 years. The upgrade is reported to require in the order of 8,600,000 tonnes of imported material. The quarry would also continue to supply material to the local market.

To provide the required material, the area of the quarry would need to be extended to approximately 9.02 hectares and about 17 m below the current floor level. It is estimated that the quarry would have an available resource of 4,000,000 tonnes which would allow extraction for a period of between 20 and 30 years, depending on demand.

1.3 Location of the proposal

Church Hill Quarry is located at Lot 1 DP 914805, Lots 14 and 16, DP 1157615 and Lots 186, 187, 189 DP 754400, Crescent Head Road, Kempsey. This Quarry is within the Kempsey Local Government Area (LGA).

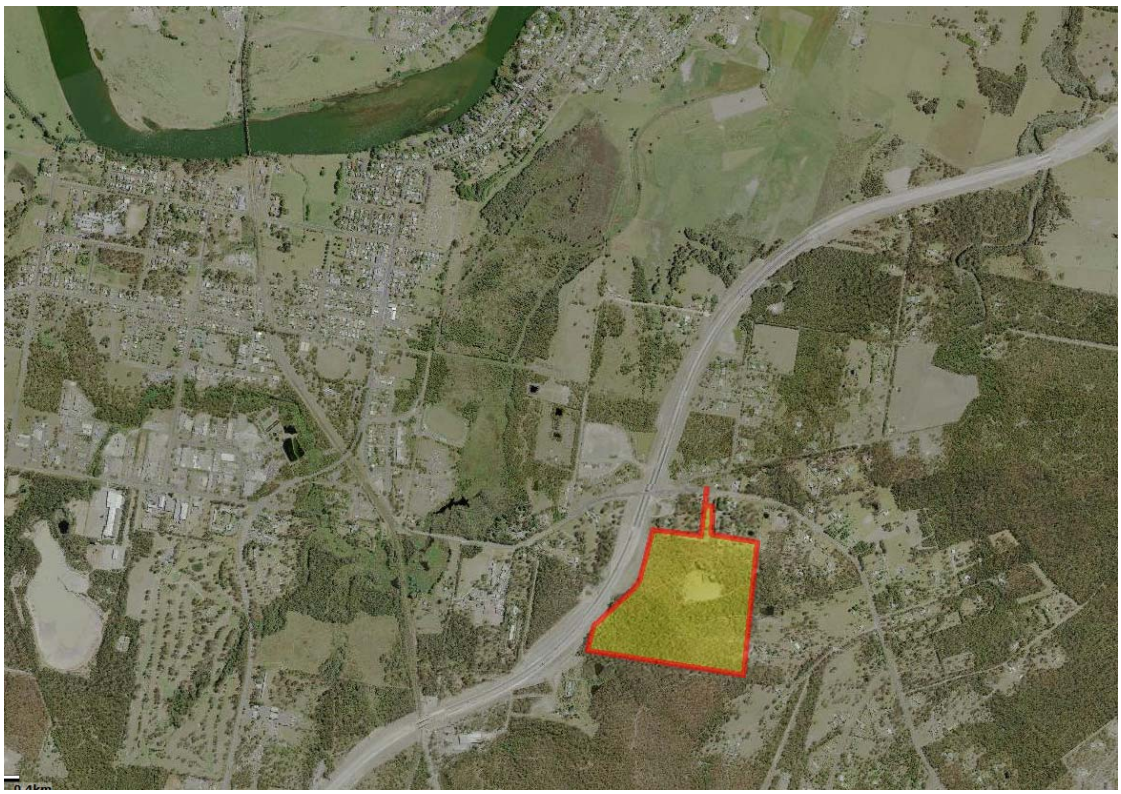

Figure 1.1 Proposal site location

1.4 Scope and structure of the report

The scope of the greenhouse gas assessment was to quantify emissions associated with construction activities and quarry operation (including downstream emissions) of the development.

The following scopes of emissions were considered:

- Scope 1: Emissions from direct energy use
- Scope 2: Indirect energy use from imports and exports of electricity, heat or steam
- Scope 3: Limited to emissions associated with Scope 1 and 2 emissions and downstream emissions from the transportation of material from the quarry.

The methodology used to estimate the greenhouse gas emissions associated with the proposal and all assumptions are outlined in Section 3.

The greenhouse gas emissions associated with the proposal are summarised in Section 4.

The impact of the proposal on greenhouse gas emissions is discussed in Section 5 and potential mitigation measures are provided in Section 6.

1.5 Abbreviations

Table 1.1 contains some of the key acronyms and abbreviations adopted within this report.

Table 1.1. Acronyms and abbreviations

Acronyms	Definition
CFI	Carbon Farming Initiative
CH_4	Methane
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent

Acronyms	Definition
Defra	The United Kingdom Department for Environment, Food and Rural Affairs
DGR	Director-General's Requirements
EEO	Energy Efficiency Opportunities
EP&A Act	*Environmental Planning and Assessment Act*
EPA	Environment Protection Authority
GHD	GHD Pty Ltd
GHG	Greenhouse Gas
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
LGA	Local Government Area
N_2O	Nitrous oxide
NGERS	The National Greenhouse and Energy Reporting Scheme
NSW	New South Wales
PFCs	Perfluorocarbons
RMS	Roads and Maritime Services
SF_6	Sulphur hexafluoride
UNFCCC	United Nations Framework Convention on Climate Change

2. Existing environment

2.1 Australian, New South Wales and global greenhouse gas emissions

The Commonwealth Department of the Environment estimates annual greenhouse gas emissions for Australia to fulfil reporting requirements of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The latest breakdown of Australia's GHG emissions by state and territory was published by the Department of Environment for 2011/12 (Department of Environment, 2014).

Australia's and New South Wales' total greenhouse gas emissions for 2011/12 were estimated as 554.6 million tonnes of carbon dioxide equivalent (Mt CO_2-e) and 154.7 Mt CO_2-e respectively. The major emission sources for New South Wales were fuel combustion for stationary energy purposes and fuel combustion for transport purposes.

In 2010, global GHG emissions for Annex 1 Parties to the United Nations Framework Convention on Climate Change were 23 gigatons of carbon dioxide equivalent (Gt CO_2-e) (UNFCCC, 2013).

2.2 Key legislation

Key Commonwealth legislation relevant to the proposal at the time of the assessment includes the following:

- *Clean Energy Act 2011*. The Clean Energy Act introduced a carbon pricing mechanism that has a broad coverage from commencement, encompassing the stationary energy sector, transport, industrial processes, non-legacy waste and fugitive emissions. The carbon pricing mechanism commenced on 1 July 2012, with a fixed price for the first three years, after which the carbon price will transition to a fully flexible price under an emissions trading scheme, with the price determined by the market.
- *National Greenhouse and Energy Reporting Act 2007*. The National Greenhouse and Energy Reporting Scheme (NGERS) applies to facilities that emit over 25,000 t CO_2-e per year or consume more than 100 TJ of energy or corporations that emit over 50,000 t CO_2-e per year or consume more than 200 TJ of energy. These thresholds relate to Scope 1 and Scope 2 emissions.
- *Energy Efficiency Opportunities Act 2006*. The Energy Efficiency Opportunities (EEO) program requires businesses to identify, evaluate and publicly report cost effective energy saving opportunities. Participation in EEO is mandatory for corporations that use more than 0.5 PJ of energy per year.
- *Carbon Credits (Carbon Farming Initiative) Act 2011*. The Carbon Farming Initiative (CFI) has been developed to give farmers, forest growers and landholders the ability to generate accredited domestic offsets for access to domestic voluntary and international carbon markets.

The implications of the above legislation would need to be determined during detailed design when the resource extraction schedule has been determined. Assessing the implications of the above legislation is not required for this greenhouse gas assessment.

3. Methodology

3.1 Overview

A greenhouse gas assessment was undertaken to estimate the greenhouse gas emissions due to the proposed expansion and operation activities.

The greenhouse gas assessment was prepared in accordance with the general principles of:

- *The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, Revised Edition,* developed by the World Resource Institute and the World Business Council for Sustainable Development (GHG Protocol)
- The Commonwealth *National Greenhouse and Energy Reporting (Measurement) Determination 2008*
- The Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) *National Greenhouse Accounts (NGA) Factors*, July 2013 (DIICCSRTE, 2013).

These are considered to represent current good practice in Australian greenhouse gas accounting.

3.2 Boundary of assessment

The greenhouse gas assessment has considered emissions from the major emission sources during construction and operation activities as follows:

Construction emission sources:

- Fuel consumption during construction activities
- Vegetation removal.

Operation emission sources:

- Fuel consumption during operation of the plant
- Transport of product off site.

3.3 Greenhouse gases considered

The greenhouse gases and associated global warming potential (GWP) considered in this assessment are listed in Table 3.1. The GWPs were sourced from the NGA Factors July 2013.

Table 3.1 Greenhouse gases and 100 year global warming potentials

Greenhouse gas	Global warming potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 – 11,700
Perfluorocarbons (PFCs)	6,500 – 9,200
Sulphur hexafluoride (SF_6)	23,900

3.4 Emission scopes

Emissions have been separated into Scopes 1, 2 and 3 in accordance with the GHG Protocol. These scopes are defined as follows:

1. Scope 1 emissions are greenhouse gas emissions created directly by a person or business from sources that are owned or controlled by that person or business.
2. Scope 2 emissions are greenhouse gas emissions created as a result of the generation of electricity, heating, cooling or steam that is purchased and consumed by a person or business. These are indirect emissions as they arise from sources that are not owned or controlled by the person or business who consumes the electricity.
3. Scope 3 emissions are greenhouse gas emissions that are generated in the wider economy as a consequence of a person's or business's activities. These are indirect emissions as they arise from sources that are not owned or controlled by that person or business but they exclude Scope 2.

Scope 1 emissions are produced by the combustion of fuels such as diesel at the development site, and by vehicles and equipment which the proponent owns and has operational control over. Note that only the direct combustion of the fuels is considered as Scope 1 emissions.

Scope 2 emissions arise from the consumption of electricity from the grid at the development site, in plant and equipment that is owned and operated by the proponent.

Emissions arising from the extraction, processing and transportation and distribution of fuels and electricity are classified as Scope 3, since these activities are not within the operational control of the end user.

All other emissions associated with the Project are defined as Scope 3, since they are produced outside the development site, and the proponent does not have operational control of the facilities from which they originate.

3.5 Data collection and calculation procedures

The calculation of greenhouse gas emissions for the proposal was based on the methodology detailed in the GHG Protocol and the relevant emission factors. The main sources of emission factors included:

- The Commonwealth *National Greenhouse and Energy Reporting (Measurement) Determination 2008*
- The Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education *National Greenhouse Accounts (NGA) Factors*, July 2013
- The United Kingdom Department for Environment, Food and Rural Affairs (Defra) Greenhouse Gas Conversion Factors 2014.
- VicRoads, *Greenhouse Gas Assessment Calculator for Road Projects*.

A spreadsheet model was specifically developed to estimate the greenhouse gas emissions for the proposal.

When data was unavailable, assumptions and approximations were made to obtain a reasonable estimate of activity levels or emission factors. All assumptions are detailed in Section 3.7.

All fuel consumption and emissions data was converted into quantities of carbon dioxide equivalent. The emission values have been summed to reach an estimate of the total greenhouse gas emissions for the project.

3.6 Exclusions from the assessment

- Combustion of oils and greases in plant. These emissions were considered to be negligible compared with the emissions over the life of the proposal.
- Emissions associated with the manufacture of minor consumables such as office supplies, cleaning products and personal protective equipment and the transportation of these consumables to site. These emissions were considered negligible compared to the overall emissions.
- Leakage of hydrofluorocarbons from air conditioning units and refrigeration. These emissions were considered to be negligible compared with the emissions over the life of the proposal.
- Wastewater treatment. These emissions were considered to be negligible compared with the emissions over the life of the proposal.

3.7 Assumptions

Assumptions used in estimating the activity levels and greenhouse gas emissions for the proposal are listed in Table 3.2.

The assessment was based on emission factors available at the time of the assessment and future changes in emission factors were not considered.

Table 3.2 Assumptions for the greenhouse gas assessment

Parameter measured	Assumptions
Construction	
Vegetation removal	Vegetation clearing emissions were calculated using the VicRoads Carbon Gauge Greenhouse Calculator assuming that the vegetation was dense mature forest (based on 6.97 ha of area of removal).
Diesel consumed by plant and equipment	The quantity of diesel consumed by plant and equipment for construction was estimated as 61 kL. EFs for diesel were sourced from the *NGA Factors 2013*, Tables 3 and 40.
Operation	
Diesel consumed by plant and equipment	The quantity of diesel consumed by plant and equipment during operations was estimated as 4,159 kL over a 20 year life of the facility based on typical fuel consumption rates of plant and estimated operating hours. EFs for diesel were sourced from the *NGA Factors 2013*, Tables 3 and 40.
Transportation of product off site	Quantity of product transported from the quarry was estimated as 4.0 Mt over a 20 year life of the quarry (based on the resource estimate). It was assumed that product would be transported a maximum of 50 km from the quarry. EF for transportation was sourced from Defra conversion factors 2014 as the average for all heavy goods vehicles.

4. Potential impacts

4.1 Construction and Operation

Greenhouse gas emissions for the proposal were calculated based on emissions from fuel usage during construction and operation activities, emissions from vegetation removal during construction operations, and transport of product off site.

Scope 1, 2 and 3 emissions for the proposal are summarised in Table 4.1. Emissions were based on the facility operating for 20 years. Greenhouse gas emissions were estimated to be approximately 37,531 t CO_2-e over a 20 year life (approximately 1,877 t CO_2-e per annum on average). The full inventory is provided in Appendix A.

Emissions associated with the transportation product from the facility were estimated as the major source of emission for the proposal, followed by fuel consumption during operations, vegetation removal during construction and fuel consumption during construction.

Table 4.1 Greenhouse gas emissions over the proposal life

Emission source	Scope 1 emissions (t CO_2-e)	Scope 2 emissions (t CO_2-e)	Scope 3 emissions (t CO_2-e)	Total emissions (t CO_2-e)
Construction				
Vegetation removal during construction	706	0	0	706
Fuel consumed during construction	164	0	12	176
Operation				
Fuel consumed during operations	11,158	0	851	12,009
Transportation of product off site (downstream emissions)	0	0	24,640	24,640
Project total	**12,027**	**0**	**25,503**	**37,531**

5. Impact assessment

5.1 Construction and operation

The proposal emissions were estimated to be approximately 37,531 t CO_2-e over a 20 year life or approximately 1,877 t CO_2-e per year.

The proposal total emissions were estimated based on construction and operations activities for an estimated quarry resource of 4 million tonnes over a 20 year life. However, the annual extraction rate of materials from the quarry depends on the demand; particularly from the Pacific Highway upgrade works. It is expected that emissions from operation activities and product transport will be higher during the current highway upgrade works over the next 5 years, with a significant decrease once the Highway upgrade is complete.

The proposal emissions are minor compared with Australia's and New South Wales total GHG emissions. In 2011/12 Australia's greenhouse gas emissions were estimated as 554.6 Mt CO_2-e and New South Wales' greenhouse gas emissions were 154.7 Mt CO_2-e. The proposal emissions per annum would be approximately 0.001% of New South Wales' total greenhouse gas emissions and 0.0003% of Australia's total GHG emissions in 2010/11. Emissions during the first five years of operations could be as high as double the average annual emissions. These high emissions will still be minor compared with total emissions for NSW and Australia.

6. Recommendations

6.1 Construction and operation

The management of adverse impacts arising from the Project has been addressed according to the hierarchy of avoidance, mitigation and offsetting of adverse impacts.

The consumption of diesel is a necessary requirement of the proposal. However, a reduction in the quantity of fuel consumed may be achievable through optimisation of operational activities and logistics. Optimisation of these activities may reduce the number of vehicles and/or trips required. This optimisation should be undertaken during the detailed project design and planning stage.

A small reduction in fuel consumption may be achieved through the use of more efficient plant and vehicles. Modern vehicle and plant models are typically more fuel efficient than the older models. The use of more recent vehicles and plant models would need to be part of a wider fuel management strategy that incorporates project planning, logistics, driver education and maintenance as any fuel reduction due to more efficient models may be outweighed by poor management in other areas.

The most significant greenhouse gas mitigation option for fuel-related emissions is likely to be the use of biodiesel. Biodiesel blends (diesel that has a percentage of the fuel replaced with biodiesel) may reduce greenhouse gas emissions due to fuel consumption; however, this is dependent on a number of factors including the origin of the biodiesel feedstock.

When sourced from appropriate feedstocks, the reduction in emissions is approximately equivalent to the percentage of biodiesel in the blend (for example diesel with 20 percent biodiesel will reduce greenhouse gas emissions by approximately 20 percent). Opportunities for the use of biodiesel should be further investigated and used where possible on the proposal.

7. Conclusion

The proposal emissions were estimated to be approximately 1,877 t CO_2-e per year. It is expected that emissions will be higher during the current highway upgrade works over the next 5 years, with a significant decrease once the Highway upgrade is complete.

Emissions associated with the transportation product from the facility were estimated as the major source of emission for the proposal, followed by fuel consumption during operations, vegetation removal during construction and fuel consumption during construction.

The emissions generated from the proposal are considered to be insignificant but could be further reduced through the implementation of several recommended mitigation measures.

Recommendations to mitigate the generation of emissions include:

- Optimisation of operational activities and logistics
- Use of more efficient plant and vehicles
- Use of biodiesel should be further investigated and used, where possible, on the proposal.

Appendices

Appendix A – Greenhouse Gas Inventory

Emission source	Value		CO_2 Emission Factor	CH_4 Emission Factor	N_2O Emission Factor	Scope 1 Emission Factor	Scope 2 Emission Factor	Scope 3 Emission Factor	Total Emission Factor		Method	CO_2 Emissions	CH_4 Emissions	N_2O Emissions	Scope 1 Emissions	Scope 2 Emissions	Scope 3 Emissions	Total Emissions
	(Q)	Units	t CO_2 / unit	t CH_4 / unit	t N_2O / unit	t CO_2-e / units	t CO_2-e / units	t CO_2-e / units	t CO_2-e / units	Units		t CO_2	t CH_4	t N_2O	(t CO_2-e)	(t CO_2-e)	(t CO_2-e)	(t CO_2-e)
Vegetation removal during construction	706	t CO2	1.00	0.0000	0.00000	1.000	0.00	0.00	1.00	t	Q x EF	706	0	0	706	0	0	706
Fuel consumed during construction	61	kL	2.67	0.00	0.00	2.68	0.00	0.20	2.89	kL	Q x EF	163	0	0	164	0	12	176
Fuel consumed during operations	4,159	kL	2.67	0.00	0.00	2.68	0.00	0.20	2.89	kL	Q x EF	11,110	1	0	11,158	0	851	12,009
Transportation of product off site	4,000,000	tonnes	0.00	0.00	0.00	0.00	0.00	0.0062	0.01	t.km	Q x EF	0	0	0	0	0	24,640	24,640
												11,979	**1**	**0**	**12,027**	**0**	**25,503**	**37,531**

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