APPENDIX M

Greenhouse Emissions Assessment

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GREENHOUSE EMISSIONS ASSESSMENT

Submission to Ballina Shire Council

New Extractive Industry
Lot 32 DP 1151612
Newrybar Swamp Road, Lennox Head

for:
Ballina Sands Pty Ltd

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1 Introduction

This greenhouse emissions assessment has been prepared by Ardill Payne & Partners on behalf of Ballina Sands Pty Ltd in relation to the proposed sand extraction operation (hereafter "the Project") on land described as Lot 32 DP 1151612, Newrybar Swamp Road, Lennox Head. The site is located in the Northern Rivers Region of NSW some 4km to the north west of Lennox Head. The site in relation to its locality is depicted below.

Figure 1: Site in relation to Ross Lane and Pacific Highway

1.1 Proposed Development

The primary objective of the operation is the commercial extraction of sand. Subject to any further applications to modify consent or applications to extract further resources from the site, the operations will remove a maximum of 610 000 m^3 over 15 years to supply filling sand for use in residential, industrial and infrastructural developments in the region.

Mining operations will include stripping of topsoil (for use in minor site filling and earthen acoustic and visual mounds where and if required), extraction using excavators, stockpiling and loading into haulage trucks for dispatch to market.

The quarry will have an extracted footprint of approximately 10.6 ha in the south eastern corner of the allotment.

1.2 Expected Quarry Life

At the proposed maximum extraction rates, the quarry would be expected to have a minimum life of 5 years, however to accommodate demand variations a maximum life of 15 years is envisaged.

2 Scope of Work

A quantitative greenhouse emissions assessment has been undertaken to estimate potential greenhouse gas emissions associated with the Project. The Department of Climate Change and Energy Efficiency document, *National Greenhouse Accounts (NGA) Factors* (July 2011) (hereafter "NGA Workbook"), will be used to estimate greenhouse emissions.

The predicted greenhouse gas emissions associated with the project have been calculated on:

- A total annual emissions basis;
- A tonnes per unit of production basis (assuming maximum extraction is achieved, i.e. 80 000 m^3); and
- A total project lifetime basis (assuming maximum lifetime of 15 years).

Predicted emissions have been compared against 'best practice' emissions for the activity and total annual NSW emissions.

3 Greenhouse Emissions

3.1 Greenhouse Gases and the Greenhouse Effect

A greenhouse gas is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. Common greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and water (H_2O).

Quantification of potential Project emissions has been undertaken in relation to both CO_2 and other non-CO_2 greenhouse gases. For comparative purposes, non-CO_2 greenhouse gases are awarded a "CO_2-equivalence" (CO_2-e) based on their contribution to the enhancement of the greenhouse effect. The CO_2-e of a gas is calculated using an index called the Global Warming Potential (GWP). The GWPs for a variety of non-CO_2 greenhouse gases are contained within Table 26 of the NGA Workbook. The GWPs of relevance to this assessment are:

- Methane (CH_4): GWP of 21 (21 times more effective as a greenhouse gas than CO_2).
- Nitrous Oxide (N_2O): GWP of 310 (310 times more effective as a greenhouse gas than CO_2).

The short-lived gases such as CO, NO_2, and NMVOCs (non-methane volatile organic compounds) vary spatially and it is consequently difficult to quantify

their global radiative forcing impacts. For this reason, GWP values are generally not attributed to these gases nor have they been considered further as part of this assessment.

3.2 Greenhouse Gas Emission 'Scopes'

Greenhouse emissions are thought of in terms of direct and indirect emissions.

Direct emissions are produced from sources within the boundary of an organisation and as a result of that organisation's activities (e.g. fuel consumption, on-site electricity generation). The NGA workbook terms these emissions as 'Scope 1 emissions'.

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. The most important category of indirect emissions is from the consumption of electricity. The NGA workbook terms indirect emissions associated with electricity consumption as 'Scope 2 emissions'.

There are other examples of indirect emissions, for example: upstream emissions generated in the extraction and production of fossil fuels; downstream emissions from transport of an organisation's product to customers; and emissions from contracted/outsourced activities. The NGA workbook terms these indirect emissions as 'Scope 3 emissions'.

4 Assumptions and Methodology

Predicted greenhouse emissions were calculated based on direct emissions (Scope 1) relating to fuel combustion (for stationery energy and transport purposes), and indirect emissions (Scope 3) associated with employee travel to and from the Project site. Scope 3 emissions associated with transport and distribution of the product were not included as the details of this are largely unknown. Scope 2 emissions resulting from electricity consumption are not applicable as power requirements will be met by a solar powered generator.

4.1 Scope 1 Emissions

The primary fuel source used on site will be automotive diesel oil (ADO). Discussions with the proponent indicate various diesel consumption rates for the different vehicles and heavy machinery associated with the Project. They are summarised below alongside the assumed annual use:

Table 1 – Fuel Consumption Assumptions

Source	Fuel Consumption (L/h)	Annual Use
Water Pumps (x2)	2	2 pumps, 24 hours per day, 6 days per week, 18 weeks per annum = **5184 h**
Excavator	20	8 hours per day, 5.5 days per week, 26 weeks per annum = **1144 h**
Moxy Dump Trucks (x2)	10	2 dump trucks, 8 hours per day, 5.4 days per week, 26 weeks per annum = **2288 h**
Front End Loader	10	6 hours per day, 5.5 days per week, 52 weeks per annum = **1716 h**
Water Trucks	5	1 hour per day, 6 days per week, 26 weeks per annum = **156 h**

Fuel consumption rates have been calculated based on the maximum extraction volume of 80 000 m^3 per annum and an upper limit extraction volume of 610 000 m^3 over the whole Project lifetime.

4.2 Scope 3 Emissions

Employee vehicle movements have been estimated based on the following broad assumptions:

- Three employees, 6 days per week, 40 weeks per annum driving petrol fuel vehicles;
- Car fuel consumption rate of 10 L/100km; and
- Average employee round trip distance of 34.6 km (assuming staff travel from Ballina each day).

5 Results

Scope 1 & 3 emissions of CO_2 and other greenhouse gases associated with diesel combustion have been estimated using emission factors and energy content information contained in Tables 3 and 4 of the NGA workbook. Predicted emissions are summarised below. Calculations are provided in Attachment 1.

Table 2 – Predicted Greenhouse Gas Emissions

Scope 1	**Total Predicted Annual Emissions (t CO_2-e)**	200
	Predicted Emissions per Unit of Production *Maximum Extraction Assumed, i.e. 80 000 m³/annum* **(t CO_2-e / m³ extracted material)**	0.002
	Predicted Emissions: Total Project Lifetime *Maximum Extractable Amount Assumed, i.e. 610 000 m³* **(t CO_2-e)**	1523
Scope 3	**Total Predicted Annual Emissions (t CO2-e)**	570
	Predicted Emissions per Unit of Production *Maximum Extraction Assumed, i.e. 80 000 m³/annum* **(t CO2-e / m3 extracted material)**	0.007
	Predicted Emissions: Total Project Lifetime *Maximum Extractable Amount Assumed, i.e. 610 000 m³* **(t CO2-e)**	4347

6 Conclusion

The greenhouse impact of this activity is diminutive. Scope 3 emissions, i.e. emissions associated with employee transport to and from the site are more than double the emissions generated by on site activities.

The Department of Climate Change and Energy Efficiency publishes Australia's National Greenhouse Accounts[1], which outline Australia's greenhouse gas emissions as a nation, by state and by industry. The most recent published data is from 2009.

In 2009, Australia's greenhouse gas emissions across all economic sectors was 564.5 Mt CO_2-e. Within the non-energy mining sector emissions were 7.4 Mt CO_2-e. NSW total greenhouse emissions were 160 Mt CO_2-e. Emissions from the Project would thus represent:

- 0.0001% of the nation's direct emissions across all economic sectors (in 2009);
- 0.01% of the nation's non-energy mining sector direct emissions (in 2009); and
- 0.0005% of NSW total emissions (in 2009).

[1] http://www.climatechange.gov.au/climate-change/emissions.aspx

7 Scope of Engagement

This report has been prepared by Ardill Payne & Partners (APP) at the request of Ballina Sands Pty Ltd for the purpose of assessing the greenhouse contribution of their extractive industry and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared from the information provided to us and from other information obtained as a result of enquiries made by us. APP accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

APP declares that it does not have, nor expects to have, a beneficial interest in the subject project.

To avoid this advice being used inappropriately it is recommended that you consult with APP before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

8 Attachments

Attachment 1 Calculations

ATTACHMENT 1

Attachment 1
Calculations

Ballina Sands – Predicted Greenhouse Gas Emissions (Scope 1)

	Emission Factors (EF) (kg CO_2-e/GJ)			Energy Content (GJ/kL)
	CO_2	CH_4	N_2O	
ADO Fuel Combustion EF Scope 1 (Stationary Energy)	69.2	0.1	0.2	38.6
ADO Fuel Combustion EF Scope 1 (Transport Fuels)	69.2	0.2	0.5	

Stationary Energy Emissions	**Fuel Consumption (L/h)**	**Hours per annum**	**Annual Fuel Quantity (kL)**	**Projected Annual GHG Emissions (t CO_2-e)**
Water Pumps (x2)	2	5184	10.368	28

Transport Fuel Emissions	**Fuel Consumption (L/h)**	**Hours per annum**	**Annual Fuel Quantity (kL)**	**Projected Annual GHG Emissions (t CO_2-e)**
Excavator	20	1144	22.88	62
Moxy Dump Trucks (x2)	10	2288	22.88	62
Front End Loader	10	1716	17.16	46
Water Trucks	5	156	0.78	2
Sum Transport Fuel Emissions				172

Total Predicted Annual Emissions (t CO_2-e)	200
Predicted Emissions per Unit of Production *Maximum Extraction Assumed* **(t CO_2-e / m^3 extracted material)**	0.002
Predicted Emissions - Total Project Lifetime *610 000 m^3 extracted* **(t CO_2-e)**	1523

Ballina Sands – Predicted Greenhouse Gas Emissions (Scope 3)

	Emission Factors (EF) (kg CO_2-e/GJ)			Energy Content (GJ/kL)
	CO_2	CH_4	N_2O	
Gasoline Fuel Combustion EF Scope 1 (Transport Fuels)	66.7	0.02	0.2	34.2

Transport Fuel Emissions	**Fuel Consumption (L/km)**	**km per annum**	**Annual Fuel Quantity (kL)**	**Projected Annual GHG Emissions (t CO_2-e)**
Car	10	24912	249.12	570

Total Predicted Annual Emissions (t CO_2-e)	570
Predicted Emissions per Unit of Production *Maximum Extraction Assumed* **(t CO_2-e / m^3 extracted material)**	0.007
Predicted Emissions - Total Project Lifetime *610 000 m^3 extracted* **(t CO_2-e)**	4347