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GREENHOUSE GAS ASSESSMENT

FORMER HYDRO ALUMINIUM KURRI KURRI SMELTER DEMOLITION AND REMEDIATION

RAMBØLL ENVIRON

GREENHOUSE GAS ASSESSMENT
FORMER HYDRO ALUMINIUM KURRI KURRI SMELTER
DEMOLITION AND REMEDIATION

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CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

GHG	Greenhouse gas
LED	Light emitting dioxide
tCO_{2e}	Total carbon dioxide equivalent

GLOSSARY OF TERMS

Hydro	Hydro Aluminium Kurri Kurri Pty Ltd
The Project	The following key elements: • The Works. The Works are the activities required to make the Project Site suitable for future use. The key element of the Works is the construction of a waste management facility, comprising a state of the art, modern and purpose built Containment Cell. Other ancillary elements of the Works are: • Demolition of the remaining Smelter buildings and structures. • Site remediation, including leachate and groundwater treatment. Containment Cell Operation. Following completion of the Works, the Containment Cell would be subject to a monitoring and management program. As described in Section 2 of this Report.
The Smelter	The former Hydro Aluminium Kurri Kurri Pty Ltd aluminium smelter at Hart Road, Loxford
Stage 1 Demolition	Demolition of Smelter buildings addressed in a Development Application submitted to Cessnock City Council.

EXECUTIVE SUMMARY

This Greenhouse Gas Assessment has been prepared by Ramboll Environ Australia Pty Ltd (Ramboll Environ) on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to support an Environmental Impact Statement for submission to the Department of Planning and Environment prepared to assess for the Demolition and Remediation Project (the Project) at the former Hydro Aluminium Kurri Kurri aluminium smelter at Hart Road Loxford (the Smelter).

This assessment was undertaken to estimate the potential Scope 1, 2 and 3 greenhouse gas (GHG) emissions from the Project, and to assess the potential impacts of such emissions on the environment.

The key source of GHG emissions from the Project are associated with on-site fuel consumption, electricity imported to the Project site, energy used for the transportation of major construction materials and equipment to the Project site and waste from the Project site, and the encapsulation of waste material in an on-site Containment Cell.

To ensure that cumulative GHG impacts were assessed, this report also determined the potential GHG emissions from the Stage 1 Demolition that is the subject of a separate Development Application lodged with Cessnock City Council. If approved, the Stage 1 Demolition activities would occur concurrently with many of the activities comprised in the Project.

GHG emissions were estimated as 86,015 tCO_2e comprising 2,423 tCO_2e for Stage 1 Demolition and 83,592 tCO_2e for the Project. On-site waste encapsulation is estimated to contribute 64% of total emissions, electricity consumption 23% and fuel use on-site and for transport 13% of total emissions.

The total emissions are summarised in **Table ES1**.

Table ES1: Total Emissions

Activity Stage	Scope	Emissions (tCO2e)
Stage 1 Demolition	1	2,280
	2	0
	3	142
Total Stage 1 Demolition		**2,423**
The Project	1	63,341
	2	19,729
	3	522
Total the Project		**83,592**
Total GHG Emissions		**86,015**

The annual GHG emissions have been estimated by normalising estimated total emissions over the expected four years of the Project timeline. This approach has been taken due to the difficulty in determining the exact duration of each activity during any one year of the Project. Based on the estimated total GHG emissions for the Project, the annual GHG emissions for the Project works are approximately 20,898 tCO2e.

The Containment Cell is designed to operate for the long term with estimated annual GHG emissions for the Project works of approximately 836 tCO2e over the life of the Containment Cell.

A number of design and operational management measures have been recommended to ensure efficient use of energy and to reduce GHG emissions from the Project. Measures include optimising Containment Cell design to reduce emissions leakage from the cell structure and implementing stringent quality control during cell construction, covering waste material during stockpiling and transport to reduce exposure to moisture and generation of methane; selection of energy efficient lighting, hand-held and heavy equipment and machinery, and air conditioning systems; optimising construction activities and logistics to reduce fuel consumption; and consideration of the use of low GHG emission fuels (e.g. biodiesel) in the equipment schedule.

During the fully operational period of the Smelter in 2011-12, the GHG emissions generated by the Smelter (i.e. 2,963,825 tCO_2e) were approximately 1.92% of the total GHG emissions for NSW (i.e. 154.7 million tCO_2e). The estimated GHG emissions from Stage 1 Demolition and the Project (of 86,015tCO_2e) would represent 0.06% of the total NSW emissions which is a significant reduction from those associated with the Smelter when it was operational and demonstrates a reduction in the GHG emissions released to the environment. The estimated emissions generated from the Stage 1 Demolition and Project are minor when considered on a state and nation-wide basis and potential impacts to the environment are unlikely to be significant when considered in this regional context.

1. INTRODUCTION

This Greenhouse Gas Assessment has been prepared by Ramboll Environ Australia Pty Ltd (Ramboll Environ) on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to support an Environmental Impact Statement for submission to the Department of Planning and Environment prepared to assess for the Demolition and Remediation Project (the Project) at the former Hydro Aluminium Kurri Kurri aluminium smelter at Hart Road Loxford (the Smelter)

1.1 Background

The Smelter is located on Hart Road, Loxford near Kurri Kurri in New South Wales, Australia. The area owned and managed by Hydro incorporates the former smelter area comprising approximately 60 hectares, and the surrounding Hydro owned lands, comprising approximately 1,940 hectares (the Hydro land).

Smelting activities ceased in September 2012, and in May 2014 Hydro formally announced the closure of the Smelter.

It is Hydro's strategic vision for the Hydro land to play a key role in allowing the Hunter Region to achieve the economic, employment and environmental objectives identified in the NSW Government NSW State Plan 2021 and the Hunter Regional Action Plan. Hydro aims to achieve this strategic vision by facilitating the rezoning and development of the Project site for significant employment, residential, rural and biodiversity conservation purposes.

Hydro has commenced a number of decommissioning activities to facilitate demolition and remediation of the Smelter. In addition Hydro has received Development Consent from Cessnock City Council for the demolition of the majority of the Smelter (Stage 1 Demolition) excluding the buildings and structures at the Smelter used to store spent potlining used for material storage, various workshops, offices and storage sheds, the three concrete stacks and the main water tower.

The remaining activities that would make the Smelter suitable for future employment and industrial land uses are the following:

- The Works. The Works are the activities required to make the Project site suitable for future use. The key element of the Works is the construction of a waste management facility, comprising a state of the art, modern and purpose built Containment Cell.

  Other ancillary elements of the Works are:

  – Demolition of the remaining Smelter buildings and structures.

  – Site remediation.

  – Leachate and groundwater treatment.

- Containment Cell Management. Following completion of the Works, the Containment Cell would be subject to a monitoring and management program.

These activities form the Project, which is the subject of the Environmental Impact Statement and this Greenhouse Gas Assessment.

1.2 Objectives

The purpose of the greenhouse gas assessment is to assist the Department of Planning and Environment in assessing the Project in accordance with Section 79(c)(1) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The objectives of this greenhouse gas assessment are to:

- Quantify the Scope 1, Scope 2 and Scope 3 GHG emissions associated with the Project;
- Compare GHG emissions before and after implementation of the Project including annual emissions for each year of the Project.

- Estimate the GHG emissions intensity (per unit of production) and compare with best practice if possible.
- Assess the potential impacts of predicted GHG emissions from the Project on the environment.
- Identify greenhouse gas mitigation measures for the Project.

2. PROJECT DESCRIPTION

The Project would be located within the existing Hydro Aluminium Kurri Kurri Smelter site (the Smelter) at Hart Road Loxford. The Smelter location is shown in Figure 1. Figure 2 shows the overall Project layout, including the locations of key activities.

Table 2.1 outlines the major elements of the Project and the key activities. A detailed description of the Project is provided in **Chapters 8** and **9** of the Environmental Impact Statement.

Table 2.1 Outline of The Project

Element	Key Activities
The Works	
Project Site Establishment	• Establishment of environmental controls (erosion and sediment controls, water quality controls). • Construction of the Containment Cell haul road. • Continued use of Stage 1 Demolition compounds. • Continued use of Stage 1 Demolition stockpile and storage areas.
Containment Cell Construction	• Vegetation clearance. • Site preparatory works. • Establishment and implementation of environmental controls (erosion and sediment controls, water quality controls). • Construction of the Containment Cell base layers. • Construction of internal cell walls within the Containment Cell. • Transport and placement of remediation and demolition materials to the Containment Cell. • Leachate and stormwater management. • Construction of the final Containment Cell capping layers.
Stage 2 Demolition	• Completion of hazardous materials removal. • Establishment and implementation of environmental controls (dust mitigation and water quality management). • Demolition of three concrete stacks and a water tower using detonation. • Mechanical demolition of remaining buildings and structures. • Material collection, separation, processing and storage. • Transportation of recyclable metals offsite. • Transport non-recyclable demolition material to the Containment Cell. • Grading of former building footprints.
Demolition Material Management	• Operation of a concrete and refractory crushing plant processing of up to 140 tonnes per day. • Manage a large stockpile area in the west of the Smelter. • Ferrous (steel) and non-ferrous (predominantly aluminium and copper) metals would be sorted and sized before being transported off site for recycling. It is anticipated that there would be up to 20 truck movements per day.
Contamination Remediation	• Removal of the capped waste stockpile. • Excavation of the contaminated soils within the Smelter (including stockpiled soils sourced from other Hydro land). • Transport to the Containment Cell. • Filling and grading following removal of contaminated materials.
Leachate and Groundwater Treatment	• Establish and operate water treatment plants (capped waste stockpile and Containment Cell). • Groundwater monitoring. • Water treatment plant, pumping well network and dam decommissioning.

Table 2.1 Outline of The Project

Element	Key Activities

Environmental Controls	• Dust controls during demolition would include:
	  • Accumulated fines from within the buildings would be removed where safe, reasonable and feasible to do so.
	  • Pre-wetting of buildings prior to undertaking the induced collapse and use of water sprays for dust suppression (as required due to wind conditions) during induced collapse.
	  • Ceasing activities that have the potential to generate significant dust that could have adverse impacts on sensitive receivers.
	• Watering of the demolition areas, unsealed access roads and other unsealed areas.
	• Vehicles would use (where possible) existing sealed roads.
	• Erosion and sediment controls would be installed, monitored and managed to reduce sediment run off entering the existing drainage system.
	• The existing site water management system would capture runoff.
	• Where possible, clean water would be diverted from Works areas.

Containment Cell Management	
Monitoring	• Monitoring of leachate generation within the Containment Cell.
Maintenance	• Mowing of the Containment Cell grass cover. • Maintenance (if required) of the capping layers.

The Works component of the Project would take approximately three years to complete.

Project traffic would predominantly travel to and from the Smelter via Hart Road and the Hunter Expressway (using the Hart Road interchange). A small number of vehicles (predominantly small vehicles used by Works personnel) are likely to continue to the intersection with Sawyers Gully Road, Gingers Lane and Government Road and along one of these roads.

Works activities that could generate an audible noise at the nearest sensitive receiver would be undertaken between 7:00 am to 6:00 pm, Mondays to Fridays and 7:00 am to 1:00 pm on Saturdays.

2.1 Stage 1 Demolition

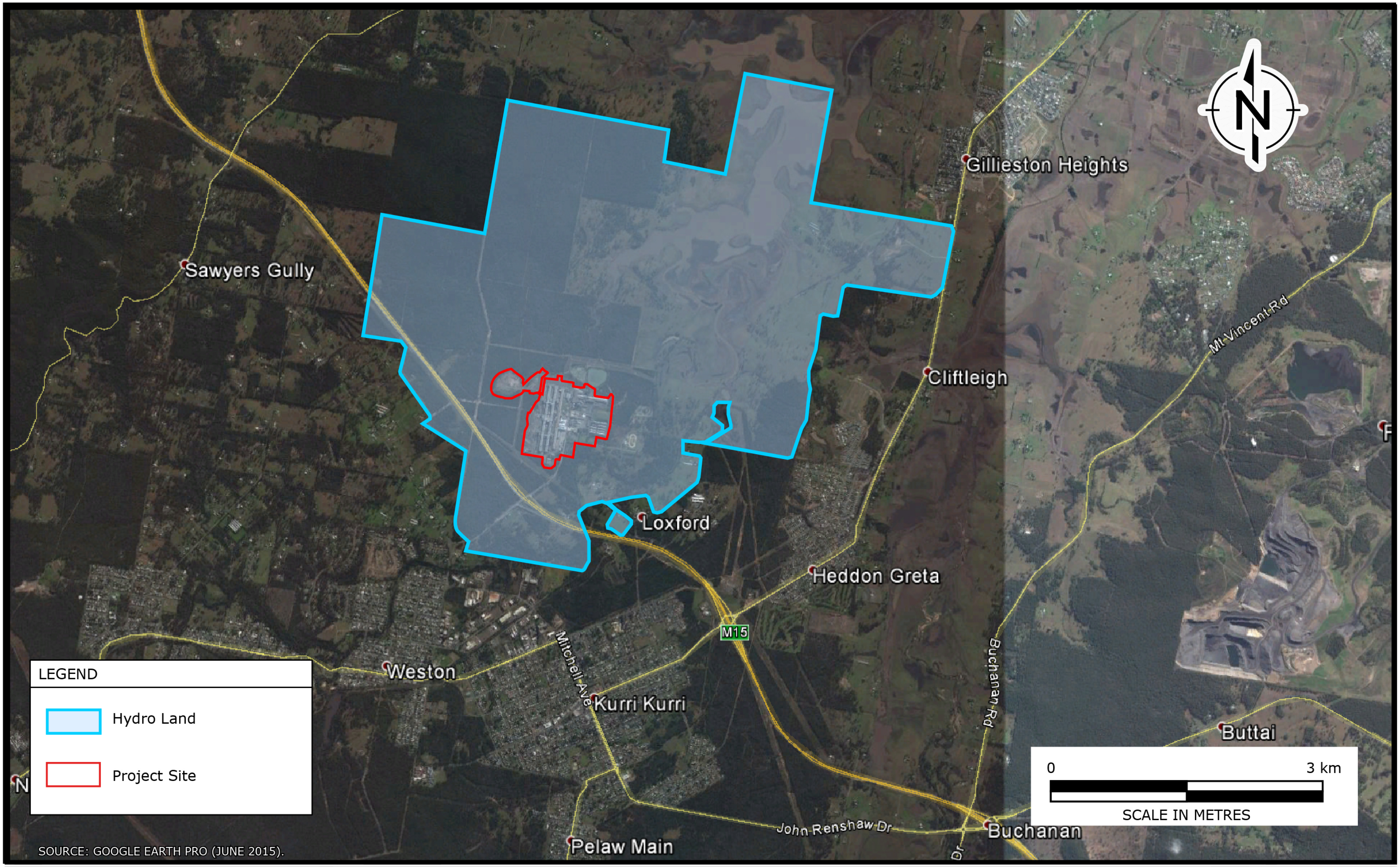
In August 2015 Hydro submitted a Development Application (supported by a Statement of Environmental Effects) to Cessnock City Council requesting approval of the following:

- Demolition of all buildings and structures at the Smelter excluding:
  - Buildings used for the storage of materials.
  - Three concrete stacks, and one concrete water tower (structures requiring the use of explosives for demolition).
  - The transformer yard and major power supply infrastructure in the north of the Smelter.
  - Administration buildings, amenities building and various workshops and storage sheds
- Establishment of a contractor’s compound, either within an existing building located in the south of the Smelter (the former Building 77A Pot Rebuild building), or in the car park near the main entrance to the Smelter.
- A concrete and refractory crushing plant processing up to 28,000 tonnes per year or 140 tonnes per day.
- A demolition materials stockpile area.
- The sorting of recyclable metallic demolition materials and transportation to a metal recycling facility.

It is proposed that the contractor’s compound, the demolition materials stockpile area and the concrete and refractory crushing plant included in the Development Application for the Stage 1

Demolition would continue to be used for the Project. It is anticipated that some Stage 1 Demolition activities would occur concurrently with the early stages of the Project.

So that the potential cumulative greenhouse gas impacts of Stage 1 Demolition activities are considered when assessing the Project, these activities have been included as appropriate in **Chapter 5** (Impact Assessment) of this report.



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DRAFTED BY: KK | DATE: July 2016

LOCATION PLAN

FORMER HYDRO ALUMINIUM KURRI KURRI SMELTER
DEMOLITION AND REMEDIATION

FIGURE 1

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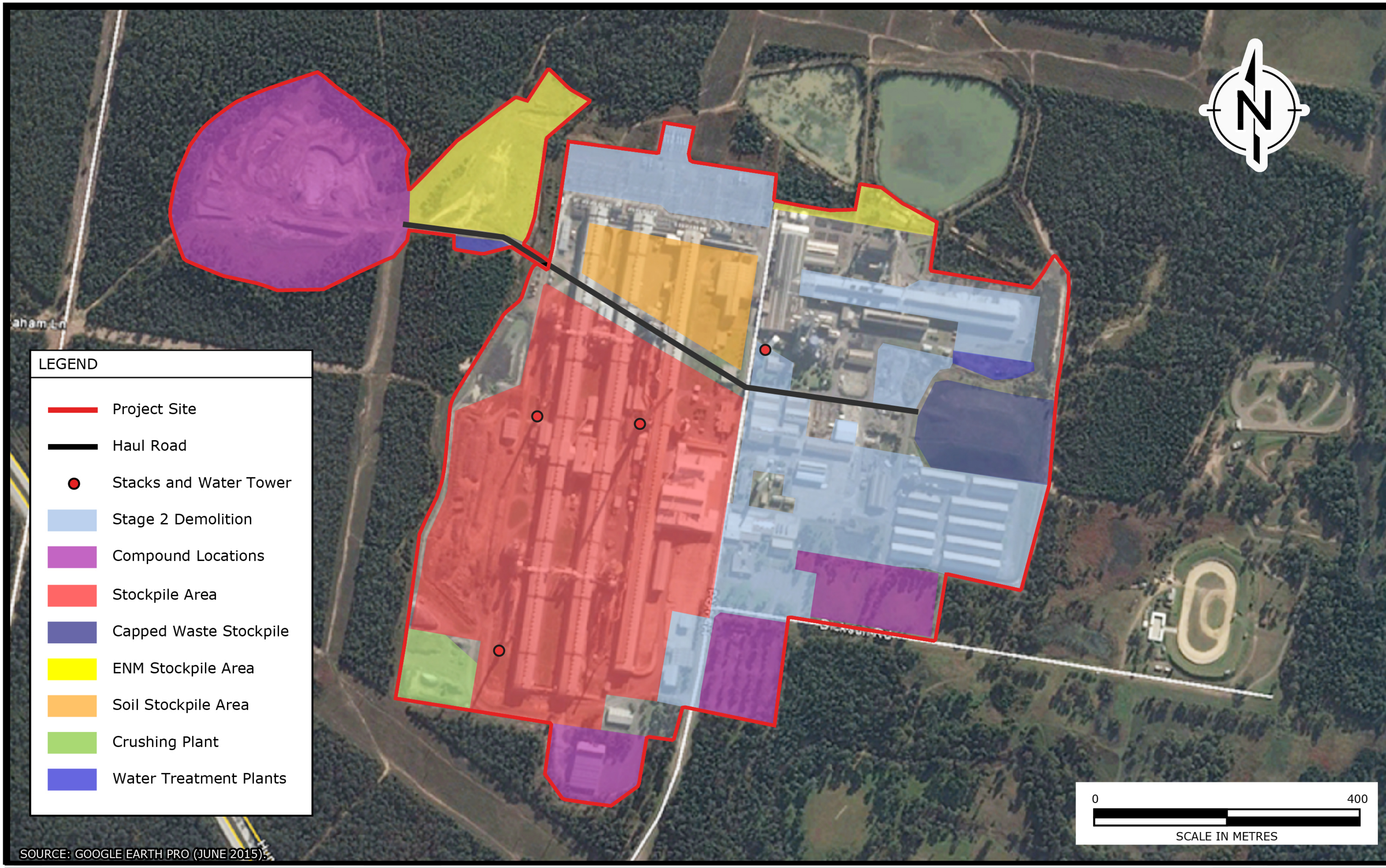

RAMBOLL ENVIRON	**PROJECT LAYOUT** FORMER HYDRO ALUMINIUM KURRI KURRI SMELTER DEMOLITION AND REMEDIATION	FIGURE **2**
DRAFTED BY: KK / DATE: July 2016		AS130401

3. EXISTING ENVIRONMENT

3.1 Criteria

The scope and methodology for the greenhouse gas assessment has been undertaken in accordance with the following guidelines:

- The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Edition, 2004 (the GHG Protocol), developed by World Resources Institute (WRI) and World Business Council on Sustainable Development (WBCSD).
- National Greenhouse and Energy Reporting (Measurement) Determination 2008, July 2014.
- National Greenhouse and Energy Reporting (Measurement) Determination 2008, Technical Guidelines, July 2014, Australian Department of the Environment.

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

The GHG Protocol describes the process for the accounting of GHG emissions and compiling of GHG emission inventories. This standard is widely accepted for use in Australia.

The National Greenhouse and Energy Reporting System (NGERS), comprising the Commonwealth National Greenhouse and Energy Reporting Act 2007 (NGER Act), Commonwealth National Greenhouse and Energy Reporting Regulations 2008 (NGER Regulations), Commonwealth National Greenhouse and Energy Reporting (Measurement) Determination 2008 (NGER Measurement Determination), and National Greenhouse and Energy Reporting (Measurement) Technical Guidelines (Australian Department of the Environment, 2014), provides a higher level of detail than the Greenhouse Gas Protocol as to how emissions should be calculated by Australian companies. This includes guidance on collating activity data, selecting fuel energy content and emissions factors, calculating emissions and estimating uncertainty. This is the standard Hydro has previously followed for reporting energy and emissions data under the NGERS when the Smelter was operational, and is the primary standard that has been used in preparing this assessment.

3.2 Methodology

3.2.1 Organisational Boundary

The organisational boundary for this assessment has been defined using the Operational Control approach. Hydro will account for all GHG emissions over which it has operational control. It will not account for emissions in which it owns an interest but does not have operational control.

The demolition, remediation and construction works of the Project would rely on a number of contractors. Hydro would account for emissions associated with its major contractors as its own scope 1 and 2 emissions, since it has authority to implement work health and safety and environmental policies in relation to the activity of these contractors at the Project site.

3.2.2 Emission Scopes

Emissions associated with the Project are described as Scope 1, 2 and 3 emissions in accordance with the GHG Protocol. These are defined as:

- Scope 1 emissions – direct emissions created from sources owned and controlled by the proponent, Hydro.
- Scope 2 emissions – indirect emissions created from purchasing energy (heat or electricity) consumed by the Project. These indirect emissions are a consequence of the activities of the Project, but arise from sources that are not owned or controlled by Hydro.
- Scope 3 emissions – all other indirect emissions that occur in the value chain of the reporting organisation, including upstream and downstream activities.

3.2.3 Scope 1 and 2 emission sources for the Project

Scope 1 emissions are produced by the combustion of fuels such as diesel used by equipment and machinery for the demolition, remediation and construction works. Scope 2 emissions arise from the consumption of electricity, in miscellaneous plant and equipment, office and contractor compounds and from temporary lighting that is owned and operated by Hydro. A summary of the emissions associated with site activities is provided in Table 3.1.

Table 3.1: Scope 1 and 2 GHG Emission Sources

Stage 1 Demolition	The Project
Scope 1 Emissions	
Diesel consumption by excavation equipment used on-site (including excavators, boom lifts, trucks, telehandlers, water trucks, service vehicles, prime movers)	Diesel consumption by excavation and construction equipment used on-site (including excavators, graders, dozers, rollers, telehandlers, rollers, compactors, backhoes, water carts, mulching machines)
Diesel consumption by concrete crushing plant used on-site	Diesel consumption by concrete crushing plant used on-site
	Buried waste in on-site Containment Cell
Scope 2 Emissions	
	Electricity for on-site office and contractor compounds, and temporary lighting
	Consumption of purchased electricity for water treatment plant

3.2.4 Scope 3 emission sources for the Project

All other emissions are defined as Scope 3 emissions as they are produced outside the Project site, and Hydro does not have operational control of the facilities from which they originate. Hydro does not own or operate any of the vehicles that transport raw materials, plant, equipment, machinery or contractor personnel to the Project site. As such, the emissions resulting from the combustion of fuels for this transportation are classified as Scope 3 emissions. However, these emissions have been included in this assessment as there would be considerable vehicle movements to and from the Project site that are considered appropriate to report. A summary of the emissions associated with site activities is provided in **Table 3.2**.

Table 3.2: Scope 3 GHG Emission Sources

Stage 1 Demolition	The Project
Diesel consumption in vehicles transporting scrap metal from the Project site to Port of Newcastle	Diesel consumption in vehicles transporting Containment Cell construction materials and site establishment materials to the Project site (such as sand, gravel, liner, filter fabric and security fencing)
Diesel consumption in vehicles transporting plant, equipment and machinery to and from the Project site	Diesel consumption in vehicles transporting plant, equipment and machinery to and from the Project site
Unleaded petrol consumption in vehicles bringing Hydro and contractor personnel to and from the Project site	Diesel consumption in vehicles transporting waste oil and scrap metal from the Project site to Port of Newcastle
	Unleaded petrol consumption in vehicles bringing Hydro and contractor personnel to and from the Project site

3.2.5 Data Collection and Calculation Procedure

All GHG emissions in this assessment have been quantified by calculation (rather than direct measurement), by multiplying estimated quantities by an emission factor. Quantities of fuel, electricity and waste (i.e. activity data) were estimated based on concept design quantities for the Project. Emission factors used in the GHG calculations are detailed in Section 3.2.6 of this report. Factors have been primarily sourced from the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Commonwealth, 2014). If factors have been sourced elsewhere, the source reference has been provided in this report.

When data was unavailable, assumptions and approximations were made to obtain a reasonable estimate of activity data and emission factors. All assumptions are detailed in Section 3.2.7.

Energy consumption and emissions data has been reported in tonnes of carbon dioxide equivalent for each stage of the Project, and each stage totalled to provide an estimate of the total greenhouse gas emissions for the Project.

3.2.6 Emission Factors

Table 3.3 summarises the emission factors for all emission sources included in this GHG assessment.

Table 3.3: Emission Factors for the GHG Assessment

Emission Source	Scope	NGERS ID	Emission Factor	Unit	Reference
Diesel oil - stationary, used on-site	1	40	2,682.70	kgCO_2e/kL	*National Greenhouse and Energy Reporting (Measurement) Determination 2008*, (Commonwealth, 2014); Schedule 1, Part 3
Diesel oil - transport, used on-site	1	65	2,694.67	kgCO_2e/kL	*National Greenhouse and Energy Reporting (Measurement) Determination 2008*, (Commonwealth, 2014); Schedule 1, Part 4
Construction and demolition waste	1		0.2	tCO_2e/t	*National Greenhouse Accounts Factors* **(**Australian Department of the Environment, 2014). Appendix 4, Table 44
Purchased electricity from grid, NSW	2	77	0.86	kgCO_2e/kWh	*National Greenhouse and Energy Reporting (Measurement) Determination 2008*, (Commonwealth, 2014); Schedule 1, Part 6
Gasoline - transport, personnel commuting	3	64	2,288.66	kgCO_2e/kL	*National Greenhouse and Energy Reporting (Measurement) Determination 2008*, (Commonwealth, 2014); Schedule 1, Part 4

Table 3.3: Emission Factors for the GHG Assessment

Emission Source	Scope	NGERS ID	Emission Factor	Unit	Reference
Diesel oil - transport, used to transport equipment, machinery, materials and waste	3	65	2,694.67	$kgCO_2e/kL$	*National Greenhouse and Energy Reporting (Measurement) Determination 2008*, (Commonwealth, 2014); Schedule 1, Part 4

3.2.7 Assumptions

Assumptions used in estimating the activity data and associated greenhouse gas emissions for the Project are listed in **Table 3.4**.

Table 3.4: Assumptions

Parameter measured	Assumptions
On-site fuel consumption	
Diesel consumption in equipment, machinery and small vehicles	Quantity of diesel estimated as 3,919 kL, comprising 847 kL for Stage 1 and 3,072 kL for Stage 2 works. This is based on Stage 1 works operating over 52 weeks (260 working days) and Stage 2 works ranging from four weeks up to 156 weeks (780 working days), depending on the type of activity undertaken. Each item of equipment and machinery is assumed to be running at 50% capacity (i.e. four hours/day).
Transportation of materials to site and waste from site	
Scrap metal to recycling facility	It was assumed that the scrap metal recycling facility would be located in the vicinity of the Port of Newcastle. Scrap metal would be transported by 20 tonne trucks, with 20 truck movements per day and a total of 918 truck movements required. A return trip from site to the Port area of 70 km was assumed. Quantity of diesel estimated as 31 kL, comprising 22 kL in Stage 1 and 9 kL in Stage 2 works.
Containment cell construction materials	It was assumed that the construction materials would be sourced from a supplier located in the Port of Newcastle, NSW area and transported by 20 tonne trucks, with a total of 600 truck movements required. Quantity of diesel estimated as 28 kL during Stage 2 works.
Waste oil to disposal facility	It was assumed that the waste oil would be disposed to a facility in the vicinity of the Port of Newcastle, with disposal occurring over 10 working days. Quantity of diesel estimated as 0.3 kL during Stage 2 works.

Table 3.4: Assumptions

Parameter measured	Assumptions
Excavation and construction equipment and machinery	It was assumed that: • For each item of equipment/ machinery used on-site these would be transported by a prime mover from the Port of Newcastle vicinity in one trip (i.e. one item of equipment requires one prime mover). • Where 30 tonne articulated trucks are used, these are self-driven to the site (i.e. no prime mover is used for transport). • A return trip from the Port area to the site of 70 km was assumed, with an average vehicle speed of 70 km/hr. Quantity of diesel estimated as 6 kL with the majority of fuel consumption associated with Stage 2 works.
Transportation of employees and contractors to site	
Petrol consumption in private vehicles	Fuel used by personnel travelling to and from home to the Smelter is assumed to be petrol. Distance travelled is assumed to be 70 km return trip with a fuel efficiency of 8 L/100 km travelled. Quantity of petrol estimated as 216 kL, comprising 36 kL for Stage 1 and 180 kL for Stage 2 works. This is based on Stage 1 works operating from six weeks up to 52 weeks and Stage 2 works ranging from four weeks up to 156 weeks (780 working days) depending upon the type of activity undertaken.
Methane Generation	
Encapsulation of waste in Containment Cell	The exact waste mix types to be placed in the Containment Cell are not known (due to the mixed nature of the material in the capped waste stockpile) and an analysis is not considered practical given the varied and non-homogenous nature of the waste material. The methane gas generated from the encapsulation was estimated using scope 3 emissions methodology (i.e. using NGA Factors) although the emissions are classified as scope 1 due to the on-site location of the waste. The waste was assumed to be construction and demolition waste given the nature of the Project activities. The total quantity of waste material to be encapsulated in the Containment Cell is estimated as 356,000 tonnes.

Exclusions from the GHG assessment included the following sources. The emissions from these sources were all considered minor when compared to the overall emissions.

- Emissions associated with the consumption of gaseous fuels for demolition and construction activities (e.g. for oxy cutting).
- Emissions associated with the use of various hand operated equipment.
- Emissions associated with the use of diesel pumps for pumping water to the water treatment plant.
- Emissions associated with the operation of the water treatment plant. The plant is proposed to operate only for a short duration (i.e. a few months) at the completion of the Containment

Cell in the event that leachate is generated and requires treatment, where emissions from electricity consumption would be minor due to the small scale of the water treatment plant.

4. IMPACT ASSESSMENT

4.1 Project Emissions

Greenhouse gas emissions during Stage 1 Demolition and the Project are presented in Table 4.1. Stage 1 Demolition is predicted to result in scope 1 and 2 emissions of 2,281 tCO2e all of which is due to the consumption of diesel for equipment and machinery use. The Project is predicted to result in emissions of 83,070 tCO2e primarily due to emissions from the encapsulated waste in the Containment Cell. Total scope 1 and 2 emissions for Stage 1 Demolition and the Project are estimated to be 85,350 tCO2e.

Table 4.1: Stage 1 Demolition and the Project – Scope 1 & 2 GHG Emissions

Emission Source	Quantity	Units	Scope 1 Emissions (tCO_2e)	Scope 2 Emissions (tCO_2e)	Total Emissions (tCO_2e)
Stage 1 Demolition					
Diesel	846.56	kL	2,280.45		
Electricity	0	kWh			
Total Stage 1			***2,280.45***	***0.00***	***2,280.45***
The Project					
Diesel	3072.008	kL	8,140.61		
Electricity	22,940,972.00	kWh		19,729.24	
Waste	276,000.00	tonnes	55,200		
Total the Project			***63,340.61***	***19,729.24***	***83,069.84***
Total Stages 1 Demolition and the Project			**65,621.06**	**19,729.24**	**85,350.29**

A breakdown of the emissions by emissions type and source is provided in Figures 3 and 4.

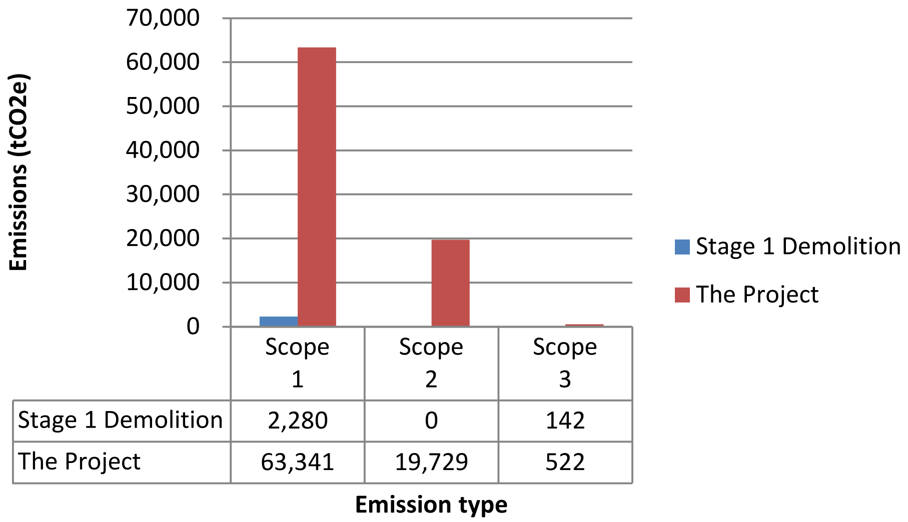

Figure 3: Emissions by Scope type

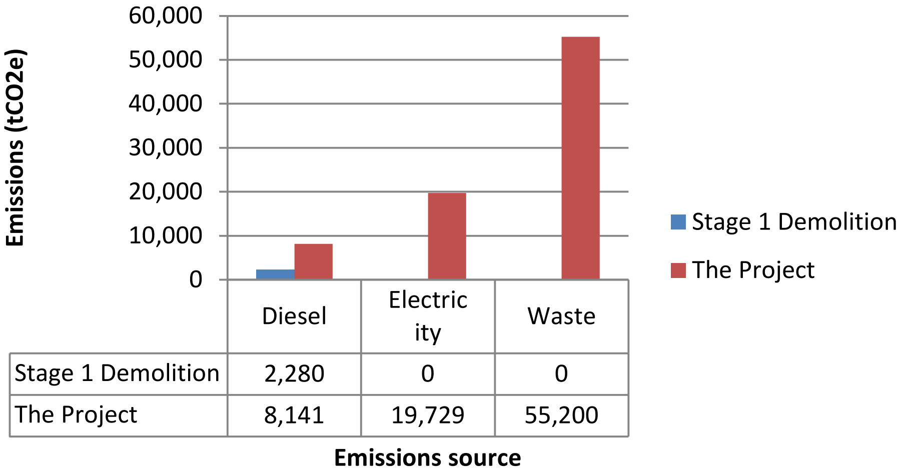

Figure 4: Emissions by source

Scope 3 emissions associated with the Stage 1 Demolition and the Project are presented in Table 4.2. Total scope 3 emissions for Stage 1 Demolition and the Project are estimated to be 664 tCO_2e.

Table 4.2: Stage 1 Demolition and The Project – Scope 3 GHG Emissions

Emission Source	Quantity	Units	Scope 3 Emissions (tCO_2e)
Stage 1 Demolition			
Diesel – equipment delivery	0.34	kL	0.91
Diesel – scrap metal recycling	21.58	kL	58.16
Petrol – personnel travel	36.33	kL	83.14
Total Stage 1			***142.21***
The Project			
Diesel – equipment delivery	5.56	kL	14.97
Diesel – scrap metal recycling	9.25	kL	24.92
Diesel – waste oil disposal	0.32	kL	0.86
Diesel – Containment Cell construction material delivery	28.2	kL	75.99
Petrol – personnel travel	177.12	kL	405.36
Total the Project			***522.10***
Total Stage 1 Demolition and the Project			**664.31**

In Stage 1 Demolition, all scope 1 emissions are due to emissions from equipment and machinery use with no scope 2 emissions generated. Scope 3 emissions arising from personnel travelling to and from the Smelter account for approximately 58%, followed by emissions from the removal of scrap metal representing 41% and the remainder of emissions due to delivery of equipment and machinery.

In the Project, approximately 87% of the emissions generated are attributed to the wastes encapsulated in the Containment Cell and the remainder due to emissions from on-site equipment and machinery use. Scope 3 emissions arising from personnel travelling to and from the Smelter for the Project account for approximately 78%, followed by emissions from the delivery of Containment Cell construction materials (14%), removal of scrap metal (5%), and for the delivery of equipment and machinery and disposal of waste oil (3%).

The total emissions are summarised in **Table 4.3**.

Table 4.3: Total Emissions

Activity Stage	Scope	Emissions (tCO_2e)
Stage 1 Demolition	1	2,280
	2	0
	3	142
Total Stage 1 Demolition		***2,423***
The Project	1	63,341
	2	19,729
	3	522
Total the Project		***83,592***
Total GHG Emissions		**86,015**

The annual GHG emissions have been estimated by normalising estimated total emissions over the expected four years of the Project timeline. This approach has been taken due to the difficulty in determining the exact duration of each activity during any one year of the Project. Based on the estimated total GHG emissions for the Project, the annual GHG emissions for the Project works are approximately 20,898 tCO2e.

The Containment Cell is designed to operate for the long term with estimated annual GHG emissions for the Project works of approximately 836 tCO2e over the life of the Containment Cell.

Stage 1 Demolition works are estimated to take approximately one year with emissions over this period to be approximately 2,423 tCO2e.

4.2 Emissions Comparison

During the fully operational period of the Smelter, emissions generated by the facility were reported under the National Greenhouse and Energy Reporting Scheme (NGERS). For the 2010-11 reporting year (latest full year of operation) emissions were reported to be 2,963,825 tCO_2e comprising scope 1 and 2 emissions. The estimated emissions associated with Stage 1 Demolition and the Project are 2.88% of the total greenhouse gas emissions during the 2010-11 operational period of the Smelter, taking into account scope 1 and 2 emissions associated with the Project and Smelter operations.

The latest total annual greenhouse gas emissions for NSW reported by the Australian Government's Department of the Environment was 154.7 million tCO_2e for 2011-12 The estimated emissions associated with Stage 1 Demolition and the Project are 0.06% of the total greenhouse gas emissions for NSW, taking into account scope 1, 2 and 3 emissions associated with the Project.

When the Smelter was fully operational (in 2011-12), the annual GHG emissions generated (of 2,963,825 tCO_2e) represented approximately 1.92% of the total annual GHG emissions for NSW (in 2011-12).

The emissions intensity (per unit of production) is assumed to relate to emissions from a manufacturing/production operation (e.g. an operational Smelter). As there are currently no manufacturing operations at the site and the EIS relates to demolition, construction and remediation related activities, determination of an emissions intensity (based on per unit of production) is not possible.

5. GHG EMISSIONS MITIGATION

Hydro is committed to identifying climate change risks at the design stage of the Project and mitigating these potential risks.

The following describes the design and operational management measures proposed to minimise energy usage and greenhouse gas emissions from the Project.

5.1 Containment Cell

Emissions associated with the on-site waste encapsulation represent the largest contributor to Project emissions at 70%. To minimise the release of methane gas from the Containment Cell and during material placement activities, Hydro would design the cell to minimise the potential for emissions leakage from the cell structure and require stringent construction quality control measures are in place. Management processes would be implemented during material placement activities to reduce the exposure of the waste material to moisture which can result in increased generation of methane emissions. Cover material would be used to protect the waste material from moisture exposure during the stockpiling, transport and placement of waste materials.

5.2 Office and Contractor Compounds

It is estimated that electricity consumption during the Project by office areas, contractor compounds, and for temporary lighting would contribute 19% of total emissions. Energy use savings can be made through installing energy efficient equipment, where appropriate, such as:

- Using light emitting dioxide (LED) lighting in offices, contractor compounds and for temporary site lighting.
- Specifying energy efficient inverter split system units be installed in contractor compounds and timers set so that air conditioning systems are switched off after hours.

In addition, personnel would be instructed to turn off lights and office equipment when these are not in use such as before and after the working day.

5.3 Fuel for Equipment and Transport

Fuel consumption by on-site equipment and machinery, transport of these items, removal of waste material and personnel travelling to the Smelter is estimated to contribute 11% of total emissions.

The consumption of fuel is a necessary requirement of the Project, however, a reduction in the quantity of fuel consumed, in particular diesel for on-site use, may be achievable through optimisation of construction activities and logistics. Optimisation of these activities may reduce the number of vehicles and/or trips required. This optimisation will 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 equipment and vehicles. Newer vehicle and equipment models are typically more fuel efficient than older models. The use of more recent vehicles and equipment models would be considered in the detailed project design, where possible.

The most significant greenhouse gas mitigation option for fuel related emissions would be the use of biodiesel, rather than conventional diesel. Biodiesel blends have 90% of the energy content and <1% of diesel's emission factor. The potential for use of these alternative, low GHG emission fuels in its equipment schedule would be investigated by Hydro and discussed with contractors.

There is an opportunity for a small emissions reduction associated with petrol consumption for travel by personnel to and from the Smelter by encouraging carpooling. Hydro would encourage carpooling in the Project site induction.

6. CONCLUSIONS

A greenhouse gas assessment was undertaken for the Project that takes into account the Project and Stage 1 Demolition. This included: an assessment of on-site fuel consumption; electricity imported to the Project site; energy used for the transportation of major construction materials and equipment to site and waste from site; and the encapsulation of waste material in an on-site Containment Cell.

Greenhouse gas emissions were estimated as 86,015 tCO_2e, comprising 2,423 tCO_2e for Stage 1 Demolition and 83,592 tCO_2e for the Project. These included 65,621 tCO_2e Scope 1 emissions, 19,729 tCO_2e Scope 2 emissions and 664 tCO_2e Scope 3 emissions. On-site waste encapsulation is estimated to contribute 64% of total emissions, electricity consumption 23% and fuel use on-site and for transport 13% of total emissions.

A number of design and operational management measures have been incorporated into the Project to provide efficient use of energy and to reduce greenhouse gas emissions from the Project. Measures include optimising Containment Cell design to reduce emissions leakage from the cell structure and implementing stringent quality control during cell construction, covering waste material during stockpiling and transport to reduce exposure to moisture and generation of methane; selection of energy efficient lighting, hand-held and heavy equipment and machinery, and air conditioning systems; optimising construction activities and logistics to reduce fuel consumption; and consideration of the use of low greenhouse gas emission fuels (such as biodiesel) in the equipment schedule.

During the fully operational period of the Smelter in 2011-12, the GHG emissions generated by the Smelter (i.e. 2,963,825 tCO_2e) were approximately 1.92% of the total GHG emissions for NSW (i.e. 154.7 million tCO_2e). The estimated GHG emissions from Stage 1 Demolition and the Project (of 86,015tCO_2e) would represent 0.06% of the total NSW emissions which is a significant reduction from those associated with the Smelter when it was operational and demonstrates a reduction in the GHG emissions released to the environment. The estimated emissions generated from the Stage 1 Demolition and Project are minor when considered on a state and nation-wide basis and potential impacts to the environment are unlikely to be significant when considered in this regional context.

7. REFERENCES

Australian Department of the Environment, 2014: National Greenhouse and Energy Reporting (Measurement) Determination 2008, July 2014.

Australian Department of the Environment, 2014: National Greenhouse and Energy Reporting (Measurement) Determination 2008, Technical Guidelines, July 2014

Australian Department of the Environment, 2014: National Greenhouse Accounts Factors, December 2014.

Caterpillar Performance Handbook, Edition 44, 2014

ENVIRON Australia Pty Ltd, 2014: Former Kurri Kurri Aluminium Smelter, Preliminary Environmental Assessment, August 2014, Project Number AS130349.

NSW Department of Environment & Heritage: About Climate Change in NSW, NSW Emissions. Accessed 27 March 2015. http://www.climatechange.environment.nsw.gov.au/About-climate-change-in-NSW/NSW-emissions

Mobile Screening and Crushing (MSC) Group of Companies: Pegson Premiertrak mobile crushing plant. http://www.msc.net.au/pegson-premier.html

WRI and WBCSD, 2004: World Resources Institute and World Business Council for Sustainable Development: GHG Protocol Corporate Accounting and Reporting Standard (revised).

8. LIMITATIONS

Ramboll Environ Australia prepared this report in accordance with the scope of work as outlined in our proposal to Hydro Aluminium Kurri Kurri Pty Ltd dated 28 October 2014 and in accordance with our understanding and interpretation of current regulatory standards.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and Ramboll Environ disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent Ramboll Environ's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll Environ's knowledge as at the date of the assessment.

Ramboll Environ did not independently verify all of the written or oral information provided to Ramboll Environ during the course of this investigation. While Ramboll Environ has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll Environ was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

8.1 User Reliance

This report has been prepared exclusively for Hydro Aluminium Kurri Kurri Pty Ltd and may not be relied upon by any other person or entity without Ramboll Environ's express written permission.