APPENDIX F
COMPARATIVE GREENHOUSE GAS EMISSIONS ASSESSMENT

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Hydro Aluminium Kurri Kurri Pty Ltd

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RAMBOLL

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Description	**Ramboll Environ Australia Pty Ltd has prepared this Comparative GHG Emissions Assessment (CGHGA) as supporting information for the Capped Waste Stockpile Waste Management Options Evaluation Study at the request of Hydro Aluminium Kurri Kurri.**

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1. INTRODUCTION

This Comparative Greenhouse Gas Assessment (CGHGA) has been prepared by Ramboll Environ Australia Pty Ltd (Ramboll Environ) on behalf of Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to inform a Capped Waste Stockpile Waste Management Options Analysis (the Management Options Analysis) for submission to the Environmental Protection Authority (EPA). This CGHGA was prepared to assess the greenhouse gas (GHG) emissions from the identified Management Options for the Capped Waste Stockpile (CWS) at the former Hydro Aluminium Kurri Kurri aluminium smelter at Hart Road Loxford (the Smelter).

1.1 Background

The objective of the Management Options Analysis relevant to this CGHGA is to prepare a report for submission to the EPA that provides a detailed assessment of the options considered for the management of the wastes within the CWS (the Management Options).

The rational for, and background to, the identified Management Options is detailed in **Section 2** and **Section 3** of the Management Options Analysis. Six options (Management Options 2 to 7) have been identified for the management of the wastes within the CWS and for comparison against a do nothing scenario. These Management Options are the subject of the Management Options Analysis and this CGHGA. A brief description of each of the CWS Management Options is provided in **Table F1.1**.

Table F1.1: Capped Waste Stockpile Waste Management Options

Option	Description	Outline
Do Nothing	CWS remains *in situ*	The CWS would remain in its current location, with no improvement works. Ongoing groundwater, leachate and gas monitoring would occur at the CWS. Visual inspections would also be required to identify any faults in the capping layer. Long-term management and maintenance would comprise vegetation cover maintenance such as mowing, weed and tree/deep rooted plant removal and cap repairs as required.
2	Containment Cell	Removal of the CWS and onsite transport of materials for placement in an onsite Containment Cell. This would involve ongoing long term monitoring and maintenance of the Containment Cell for leachate, gas and any visual changes.
3	Sorting of Recyclables from the CWS and Treatment of Non-Recyclables Placed in Containment Cell	Removal of the CWS and onsite transport of materials for placement in an onsite Containment Cell. Potentially recyclable materials from the CWS (steel and carbon) would be sorted, cleaned, validated and make available for recycling. Non-recyclable materials from the CWS would be crushed prior to being treated to comply with the Chemical Control Order (CCO) and placement in the onsite Containment Cell. The ongoing maintenance and monitoring of the onsite Containment Cell would be as per Management Option 2.
4	Treatment of All Material within Containment Cell	Removal of the CWS and placement of all materials in the onsite Containment Cell with layers of lime interlayered with the placed CWS material. This option does not include any recycling or sorting of material. The ongoing maintenance and monitoring of the onsite Containment Cell would be as per Management Option 2.
5	Offsite Disposal of CWS to Licensed Waste Facility in NSW	Removal of the CWS, separation of the steel for cleaning and recycling and transport of the remaining waste offsite to a licensed waste management facility/facilities in NSW. Treatment to comply with the COO would occur at the receiving facility. There would be ongoing maintenance and monitoring at the receiving waste management facility/facilities.
6	Offsite Disposal of CWS to Salt Mine	Removal of the CWS material, separation of the steel for cleaning and recycling and heat treatment of the remaining material to 600 °C (in an onsite purpose built facility) prior to transportation offsite via road and rail to a salt mine in the Northern Territory. The receiving facility would dispose of the CWS material without further treatment. There would be ongoing maintenance and monitoring at the receiving waste management facility.
7	Onsite Destruction (Plasma Gasification) of CWS Material	Removal of the CWS material, separation of the steel for cleaning and recycling with the remaining waste material being subject to an onsite plasma gasification process to remove fluorides and cyanides. By-products of the plasma gasification process would include vitrified rock (slag) and elemental metal which would theoretically be suitable for a beneficial re-use.

1.2 Comparative Greenhouse Gas Assessment Objective

The purpose of this CGHGA is to assist Hydro in comparatively assessing the GHG emissions arising from the utilisation of any of the seven assessed management options identified for the CWS.

The objective of this CGHGA is to assess the potential GHG emissions associated with each of the Management Options, including estimation of lifecycle emissions where significant.

In addition to considering the GHG emissions associated with the tasks and activities that are required to be undertaken as part of the Option, the CGHGA also assesses the GHG emissions associated with potential tasks or events associated with the Management Options which have a lower probability of occurring. For example, a truck turnover spilling contaminated load on public road or a minor or major cap repair. For the purpose of the Management Options Analysis these are known as 'alternative scenarios'.

1.3 Comparative Greenhouse Gas Assessment Methodology

The CGHGA 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 and Technical Guidelines, 2016, Australian Department of the Environment.

These are considered to represent current good practice in Australian GHG 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.

Within Australia, the National Greenhouse and Energy Reporting System (NGERS) (Act, Regulations, Determination and guidance documents) provides the reporting standard for how large emitters and provides guidance on how emissions should be calculated by Australian companies, including methods for collating activity data, selecting fuel energy content and emissions factors, calculating emissions and estimating uncertainty. NGERS has been designed to be consistent with the GHG Protocol. While the greenhouse gas assessment has not be prepared in full compliance with NGERS, it adheres to the estimation methods and approach and uses the emissions factors defined in the most recent iteration of the Determination.

The National Greenhouse Accounts (NGA) Factors is prepared by the Department of the Environment and is designed for use by companies and individuals to estimate GHG emissions. The NGA Factors are not published for the purposes of reporting under the NGER Act 2007 but have general application to the estimation of a broad range of GHG emissions inventories. The default emission factors listed in the NGA Factors have been estimated using the Australian Greenhouse Emissions Information Systems (AGEIS).

1.4 Scope

The assessment accounts for all significant scope 1 and 2 emissions sources associated with each of the Management Options. This is primarily related to fuel use (for transport and stationary purposes) and electricity (in the case of the Management Option 7). A number of immaterial emission sources are acknowledged in the assumptions but excluded from the analysis.

Under Australian GHG reporting legislation and international GHG standards, the identification of Scope 3 emissions is (in general) not mandatory, as reporting of Scope 3 emissions is essentially accounting for emissions which another entity (the primary emitter) would also be accounting for. However, as part of the GHG assessment of various Management Options, significant sources of Scope 3 GHG emissions associated with upstream and downstream activities of the Project have been considered, particularly in relation to steel and carbon recycling in order to facilitate the comparative analysis of potential emissions between the six Management Options and the do nothing scenario.

For the purposes of this assessment, the time period is the period of active operation by Hydro and contractors to dispose of the waste under each Management Option, as well as any ongoing monitoring (for a period of 5 years) and maintenance (for a period of 30 years) associated with Smelter Site remediation and leachate/groundwater treatment.

1.5 Approach

The overall approach taken for the work included:

- Mapping the activities associated with each Management Option
- Estimating the basic GHG metrics and applying assumptions for the key activities
- Estimating the quantities consumed for inputs to each activity
- Calculating the emissions for each activity by applying relevant conversion and emissions factors to the consumption quantities

GHG emissions in this assessment have been quantified by calculation (rather than direct measurement) by applying emissions factors to estimated quantities. Quantities of fuel, electricity and waste (i.e. activity data) were estimated based on concept design quantities for the Options Study. Emission factors for electricity, diesel, petrol and natural gas were obtained from the 2016 NGER Measurement Determination. When data was unavailable, assumptions and approximations were made to obtain a reasonable estimate of activity data and emission factors. If factors have been sourced elsewhere, the source reference has been provided in this report.

Information was provided by Hydro Aluminium in relation to the SPL disposal volume and typical vehicle types used on-site. Regain provided information on the Regain process and a life cycle assessment of this process.

2. KEY ASSUMPTIONS

Key assumptions for the GHG assessment are outlined in the following section and emissions inventories are provided for each Management Option in **Appendix F1**.

2.1 Emissions Factors

Emission factors for electricity, diesel, petrol and natural gas were obtained from the 2016 NGER Measurement Determination.

2.2 Direct Emissions from Waste (Off-gassing/landfill emissions)

An emission factor for the direct emission from spent pot lining in a landfill was not readily available. In the GHG assessment completed for the Stage 2 Demolition and Remediation Environmental Impact Assessment (Ramboll Environ, 2016), spent pot lining was assumed to be analogous to brick/construction waste for the purposes of calculating emissions from landfill. However, recent site monitoring for fugitive emissions of methane and carbon dioxide from the CWS is subsequently available and indicate that emissions are negligible, accounting for less than 1 tCO2e per year. Fugitive emissions from waste have therefore not been included in the accounting for the Management Options which would involve Do Nothing or containment of the waste in improved circumstances. This source is disregarded as immaterial.

2.3 Equipment

In collaboration with Hydro, Ramboll Environ developed a register of activities and equipment that was associated with each Management Option. Light/private vehicles were calculated by taking an average fuel efficiency for a range of common car types, which amounted to 8 L/100km. Emissions and fuel efficiency factors for heavy vehicles and equipment use has been obtained by researching manufacturer specifications and other publicly available sources of information. Assumptions have also been made in relation to whether the activity would require low, medium or high fuel consumption for those given equipment models, and the average speed of travel of vehicles (generally 70 km/hr on roads) in order to calculate emissions. Different models of equipment with differing fuel consumption may be used, depending on the contractors, and this would change the result. However, as equipment is relatively standard across many of the options (with the exception of certain options which utilise plasma technology or rotary kilns for carbon processing), the results are likely to be proportionally accurate - this emissions assessment is intended to be indicative of the relative scale of emissions between Management Options, rather than as a precise prediction for each individual option.

2.4 Waste Processing

For Management Option 3, emissions for carbon processing is based on a factor of 0.2 t CO2e/tonne quoted by Regain (2014). This factor for the processing of SPL includes recovery, metal sorting, crushing and homogenising along with chemical processing to remove cyanide and explosive gas hazards such that the resultant processed carbon is safe to handle and use and is no longer considered 'hazardous waste' under the EPA's *Waste Classification Guideline* (2014).

For Management Option 6, all crushable waste is required to be heat treated in a rotary kiln to remove the potential for gas generation prior to transport to the salt mine. The Regain value of 0.2 t CO2e/tonne has been adopted as representative of this activity.

2.5 Carbon Recycling

Processed carbon can be substituted for coal as a source of energy to various industrial processes. As such, the emissions of the CWS carbon preparation were calculated and compared to the emissions of coal extraction to achieve a stockpile appropriate for beneficial use of the same calorific value. The calorific value of the available carbon and coal was calculated using the following assumptions:

- Calorific value of first cut spent pot lining is 14.6 – 16.3 GJ/tonne. Assumed 15.5 GJ/tonne
- Calorific value of anode carbon is approximately 20 GJ/tonne
- Calorific value of coal is between 21 and 27 GJ/tonne. Assumed 24 GJ/tonne

The total energy of the available carbon (18,500 tonnes of first cut spent pot lining and 30,000 tonnes of anode carbon) was calculated to be 886,750 GJ. Therefore, 36,947 tonnes of coal would be required to achieve the same energy output.

The per tonne emissions from extraction and processing of coal from five mines within the Hunter region was calculated from 2015-2016 annual reports to reach an 'average emissions of 1 tonne coal production'. The average emissions of 1 tonne of coal production was calculated to be to be 0.065 tCO2e/tonne. GHG emissions associated with the preparation of the available carbon from the CWS was assumed to be 0.2 tCO2e/tonne based on Regain's quoted 0.2tCO2e/tonne processing factor (Regain 2014). It was determined that the processing of the available carbon from the CWS rather than coal would result in the additional GHG emissions of 7,427 tCO2e. This was accounted for as a positive/emissions benefit within the assessment, as it represent potential emissions offsets from business-as-usual production. **Table F2.1** summarises the assumptions and calculations.

Table F2.1: Carbon Recycling Assumptions and Calculations

Product	Calorific Value	Total tonnage	Extraction/processing emission factor	Total emissions
CWS first cut spent pot lining	15.5 GJ/tonne	18,500	0.2 tCO2e/t	3,700 tCO2e
CWS anode carbon	20 GJ/tonne	30,000	0.2 tCO2e/t	6,000 tCO2e
Coal	24 GJ/tonne	36,947	0.065 tCO2e/t	2,427 tCO2e

2.6 Steel Recycling

For Management Options 3, 5, 6 and 7, emissions from processing of scrap steel in an Electric Arc Furnace (EAF) in an Australian context is estimated to be 1.12 tCO2e/tonne steel (direct and indirect emissions) (IGCC, 2007). It is assumed that scrap steel will be processed using an Electric Arc Furnace, which uses scrap steel as its primary input, rather than a Blast Furnace / Basic Oxygen Steel Making (BF/BOS) which uses iron ore as the primary input. BF/BOS steel production is considerably more greenhouse gas intensive than scrap-based EAF production – around 2.3 times the emissions of EAF per tonne of steel produced. The majority of emissions from BF/BOS production are direct (relating to coking coal, a necessary input in the chemical process of converting iron ore to pig iron), while the majority of emissions from scrap-based EAF production are indirect, associated with electricity consumption. However, GHG emissions intensity will vary depending on a number of factors including: the scale/efficiency of the blast furnace, extent to which waste heat is captured, type of steel products produced, proportion of scrap steel used, and location of the plant and corresponding emissions intensity of electricity. The lifecycle benefit associated with using scrap steel from commercial and industrial and construction and demolition sources in New South Wales is estimated to be 0.44 tCO2e/tonne (DECCW, 2010) or 2200 tCO2e in total for the 5000 tonnes of available steel. The above estimate is in the Australian context - a similar study (http://climate.columbia.edu/files/2012/04/GNCS-Iron-Steel.pdf) of US production estimated an EAF coefficient of 0.6 tCO2 per tonne of steel.

2.7 Train transportation

For Management Option 6, a freight rail emissions factor of 0.01 kgCO2e/tonne km travelled was sourced from Deloitte Access Economics (2011). The emissions calculation for this activity assumes 333,500 tonnes of material is moved via 334 train movements of 6,000 km each which accounts for the empty return trip.

2.8 Plasma Plant usage and efficiency

The plasma gasification plant has been assumed to have a rated power consumption of 7 MW/day based on information provided by a confidential company specialising in waste solutions. Further advice from the same company advises that in the case of spent pot lining (which represents 26% of the material that will be treated), there is an energy recovery/ efficiency of approximately 15%. This would result in the actual consumption of the plant being 6.7 MW/day.

2.9 Other immaterial sources

Emissions associated with the following were excluded from the GHG assessment as being immaterial to the assessment of total emissions:

- The consumption of gaseous fuels for demolition and construction activities (e.g. for welding/oxy cutting)
- Petroleum based oils and greases
- The operation of the water treatment plant
- The use of various hand operated equipment

3. FINDINGS

3.1 Management Options

The total GHG emissions for each of the Management Options was graphed. **Table F3.1** presents the total predicted emissions for each of the Management Options. **Figure F3-1** demonstrates that the transport component of Management Option 6 (that is, the train transportation of treated material to a salt mine in the Northern Territory, entailing 334 movements of over 6,000km each) far outweighs any other emissions source in the Options Study. However even in the instance where the transport component (3,342,157 t CO2e) is removed from Management Option 6, it remains 2.6 times larger than the second largest emission generating Management Option (being Management Option 3). This is as a result of the heat treatment process discussed in **Section 2.4**.

Table F3.1: Total Predicted Emissions for Management Options

Management Option		Total Emissions (t CO2e)
Do Nothing	CWS remains *in situ*	10
2	Containment Cell	8842
3	Sorting of recyclables from the CWS and treatment of non-recyclables to place in cell	43,519
4	Treatment of all material within Containment Cell	10,773
5	Offsite disposal to licenced waste facility in NSW	27,046
6	Offsite disposal to salt mine in the Northern Territory	3,420,300
7	Onsite destruction using plasma gasification	21,727

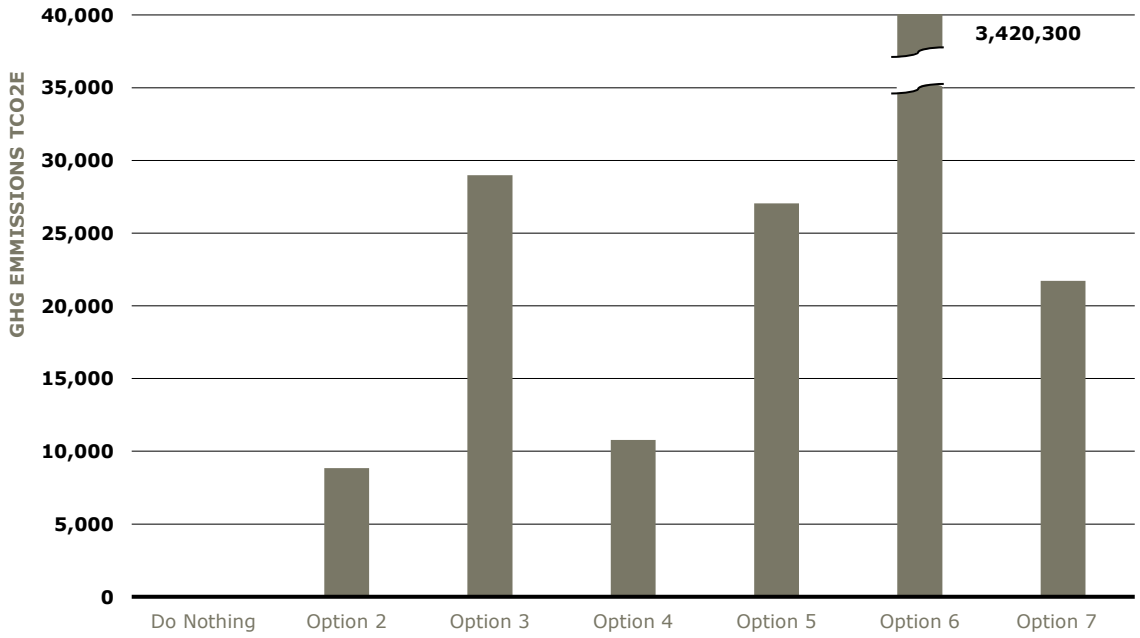

Figure F3-1: GHG Emissions Summary for Management Options

Do Nothing entails very minimal emissions, associated with monitoring and maintenance of the CWS.

Emissions from Management Options 2 and 4 (approximately 9-11 kt CO2e) are primarily from machinery onsite used for material removal and transport and construction of the Containment Cell.

Management Options 3, 5 and 7 (approximately20-30 kt) all involve emissions associated with treatment of the material (waste processing and steel recycling), as well as the lifecycle benefits which may accrue from this processing (that is, offset of emissions from business-as-usual production by using scrap steel or from avoided coal extraction). Management Option 5 also involves emissions associated with offsite heavy vehicle movements to transport the CWS waste material to an offsite licenced waste facility.

The carbon processing component of Management Option 3 is via the Regain treatment process (which would be classified as Scope 3), while Management Options 6 and 7 involves treatment via an onsite rotary kiln or plasma gasification plant (classified as Scope 2 due to the onsite diesel or electricity use).

In terms of the lifecycle emissions benefit, the avoided emissions from using scrap steel offsets approximately half of the emissions used in processing this steel, while additional emissions from processing the same calorific value of CWS carbon compared to Hunter Valley coal extraction are equal to 7,427 t CO2e, as described in **Section 2.5**.

3.2 Additional Scenarios

As discussed in **Section 1.2**, in addition to considering the hazards and risks associated with the tasks and activities that are required to be undertaken as part of the Management Option, Ramboll Environ and Hydro also identified future events that could occur during or following the Management Option. These events are referred to as 'Additional Scenarios' and were assigned a probability of occurring. For each Additional Scenario the associated emissions were determined. For example, a truck turnover spilling contaminated load on public road that may occur during the option; or a minor or major cap repair that could occur in the future. The Additional Scenarios which have been included within the assessments and their probability of occurring are presented within the Options Study. The results of the CGHGA including the assessment of the Additional Scenarios are presented in **Figure F3-2**.

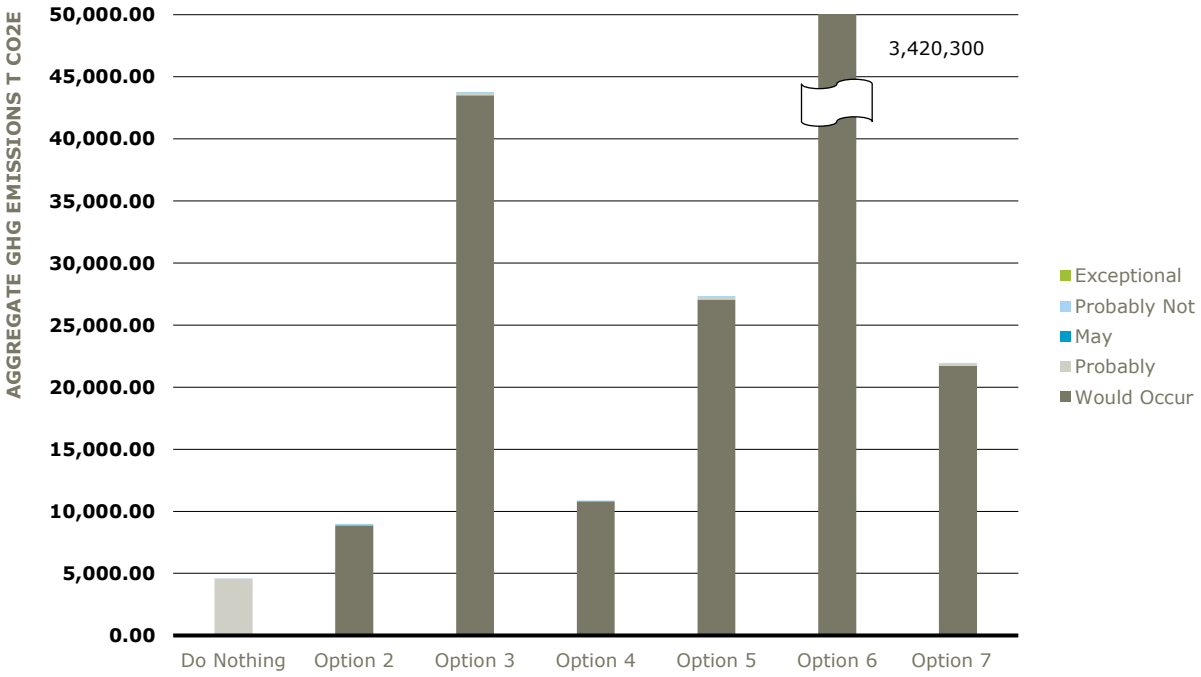

Figure F3-2: Aggregate GHG Emissions Summary for Management Options incorporating Additional Scenarios.

It can be seen from **Figure F3-2** that the Additional Scenarios do not alter the outcomes of the CGHGA nor do they have any material influence. This is mostly due to the short term and one off nature of the Additional Scenarios.

4. CONCLUSION

This CGHGA has been prepared by Ramboll Environ on behalf of Hydro to inform the Options Study for submission to the EPA.

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 (that is, activity data) were estimated based on concept design quantities for the Options Study. Emission factors for electricity, diesel, petrol and natural gas were obtained from the 2016 NGER Measurement Determination. When data was unavailable, assumptions and approximations were made to obtain a reasonable estimate of activity data and emission factors. If factors have been sourced elsewhere, the source reference has been provided in this report.

The outcome of the CGHGA identifies that the GHG emissions associated with the transport of the CWS waste material to a salt mine in the Northern Territory emits substantially more emissions than the sum total of any other Management Option. The nearest Management Option (Management Option 3) is predicted to emit only 13% of Management Option 6.

Further, the CGHGA also identified in the lifecycle assessment of the carbon from the CWS that the extraction and processing of coal for beneficial reuse results in additional GHG emissions of 7,427 t CO2e when compared to extraction of coal to the equivalent calorific value.

GHG emissions are predictably lowest for the Do Nothing Management Option followed by Management Option 2 which is closely followed by Management Option 4.

5. REFERENCES:

Department of Environment, Climate Change and Water NSW (DECCW), June 2010. *Environmental benefits of recycling*. http://www.epa.nsw.gov.au/resources/warrlocal/100058-benefits-of-recycling.pdf

Deloitte Access Economics, 2011. *The true value of rail*. The Australasian Railway Association. https://www.deloitteaccesseconomics.com.au/uploads/File/20110603%20-%20The%20True%20Value%20of%20Rail%20(Final).pdf

Investor Group on Climate Change (IGCC), 2007. *Potential Earnings Impacts from Climate Change - Steel Sector*. Monash University. http://www.igcc.org.au/resources/Documents/IGCC_Potential_Earnings_Impacts_from_Climate_Change_-_Steel_Sector.pdf

Randell Environmental Consulting, 2016. *Spent pot lining project (feasibility of an agreement based approach to clear stockpiles) - Final national summary report*. The Department of the Environment and Energy (DoEE).

Regain Technologies 2014a, *Considerations for Dealing with Spent Potlining.* Technical Paper for 11th Australasian Aluminium Smelting Technology Conference, available at http://www.regainmaterials.com/~/media/regain/files/cb112115technical-paper11aastcconsiderationsfordealingwithspentpotliningv10.pdf?la=en-gb

Regain Technologies 2014b, *Indicative Life Cycle Assessment of Regain Products which are Derived from By-products of the Kurri Kurri Smelter*. Version 111_163 v0.3B.

6. LIMITATIONS

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

The conclusions presented in this report represent Ramboll Environ's professional judgement 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 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.

6.1 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.

APPENDIX F1
EMISSIONS INVENTORY

Do Nothing

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Scope	Fuel Consumption (L/hr)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e)	Emissions (tCO2e)
1.1	**Monitoring**													
1.1.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	1	**8**	Quarterly for 5 years		**80**	0.64	2312.60	1480.07	1.48
			Hand held tools and equipment											
1.1.2	**Visual capping monitoring**	Visual inspections of the cap (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).												
1.1.3	**Leachate monitoring**	Compliance with current EPL conditions.												
1.1.4	**Gas monitoring**	Gas monitoring (quarterly) for ammonia and methane.												
1.2	**Long Term Management**													
1.2.1	**Maintenance activities (as required)**	Vegetation cover maintenance (mowing, weed and tree/ deep rooted plant removal)	Light Vehicles	1	Transport Petrol	1	**8**	Quarterly for 30 years		**480**	3.84	2312.60	8880.40	8.88
		Repairs and maintenance	Hand held tools and equipment											

10.36

Option 2 - Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
2.1	**Containment Cell Establishment and Construction**														
2.1.1	**Vegetation clearance**	Clearance of trees and shrubs (using ecologist as required)	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Grubbing (removal of remaining surface vegetation and roots)	Scraper/ Dozer	1	Transport Diesel	**60.9**			4	**20**	**160**	9.744	2721.69	26520.11	26.52
		Mulching of green waste for reuse on site or to be provided to green waste processors	30T Articulated Truck	1	Transport Diesel	**37.35**			4	**20**	**160**	5.976	2721.69	16264.80	16.26
			Mulching/ composting machine	1	Stationary Petrol	**60**			4	**20**	**160**	9.6	2318.76	22260.10	22.26
			Heavy Vehicle Movements	4	Transport Diesel	**18.75**	**70**	**280**			**4**	0.075	2721.69	204.13	0.20
			Light Vehicles	5	Transport Petrol	**8**	**1400**	**7000**			**100**	0.8	2312.60	1850.08	1.85
2.1.2	**Preparatory works**	Topsoil scraping and stockpiling (including transport to long term stockpile area)	Excavators	2	Transport Diesel	**35**			18	**90**	**1440**	50.4	2721.69	137172.97	137.17
		Excavation of non-containment cell subsurface materials and stockpiling (including wet weather cover, and transport of remainder to long term stockpile area)	Scraper/ Dozer	2	Transport Diesel	**60.9**			18	**90**	**1440**	87.696	2721.69	238680.98	238.68
		Installation of initial drainage and environmental controls, including water collection/ sump system and water treatment plant.	30T Articulated Truck	2	Transport Diesel	**37.35**			18	**90**	**1440**	53.784	2721.69	146383.16	146.38
		Excavation and construction of perimeter dish drain	Water Cart	1	Transport Diesel	**27**			18	**90**	**720**	19.44	2721.69	52909.58	52.91
			Heavy Vehicle Movements	7	Transport Diesel	**18.75**	**70**	**490**			**7**	0.13125	2721.69	357.22	0.36
			Light Vehicles	8	Transport Petrol	**8**	**6300**	**50400**			**720**	5.76	2312.60	13320.60	13.32
2.1.3	**Cell Base liner Construction**	As described in the Concept Design	Excavators	3	Transport Diesel	**35**			26	**130**	**3120**	109.2	2721.69	297208.11	297.21
			Loaders	3	Transport Diesel	**15.3**			26	**130**	**3120**	47.736	2721.69	129922.40	129.92
			Compactors	1	Transport Diesel	**20.8**			26	**130**	**1040**	21.632	2721.69	58875.51	58.88
			30T Articulated Truck	4	Transport Diesel	**37.35**			26	**130**	**4160**	155.376	2721.69	422884.68	422.88
			Water Cart	2	Transport Diesel	**27**			26	**130**	**2080**	56.16	2721.69	152849.89	152.85
			Machinery Service Vehicle	1	Transport Petrol	**8**			26	**130**	**1040**	8.32	2312.60	19240.87	19.24
			Backhoes	4	Transport Diesel	**21.9**			26	**130**	**4160**	91.104	2721.69	247956.48	247.96
			Heavy Vehicle Movements	820	Transport Diesel	**18.75**	**120**	**98400**			**1405.7143**	26.357143	2721.69	71735.87	71.74
			Light Vehicles	16	Transport Petrol	**8**	**9100**	**145600**			**2080**	16.64	2312.60	38481.73	38.48
2.2	**Capped Waste Stockpile Removal**														
2.2.1	**Site Establishment**	Installation of water treatment plant.	Backhoes	1	Transport Diesel	**21.9**			10	**50**	**400**	8.76	2721.69	23841.97	23.84
		Installation of water collection, pipes and pumping system.	Diesel Pump	1	Stationary Diesel	**6**			10	**50**	**400**	2.4	2709.72	6503.33	6.50
		Establishment of capped waste stockpile area.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Establishment of erosion and sediment control measures.	Light Vehicles	4	Transport Petrol	**8**	**3500**	**14000**			**200**	1.6	2312.60	3700.17	3.70
2.2.2	**Cap removal**	Removal of grass cover	Excavators	2	Transport Diesel	**35**			16	**80**	**1280**	44.8	2721.69	121931.53	121.93
		Removal and stockpiling of topsoil (to stockpile area).	Scraper/ Dozer	2	Transport Diesel	**60.9**			16	**80**	**1280**	77.952	2721.69	212160.87	212.16
		Removal and stockpiling of reusable clay layer for use at the containment cell.	30T Articulated Truck	4	Transport Diesel	**37.35**			16	**80**	**2560**	95.616	2721.69	260236.73	260.24
		Removal of remaining capping layers:	Water Cart	1	Transport Diesel	**27**			16	**80**	**640**	17.28	2721.69	47030.73	47.03
		Suitable material stockpiled for use as wet weather cover.	Hand held power tools and equipment	1											
		Remaining material transported for disposal at containment cell.	Heavy Vehicle Movements	9	Transport Diesel	**18.75**	**70**	**630**			**9**	0.16875	2721.69	459.28	0.46
			Light Vehicles	12	Transport Petrol	**8**	**5600**	**67200**			**960**	7.68	2312.60	17760.80	17.76
2.2.3	**Material removal**	Removal of recyclable waste materials:	Excavators	4	Transport Diesel	**35**			44	**220**	**7040**	246.4	2721.69	670623.43	670.62
		Removal of carbon materials (first cut spent pot lining and anodes) of greater than 500mm in size	Scraper/ Dozer	3	Transport Diesel	**60.9**			44	**220**	**5280**	321.552	2721.69	875163.58	875.16
		Removal of metals greater than 500mm in size	Water Cart	1	Transport Diesel	**27**			44	**220**	**1760**	47.52	2721.69	129334.52	129.33
		Transport material to cleaning/ storage shed.	Light Vehicles	8	Transport Petrol	**8**	**9100**	**72800**			**1040**	8.32	2312.60	19240.87	19.24
		Removal of non-recyclable materials and transport to the sorting area.													
		Removal of waste materials would cease in rain events and the temporary cover placed over the exposed waste.													

Option 2 - Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L / hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e / kL)	Emissions (kgCO2e / kL)	Emissions (tCO2e / kL)
		Excavation of natural materials affected by wastes and contaminants. Investigations to be undertaken of stockpile footprint to determine soils to be removed.													
		Removal and transportation of stockpiled wet weather cover material to the containment cell.													
		Material tracking system implemented throughout the removal process.													
		Placement and compaction of suitable material for filling of capped waste stockpile excavation void													
2.2.4	**Operate water treatment plant (installed as part of capped waste stockpile removal Key Task)**	Leachate and captured stormwater from capped waste stockpile during material removal to be pumped to and treated at the treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			64	**320**	**2560**	15.36	2709.72	41621.30	41.62
		Pumping and treatment of groundwater from below and surrounding the capped waste stockpile footprint.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Dam water treatment.	Light Vehicles	2	Transport Petrol	**8**	**3220**	**6440**			**92**	0.736	2312.60	1702.08	1.70
		Discharge of treated water to existing dam.													
		Groundwater monitoring.													
2.2.5	**Leachate pond removal at CWS**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
2.3	**Haul Road Maintenance**														
2.3.1	**Maintain the Haul Road surface condition**	Scraping and grading of the Haul Road surface	Excavators	1	Transport Diesel	**35**			82	**410**	**3280**	114.8	2721.69	312449.55	312.45
		Remove any major material spills along the haul road an transport the material to the Containment Cell for disposal	Scraper/ Dozer	1	Transport Diesel	**60.9**			82	**410**	**3280**	199.752	2721.69	543662.22	543.66
			Grader	1	Transport Diesel	**21.1**			82	**410**	**3280**	69.208	2721.69	188362.44	188.36
			30T Articulated Truck	1	Transport Diesel	**37.35**	**105**	**105**			**1.5**	0.056025	2721.69	152.48	0.15
			Light Vehicles	1	Transport Petrol	**8**	**105**	**105**			**1.5**	0.012	2312.60	27.75	0.03
2.4	**Containment Cell Material Placement and Capping**														
2.4.1	**Cell Material Acceptance and Placement**	Transportation of material to the cell	Excavators	3	Transport Diesel	**35**			44	**220**	**5280**	184.8	2721.69	502967.57	502.97
		Temporary material stockpiling	Compactors	2	Transport Diesel	**20.8**			44	**220**	**3520**	73.216	2721.69	199270.96	199.27
		Placement of materials in dedicated cell: demolition waste, contaminated soils and capped waste stockpile materials.	30T Articulated Truck	4	Transport Diesel	**37.35**			44	**220**	**7040**	262.944	2721.69	715651.00	715.65
		Cover placed material in the event of predicted rainfall and/ or strong winds.	Light Vehicles	2	Transport Petrol	**8**	**2200**	**4400**			**62.857143**	0.5028571	2312.60	1162.91	1.16
		Material tracking and quantifying/ survey of placed material.	Water Cart	2	Transport Diesel	**27**			44	**220**	**3520**	95.04	2721.69	258669.04	258.67
2.4.2	**Operate water treatment infrastructure at the Containment Cell**	Installation of water treatment plant.	Hand held power tools and equipm	1											
		Operation and maintenance of water collection/ sump system and water treatment plant.	Diesel pump	1	Stationary Diesel	**6**			56	**280**	**2240**	13.44	2709.72	36418.64	36.42
		Captured water pumped to water treatment plant.	Tanks and ancillary pipework												
			Heavy Vehicle Movements	1	Transport Diesel	**18.75**	**70**	**70**			**1**	0.01875	2721.69	51.03	0.05
			Light Vehicles	2	Transport Petrol	**8**	**260**	**520**			**7.4285714**	0.0594286	2312.60	137.43	0.14
2.4.3	**Leachate pond removal at Containment Cell**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74

Option 2 - Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
2.4.4	**Haul road surface scrape**	Scraping top xx mm of haul road for placement within the Containment Cell prior to closure	Scraper/ Dozer	2	Transport Diesel	**60.9**			4	**20**	**320**	19.488	2721.69	53040.22	53.04
			30T Articulated Truck	1	Transport Diesel	**37.35**			4	**20**	**160**	5.976	2721.69	16264.80	16.26
			Water Cart	1	Transport Diesel	**27**			4	**20**	**160**	4.32	2721.69	11757.68	11.76
			Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**			4	**20**	**320**	2.56	2312.60	5920.27	5.92
2.4.5	**Containment Cell Cap Construction**	As described in the Concept Design	Excavators	2	Transport Diesel	**35**			50	**130**	**2080**	72.8	2721.69	198138.74	198.14
			Compactors	2	Transport Diesel	**20.8**			50	**130**	**2080**	43.264	2721.69	117751.02	117.75
			Scraper/ Dozer	2	Transport Diesel	**60.9**			50	**130**	**2080**	126.672	2721.69	344761.41	344.76
			Grader	1	Transport Diesel	**21.1**			50	**130**	**1040**	21.944	2721.69	59724.68	59.72
			30T Articulated Truck	2	Transport Diesel	**37.35**			50	**130**	**2080**	77.688	2721.69	211442.34	211.44
			Water Cart	1	Transport Diesel	**27**			50	**250**	**2000**	54	2721.69	146971.04	146.97
			Hand held tools and equipment	1											
			Diesel pump	1	Stationary Diesel	**6**			50	**130**	**1040**	6.24	2709.72	16908.65	16.91
			Bobcat	3	Transport Diesel	**11.4**			60	**132**	**3168**	36.1152	2721.69	98294.23	98.29
			Heavy Vehicle Movements	830	Transport Diesel	**18.75**	**120**	**99600**			**1422.8571**	26.678571	2721.69	72610.69	72.61
			Light Vehicles	14	Transport Petrol	**8**	**9100**	**127400**			**1820**	14.56	2312.60	33671.51	33.67
2.5	**Post Works Activities**														
2.5.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85
2.6	**Operation/ Post-Completion Phase Activities**														
2.6.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	**8**					**80**	0.64	2312.60	1480.07	1.48
2.6.2	**Undertake monitoring of the Containment Cell**	Visual inspections of the cap (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).													
		Leachate inspections (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).													
		Gas monitoring (quarterly) for ammonia and methane.													
2.6.3	**Maintenance activities (as required)**	Vegetation cover maintenance (weed and tree/ deep rooted plant removal)	Light Vehicles	1	Transport Petrol	**8**					**480**	3.84	2312.60	8880.40	8.88
		Water treatment plant servicing/ maintenance (in accordance with manufacturer's requirements)	Hand held power tools and equipment												
2.6.4	**Leachate treatment**	Captured leachate pumped to water treatment plant and treated; OR	Light Vehicles	1	Transport Petrol	**8**					**480**	3.84	2312.60	8880.40	8.88
		Captured leachate pumped to truck for off-site treatment and disposal.	Hand held power tools and equipment												
			Wastewater truck	1	Transport Diesel	**27**					**480**	12.96	2721.69	35273.05	35.27

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Option 3 - Sorting of recyclables from the CWS and treatment of Non - recyclables to place in onsite Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled per movement (km)	Total Distance (km)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
3.1	**Containment Cell Establishment and Construction**														
3.1.1	**Vegetation clearance**	Clearance of trees and shrubs (using ecologist as required)	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Grubbing (removal of remaining surface vegetation and roots)	Scraper/ Dozer	1	Transport Diesel	**60.9**			4	**20**	**160**	9.744	2721.69	26520.11	26.52
		Mulching of green waste for reuse on site or to be provided to green waste processors	30T Articulated Truck	1	Transport Diesel	**37.35**			4	**20**	**160**	5.976	2721.69	16264.80	16.26
			Mulching/ composting machine	1	Stationary Petrol	**60**			4	**20**	**160**	9.6	2318.76	22260.10	22.26
			Heavy Vehicle Movements	4	Transport Diesel	**18.75**	**70**	**280**			**4**	0.075	2721.69	204.13	0.20
			Light Vehicles	5	Transport Petrol	**8**	**1400**	**7000**			**100**	0.8	2312.60	1850.08	1.85
3.1.2	**Preparatory works**	Topsoil scraping and stockpiling (including transport to long term stockpile area)	Excavators	2	Transport Diesel	**35**			18	**90**	**1440**	50.4	2721.69	137172.97	137.17
		Excavation of non-containment cell subsurface materials and stockpiling (including wet weather cover, and transport of remainder to long term stockpile area)	Scraper/ Dozer	2	Transport Diesel	**60.9**			18	**90**	**1440**	87.696	2721.69	238680.98	238.68
		Installation of initial drainage and environmental controls, including water collection/ sump system and water treatment plant.	30T Articulated Truck	2	Transport Diesel	**37.35**			18	**90**	**1440**	53.784	2721.69	146383.16	146.38
		Excavation and construction of perimeter dish drain	Water Cart	1	Transport Diesel	**27**			18	**90**	**720**	19.44	2721.69	52909.58	52.91
			Heavy Vehicle Movements	7	Transport Diesel	**18.75**	**70**	**490**			**7**	0.13125	2721.69	357.22	0.36
			Light Vehicles	8	Transport Petrol	**8**	**6300**	**50400**			**720**	5.76	2312.60	13320.60	13.32
3.1.3	**Cell Base liner Construction**	As described in the Concept Design	Excavators	3	Transport Diesel	**35**			26	**130**	**3120**	109.2	2721.69	297208.11	297.21
			Loaders	3	Transport Diesel	**15.3**			26	**130**	**3120**	47.736	2721.69	129922.40	129.92
			Compactors	1	Transport Diesel	**20.8**			26	**130**	**1040**	21.632	2721.69	58875.51	58.88
			30T Articulated Truck	4	Transport Diesel	**37.35**			26	**130**	**4160**	155.376	2721.69	422884.68	422.88
			Water Cart	2	Transport Diesel	**27**			26	**130**	**2080**	56.16	2721.69	152849.89	152.85
			Machinery Service Vehicle	1	Transport Petrol	**8**			26	**130**	**1040**	8.32	2312.60	19240.87	19.24
			Backhoes	4	Transport Diesel	**21.9**			26	**130**	**4160**	91.104	2721.69	247956.48	247.96
			Heavy Vehicle Movements	820	Transport Diesel	**18.75**	**120**	**98400**			**1405.714**	26.357143	2721.69	71735.87	71.74
			Light Vehicles	16	Transport Petrol	**8**	**9100**	**145600**			**2080**	16.64	2312.60	38481.73	38.48
3.2	**Capped Waste Stockpile Removal**														
3.2.1	**Site Establishment**	Installation of water treatment plant.	Backhoes	1	Transport Diesel	**21.9**			10	**50**	**400**	8.76	2721.69	23841.97	23.84
		Installation of water collection, pipes and pumping system.	Diesel Pump	1	Stationary Diesel	**6**			10	**50**	**400**	2.4	2709.72	6503.33	6.50
		Establishment of capped waste stockpile area.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Establishment of erosion and sediment control measures.	Light Vehicles	4	Transport Petrol	**8**	**3500**	**14000**			**200**	1.6	2312.60	3700.17	3.70
3.2.2	**Cap removal**	Removal of grass cover	Excavators	2	Transport Diesel	**35**			169	**169**	**2704**	94.64	2721.69	257580.36	257.58
		Removal and stockpiling of topsoil (to stockpile area).	Scraper/ Dozer	2	Transport Diesel	**60.9**			169	**169**	**2704**	164.6736	2721.69	448189.83	448.19
		Removal and stockpiling of reusable clay layer for use at the containment cell.	30T Articulated Truck	4	Transport Diesel	**37.35**			169	**169**	**5408**	201.9888	2721.69	549750.09	549.75
		Removal of remaining capping layers:	Water Cart	1	Transport Diesel	**27**			169	**845**	**6760**	182.52	2721.69	496762.13	496.76

Option 3 - Sorting of recyclables from the CWS and treatment of Non - recyclables to place in onsite Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled per movement (km)	Total Distance (km)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
		Suitable material stockpiled for use as wet weather cover.	Hand held power tools and equipment	1											
		Remaining material transported for disposal at containment cell.	Heavy Vehicle Movements	9	Transport Diesel	**18.75**	**70**	**630**			**9**	0.16875	2721.69	459.28	0.46
			Light Vehicles	12	Transport Petrol	**8**	**1120**	**13440**			**192**	1.536	2312.60	3552.16	3.55
3.2.3	**Material removal and sort**	Removal of recyclable waste materials:	Excavators	4	Transport Diesel	**35**			169	**169**	**5408**	189.28	2721.69	515160.73	515.16
		Removal of carbon materials (first cut spent pot lining and anodes) of greater than 500mm in size	Scraper/ Dozer	3	Transport Diesel	**60.9**			169	**169**	**4056**	247.0104	2721.69	672284.75	672.28
		Removal of metals greater than 500mm in size	Water Cart	1	Transport Diesel	**27**			169	**169**	**1352**	36.504	2721.69	99352.43	99.35
		Transport material to cleaning/ storage shed.	Light Vehicles	8	Transport Petrol	**8**	**11830**	**94640**			**1352**	10.816	2312.60	25013.12	25.01
		Removal of non-recyclable materials and transport to the sorting area.	Wash-down bay	1	Stationary Diesel	**15**			169	**845**	**6760**	101.4	2709.72	274765.61	274.77
		Removal of waste materials would cease in rain events and the temporary cover placed over the exposed waste.													
		Excavation of natural materials affected by wastes and contaminants. Investigations to be undertaken of stockpile footprint to determine soils to be removed.													
		Removal and transportation of stockpiled wet weather cover material to the containment cell.													
		Material tracking system implemented throughout the removal process.													
		Placement and compaction of suitable material for filling of capped waste stockpile excavation void													
3.2.4	**Operate water treatment plant (installed as part of CWS removal).**	Leachate and captured stormwater from capped waste stockpile during material removal to be pumped to and treated at the treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			185	**925**	**7400**	44.4	2709.72	120311.57	120.31
		Pumping and treatment of groundwater from below and surrounding the capped waste stockpile footprint.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Dam water treatment.	Light Vehicles	2	Transport Petrol	**8**	**12950**	**25900**			**370**	2.96	2312.60	6845.31	6.85
		Discharge of treated water to existing dam.													
		Groundwater monitoring.													
3.2.5	**Leachate pond removal at CWS**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
3.3	**Recyclables Cleaning and Storage**														
3.3.1	**Carbon and carbon with embedded steel materials cleaning**	Approximately 48,500T of recyclable carbon material.	Excavators	2	Transport Diesel	**35**			177	**885**	**14160**	495.6	2721.69	1348867.58	1348.87
		High pressure cleaning of material to remove asbestos and other fines.	Wash-down bay	1	Stationary Diesel	**15**			177	**885**	**7080**	106.2	2709.72	287772.26	287.77
			Light Vehicles	4	Transport Petrol	**8**	**61950**	**247800**			**3540**	28.32	2312.60	65492.95	65.49

Option 3 - Sorting of recyclables from the CWS and treatment of Non - recyclables to place in onsite Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled per movement (km)	Total Distance (km)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
3.3.2	**Metals cleaning**	Approximately 5,000T of recyclable metal	Excavators	1	Transport Diesel	**35**			50	**250**	**2000**	70	2721.69	190518.02	190.52
			Wash-down bay	1	Stationary Diesel	**15**			50	**250**	**2000**	30	2709.72	81291.60	81.29
			Light Vehicles	4	Transport Petrol	**8**	**17500**	**70000**			**1000**	8	2312.60	18500.83	18.50
3.3.3	**Separation of Carbon from embedded metals**	Physical removal of steel from carbon	Excavators	1	Transport Diesel	**35**			66	**330**	**2640**	92.4	2721.69	251483.79	251.48
			Wash-down bay	1	Stationary Diesel	**15**			66	**330**	**2640**	39.6	2709.72	107304.91	107.30
3.3.4	**Final carbon clean (second clean) and store**	Cleaning as above, 48,500 T carbon	Excavators	1	Transport Diesel	**35**			162	**810**	**6480**	226.8	2721.69	617278.38	617.28
		Cleaned carbon to be transported for appropriatestorage.	Wash-down bay	1	Stationary Diesel	**15**			162	**810**	**6480**	97.2	2709.72	263384.78	263.38
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	**37.35**			5	**25**	**400**	14.94	2721.69	40661.99	40.66
			Light Vehicles	4	Transport Petrol	**8**	**56700**	**226800**			**3240**	25.92	2312.60	59942.70	59.94
3.3.5	**Final steel clean (second clean) and store**	Cleaning as above, 5,000T of separated steel	Excavators	1	Transport Diesel	**35**			50	**250**	**2000**	70	2721.69	190518.02	190.52
		Cleaned metals to be transported for storage adjacent to other stored metals.	Wash-down bay	1	Stationary Diesel	**15**			50	**250**	**2000**	30	2709.72	81291.60	81.29
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	**37.35**			1	**5**	**80**	2.988	2721.69	8132.40	8.13
			Light Vehicles	4	Transport Petrol	**8**	**17500**	**70000**			**1000**	8	2312.60	18500.83	18.50
3.4	**Recyclable Material Transport**														
3.4.1	**Load and Transport 48,500 tonnes of cleaned and crushed carbon to carbon processing facility**	Load 28,500 tonnes of carbon into 20 tonne articulated trucks	Excavators	4	Transport Diesel	**35**			162	**810**	**25920**	907.2	2721.69	2469113.54	2469.11
		Truck 28,500 tonnes of carbon to carbon recycling facility	Loaders	1	Transport Diesel	**15.3**			163	**815**	**6520**	99.756	2721.69	271504.51	271.50
			Light Vehicles	6	Transport Petrol	**8**	**11410**	**68460**			**978**	7.824	2312.60	18093.81	18.09
			Heavy Vehicle Movements	2425	Transport Diesel	**18.75**	**70**	**169750**			**2425**	45.46875	2721.69	123751.66	123.75
3.4.2	**Load and Transport 5,000 tonnes of cleaned steel to steel processing facility**	Load 5000 tonnes of steel into 30 T articulated trucks	Excavators	4	Transport Diesel	**35**			50	**250**	**8000**	280	2721.69	762072.08	762.07
		Truck 5,000 tonnes of steel to steel recycling facility	Loaders	1	Transport Diesel	**15.3**			50	**250**	**2000**	30.6	2721.69	83283.59	83.28
			Light Vehicles	4	Transport Petrol	**8**	**17500**	**70000**			**1000**	8	2312.60	18500.83	18.50
			Heavy Vehicle Movements	250	Transport Diesel	**18.75**	**70**	**17500**			**250**	4.6875	2721.69	12757.90	12.76
3.5	**Recyclable Material Processing**														
3.5.1	**Processing of 48,500 tonnes of cleaned and crushed carbon at a carbon processing facility**	This would generally include: initial crushing (where necessary); blending with other additives, as required; fine milling; thermal treatment; crushing and mixing (as required) and subsequent distribution to end markets.	Emissions for SPL processing (carbon component) is based on a factor of 0.2 t CO2e/tonne quoted by Regain, which includes all recovery, crushing etc. See 3.5.1.												9,700.00
3.5.2	**Processing of 5,000 tonnes of cleaned Steel at a steel processing facility**	Generally steel recycling involves breakdown of the steel into smaller blocks, melting in a furnace, purification, solidifying and transport of bars for use as raw material.	Emissions from processing of scrap steel in an EAF = 1.12 tCO2e/tonne steel (direct and indirect emissions) (see Factors tab)												5,600.00

Option 3 - Sorting of recyclables from the CWS and treatment of Non - recyclables to place in onsite Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled per movement (km)	Total Distance (km)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
3.6	**Non-Recyclable Material Sorting and Treating**														
3.6.1	**Transport untreated non-crushable/ non-recyclable material to the Containment Cell**	Transportation of removed materials would include:	Excavators	2	Transport Diesel	**35**			169	**169**	**2704**	94.64	2721.69	257580.36	257.58
		All truck loads are to be covered.	30T Articulated Truck	2	Transport Diesel	**37.35**			169	**169**	**2704**	100.9944	2721.69	274875.04	274.88
		Trucks transporting capped waste stockpile materials to have priority on haul road.	Light Vehicles	4	Transport Petrol	**8**	**11830**	**47320**			**676**	5.408	2312.60	12506.56	12.51
3.6.2	**Crushing of fines and crushable materials**	Jaw crushing/screening – to size fraction required for mixing (50-100T/hr)	Excavators	2	Transport Diesel	**35**			173	**865**	**13840**	484.4	2721.69	1318384.70	1318.38
		Pulverising to minus 10mm (5-10T/hr)	Diesel Pump	1	Stationary Diesel	**6**			173	**865**	**6920**	41.52	2709.72	112507.57	112.51
			Impact Crusher	1	Stationary Diesel	**35**			173	**865**	**6920**	242.2	2709.72	656294.18	656.29
			Tracked Stockpiler	1	Stationary Diesel	**9**			173	**865**	**6920**	62.28	2709.72	168761.36	168.76
			Wash-down bay	1	Stationary Diesel	**15**			173	**865**	**6920**	103.8	2709.72	281268.94	281.27
			Light Vehicles	3	Transport Petrol	**8**	**60550**	**181650**			**2595**	20.76	2312.60	48009.66	48.01
3.6.3	**Treatment Material Delivery**	Filling of trucks	Scraper/ Dozer	1	Transport Diesel	**60.9**			39	**195**	**1560**	95.004	2721.69	258571.06	258.57
		Transport of 50,000 tonnes lime	Heavy Vehicle Movements	2000	Transport Diesel	**18.75**	**610**	**1220000**			**17428.57**	326.78571	2721.69	889408.10	889.41
		Delivery and stockpiling of lime	Light Vehicles	1	Transport Petrol	**8**	**13650**	**13650**			**195**	1.56	2312.60	3607.66	3.61
3.6.4	**Calcium treating of fines and crushables**	Crushed material will be mixed with lime slurry in pug mill and transported directly for disposal in the containment cell. Batch process.	Excavators	1	Transport Diesel	**35**			144	**360**	**2880**	100.8	2721.69	274345.95	274.35
			Pug mill	1	Stationary Diesel	**29**			144	**360**	**2880**	83.52	2709.72	226315.81	226.32
			Wash-down bay	1	Stationary Diesel	**15**			144	**360**	**2880**	43.2	2709.72	117059.90	117.06
		Transport of pug mill componenets to Smelter Site	Heavy Vehicle Movements	6	Transport Diesel	**18.75**	**60**	**360**			**5.142857**	0.0964286	2721.69	262.45	0.26
			Light Vehicles	8	Transport Petrol	**8**	**50575**	**404600**			**5780**	46.24	2312.60	106934.81	106.93
3.6.5	**Transport treated fines and crushables to the Containment Cell**	Transportation of removed materials would include:	Excavators	2	Transport Diesel	**35**			144	**216**	**3456**	120.96	2721.69	329215.14	329.22
		Transportation to cease during rain events.	30T Articulated Truck	2	Transport Diesel	**37.35**			144	**216**	**3456**	129.0816	2721.69	351319.58	351.32
		All truck loads are to be covered.	Water Cart	1	Transport Diesel	**27**			144	**216**	**1728**	46.656	2721.69	126982.98	126.98
		Trucks transporting capped waste stockpile materials to have priority on haul road.	Light Vehicles	7	Transport Petrol	**8**	**20230**	**141610**			**2023**	16.184	2312.60	37427.18	37.43
3.7	**Haul Road Maintenance**														
3.7.1	**Maintain the Haul Road surface condition**	Scraping and grading of the Haul Road surface	Excavators	1	Transport Diesel	**35**			289	**11.115385**	**44.46154**	1.5561538	2721.69	4235.36	4.24
		Remove any major material spills along the haul road an transport the material to the Containment Cell for disposal	Scraper/ Dozer	1	Transport Diesel	**60.9**			289	**289**	**1156**	70.4004	2721.69	191607.78	191.61
			Grader	1	Transport Diesel	**21.1**			289	**289**	**1156**	24.3916	2721.69	66386.28	66.39
			30T Articulated Truck	1	Transport Diesel	**37.35**	**722.5**	**722.5**			**10.32143**	0.3855054	2721.69	1049.22	1.05
			Light Vehicles	1	Transport Petrol	**8**	**722.5**	**722.5**			**10.32143**	0.0825714	2312.60	190.96	0.19

Option 3 - Sorting of recyclables from the CWS and treatment of Non - recyclables to place in onsite Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled per movement (km)	Total Distance (km)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
3.8	**Containment Cell Material Placement and Capping**														
3.8.1	**Cell Material Acceptance and Placement**	Transportation of material to the cell	Excavators	3	Transport Diesel	**35**			186	**223.2**	**5356.8**	187.488	2721.69	510283.46	510.28
		Temporary material stockpiling	Compactors	2	Transport Diesel	**20.8**			186	**223.2**	**3571.2**	74.28096	2721.69	202169.45	202.17
		Placement of materials in dedicated cell: demolition waste, contaminated soils and capped waste stockpile materials.	30T Articulated Truck	4	Transport Diesel	**37.35**			186	**223.2**	**7142.4**	266.76864	2721.69	726060.47	726.06
		Cover placed material in the event of predicted rainfall and/ or strong winds.	Water Cart	2	Transport Diesel	**27**			186	**930**	**14880**	401.76	2721.69	1093464.57	1093.46
		Material tracking and quantifying/ survey of placed material.													
3.8.2	**Operate water treatment infrastructure at the Containment Cell**	Installation of water treatment plant.	Hand held power tools and	1											
		Operation and maintenance of water collection/ sump system and water treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			186	**930**	**7440**	44.64	2709.72	120961.90	120.96
		Captured water pumped to water treatment plant.	Tanks and ancillary pipewo	1											
			Heavy Vehicle Movements	1	Transport Diesel	**18.75**	**70**	**70**			**1**	0.01875	2721.69	51.03	0.05
			Light Vehicles	2	Transport Petrol	**8**	**13020**	**26040**			**372**	2.976	2312.60	6882.31	6.88
3.8.3	**Leachate pond removal**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
3.8.4	**Haul road surface scrape**	Scraping top xx mm of haul road for placement within the Containment Cell prior to closure	Scraper/ Dozer	2	Transport Diesel	**60.9**			4	**20**	**320**	19.488	2721.69	53040.22	53.04
			30T Articulated Truck	1	Transport Diesel	**37.35**			4	**20**	**160**	5.976	2721.69	16264.80	16.26
			Water Cart	1	Transport Diesel	**27**			4	**20**	**160**	4.32	2721.69	11757.68	11.76
			Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
3.8.5	**Containment Cell Cap Construction**	As described in the Concept Design	Excavators	2	Transport Diesel	**35**			26	**130**	**2080**	72.8	2721.69	198138.74	198.14
			Compactors	2	Transport Diesel	**20.8**			26	**130**	**2080**	43.264	2721.69	117751.02	117.75
			Scraper/ Dozer	2	Transport Diesel	**60.9**			26	**130**	**2080**	126.672	2721.69	344761.41	344.76
			Grader	1	Transport Diesel	**21.1**			26	**130**	**1040**	21.944	2721.69	59724.68	59.72
			30T Articulated Truck	2	Transport Diesel	**37.35**			26	**130**	**2080**	77.688	2721.69	211442.34	211.44
			Water Cart	1	Transport Diesel	**27**			26	**130**	**1040**	28.08	2721.69	76424.94	76.42
			Hand held tools and equip	1											
			Diesel Pump	1	Stationary Diesel	**6**			26	**130**	**1040**	6.24	2709.72	16908.65	16.91
			Heavy Vehicle Movements	830	Transport Diesel	**18.75**	**120**	**99600**			**1422.857**	26.678571	2721.69	72610.69	72.61
			Light Vehicles	14	Transport Petrol	**8**	**9100**	**127400**			**1820**	14.56	2312.60	33671.51	33.67

Option 3 - Sorting of recyclables from the CWS and treatment of Non - recyclables to place in onsite Containment Cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled per movement (km)	Total Distance (km)	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
3.9	**Post Works Activities**														
3.9.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85
3.1	**Operation/ Post-Completion Phase Activities**														
3.10.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	**8**					**80**	0.64	2312.60	1480.07	1.48
3.10.2	**Undertake monitoring of the Containment Cell**	Visual inspections of the cap (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).													
		Leachate inspections (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).													
		Gas monitoring (quarterly) for ammonia and methane.													
3.10.3	**Maintenance activities (as required)**	Vegetation cover maintenance (weed and tree/ deep rooted plant removal)	Light Vehicles	1	Transport Petrol	**8**					**480**	3.84	2312.60	8880.40	8.88
		Water treatment plant servicing/ maintenance (in accordance with manufacturer's requirements)	Hand held power tools and equipment												
3.10.4	**Leachate treatment**	Captured leachate pumped to water treatment plant and treated; OR	Light Vehicles	1	Transport Petrol	**8**					**480**	3.84	2312.60	8880.40	8.88
		Captured leachate pumped to truck for off-site treatment and disposal.	Hand held power tools and equipment												
			Wastewater truck	1	Transport Diesel	**27**					**480**	12.96	2721.69	35273.05	35.27
	Carbon Benefits														
	Processing of 5,000 tonnes of cleaned Steel at a steel processing facility	Lifecycle benefit associated with using scrap steel - Estimation of the net benefit of recycling 1 tonne of steel from commercial and industrial (C&I) and construction and demolition (C&D) sources in New South Wales (0.44 tCO2e/tonne)													(2,200.00)
	Processing of 48,500 tonnes of cleaned and crushed carbon at a carbon processing facility	Lifecycle benefit associated with using SPL rather than coal - estimation of lifecycle emission of the avoided emissions of an equivalent calorific value of coal being produced (see Factors tab).													7,272.77

43,519.56

Option 4 - Treatment of all material within the Containment cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
4.1	**Containment Cell Establishment and Construction**														
4.1.1	**Vegetation clearance**	Clearance of trees and shrubs (using ecologist as required)	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Grubbing (removal of remaining surface vegetation and roots)	Scraper/ Dozer	1	Transport Diesel	**60.9**			4	**20**	**160**	9.744	2721.69	26520.11	26.52
		Mulching of green waste for reuse on site or to be provided to green waste processors	30T Articulated Truck	1	Transport Diesel	**37.35**			4	**20**	**160**	5.976	2721.69	16264.80	16.26
			Mulching/ composting machine	1	Stationary Petrol	**60**			4	**20**	**160**	9.6	2318.76	22260.10	22.26
			Heavy Vehicle Movements	4	Transport Diesel	**18.75**	**70**	**280**			**4**	0.075	2721.69	204.13	0.20
			Light Vehicles	5	Transport Petrol	**8**	**1400**	**7000**			**100**	0.8	2312.60	1850.08	1.85
4.1.2	**Preparatory works**	Topsoil scraping and stockpiling (including transport to long term stockpile area)	Excavators	2	Transport Diesel	**35**			18	**90**	**1440**	50.4	2721.69	137172.97	137.17
		Excavation of non-containment cell subsurface materials and stockpiling (including wet weather cover, and transport of remainder to long term stockpile area)	Scraper/ Dozer	2	Transport Diesel	**60.9**			18	**90**	**1440**	87.696	2721.69	238680.98	238.68
		Installation of initial drainage and environmental controls, including water collection/ sump system and water treatment plant.	30T Articulated Truck	2	Transport Diesel	**37.35**			18	**90**	**1440**	53.784	2721.69	146383.16	146.38
		Excavation and construction of perimeter dish drain	Water Cart	1	Transport Diesel	**27**			18	**90**	**720**	19.44	2721.69	52909.58	52.91
			Heavy Vehicle Movements	7	Transport Diesel	**18.75**	**70**	**490**			**7**	0.13125	2721.69	357.22	0.36
			Light Vehicles	8	Transport Petrol	**8**	**6300**	**50400**			**720**	5.76	2312.60	13320.60	13.32
4.1.3	**Cell Base liner Construction**	As described in the Concept Design	Excavators	3	Transport Diesel	**35**			26	**130**	**3120**	109.2	2721.69	297208.11	297.21
			Loaders	3	Transport Diesel	**15.3**			26	**130**	**3120**	47.736	2721.69	129922.40	129.92
			Compactors	1	Transport Diesel	**20.8**			26	**130**	**1040**	21.632	2721.69	58875.51	58.88
			30T Articulated Truck	4	Transport Diesel	**37.35**			26	**130**	**4160**	155.376	2721.69	422884.68	422.88
			Water Cart	2	Transport Diesel	**27**			26	**130**	**2080**	56.16	2721.69	152849.89	152.85
			Machinery Service Vehicle	1	Transport Petrol	**8**			26	**130**	**1040**	8.32	2312.60	19240.87	19.24
			Backhoes	4	Transport Diesel	**21.9**			26	**130**	**4160**	91.104	2721.69	247956.48	247.96
			Heavy Vehicle Movements	820	Transport Diesel	**18.75**	**120**	**98400**			**1405.7143**	26.357143	2721.69	71735.87	71.74
			Light Vehicles	16	Transport Petrol	**8**	**9100**	**145600**			**2080**	16.64	2312.60	38481.73	38.48
4.2	**Capped Waste Stockpile Removal**														
4.2.1	**Site Establishment**	Installation of water treatment plant.	Backhoes	1	Transport Diesel	**21.9**			10	**50**	**400**	8.76	2721.69	23841.97	23.84
		Installation of water collection, pipes and pumping system.	Diesel Pump	1	Stationary Diesel	**6**			10	**50**	**400**	2.4	2709.72	6503.33	6.50
		Establishment of capped waste stockpile area.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Establishment of erosion and sediment control measures.	Light Vehicles	4	Transport Petrol	**8**	**3500**	**14000**			**200**	1.6	2312.60	3700.17	3.70
4.2.2	**Cap removal**	Removal of grass cover	Excavators	2	Transport Diesel	**35**			16	**80**	**1280**	44.8	2721.69	121931.53	121.93
		Removal and stockpiling of topsoil (to stockpile area).	Scraper/ Dozer	2	Transport Diesel	**60.9**			16	**80**	**1280**	77.952	2721.69	212160.87	212.16
		Removal and stockpiling of reusable clay layer for use at the containment cell.	30T Articulated Truck	4	Transport Diesel	**37.35**			16	**80**	**2560**	95.616	2721.69	260236.73	260.24
		Removal of remaining capping layers:	Water Cart	1	Transport Diesel	**27**			16	**80**	**640**	17.28	2721.69	47030.73	47.03
		Suitable material stockpiled for use as wet weather cover.	Hand held power tools and equipment	1											
		Remaining material transported for disposal at containment cell.	Heavy Vehicle Movements	9	Transport Diesel	**18.75**	**70**	**630**			**9**	0.16875	2721.69	459.28	0.46
			Light Vehicles	12	Transport Petrol	**8**	**5600**	**67200**			**960**	7.68	2312.60	17760.80	17.76
4.2.3	**Material removal**	Removal of recyclable waste materials:	Excavators	4	Transport Diesel	**35**			44	**220**	**7040**	246.4	2721.69	670623.43	670.62
		Removal of carbon materials (first cut spent pot lining and anodes) of greater than 500mm in size	Scraper/ Dozer	3	Transport Diesel	**60.9**			44	**220**	**5280**	321.552	2721.69	875163.58	875.16
		Removal of metals greater than 500mm in size	Water Cart	1	Transport Diesel	**27**			44	**220**	**1760**	47.52	2721.69	129334.52	129.33
		Transport material to cleaning/ storage shed.	Light Vehicles	8	Transport Petrol	**8**	**15400**	**123200**			**1760**	14.08	2312.60	32561.46	32.56
		Removal of non-recyclable materials and transport to the sorting area.													

Option 4 - Treatment of all material within the Containment cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
		Removal of waste materials would cease in rain events and the temporary cover placed over the exposed waste.													
		Excavation of natural materials affected by wastes and contaminants. Investigations to be undertaken of stockpile footprint to determine soils to be removed.													
		Removal and transportation of stockpiled wet weather cover material to the containment cell.													
		Material tracking system implemented throughout the removal process.													
		Placement and compaction of suitable material for filling of capped waste stockpile excavation void													
4.2.4	**Operate water treatment plant (installed as part of capped waste stockpile removal Key Task).**	Leachate and captured stormwater from capped waste stockpile during material removal to be pumped to and treated at the treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			64	**320**	**2560**	15.36	2709.72	41621.30	41.62
		Pumping and treatment of groundwater from below and surrounding the capped waste stockpile footprint.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Dam water treatment.	Light Vehicles	2	Transport Petrol	**8**	**4480**	**8960**			**128**	1.024	2312.60	2368.11	2.37
		Discharge of treated water to existing dam.													
		Groundwater monitoring.													
4.2.5	**Leachate pond removal at CWS**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
4.3	**Haul Road Maintenance**														
4.3.1	**Maintain the Haul Road surface condition**	Scraping and grading of the Haul Road surface	Excavators	1	Transport Diesel	**35**			82	**410**	**3280**	114.8	2721.69	312449.55	312.45
		Remove any major material spills along the haul road an transport the material to the Containment Cell for disposal	Scraper/ Dozer	1	Transport Diesel	**60.9**			82	**410**	**3280**	199.752	2721.69	543662.22	543.66
			Grader	1	Transport Diesel	**21.1**			82	**410**	**3280**	69.208	2721.69	188362.44	188.36
			30T Articulated Truck	1	Transport Diesel	**37.35**	**205**	**205**			**2.9285714**	0.1093821	2721.69	297.70	0.30
			Light Vehicles	1	Transport Petrol	**8**	**205**	**205**			**2.9285714**	0.0234286	2312.60	54.18	0.05
4.4	**Containment Cell Material Placement and Capping**														
4.4.1	**Cell Material Acceptance and Placement**	Transportation of material to the cell	Excavators	3	Transport Diesel	**35**			46	**230**	**5520**	193.2	2721.69	525829.74	525.83
		Temporary material stockpiling	Compactors	2	Transport Diesel	**20.8**			46	**230**	**3680**	76.544	2721.69	208328.73	208.33
		Placement of materials in dedicated cell: demolition waste, contaminated soils and capped waste stockpile materials.	30T Articulated Truck	4	Transport Diesel	**37.35**			46	**230**	**7360**	274.896	2721.69	748180.59	748.18
		Cover placed material in the event of predicted rainfall and/ or strong winds.	Light Vehicles	2	Transport Petrol	**8**			46	**230**	**3680**	29.44	2312.60	68083.06	68.08
		Material tracking and quantifying/ survey of placed material.													
4.4.2	**Treatment Material Delivery**	Filling of trucks	Scraper/ Dozer	1	Transport Diesel	**60.9**			52	**260**	**2080**	126.672	2721.69	344761.41	344.76
		Transport of 60,000 tonnes lime	Light Vehicles	1	Transport Petrol	**8**			52	**260**	**2080**	16.64	2312.60	38481.73	38.48
		Delivery and stockpiling of lime	Water Cart	1	Transport Diesel	**27**			52	**260**	**2080**	56.16	2721.69	152849.89	152.85
			30T Articulated Truck	1	Transport Diesel	**37.35**			46	**230**	**230**	8.5905	2721.69	23380.64	23.38
			Heavy Vehicle Movements	2400	Transport Diesel	**18.75**	**305**	**732000**			**10457.143**	196.07143	2721.69	533644.86	533.64
4.4.3	**Treatment Material Placement**	Treatment material (lime) added through placed waste material as part of the daily cover	Excavators	3	Transport Diesel	**35**			46	**230**	**5520**	193.2	2721.69	525829.74	525.83
			Scraper/ Dozer	1	Transport Diesel	**60.9**			46	**230**	**1840**	112.056	2721.69	304981.25	304.98
			Water Cart	1	Transport Diesel	**27**			46	**230**	**1840**	49.68	2721.69	135213.36	135.21
4.4.4	**Operate water treatment infrastructure at the Containment Cell**	Installation of water treatment plant.	Hand held power tools and	1											

Option 4 - Treatment of all material within the Containment cell

Action No.	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
		Operation and maintenance of water collection/ sump system and water treatment plant.	Diesel pump	1	Stationary Diesel	6			58	290	2320	13.92	2709.72	37719.30	37.72
		Captured water pumped to water treatment plant.	Tanks and ancillary pipework												
			Heavy Vehicle Movements	1	Transport Diesel	18.75	70	70			1	0.01875	2721.69	51.03	0.05
			Light Vehicles	2	Transport Petrol	8	560	1120			16	0.128	2312.60	296.01	0.30
4.4.5	**Leachate pond removal at Containment Cell**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	35			4	20	160	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	37.35			4	20	320	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	18.75	70	210			3	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	8	1400	2800			40	0.32	2312.60	740.03	0.74
4.4.6	**Haul road surface scrape**	Scraping top of haul road for placement within the Containment Cell prior to closure	Scraper/ Dozer	2	Transport Diesel	60.9			4	20	320	19.488	2721.69	53040.22	53.04
			30T Articulated Truck	1	Transport Diesel	37.35			4	20	160	5.976	2721.69	16264.80	16.26
			Water Cart	1	Transport Diesel	27			4	20	160	4.32	2721.69	11757.68	11.76
			Heavy Vehicle Movements	3	Transport Diesel	18.75	70	210			3	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	8			4	20	320	2.56	2312.60	5920.27	5.92
4.4.7	**Containment Cell Cap Construction**	As described in the Concept Design	Excavators	2	Transport Diesel	35			52	135.2	2163.2	75.712	2721.69	206064.29	206.06
			Compactors	2	Transport Diesel	20.8			52	135.2	2163.2	44.99456	2721.69	122461.06	122.46
			Scraper/ Dozer	2	Transport Diesel	60.9			52	135.2	2163.2	131.73888	2721.69	358551.87	358.55
			Grader	1	Transport Diesel	21.1			52	130	1040	21.944	2721.69	59724.68	59.72
			30T Articulated Truck	2	Transport Diesel	37.35			52	135.2	2163.2	80.79552	2721.69	219900.04	219.90
			Water Cart	1	Transport Diesel	27			52	130	1040	28.08	2721.69	76424.94	76.42
			Hand held tools and equipm	1											
			Diesel pump	1	Stationary Diesel	6			52	260	2080	12.48	2709.72	33817.31	33.82
			Bobcat	3	Transport Diesel	11.4			52	135.2	3244.8	36.99072	2721.69	100677.12	100.68
			Heavy Vehicle Movements	830	Transport Diesel	18.75	120	99600			1422.8571	26.678571	2721.69	72610.69	72.61
			Light Vehicles	14	Transport Petrol	8	9100	127400			1820	14.56	2312.60	33671.51	33.67
4.5	**Post Works Activities**														
4.5.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	18.75	70	140			2	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	8	3500	7000			100	0.8	2312.60	1850.08	1.85
4.6	**Operation/ Post-Completion Phase Activities**														
4.6.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	8					80	0.64	2312.60	1480.07	1.48
4.6.2	**Undertake monitoring of the Containment Cell**	Visual inspections of the cap (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).													
		Leachate inspections (quarterly, following 5% AEP storm event, and following an earthquake event of magnitude five or greater).													
		Gas monitoring (quarterly) for ammonia and methane.													
4.6.3	**Maintenance activities (as required)**	Vegetation cover maintenance (weed and tree/ deep rooted plant removal)	Light Vehicles	1	Transport Petrol	8					480	3.84	2312.60	8880.40	8.88
		Water treatment plant servicing/ maintenance (in accordance with manufacturer's requirements)	Hand held power tools and equipment												
4.6.4	**Leachate treatment**	Captured leachate pumped to water treatment plant and treated; OR	Light Vehicles	1	Transport Petrol	8					480	3.84	2312.60	8880.40	8.88
		Captured leachate pumped to truck for off-site treatment and disposal.	Hand held power tools and equipment												
			Wastewater truck	1	Transport Diesel	27					480	12.96	2721.69	35273.05	35.27

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Option 5 - Offsite Disposal to Licenced Waste Facility within NSW

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
5.1	**Capped Waste Stockpile Removal**														
5.1.1	**Site Establishment**	Installation of water treatment plant.	Backhoes	1	Transport Diesel	**21.9**			10	**50**	**400**	8.76	2721.69	23841.97	23.84
		Installation of water collection, pipes and pumping system.	Diesel Pump	1	Stationary Diesel	**6**			10	**50**	**400**	2.4	2709.72	6503.33	6.50
		Establishment of capped waste stockpile area.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Establishment of erosion and sediment control measures.	Light Vehicles	4	Transport Petrol	**8**	**3500**	**14000**			**200**	1.6	2312.60	3700.17	3.70
5.1.2	**Cap removal**	Removal of grass cover	Excavators	2	Transport Diesel	**35**			16	**80**	**1280**	44.8	2721.69	121931.53	121.93
		Removal and stockpiling of topsoil (to stockpile area).	Scraper/ Dozer	2	Transport Diesel	**60.9**			16	**80**	**1280**	77.952	2721.69	212160.87	212.16
		Removal and stockpiling of reusable clay layer for use at the containment cell.	30T Articulated Truck	4	Transport Diesel	**37.35**			16	**80**	**2560**	95.616	2721.69	260236.73	260.24
		Removal of remaining capping layers:	Water Cart	1	Transport Diesel	**27**			16	**80**	**640**	17.28	2721.69	47030.73	47.03
		Suitable material stockpiled for use as wet weather cover.													
		Remaining material transported for disposal at containment cell.	Heavy Vehicle Movements	9	Transport Diesel	**18.75**	**70**	**630**			**9**	0.16875	2721.69	459.28	0.46
			Light Vehicles	12	Transport Petrol	**8**	**5600**	**67200**			**960**	7.68	2312.60	17760.80	17.76
5.1.3	**Material removal and sort**	Removal of recyclable waste materials:	Excavators	4	Transport Diesel	**35**			66	**165**	**5280**	184.8	2721.69	502967.57	502.97
		Removal of carbon materials (first cut spent pot lining and anodes) of greater than 500mm in size	Scraper/ Dozer	3	Transport Diesel	**60.9**			66	**198**	**4752**	289.3968	2721.69	787647.22	787.65
		Removal of metals greater than 500mm in size	Water Cart	1	Transport Diesel	**27**			66	**330**	**2640**	71.28	2721.69	194001.78	194.00
		Transport material to cleaning/ storage shed.	Light Vehicles	8	Transport Petrol	**8**	**35490**	**283920**			**4056**	32.448	2312.60	75039.37	75.04
		Removal of non-recyclable materials and transport to the sorting area.	Wash-down bay	1	Stationary Diesel	**15**			66	**330**	**2640**	39.6	2709.72	107304.91	107.30
		Removal of waste materials would cease in rain events and the temporary cover placed over the exposed waste.													
		Excavation of natural materials affected by wastes and contaminants. Investigations to be undertaken of stockpile footprint to determine soils to be removed.													
		Removal and transportation of stockpiled wet weather cover material to the containment cell.													
		Material tracking system implemented throughout the removal process.													
		Placement and compaction of suitable material for filling of capped waste stockpile excavation void													
5.1.4	**Operate water treatment plant (installed as part of capped waste stockpile removal Key Task)**	Leachate and captured stormwater from capped waste stockpile during material removal to be pumped to and treated at the treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			86	**430**	**3440**	20.64	2709.72	55928.62	55.93
		Pumping and treatment of groundwater from below and surrounding the capped waste stockpile footprint.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Dam water treatment.	Light Vehicles	2	Transport Petrol	**8**	**6020**	**12040**			**172**	1.376	2312.60	3182.14	3.18
		Discharge of treated water to existing dam.													
		Groundwater monitoring.													
5.1.5	**Leachate pond removal at CWS**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
5.2	**Capped Waste Stockpile Post Works Activities**														
5.2.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85

Option 5 - Offsite Disposal to Licenced Waste Facility within NSW

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
5.3	**Capped Waste Stockpile Post-Completion Phase Activities**														
5.3.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	**8**			260	**4**	**16**	0.128	2312.60	296.01	0.30
5.4	**Recyclables Cleaning and Storage**														
5.4.1	**Separation of Carbon from embedded metals**	Physical removal of steel from carbon	Excavators	1	Transport Diesel	**35**			66	**330**	**2640**	92.4	2721.69	251483.79	251.48
			Wash-down bay	1	Stationary Diesel	**15**			66	**330**	**2640**	39.6	2709.72	107304.91	107.30
5.4.2	**Steel clean and store**	Cleaning 5,000T of separated steel	Excavators	1	Transport Diesel	**35**			50	**250**	**2000**	70	2721.69	190518.02	190.52
		Cleaned metals to be transported for storage adjacent to other stored metals.	Wash-down bay	1	Stationary Diesel	**15**			50	**250**	**2000**	30	2709.72	81291.60	81.29
		Storage location to be recorded within the internal material tracking system.	Light Vehicles	4	Transport Petrol	**8**	**23100**	**92400**			**1320**	10.56	2312.60	24421.10	24.42
			30T Articulated Truck	2	Transport Diesel	**37.35**			1	**5**	**80**	2.988	2721.69	8132.40	8.13
5.4.3	**Carbon storage**	Cleaned carbon to be transported for appropriatestorage.	Excavators	2	Transport Diesel	**35**			5	**25**	**400**	14	2721.69	38103.60	38.10
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	**37.35**			5	**25**	**400**	14.94	2721.69	40661.99	40.66
			Light Vehicles	4	Transport Petrol	**8**	**1750**	**7000**			**100**	0.8	2312.60	1850.08	1.85
5.5	**Recyclable Material Transport**														
5.5.1	**Load and Transport 5,000 tonnes of cleaned steel to steel processing facility**	Load 5000 tonnes of steel into 30 T articulated trucks	Excavators	4	Transport Diesel	**35**			50	**250**	**8000**	280	2721.69	762072.08	762.07
		Truck 5,000 tonnes of steel to steel recycling facility	Loaders	1	Transport Diesel	**15.3**			50	**250**	**2000**	30.6	2721.69	83283.59	83.28
			Light Vehicles	4	Transport Petrol	**8**	**17500**	**70000**			**1000**	8	2312.60	18500.83	18.50
			Heavy Vehicle Movements	250	Transport Diesel	**18.75**	**70**	**17500**			**250**	4.6875	2721.69	12757.90	12.76
5.6	**Recyclable Material Processing**														
5.6.1	**Processing of 5,000 tonnes of cleaned Steel at a steel processing facility**	Generally steel recycling involves breakdown of the steel into smaller blocks, melting in a furnace, purification, solidifying and transport of bars for use as raw material.	Emissions from processing of scrap steel in an EAF = 1.12 tCO2e/tonne steel (direct and indirect emissions) (see Factors tab)												5,600.00
5.7	**Waste Material Transportation**														
5.7.1	**Preparatory works**	Topsoil scraping and stockpiling (including transport to long term stockpile area)	Excavators	2	Transport Diesel	**35**			18	**90**	**1440**	50.4	2721.69	137172.97	137.17
		Excavation of non-containment cell subsurface materials and stockpiling (including wet weather cover, and transport of remainder to long term stockpile area)	Scraper/ Dozer	2	Transport Diesel	**60.9**			18	**90**	**1440**	87.696	2721.69	238680.98	238.68
		Installation of initial drainage and environmental controls, including water collection/ sump system and water treatment plant	30T Articulated Truck	2	Transport Diesel	**37.35**			18	**90**	**1440**	53.784	2721.69	146383.16	146.38
		Excavation and construction of perimeter dish drain	Water Cart	1	Transport Diesel	**27**			18	**90**	**720**	19.44	2721.69	52909.58	52.91
			Heavy Vehicle Movements	7	Transport Diesel	**18.75**	**70**	**490**			**7**	0.13125	2721.69	357.22	0.36
			Light Vehicles	8	Transport Petrol	**8**	**6300**	**50400**			**720**	5.76	2312.60	13320.60	13.32
5.7.2	**Cell Base liner Construction**	As described in the Concept Design	Excavators	3	Transport Diesel	**35**			26	**130**	**3120**	109.2	2721.69	297208.11	297.21
			Loaders	3	Transport Diesel	**15.3**			26	**130**	**3120**	47.736	2721.69	129922.40	129.92
			Compactors	1	Transport Diesel	**20.8**			26	**130**	**1040**	21.632	2721.69	58875.51	58.88
			30T Articulated Truck	4	Transport Diesel	**37.35**			26	**130**	**4160**	155.376	2721.69	422884.68	422.88
			Water Cart	2	Transport Diesel	**27**			26	**130**	**2080**	56.16	2721.69	152849.89	152.85
			Machinery Service Vehicle	1	Transport Petrol	**8**			26	**130**	**1040**	8.32	2312.60	19240.87	19.24
			Backhoes	4	Transport Diesel	**21.9**			26	**130**	**4160**	91.104	2721.69	247956.48	247.96
			Heavy Vehicle Movements	820	Transport Diesel	**18.75**	**120**	**98400**			**1405.714**	26.357143	2721.69	71735.87	71.74
			Light Vehicles	16	Transport Petrol	**8**	**9100**	**145600**			**2080**	16.64	2312.60	38481.73	38.48
5.7.3	**Waste transportation from Smelter to waste facility**	Truck cleaning/sterilisation	Heavy Vehicle Movements	9200	Transport Diesel	**18.75**	**173**	**1591600**			**22737.14**	426.32143	2721.69	1160313.06	1160.31

Option 5 - Offsite Disposal to Licenced Waste Facility within NSW

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
		Loaded trucks to exit Smelter and travel on public roads by licensed operators. 17 km one way to Cessnock Waste Facility; 189kn Kemps Creek Waste Facility.	Excavators	2	Transport Diesel	35			234	1170	18720	655.2	2721.69	1783248.67	1783.25
		Waste tracking as per EPA requirements.	Loaders	2	Transport Diesel	15.3			234	1170	18720	286.416	2721.69	779534.42	779.53
5.7.4	**Unload and stockpile material at receiving facility**	Unload and stockpile material at receiving facility	Loaders	2	Transport Diesel	15.3			234	1170	18720	286.416	2721.69	779534.42	779.53
			Compactors	2	Transport Diesel	20.8			234	1170	18720	389.376	2721.69	1059759.21	1059.76
5.7.5	**Sorting non-recyclable material**	sorting carbon, fines and crushables from non-crushable waste	Excavators	4	Transport Diesel	35			169	169	5408	189.28	2721.69	515160.73	515.16
			Scraper/ Dozer	3	Transport Diesel	60.9			169	169	4056	247.0104	2721.69	672284.75	672.28
			Water Cart	1	Transport Diesel	27			169	169	1352	36.504	2721.69	99352.43	99.35
			Light Vehicles	8	Transport Petrol	8	11830	94640			1352	10.816	2312.60	25013.12	25.01
			Wash-down bay	1	Stationary Diesel	15			169	845	6760	101.4	2709.72	274765.61	274.77
5.7.6	**Transport untreated non-crushable/ non-recyclable material to the Containment Cell**	Transportation of removed materials would include:	Excavators	2	Transport Diesel	35			169	169	2704	94.64	2721.69	257580.36	257.58
		All truck loads are to be covered.	30T Articulated Truck	2	Transport Diesel	37.35			169	169	2704	100.9944	2721.69	274875.04	274.88
		Trucks transporting capped waste stockpile materials to have priority on haul road.	Light Vehicles	4	Transport Petrol	8	59150	236600			3380	27.04	2312.60	62532.81	62.53
5.7.7	**Treatment Material (lime) Transportation and Stockpiling**	Loading of approximately 50,000 tonnes of treatment material	Loaders	3	Transport Diesel	15.3			52	260	6240	95.472	2721.69	259844.81	259.84
		Transportation of treatment material	Compactors	1	Transport Diesel	20.8			52	260	2080	43.264	2721.69	117751.02	117.75
		Stockpiling of treatment material adjacent to the containment cell.	Scraper/ Dozer	1	Transport Diesel	60.9			52	260	2080	126.672	2721.69	344761.41	344.76
			Water Cart	1	Transport Diesel	27			52	260	2080	56.16	2721.69	152849.89	152.85
			Heavy Vehicle Movements	2000	Transport Diesel	18.75	141	282000			4028.571	75.535714	2721.69	205584.50	205.58
5.7.8	**Crushing of all material**	Jaw crushing/screening – to size fraction required for mixing (50-100T/hr)	Excavators	2	Transport Diesel	35			206	1030	16480	576.8	2721.69	1569868.48	1569.87
			Impact Crusher	1	Stationary Diesel	35			206	1030	8240	288.4	2709.72	781483.25	781.48
			Tracked Stockpiler	1	Stationary Diesel	9			206	1030	8240	74.16	2709.72	200952.84	200.95
		Pulverising to minus 200mm (5-10T/hr)	Wash-down bay	1	Stationary Diesel	15			206	1030	8240	123.6	2709.72	334921.39	334.92
			Heavy Vehicle Movements	6	Transport Diesel	18.75	60	360			5.142857	0.0964286	2721.69	262.45	0.26
			Light Vehicles	8	Transport Petrol	8	72100	576800			8240	65.92	2312.60	152446.86	152.45
5.8.9	**Calcium treating of fines and crushables**	Crushed material will be mixed with lime slurry in pug mill and transported directly for disposal in the containment cell. Batch process.	Excavators	1	Transport Diesel	35			171	342	2736	95.76	2721.69	260628.65	260.63
			Pug mill	1	Stationary Diesel	29			171	342	2736	79.344	2709.72	215000.02	215.00
			Wash-down bay	1	Stationary Diesel	15			171	342	2736	41.04	2709.72	111206.91	111.21
		Transport of pug mill componenets to the offsite containment cell facility	Heavy Vehicle Movements	6	Transport Diesel	18.75	60	360			5.142857	0.0964286	2721.69	262.45	0.26
			Light Vehicles	8	Transport Petrol	8	59850	478800			6840	54.72	2312.60	126545.69	126.55
5.8.10	**Transport crushed material to landfill**	Transport crushed material to landfill	30T Articulated Truck	2	Transport Diesel	37.35			171	222.3	3556.8	132.84648	2721.69	361566.40	361.57
		Placement of material in landfill	Excavators	2	Transport Diesel	35			171	222.3	3556.8	124.488	2721.69	338817.25	338.82

Option 5 - Offsite Disposal to Licenced Waste Facility within NSW

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
5.9	**Containment Cell Material Placement and Capping**														
5.9.1	**Cell Material Acceptance and Placement**	Transportation of material to the cell	Excavators	3	Transport Diesel	**35**			222	**222**	**5328**	186.48	2721.69	507540.01	507.54
		Temporary material stockpiling	Compactors	2	Transport Diesel	**20.8**			222	**222**	**3552**	73.8816	2721.69	201082.52	201.08
		Placement of materials in dedicated cell: demolition waste, contaminated soils and capped waste stockpile materials.	30T Articulated Truck	4	Transport Diesel	**37.35**			222	**222**	**7104**	265.3344	2721.69	722156.92	722.16
		Cover placed material in the event of predicted rainfall and/ or strong winds.	Light Vehicles	2	Transport Petrol	**8**	**2220**	**4440**			**63.42857**	0.5074286	2312.60	1173.48	1.17
		Material tracking and quantifying/ survey of placed material.	Water Cart	2	Transport Diesel	**27**			222	**1110**	**17760**	479.52	2721.69	1305102.87	1305.10
5.9.2	**Operate water treatment infrastructure at the Containment Cell**	Installation of water treatment plant.	Hand held power tools and equi	1											
		Operation and maintenance of water collection/ sump system and water treatment plant.	Diesel pump	1	Stationary Diesel	**6**			222	**1110**	**8880**	53.28	2709.72	144373.88	144.37
		Captured water pumped to water treatment plant.	Tanks and ancillary pipework												
			Heavy Vehicle Movements	1	Transport Diesel	**18.75**	**70**	**70**			**1**	0.01875	2721.69	51.03	0.05
			Light Vehicles	2	Transport Petrol	**8**	**2220**	**4440**			**63.42857**	0.5074286	2312.60	1173.48	1.17
5.9.3	**Leachate pond removal at Containment Cell**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
5.9.4	**Haul road surface scrape**	Scraping top xx mm of haul road for placement within the Containment Cell prior to closure	Scraper/ Dozer	2	Transport Diesel	**60.9**			4	**20**	**320**	19.488	2721.69	53040.22	53.04
			30T Articulated Truck	1	Transport Diesel	**37.35**			4	**20**	**160**	5.976	2721.69	16264.80	16.26
			Water Cart	1	Transport Diesel	**27**			4	**20**	**160**	4.32	2721.69	11757.68	11.76
			Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**			4	**20**	**320**	2.56	2312.60	5920.27	5.92
5.9.5	**Containment Cell Cap Construction**	As described in the Concept Design	Excavators	2	Transport Diesel	**35**			26	**130**	**2080**	72.8	2721.69	198138.74	198.14
			Compactors	2	Transport Diesel	**20.8**			26	**130**	**2080**	43.264	2721.69	117751.02	117.75
			Scraper/ Dozer	2	Transport Diesel	**60.9**			26	**130**	**2080**	126.672	2721.69	344761.41	344.76
			Grader	1	Transport Diesel	**21.1**			26	**130**	**1040**	21.944	2721.69	59724.68	59.72
			30T Articulated Truck	2	Transport Diesel	**37.35**			26	**130**	**2080**	77.688	2721.69	211442.34	211.44
			Water Cart	1	Transport Diesel	**27**			26	**130**	**1040**	28.08	2721.69	76424.94	76.42
			Hand held tools and equipment	1											
			Diesel pump	1	Stationary Diesel	**6**			26	**130**	**1040**	6.24	2709.72	16908.65	16.91
			Bobcat	3	Transport Diesel	**11.4**			26	**130**	**3120**	35.568	2721.69	96804.93	96.80
			Heavy Vehicle Movements	830	Transport Diesel	**18.75**	**120**	**99600**			**1422.857**	26.678571	2721.69	72610.69	72.61
			Light Vehicles	14	Transport Petrol	**8**	**9100**	**127400**			**1820**	14.56	2312.60	33671.51	33.67
5.10	**Post Works Activities**														
5.10.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85
	Carbon Benefits														
	Processing of 5,000 tonnes of cleaned Steel at a steel processing facility	Lifecycle benefit associated with using scrap steel - Estimation of the bet benefit of recycling 1 tonne of steel from commercial and industrial (C&I) and construction and demolition (C&D) sources in New South Wales (0.44 tCO2e/tonne)													-2200.00

27046.53

Option 6 - Offsite Disposal of all Material to Salt Mine in the Northern Territory

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
6.1	**Capped Waste Stockpile Removal**														
6.1.1	**Site Establishment**	Installation of water treatment plant.	Backhoes	1	Transport Diesel	**21.9**			10	**50**	**400**	8.76	2721.69	23841.97	23.84
		Installation of water collection, pipes and pumping system.	Diesel Pump	1	Stationary Diesel	**6**			10	**50**	**400**	2.4	2709.72	6503.33	6.50
		Establishment of capped waste stockpile area.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Establishment of erosion and sediment control measures.	Light Vehicles	4	Transport Petrol	**8**	**3500**	**14000**			**200**	1.6	2312.60	3700.17	3.70
6.1.2	**Cap removal**	Removal of grass cover	Excavators	2	Transport Diesel	**35**			16	**80**	**1280**	44.8	2721.69	121931.53	121.93
		Removal and stockpiling of topsoil (to stockpile area).	Scraper/ Dozer	2	Transport Diesel	**60.9**			16	**80**	**1280**	77.952	2721.69	212160.87	212.16
		Removal and stockpiling of reusable clay layer for use at the containment cell.	30T Articulated Truck	4	Transport Diesel	**37.35**			16	**80**	**2560**	95.616	2721.69	260236.73	260.24
		Removal of remaining capping layers:	Water Cart	1	Transport Diesel	**27**			16	**80**	**640**	17.28	2721.69	47030.73	47.03
		Suitable material stockpiled for use as wet weather cover.	Hand held power tools and equipment	1											
		Remaining material transported for disposal at containment cell.	Heavy Vehicle Movements	9	Transport Diesel	**18.75**	**70**	**630**			**9**	0.16875	2721.69	459.28	0.46
			Light Vehicles	12	Transport Petrol	**8**	**5600**	**67200**			**960**	7.68	2312.60	17760.80	17.76
6.1.3	**Material removal and sort**	Removal of recyclable waste materials:	Excavators	4	Transport Diesel	**35**			206	**206**	**6592**	230.72	2721.69	627947.39	627.95
		Removal of carbon materials (first cut spent pot lining and anodes) of greater	Scraper/ Dozer	3	Transport Diesel	**60.9**			206	**206**	**4944**	301.0896	2721.69	819471.35	819.47
		Removal of metals greater than 500mm in size	Water Cart	1	Transport Diesel	**27**			206	**1030**	**8240**	222.48	2721.69	605520.70	605.52
		Transport material to cleaning/ storage shed.	Light Vehicles	8	Transport Petrol	**8**	**14420**	**115360**			**1648**	13.184	2312.60	30489.37	30.49
		Removal of non-recyclable materials and transport to the sorting area.	Wash-down bay	1	Stationary Diesel	**15**			206	**206**	**1648**	24.72	2709.72	66984.28	66.98
		Removal of waste materials would cease in rain events and the temporary cover placed over the exposed waste.													
		Excavation of natural materials affected by wastes and contaminants. Investigations to be undertaken of stockpile footprint to determine soils to be removed.													
		Removal and transportation of stockpiled wet weather cover material to the containment cell.													
		Material tracking system implemented throughout the removal process.													
		Placement and compaction of suitable material for filling of capped waste stockpile excavation void													
6.1.4	**Operate water treatment plant (installed as part of capped waste stockpile removal Key Task).**	Leachate and captured stormwater from capped waste stockpile during material removal to be pumped to and treated at the treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			226	**1130**	**9040**	54.24	2709.72	146975.21	146.98
		Pumping and treatment of groundwater from below and surrounding the capped waste stockpile footprint.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Dam water treatment.	Light Vehicles	2	Transport Petrol	**8**	**15820**	**31640**			**452**	3.616	2312.60	8362.38	8.36
		Discharge of treated water to existing dam.													
		Groundwater monitoring.													
6.1.5	**Leachate pond removal at CWS**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**1400**	**2800**			**40**	0.32	2312.60	740.03	0.74
6.2	**Recyclables Cleaning and Storage**														
6.2.1	**Separation of Carbon from embedded metals**	Physical removal of steel from carbon	Excavators	1	Transport Diesel	**35**			66	**330**	**2640**	92.4	2721.69	251483.79	251.48
			Wash-down bay	1	Stationary Diesel	**15**			66	**330**	**2640**	39.6	2709.72	107304.91	107.30
6.2.2	**Steel clean**	Cleaning as above, 5,000T of separated steel	Excavators	1	Transport Diesel	**35**			50	**250**	**2000**	70	2721.69	190518.02	190.52
			Wash-down bay	1	Stationary Diesel	**15**			50	**250**	**2000**	30	2709.72	81291.60	81.29
			Light Vehicles	4	Transport Petrol	**8**	**23100**	**92400**			**1320**	10.56	2312.60	24421.10	24.42

Option 6 - Offsite Disposal of all Material to Salt Mine in the Northern Territory

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
6.2.3	**Carbon storage**	Cleaned carbon to be transported for appropriatestorage.	Excavators	2	Transport Diesel	**35**			5	**25**	**400**	14	2721.69	38103.60	38.10
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	**37.35**			5	**25**	**400**	14.94	2721.69	40661.99	40.66
			Light Vehicles	4	Transport Petrol	**8**	**1750**	**7000**			**100**	0.8	2312.60	1850.08	1.85
6.2.4	**Metals storage**	Cleaned metals to be transported for storage adjacent to other stored metals.	Excavators	2	Transport Diesel	**35**			1	**5**	**80**	2.8	2721.69	7620.72	7.62
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	**37.35**			1	**5**	**80**	2.988	2721.69	8132.40	8.13
			Light Vehicles	4	Transport Petrol	**8**	**350**	**1400**			**20**	0.16	2312.60	370.02	0.37
6.3	**Material Treatment**														
6.3.1	**Crushing of all crushable materials plus fines**	Jaw crushing/screening – to size fraction required for mixing (50-100T/hr)	Excavators	2	Transport Diesel	**35**			206	**1030**	**16480**	576.8	2721.69	1569868.48	1569.87
		Pulverising to minus 10mm (5-10T/hr)	Diesel Pump	1	Stationary Diesel	**6**			206	**1030**	**8240**	49.44	2709.72	133968.56	133.97
			Impact Crusher	1	Stationary Diesel	**35**			206	**1030**	**8240**	288.4	2709.72	781483.25	781.48
			Tracked Stockpiler	1	Stationary Diesel	**9**			206	**1030**	**8240**	74.16	2709.72	200952.84	200.95
			Container Loader	1	Stationary Diesel	**6.3**			206	**1030**	**8240**	51.912	2709.72	140666.98	140.67
			Light Vehicles	3	Transport Petrol	**8**	**72100**	**216300**			**3090**	24.72	2312.60	57167.57	57.17
			Wash-down bay	1	Stationary Diesel	**15**			206	**1030**	**8240**	123.6	2709.72	334921.39	334.92
6.3.2	**Construction of a Heat Treatment Facility**	Construction of the heat treatment facility	Heavy Vehicle Movements	10	Transport Diesel	**18.75**	**300**	**3000**			**42.85714**	0.8035714	2721.69	2187.07	2.19
			Mobile Crane/Telehandler (Abov	2	Stationary Diesel	**6.3**			6	**30**	**480**	3.024	2709.72	8194.19	8.19
			Stationary crane	1	Stationary Diesel	**23**			6	**30**	**240**	5.52	2709.72	14957.65	14.96
			Forklift 8t	2	Stationary Diesel	**4.6**			6	**30**	**480**	2.208	2709.72	5983.06	5.98
			Light vehicles	4	Transport Petrol	**8**	**70**	**280**			**4**	0.032	2312.60	74.00	0.07
6.3.3	**Treat at 600 degrees celcius**	Kiln with loading and unloading	Loaders		Based on a factor of 0.2 t CO2e/tonne quoted by Regain for SPL processing, which includes all recovery, crushing etc. 308,500 tonnes of material processed.										61,700.00
		Treated product allowed to cool	Rotary kiln												
		Power supply	Genset												
6.3.4	**Decommision and disammebly of heat treatment facility**	Decomission heat treatment facility	Heavy Vehicle Movements	10	Transport Diesel	**18.75**	**300**	**3000**			**42.85714**	0.8035714	2721.69	2187.07	2.19
		Transport heat treatment facility components offsite	Mobile Crane/Telehandler (Abov	2	Stationary Diesel	**6.3**			6	**30**	**480**	3.024	2709.72	8194.19	8.19
			Stationary crane	1	Stationary Diesel	**23**			6	**30**	**240**	5.52	2709.72	14957.65	14.96
			Forklift 8t	2	Stationary Diesel	**4.6**			6	**30**	**480**	2.208	2709.72	5983.06	5.98
			Light vehicles	4	Transport Petrol	**8**	**70**	**280**			**4**	0.032	2312.60	74.00	0.07
6.3.5	**Delivery of containers and bagging and containing material**	Delivery of containers (2 per truck)	Heavy Vehicle Movements	5000	Transport Diesel	**18.75**	**70**	**350000**			**5000**	93.75	2721.69	255158.06	255.16
		Bagged in bulk bags	Light Vehicles	4	Transport Petrol	**8**	**299950**	**1199800**			**17140**	137.12	2312.60	317104.26	317.10
			Excavators	2	Transport Diesel	**35**			857	**2571**	**41136**	1439.76	2721.69	3918574.64	3918.57
6.4	**Recyclable Material Transport**														
6.4.1	**Load and Transport 5,000 tonnes of cleaned steel to steel processing facility**	Load 5000 tonnes of steel into 20 T articulated trucks	Excavators	4	Transport Diesel	**35**			50	**250**	**8000**	280	2721.69	762072.08	762.07
		Truck 5,000 tonnes of steel to steel recycling facility	Loaders	1	Transport Diesel	**15.3**			50	**250**	**2000**	30.6	2721.69	83283.59	83.28
			Light Vehicles	4	Transport Petrol	**8**	**17500**	**70000**			**1000**	8	2312.60	18500.83	18.50
			Heavy Vehicle Movements	250	Transport Diesel	**18.75**	**70**	**17500**			**250**	4.6875	2721.69	12757.90	12.76
6.5	**Recyclable Material Processing**														
6.5.1	**Processing of 5,000 tonnes of cleaned Steel at a steel processing facility**	Generally steel recycling involves breakdown of the steel into smaller blocks, melting in a furnace, purification, solidifying and transport of bars for use as raw material.	Emissions from processing of scrap steel in an EAF = 1.12 tCO2e/tonne steel (direct and indirect emissions) (see Factors tab)												5,600.00
6.6	**Material Transport**														
6.6.1	**Transport from Smelter to rail terminal**	Load treated material into shipping containers	Forklift 8t	2	Stationary Diesel	**4.6**			72	**360**	**5760**	26.496	2709.72	71796.74	71.80
		Transport of sealed shipping containers on road to rail terminal (2 per truck)	Mobile Crane/Telehandler (Abov	1	Stationary Diesel	**6.3**			72	**360**	**2880**	18.144	2709.72	49165.16	49.17
			Heavy Vehicle Movements	5000	Transport Diesel	**18.75**	**70**	**350000**			**5000**	93.75	2721.69	255158.06	255.16
			Light Vehicles	7	Transport Petrol	**8**	**21350**	**149450**			**2135**	17.08	2312.60	39499.28	39.50
6.6.2	**Transport from rail terminal to Tellus Rail Terminal**	Load shipping containers onto train	Mobile Crane/Telehandler (Abov	2	Stationary Diesel	**6.3**			67	**335**	**5360**	33.768	2709.72	91501.82	91.50
		Trains travel from terminal to Tellus Rail Terminal	Train	334			**6000**	**2,004,000**							3,341,670
		Unload containers at receiving facility													

Option 6 - Offsite Disposal of all Material to Salt Mine in the Northern Territory

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
6.7	**Receiving Facility Treated Material Disposal**														
6.7.1	**Facility Material Acceptance and Placement**	Transportation of treated material to the Facility, one container per truck	Heavy Vehicle Movements	5000	Transport Diesel	**18.75**	**60**	**300000**			**4285.714**	80.357143	2721.69	218706.91	218.71
		The proposed waste storage and isolation operation would involve:	Mobile Crane/Telehandler (Below ground)	1	Stationary Diesel	**5.1**			39	**195**	**1560**	7.956	2709.72	21558.53	21.56
		Application of the Waste Acceptance Criteria.	Salt Mine Haul truck	2	Transport Diesel	**37.35**			39	**195**	**3120**	116.532	2721.69	317163.51	317.16
		Moving waste underground (dry packaged waste backfill or hydraulic backfill).	Mobile Crane/Telehandler (Abov	2	Stationary Diesel	**6.3**			39	**195**	**3120**	19.656	2709.72	53262.26	53.26
		Arranging waste into compatible zones within emplacement rooms.													
		Backfilling and room closure.													
6.8	**Facility and Deposited Material Management and Monitoring**														
6.8.1	**Post-Closure monitoring from Tellus EIS**	The principal focus of monitoring in the post closure phase would be on groundwater monitoring.	Light Vehicles	1	Transport Petrol	**8**			260	**4**	**16**	0.128	2312.60	296.01	0.30
		The performance of revegetation programs would also be monitored.	Hand held tools and equipment	1											
6.9	**Capped Waste Stockpile Post Works Activities**														
6.9.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85
6.10	**Capped Waste Stockpile Post-Completion Phase Activities**														
6.10.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	**8**					**80**	0.64	2312.60	1480.07	1.48
	Carbon Benefits														
	Processing of 5,000 tonnes of cleaned Steel at a steel processing facility	Lifecycle benefit associated with using scrap steel - Estimation of the bet benefit of recycling 1 tonne of steel from commercial and industrial (C&I) and construction and demolition (C&D) sources in New South Wales (0.44 tCO2e/tonne)													-2200.00

3,420,340.82

Option 7 - Onsite Destruction of All Material using Plasma Gasification

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
7.1	**Capped Waste Stockpile Removal**														
7.1.1	**Site Establishment**	Installation of water treatment plant.	Backhoes	1	Transport Diesel	**21.9**			10	**50**	**400**	8.76	2721.69	23841.97	23.84
		Installation of water collection, pipes and pumping system.	Diesel Pump	1	Stationary Diesel	**6**			10	**50**	**400**	2.4	2709.72	6503.33	6.50
		Establishment of capped waste stockpile area.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Establishment of erosion and sediment control measures.	Light Vehicles	4	Transport Petrol	**8**	**3500**	**14000**			**200**	1.6	2312.60	3700.17	3.70
7.1.2	**Cap removal**	Removal of grass cover	Excavators	2	Transport Diesel	**35**			16	**80**	**1280**	44.8	2721.69	121931.53	121.93
		Removal and stockpiling of topsoil (to stockpile area).	Scraper/ Dozer	2	Transport Diesel	**60.9**			16	**80**	**1280**	77.952	2721.69	212160.87	212.16
		Removal and stockpiling of reusable clay layer for use at the containment cell.	30T Articulated Truck	4	Transport Diesel	**37.35**			16	**80**	**2560**	95.616	2721.69	260236.73	260.24
		Removal of remaining capping layers:	Water Cart	1	Transport Diesel	**27**			16	**80**	**640**	17.28	2721.69	47030.73	47.03
		Suitable material stockpiled for use as wet weather cover.	Hand held power tools and equipment												
		Remaining material transported for disposal at containment cell.	Heavy Vehicle Movements	9	Transport Diesel	**18.75**	**70**	**630**			**9**	0.16875	2721.69	459.28	0.46
			Light Vehicles	12	Transport Petrol	**8**	**5600**	**67200**			**960**	7.68	2312.60	17760.80	17.76
7.1.3	**Material removal and sort**	Removal of recyclable waste materials:	Excavators	4	Transport Diesel	**35**			206	**206**	**6592**	230.72	2721.69	627947.39	627.95
		Removal of carbon materials (first cut spent pot lining and anodes) of greater	Scraper/ Dozer	3	Transport Diesel	**60.9**			206	**206**	**4944**	301.0896	2721.69	819471.35	819.47
		Removal of metals greater than 500mm in size	Water Cart	1	Transport Diesel	**27**			206	**1030**	**8240**	222.48	2721.69	605520.70	605.52
		Transport material to cleaning/ storage shed.	Light Vehicles	8	Transport Petrol	**8**	**59150**	**473200**			**6760**	54.08	2312.60	125065.62	125.07
		Removal of non-recyclable materials and transport to the sorting area.	Wash-down bay	2	Stationary Diesel	**15**			206	**206**	**3296**	49.44	2709.72	133968.56	133.97
		Removal of waste materials would cease in rain events and the temporary cover placed over the exposed waste.													
		Excavation of natural materials affected by wastes and contaminants. Investigations to be undertaken of stockpile footprint to determine soils to be removed.													
		Removal and transportation of stockpiled wet weather cover material to the containment cell.													
		Material tracking system implemented throughout the removal process.													
		Placement and compaction of suitable material for filling of capped waste stockpile excavation void													
7.1.4	**Operate water treatment plant (installed as part of capped waste stockpile removal Key Task).**	Leachate and captured stormwater from capped waste stockpile during material removal to be pumped to and treated at the treatment plant.	Diesel Pump	1	Stationary Diesel	**6**			226	**1130**	**9040**	54.24	2709.72	146975.21	146.98
		Pumping and treatment of groundwater from below and surrounding the capped waste stockpile footprint.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Dam water treatment.	Light Vehicles	2	Transport Petrol	**8**	**12950**	**25900**			**370**	2.96	2312.60	6845.31	6.85
		Discharge of treated water to existing dam.													
		Groundwater monitoring.													
7.1.5	**Leachate pond removal at CWS**	Excavation of deposited sediments and pond lining.	Excavators	1	Transport Diesel	**35**			4	**20**	**160**	5.6	2721.69	15241.44	15.24
		Placement of excavated material into the containment cell.	30T Articulated Truck	2	Transport Diesel	**37.35**			4	**20**	**320**	11.952	2721.69	32529.59	32.53
		Operation of temporary leachate collection facilities prior to complete closure of Containment Cell.	Heavy Vehicle Movements	3	Transport Diesel	**18.75**	**70**	**210**			**3**	0.05625	2721.69	153.09	0.15
			Light Vehicles	2	Transport Petrol	**8**	**280**	**560**			**8**	0.064	2312.60	148.01	0.15
7.2	**Recyclables Cleaning and Storage**														
7.2.1	**Separation of Carbon from embedded metals**	Physical removal of steel from carbon	Excavators	1	Transport Diesel	**35**			66	**330**	**2640**	92.4	2721.69	251483.79	251.48
			Wash-down bay	1	Stationary Diesel	**15**			66	**330**	**2640**	39.6	2709.72	107304.91	107.30
7.2.2	**Steel clean**	Cleaning as above, 5,000T of separated steel	Excavators	1	Transport Diesel	**35**			50	**250**	**2000**	70	2721.69	190518.02	190.52

Option 7 - Onsite Destruction of All Material using Plasma Gasification

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
			Wash-down bay	1	Stationary Diesel	15			50	250	2000	30	2709.72	81291.60	81.29
			Light Vehicles	4	Transport Petrol	8	17500	70000			1000	8	2312.60	18500.83	18.50
7.2.3	**Carbon storage**	Cleaned carbon to be transported for appropriatestorage.	Excavators	2	Transport Diesel	35			5	25	400	14	2721.69	38103.60	38.10
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	37.35			5	25	400	14.94	2721.69	40661.99	40.66
			Light Vehicles	4	Transport Petrol	8	1750	7000			100	0.8	2312.60	1850.08	1.85
7.2.4	**Metals storage**	Cleaned metals to be transported for storage adjacent to other stored metals.	Excavators	2	Transport Diesel	35			1	5	80	2.8	2721.69	7620.72	7.62
		Storage location to be recorded within the internal material tracking system.	30T Articulated Truck	2	Transport Diesel	37.35			1	5	80	2.988	2721.69	8132.40	8.13
			Light Vehicles	4	Transport Petrol	8	350	1400			20	0.16	2312.60	370.02	0.37
7.3	**Recyclable Material Transport**														
7.3.1	**Load and Transport 5,000 tonnes of cleaned steel to steel processing facility**	Load 5000 tonnes of steel into 20 T articulated trucks	Excavators	4	Transport Diesel	35			50	250	8000	280	2721.69	762072.08	762.07
		Truck 5,000 tonnes of steel to steel recycling facility	Loaders	1	Transport Diesel	15.3			50	250	2000	30.6	2721.69	83283.59	83.28
			Light Vehicles	4	Transport Petrol	8	17500	70000			1000	8	2312.60	18500.83	18.50
			Heavy Vehicle Movements	250	Transport Diesel	18.75	70	17500			250	4.6875	2721.69	12757.90	12.76
7.4	**Recyclable Material Processing**														
7.4.1	**Processing of 5,000 tonnes of cleaned Steel at a steel processing facility**	Generally steel recycling involves breakdown of the steel into smaller blocks, melting in a furnace, purification, solidifying and transport of bars for use as raw material.	Emissions from processing of scrap steel in an EAF = 1.12 tCO2e/tonne steel (direct and indirect emissions) (see Factors tab)												5,600.00
7.5	**Non-Recyclable and non-crushable material**														
7.5.1	**Transport untreated non-crushable/ non-recyclable material to the Cessnock waste management facility**	Transportation of removed materials would include:	Excavators	2	Transport Diesel	35			9	45	720	25.2	2721.69	68586.49	68.59
			Loaders	1	Transport Diesel	15.3			50	250	2000	30.6	2721.69	83283.59	83.28
		All truck loads are to be covered.	Heavy Vehicle Movements	1250	Transport Diesel	18.75	32	40000			571.4286	10.714286	2721.69	29160.92	29.16
			Light Vehicles	4	Transport Petrol	8	3150	12600			180	1.44	2312.60	3330.15	3.33
7.6	**Material Treatment**														
7.6.1	**Crushing of all crushable materials plus fines**	Jaw crushing/screening – to size fraction required for mixing (50-100T/hr)	Excavators	2	Transport Diesel	35			206	1030	16480	576.8	2721.69	1569868.48	1569.87
		Pulverising to minus 10mm (5-10T/hr)	Diesel Pump	1	Stationary Diesel	6			206	1030	8240	49.44	2709.72	133968.56	133.97
			Impact Crusher	1	Stationary Diesel	35			206	1030	8240	288.4	2709.72	781483.25	781.48
			Jaw Crusher	2	Stationary Diesel	27			206	1030	16480	444.96	2709.72	1205717.01	1205.72
			Tracked Stockpiler	2	Stationary Diesel	9			206	1030	16480	148.32	2709.72	401905.67	401.91
			Container Loader	1	Stationary Diesel	6.3			206	1030	8240	51.912	2709.72	140666.98	140.67
			Light Vehicles	3	Transport Petrol	8	72100	216300			3090	24.72	2312.60	57167.57	57.17
			Wash-down bay	1	Stationary Diesel	15			175	875	7000	105	2709.72	284520.60	284.52
7.6.2	**Construction of a Plasma Gasification Facility**	Earthworks for foundations	Excavators	2	Transport Diesel	35			12	60	960	33.6	2721.69	91448.65	91.45
			Concrete trucks	1	Transport Diesel	72.418	10	571			8.157143	0.590724	2721.69	1607.77	1.61
		Transport of heat treatment facility components to site	Equipment delivery trucks	50	Transport Diesel	37.35			10	50	20000	747	2721.69	2033099.44	2033.10
		Construction of the heat treatment facility	Mobile Crane/Telehandler (Abo	2	Stationary Diesel	6.3			10	50	800	5.04	2709.72	13656.99	13.66
			Stationary crane	1	Stationary Diesel	23			10	50	400	9.2	2709.72	24929.42	24.93
			Forklift 8t	2	Stationary Diesel	4.6			10	50	800	3.68	2709.72	9971.77	9.97
			Light vehicles	2	Transport Petrol	8	3500	7000			100	0.8	2312.60	1850.08	1.85

Option 7 - Onsite Destruction of All Material using Plasma Gasification

	Key Action	Key Steps	Equipment	#	Source Type	Fuel Consumption (L/hr)	Distance Travelled	Total Distance	Estimated Timeframe (weeks)	Estimated Timeframe (Days)	Total Operating Hours	Total Fuel Use (kL)	Emission factor (kgCO2e/kL)	Emissions (kgCO2e/kL)	Emissions (tCO2e/kL)
7.6.3	**Transport treated fines and crushables to the plasma gasification plant**	Load stockpiled material into trucks	Excavators	2	Transport Diesel	**35**			32	**160**	**2560**	89.6	2721.69	243863.07	243.86
		Transport treated fines and crushables to the plasma gasification plant	30T Articulated Truck	4	Transport Diesel	**37.35**			32	**160**	**5120**	191.232	2721.69	520473.46	520.47
			Water Cart	1	Transport Diesel	**27**			32	**160**	**1280**	34.56	2721.69	94061.47	94.06
			Light Vehicles	7	Transport Petrol	**8**	**11200**	**78400**			**1120**	8.96	2312.60	20720.93	20.72
7.6.4	**Decommision and disammebly of Plasma Gasification Facility**	Decomission heat treatment facility	Mobile Crane/Telehandler (Abo	2	Stationary Diesel	**6.3**			10	**50**	**800**	5.04	2709.72	13656.99	13.66
			Stationary crane	1	Stationary Diesel	**23**			10	**50**	**400**	9.2	2709.72	24929.42	24.93
			Forklift 8t	2	Stationary Diesel	**4.6**			10	**50**	**800**	3.68	2709.72	9971.77	9.97
			Light vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85
		Transport heat treatment facility components offsite	Equipment delivery trucks	50	Transport Diesel	**37.35**			10	**50**	**20000**	747	2721.69	2033099.44	2033.10
7.7	**Plasma Gasification**														
7.7.1	**Treatment of crushed materials in the plasma gasification**	Place crushed materials into the chamber	Excavators	1	Transport Diesel	**35**			103	**515**	**4120**	144.2	2721.69	392467.12	392.47
		Preheat chamber with electricity	Loaders	1	Transport Diesel	**15.3**			103	**515**	**4120**	63.036	2721.69	171564.20	171.56
		Preheat crushed waste to xxx°C									**0**				
		Inject crushed waste into heated chamber	Plasma Plant - Electricity	1	Electricity	**7MW**			103	**515**	**4120**	**See Factors Tab for calc.**			2,910.10
		Collect, cool and scrub syngas													
		Store syngas in bottles for sale													
7.8	**By-Product Stockpiling and Disposal**														
7.8.1	**Transfer of by-product to stockpile**		Excavators	1	Transport Diesel	**35**			8	**40**	**320**	11.2	2721.69	30482.88	30.48
			30T Articulated Truck	1	Transport Diesel	**37.35**			8	**40**	**320**	11.952	2721.69	32529.59	32.53
			Light Vehicles	2	Transport Petrol	**8**			8	**40**	**640**	5.12	2312.60	11840.53	11.84
7.8.2	**Transfer of by-product to Cessnock waste management facility.**		Heavy Vehicle Movements	3856	Transport Diesel	**18.75**	**16.4**	**63238.4**			**903.4057**	16.938857	2721.69	46102.25	46.10
7.9	**Capped Waste Stockpile Post Works Activities**														
7.9.1	**Decommission water treatment infrastructure**	Decommission Capped Waste Stockpile water treatment plant, pumping well network and dams.	Heavy Vehicle Movements	2	Transport Diesel	**18.75**	**70**	**140**			**2**	0.0375	2721.69	102.06	0.10
		Restoration of water treatment plant location (regrading and surface stabilisation).	Light Vehicles	2	Transport Petrol	**8**	**3500**	**7000**			**100**	0.8	2312.60	1850.08	1.85
7.10	**Capped Waste Stockpile Post-Completion Phase Activities**														
7.10.1	**Groundwater monitoring at Capped Waste Stockpile location**	Ongoing groundwater monitoring (as required)	Light Vehicles	1	Transport Petrol	**8**					**80**	0.64	2312.60	1480.07	1.48
	Carbon Benefits														
	Processing of 5,000 tonnes of cleaned Steel at a steel processing facility	Lifecycle benefit associated with using scrap steel - Estimation of the bet benefit of recycling 1 tonne of steel from commercial and industrial (C&I) and construction and demolition (C&D) sources in New South Wales (0.44 tCO2e/tonne)													-2200.00

21727.52