HANCOCK PROSPECTING PTY LTD

Alpha Coal Project Environmental Impact Statement

14 Greenhouse Gas Emissions

Section 14 Greenhouse Gas Emissions

14.1 Greenhouse Gas Emissions Assessment

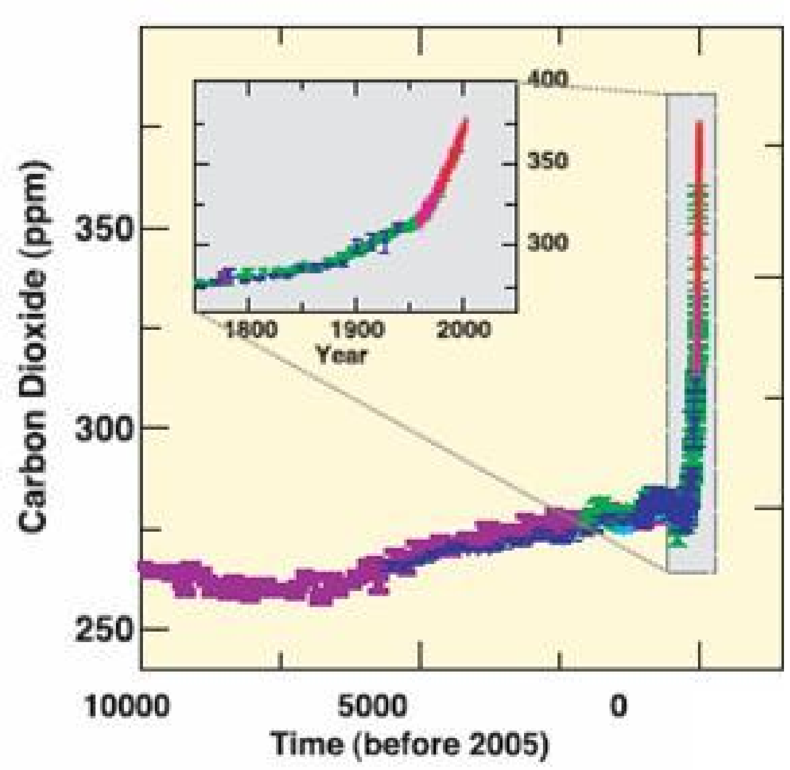
14.1.1 Introduction

The aim of this section is to present an analysis of the potential greenhouse gas (GHG) emissions that will be produced as a result of the construction and operation phases of the Alpha Coal Project (Rail) (herein referred to as the Project) and to highlight potential means by which these emissions could be reduced or avoided.

14.1.2 Background on Greenhouse Gas Assessment

GHGs are gases in the Earth's atmosphere that trap heat, allowing the temperature of the Earth to be kept at a level that is necessary to maintain life. An increase in the levels of these gases in the atmosphere results in an increase in the amount of heat being trapped, leading to warming of the Earth's surface. This is commonly referred to as the enhanced greenhouse effect. The three main GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Figure 14-1 demonstrates the increase in concentrations of CO_2 in the Earth's atmosphere since 1750 in comparison to the concentrations experienced during the last 10,000 years. This figure clearly shows that the levels of CO_2 in the Earth's atmosphere have increased significantly in the last 200 years.

Figure 14-1: Changes in carbon dioxide concentration over last 10000 years (IPCC, 2007)



Increased awareness of the impacts of an enhanced greenhouse effect has resulted in many policies and strategies being developed to quantify and reduce the amounts of these gases being released into the Earth's atmosphere. Internationally accepted reporting on GHG emissions defines three categories of emissions, namely: Scope 1, Scope 2 and Scope 3. These are defined as:

- Scope 1 emissions are produced from sources within the boundary of an organisation, due to:
  - onsite generation of energy, heat, steam and electricity;
  - emissions from manufacture or processing of chemicals or materials onsite;
  - fuel combustion in vehicles associated with the organisation; and
  - fugitive emissions.
- Scope 2 emissions are indirect emissions generated as a result of activities that use electricity, heating, cooling or steam that are consumed onsite, but that are physically produced by another organisation; and
- Scope 3 emissions cover all indirect emissions that are not included in Scope 2. Examples include upstream emissions generated in the extraction and production of fossil fuels, emissions due to the disposal of waste, and the downstream implications of transporting products to customers.

14.1.3 Methodology

A GHG assessment was prepared by:

- outlining the baseline GHG conditions;
- identifying the main potential sources of GHG emissions from the construction and operational phases of the Project:
  - where sufficient information was available, broad estimates of the potential quantities of GHG emissions were made in accordance with the general principles of the Commonwealth Department of Climate Change (DCC) National Greenhouse Accounts (NGA) Factors, (2009). Where suitable emissions factors were not available in the NGA Factors, emissions factors from Simapro (2008) software were used to estimate lifecycle emissions associated with materials.
- potential mitigation options were then identified to highlight areas where GHG emissions associated with the construction and operation phases of the Project could be reduced.

14.1.4 Baseline GHG Emissions

The latest overview of GHG emissions estimates for Australia was published by the Department of Climate Change and Energy Efficiency (DCCEE) in May 2010. These estimates relate to data for the period from 1990 to 2008. The 2008 annual estimates for Australia, Queensland and for the sectors relevant to this Project are summarised in Table 14-1.

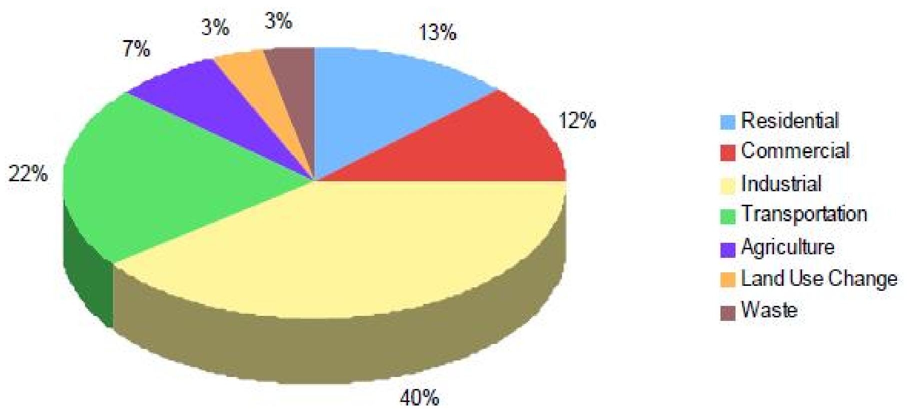
Table 14-1: 2008 annual greenhouse gas emissions estimates (DCCEE, 2010)

	Australia	Queensland	
	Emissions (Mt)	Emissions (Mt)	Percentage (%) Contribution
Total Net Emissions	575.8	160.3	27.8%
Transport	80.2	19.5	24.3%
Industrial Processes	31.1	4.3	13.9%

14.1.5 South East Queensland Current Sources of Emissions

The *South East Queensland Climate Change Management Plan 2009* (DIP, 2009) estimates that the South East Queensland region produced 47.9 million tonnes of CO_2-e in 2006. The industrial sector contributed the most to these regional emissions, with 40% of South East Queensland's emissions (refer to Figure 14-2).

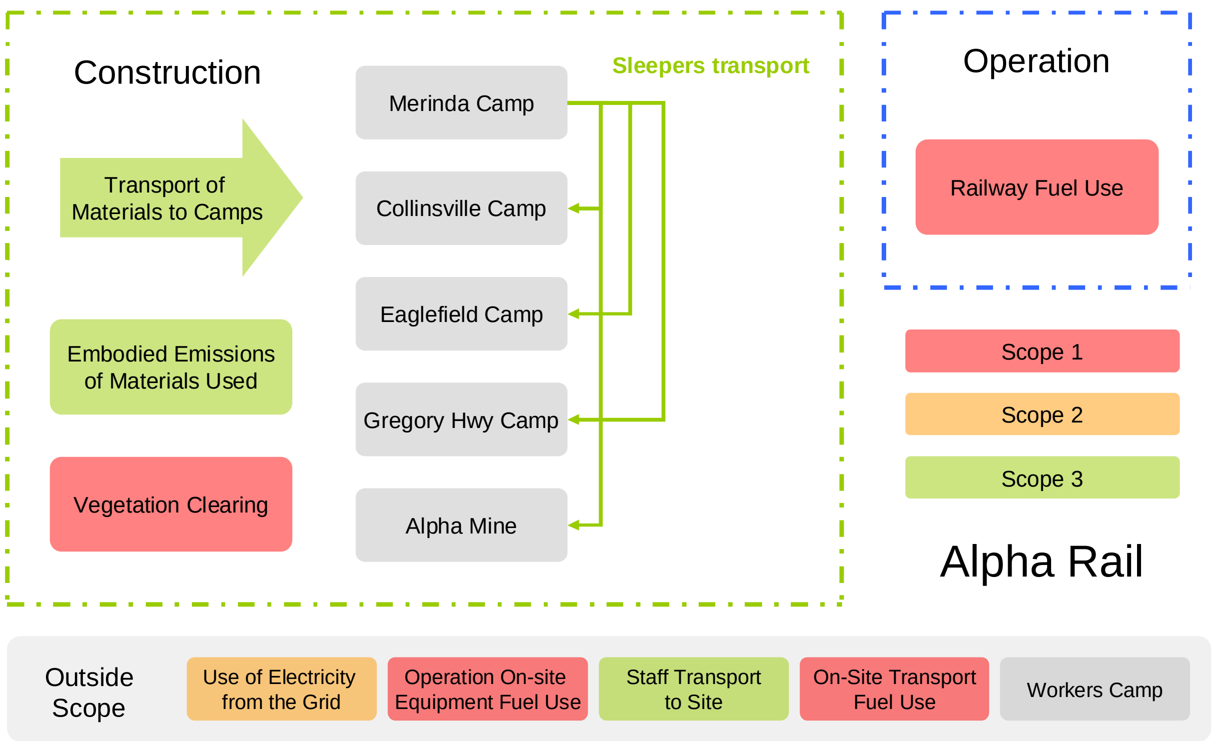
Figure 14-2: Greenhouse gas emissions in South East Queensland by sector (DIP, 2009)



14.2 Assessment Boundaries

The boundary of the assessment of potential GHG emissions is focused on the construction and operational phases of the Project and demonstrated in Figure 14-3.

Figure 14-3: GHG Assessment Boundaries



At the time of producing this Environmental Impact Statement (EIS), the Project was in the preliminary design phase and detailed information on different aspects of the construction and operation requirements were not available. Where sufficient information is available, approximate GHG emissions were quantified for activities within the boundary of this assessment. However, these will need to be reviewed when more information becomes available.

14.2.1 Assumptions

14.2.1.1 General Information

As described in Volume 3, Section 2 of this EIS the Project entails construction of a 495 km long railway line from the Alpha Coal Mine to the Port of Abbot Point. The lifespan of the Project is expected to be 30 years.

14.2.1.2 Construction

Details regarding construction are as follows:

- estimated types and quantities for embodied emissions of the major materials required for the Project as per Table 14-3:
  - general fill, common and borrow material are assumed to consist of a third of sand, a third of crushed aggregate and a third of gravel.
- 495 km maintenance track will be established along the railway line;
- the rail sleepers will be constructed at the Salisbury Plains accommodation village; and
- 163,600 kL of fuel will be used during construction

14.2.1.3 Vegetation Clearing

The total area of vegetation to be cleared is approximately 1,600 ha including endangered, of concern, least concern and regrowth vegetation.

GHG emissions due to vegetation clearing within the assessment corridor were quantified using the National Carbon Accounting Toolbox (NCAT). The NCAT provides access to the Full Carbon Accounting Model (FullCAM) and supporting data. FullCAM is the method used to quantify emissions due to forest clearing in Australia's land systems for the purposes of international reporting.

The Australian Government FullCAM model was used to project the carbon yields for the Project. For the purposes of this exercise, it has been assumed that the area is fully forested with local tree species classified as a multilayer forest system.

The Project traverses a significant variation in annual average rainfall from the Alpha Coal Mine to the Port of Abbot Point (increase of approximately 500 mm). Rainfall is a significant driver for vegetative growth and it is expected that vegetation would support greater biomass near the coast line. However, other factors such as soil nutrient availability and inundation (especially near the coast line) can cause variability in the relationship between rainfall and biomass.

To account for this variation in rainfall, the Project was stratified according to the following annual average rainfall bands:

- 450 – 500 mm;

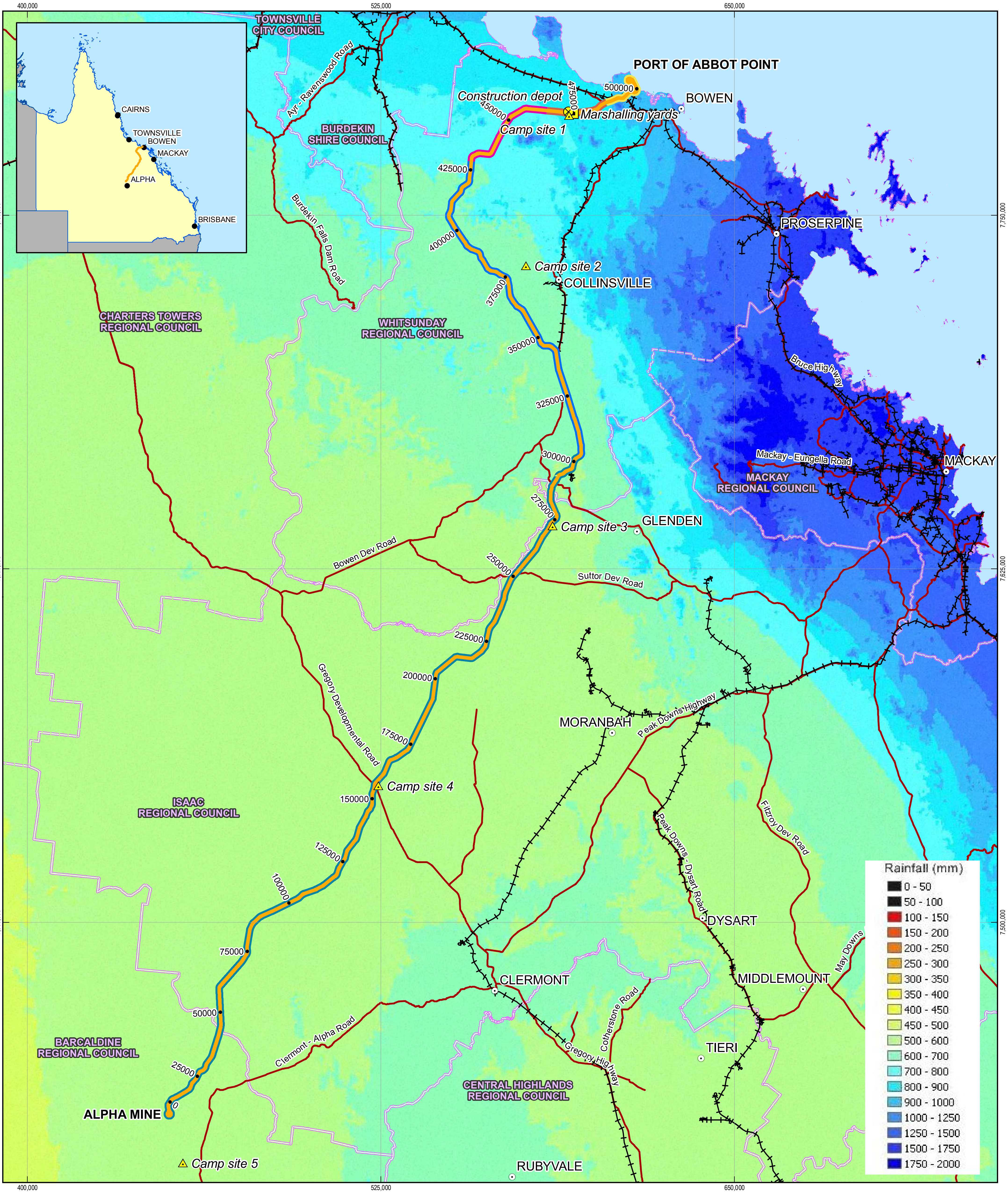
- 500 – 600 mm;
- 600 – 700 mm;
- 700 – 800 mm; and
- 800 – 900 mm.

The intersection of the Project with these rainfall bands is demonstrated in Figure 14-4.

In each of these rainfall bands FullCAM was used to quantify the amount of carbon in mature native vegetation. Where possible the FullCAM plot file developed for each rainfall band was located on a patch of native vegetation, and for the 400-450 mm band the plot was located at the eastern end of the rainfall band to ensure that estimates were as conservative as possible (i.e. an extremely dry area at the western end of the assessment corridor was not used).

The area of vegetation within the assessment corridor identified for the ecological studies was also used to determine the area of vegetation that would be cleared and thus result in the release of CO_2 to the atmosphere.

GHG emissions due to vegetation clearing were estimated by multiplying the results returned by FullCAM by 3.67 (the ratio of the mass of a carbon atom to the CO_2 molecule). It was assumed that none of the cleared vegetation would regrow after the construction of the Project.



LEGEND

- Town
- Camp
- Marshalling Yards
- Depot
- Proposed Alignment
- State Road
- Existing Railway
- Rail Section: Section 1, Section 2, Section 3, Section 4, Section 5
- Local Government Area

Source: See Copyright Details below and for full disclosure please refer to the EIS *Volume 4 - References*

1:1,250,000 (at A3)

0 5 10 20 30 40 50

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 55

N E S W

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Alpha Coal Project
Environmental Impact Statement

RAINFALL BANDS FOR VEGETATION CLEARING CALCULATIONS

Job Number 41-22090
Revision A
Date 20-09-2010

Figure: 14-4

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Results of the assessment are shown in the Table 14-2.

Table 14-2: Vegetation Clearing Calculations

Rainfall band (annual average mm)	450 - 500	500 - 600	600 - 700	700 - 800	800 - 900	Total
Area of vegetation (ha)	735	577	158	94	36	1,600
Carbon in mature native vegetation (t C / ha)	23	49	54	37	61	-
Total carbon (t C)	16,966	28,006	8,568	3,505	2,206	59,251
Emissions due to clearing (t CO_2-e)	62,265	102,782	31,446	12,864	8,095	217,451

The general trend for carbon in mature native vegetation (FullCAM output) was for it to increase from 23 t C / ha in the 450-500 mm rainfall band to 61 t C / ha in the 800-900 mm band. However, this trend was interrupted in the 700-800 mm rainfall band where carbon in mature native vegetation was estimated at 37 t C / ha, which was the second lowest value of the five values recorded. The low value in this area may be due to water logging of soils in the low lying coastal environment which may inhibit plant growth in this area.

The FullCAM model predicts that there will be a total of 220 kt CO_2-e greenhouse gas emissions (140 t CO_2-e per hectare) due to vegetation clearing in the construction phase. The total figure from vegetation clearing includes above and below ground biomass, debris and soil carbon. This represents about 10% of the total Project construction emissions.

14.2.1.4 Transport of Materials

Details on transport of material for construction of the Project include:

- transport of materials using rigid trucks;
- ballast will be sourced from a quarry in Proserpine (66.1 km from Merinda) and will be transported via road to the Project area and/or accommodation villages;
- quarry material will be sourced from the closest possible location within the Project area. It has been assumed that it will be sourced approximately 60 km away from each accommodation village;
- cement to be used for the sleepers will be sourced from Mackay;
- average distance for fill material transport is ten km; and
- distance driven to transport materials has been calculated from source to each of the accommodation villages.

Type, quantity and emission factor of construction materials is included in Table 14-3.

Table 14-3: Type, quantity and emission factor of materials to be used for construction

Major materials to be used for construction	Estimated Quantities*	Assumptions and emission factor ($t\ CO_2$-e / t)
Formation Works Excavation – Common	6,627,300 m^3	Sand - 0.0169 Gravel - 0.0170 Crushed aggregate - 0.0041
Formation Works Excavation – Rock	5,627,300 m^3	Crushed rock - 0.0169
Formation Works – Borrow Material for General Fill	7,311,500 m^3	Sand - 0.0169 Gravel - 0.0170 Crushed aggregate - 0.0041
Formation Works – General Fill (used from both excavation & borrow)	18,700,000 m^3	Sand - 0.0169 Gravel - 0.0170 Crushed aggregate - 0.0041
Formation Works Top Capping Layer	815,500 m^3	Crushed aggregate - 0.0041
Ballast	751,800 m^3	Gravel - 0.0170
Sleepers	900,000 No	Concrete – 0.1410 275 kg / each Steel – 1.8574 6 kg / each
Maintenance Track	495 km long	5 m wide 0.45 m thick Gravel – 0.0170

* These quantities are indicative only and based on preliminary design that is subject to variation pending completion of detailed engineering design.

14.2.1.5 Operation

The amount of fuel likely to be used during the operation of the Project is as follows:

- tonnes transported per year as follows:
  - 2014 – 6,000 t;
  - 2015 – 18,156,000 t;
  - 2016 – 29,168,000 t;
  - 2017 – 42,959,000 t;
  - 2018 – 46,066,000 t;
  - 2019 – 52,025,000 t; and
  - 2020-2043 – 58,600,000 t each year.
- fuel consumption per cycle using 3 locomotives – 1.36 L / t.

14.2.2 Exclusions

The following information related to the Project is not available at this stage and will be available at the detailed design stage of the Project:

- staff travel and transport to the Project from different accommodation villages;
- use of electricity from the grid during construction and operation;
- the source, supply and quantity of water to be used for the construction activities;
- source, quantities, volume, transport and type of equipment to be used during construction and operation;
- use of equipment during construction and operation;
- transportation of equipment to different sites;
- embodied emissions of materials to be used for the construction and operation of the accommodation villages;
- embodied emissions of the materials used to build the demountable single units are not considered since it is assumed that they can be reused; and
- fuel, chemical and waste storage:
  - GHG emissions results.

A breakdown of the estimated emissions for the overall Project is shown in Table 14-4. The result indicates total emissions of approximately 280 kt CO2-e / year for the Project construction and operation stages (or 8,470 kt CO2-e over the life of the Project).

The emissions have been categorised into:

- Construction - including embodied emissions of materials, transportation of materials to the Project sites, diesel use during construction, vegetation clearing; and
- Operations - including emissions from diesel use.

Overall, the diesel use during construction is the largest source of emissions (73% of all emissions), followed by the embodied emissions of materials during the construction stage estimated to contribute 11%. Transportation of materials during the construction, diesel use during the operations and vegetation clearing are estimated to contribute 7%, 6% and 3% respectively. A breakdown of the estimated emissions for the overall Project is shown in Figure 14-5.

Figure 14-5: Total greenhouse gas emissions breakdown

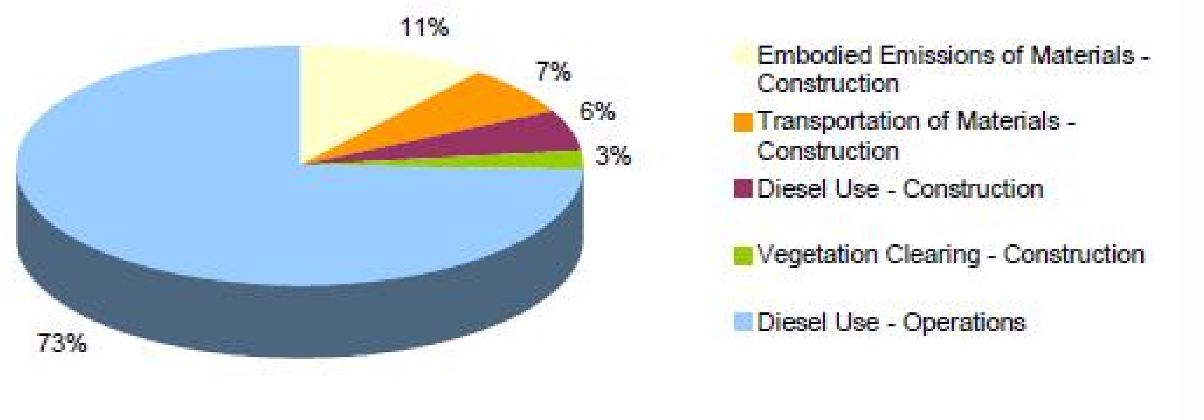


Table 14-4: Summary of greenhouse gas emissions

Phase	Emission Source	Total Emissions over Project lifetime – 30 years (kt CO_2-e)	Annualised Emissions (kt CO_2-e / year)
Construction	Embodied Emissions of Materials	920	
	Transportation of Materials	560	
	Diesel use – construction emissions	470	
	Vegetation Clearing	220	
	Total Construction Emissions	2,170	70
Operation	Diesel Use – operational emissions	6,300	
	Total Operational Emissions	6,300	210
	Total emissions	**8,470**	**280**

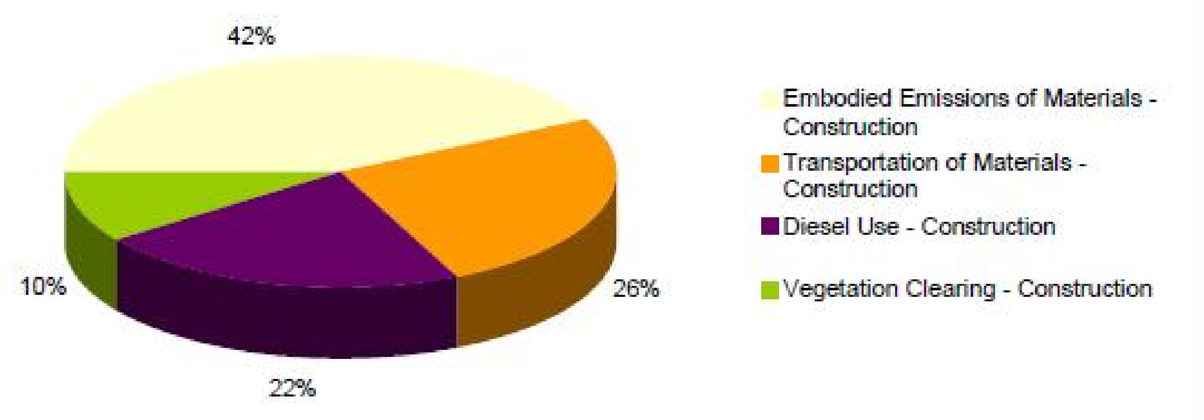
14.2.3 Construction Phase

The potential GHG emissions arising from the operational phase of the Project will focus on emissions associated with the following activities:

- embodied emissions of materials;
- transportation of materials;
- diesel used in construction; and
- vegetation clearing.

The construction phase source of emissions contributes with approximately 2,170 kt CO_2-e, representing a 26% of the total inventory. Figure 14-6 demonstrates the contribution of each emission source during the construction phase. It shows the relative impacts of the contributors to the Project's emissions.

Figure 14-6: Greenhouse gas emissions breakdown during construction



14.2.4 Operational Phase

The emissions from the operational phase are released from the use of fuel transporting coal from the Alpha Coal Mine to the Port of Abbot Point. This source of emissions contributes with approximately 6,300 kt CO_2-e over the 30 year life of the Project.

14.3 Greenhouse Gas Reduction

Methods for reducing GHG emissions are generally based on the following themes:

- **Avoid:** Identify where and how GHG emissions associated with the Project can be avoided;
- **Reduce:** Identify where behaviour or processes can be modified to achieve GHG emission reductions; and
- **Switch:** Identify where fuel and energy source switching can be used to reduce GHG emissions.

The following mitigation options could be deployed during the construction and operation phases in order to reduce the quantity of GHG emissions arising from the Project. Although some activities are potentially much larger contributors to GHG emissions, reductions achieved in all components of the Project will be important in reducing the overall GHG emissions.

Information regarding the management and mitigation measures for GHG is detailed further in Volume 3, Section 26 of this EIS.

14.4 Proposed Actions

Identification of the main GHG contributors within the Project help clarify where the significant GHG abatement opportunities exist. Therefore, these sources will be the focus of attention when investigating the GHG mitigation options for the Project.

A detailed GHG emissions assessment will be undertaken when there is more information available in the detailed design stage for a more accurate result.

The following is a list of proposed actions and opportunities to reduce the overall GHG emissions from the Project:

- develop a GHG emissions minimisation strategy for the construction and operation phases of the Project;
- investigate the use of biofuels (e.g. ethanol and biodiesel). Consult with equipment suppliers to ensure that manufacturer's warranties accept use of biodiesel;
- explore opportunities to backload on trucks;
- use gravel instead of concrete slabs as a base for the demountable single units in the construction accommodation villages to reduce emissions;
- in terms of defining the haulage routes, choose the most direct route possible which will result in further reductions in GHG emissions through reduced fuel usage. For example, Peak Downs Highway and Bruce Highway (379 km away) instead of Gregory Developmental Rd and Bowen Developmental Rd (494 km away) from Merinda to the Gregory Highway accommodation village even though it does not follow the Project alignment;
- investigate the disposal/reuse of surplus excavated material and if this material can be coordinated with concurrent construction activities in the vicinity;
- the driving methods employed by the drivers operating the trucks will also impact on the amount of fuel used and therefore reduce the GHG emissions associated with the transportation of the quarry materials to the site. Studies have shown that implementing smoother driving practices can result in fuel savings of between five and ten percent (OECD, 2001);
- coordinate staff travel arrangements to minimise trips and maximise passenger loads on each trip;
- include embodied energy considerations in material selection and procurement strategy during the detailed design stage and for the life of the Project;
- investigate opportunities to maximise the amount of revegetation on site (or off site);
- consider the potential for alternative energy sources rather than grid connected electricity, e.g. investigate cogeneration, trigeneration or renewable energy opportunities;
- select appliances based on energy efficiency;
- install timers and light level sensors on lighting systems around the accommodation villages;
- design accommodation villages and other buildings to maximise natural ventilation and cooling;
- select efficient air conditioning systems and set operating temperatures to maximise efficiency in the workers and constructions accommodation villages;
- use solar hot water heating in accommodation villages where possible;
- consider use of solar panels for accommodation villages. Solar panels might also be able to be used for road lighting and powering isolated items such as pumps;
- select any site transport vehicles based on energy consumption, with target environmental performance with no less than five points in GHG and air pollution rating; and
- offset unavoidable emissions (as desired). These offsets can be generated from a variety of sources such as renewable energy, forestry plantations or energy efficiency projects. The DCCEE has issued the National Carbon Offset Standard to guide the voluntary offsetting of emissions. This guide will be considered during the construction and operation of the Project.

Information regarding the management and mitigation measures for greenhouse gasses is detailed further in Volume 3, Section 26 of this EIS.