# 13. Greenhouse gas emissions

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## 13.1 Introduction

### 13.1.1 Overview

This chapter provides the greenhouse gas assessment undertaken for the Lower Fitzroy River Infrastructure Project (Project). The greenhouse gas emission impacts from the Project are assessed and methods by which these emissions can be reduced are identified. The assessment addresses Section 5.124 – 5.127 of the environmental impact statement terms of reference (ToR). A table cross-referencing the ToR requirements is provided in Appendix B. Climate and climate change is addressed separately in Chapter 4 Climate, natural hazards and climate change.

### 13.1.2 Regulatory framework

The Commonwealth Government has committed to reduce greenhouse gas emissions by 80 per cent of 2000 levels by 2050, with between five per cent and 15 per cent to 25 per cent reduction commitment for the period up to 2020. The five per cent target is unconditional. The up to 15 per cent and 25 per cent is conditional on the extent of international action. Key legislation includes:

- *Clean Energy Act 2011* (Cth)

  The *Clean Energy Act 2011* has been repealed. This abolished the carbon pricing mechanism as at 1 July 2014.

- *National Greenhouse and Energy Reporting Act 2007* (Cth)

  The *National Greenhouse and Energy Reporting Act 2007* established the legislative framework for the National Greenhouse and Energy Reporting Scheme (NGERS) a national framework for reporting greenhouse gas emissions, greenhouse gas projects and energy consumption and production by corporations in Australia. There are two types of thresholds to determine which corporations are required to participate in the NGERS. These are facility thresholds and corporate group thresholds. As a guide, businesses emitting more than 25,000 t $CO_2$-e, or consuming more than 25,000 megawatt hours of electricity or 2.5 million litres of fuel in a financial year, can expect to be required to report. The Project is unlikely to consume such electricity and thus, reporting is unlikely to be required.

- *Energy Efficiency Opportunities Act 2006* (Cth)

  The *Energy Efficiency Opportunities Act 2006* (Cth) required companies that used over 0.5 petajoules (PJ) of energy in a financial year to conduct energy efficiency assessments and report publicly on the outcomes. Project participation was to be assessed based on actual energy usage; however it is unlikely that the Project will trigger this threshold.

  On 11 September 2014, the *Energy Efficiency Opportunities (Repeal) Bill 2014* received Royal Assent. The repeal has a retrospective commencement clause and is effective from 29 June 2014. Accordingly, all obligations and activities under the Energy Efficiency Opportunities Program have ceased.

- *Carbon Credits (Carbon Farming Initiative) Act 2011* (Cth).

  The Carbon Farming Initiative has been developed as a legislative offsets scheme giving farmers, forest growers and landholders the ability to generate Australian carbon credit units by storing carbon or reducing greenhouse gas emissions on the land. These Australian carbon credit units can then be sold to people and businesses wishing to offset their emissions. This initiative is not relevant to the Project.

### 13.1.3 Approach and methodology

#### 13.1.3.1 Assessment scope

The purpose of the greenhouse gas assessment is to calculate the predicted emissions of greenhouse gases associated with the design, construction and operational stages of the Project and to propose strategies for reducing emissions. In order to obtain a comprehensive estimate, the following sources of emissions for both weirs were considered:

- Fuel use from on-site equipment during construction
- Emissions associated with impoundment (vegetation loss and inundated land)
- Emissions from blasting
- Fuel use and power consumption during operations

The gas assessment was prepared in accordance with the general principles considered to represent current good practice in Australian greenhouse gas accounting:

- The *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* developed by the World Business Council for Sustainable Development and World Resources Institute (2004) (Greenhouse Gas Protocol)
- Life Cycle Assessment principles (ISO 14040 series)
- Australia's National Carbon Accounting System and National Carbon Accounting Toolbox (DCCEE 2005)
- The National Greenhouse Account Factors (DCCEE 2010[1]).

In accordance with the Greenhouse Gas Protocol, emissions scopes are defined as follows:

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

Scope 1 and Scope 2 greenhouse gas emissions have been assessed for the Project as required under the ToR for the design, construction and operations phases (as applicable).

The data considered in the greenhouse gas assessment was sourced from Project documents and records including cost estimating sheets, construction methodology reports, and concept design reports. The emission factors used for this inventory were sourced primarily from the NGA Factors (DCCEE 2010; DCCEE 2012a) and the SimaPro[2] Australian Database.

[1] NGA Factors are used to estimate greenhouse gas emissions. The NGA Factors are not for the purposes of reporting under the NGER Act. The NGA Factors have a general application to the estimation of a broader range of greenhouse emissions inventories.

[2] SimaPro comprises lifecycle assessment software.

The National Carbon Accounting Toolbox Full Carbon Accounting Model (FullCAM) was used to project the carbon yields for the Project sites. The methodology required use of the infrastructure footprints, which allowed classification of the vegetation communities. Vegetation communities have identified carbon intensities which will be released to the atmosphere in the case of removal. The yields from vegetation clearing include above and below ground biomass, debris and soil carbon.

Emissions data has been converted into quantities of $CO_2$-e and expressed as tonnes (t $CO_2$-e).

#### 13.1.3.2 Assessment methodology

The greenhouse gas assessment comprised:

- A literature review of state and national greenhouse gas policy and legislation
- Development of a greenhouse gas emissions inventory for the Project
- Participation in an internal Project team climate change and greenhouse gas assessment and adaption workshop to assess and develop possible mitigation options to avoid, reduce and/or manage greenhouse gas emissions associated with the Project.

#### 13.1.3.3 Qualifications

The following items were excluded from the assessment as their contribution to the inventory is anticipated to be minor, not relevant, or outside of the scope:

- Scope 3 greenhouse gas emissions including emissions associated with the transportation of workers and materials to site
- Emissions associated with the consumption, treatment and disposal of water and wastewater during construction
- Emissions associated with the transportation and disposal of waste from construction
- Emissions associated with maintenance of vehicles and equipment and the use of oils, grease, lubricants and replacement parts. Only fuel consumption has been included
- Emissions from any diesel generators that may be required during the construction phase, except for fuel used for lighting
- Emissions associated with resource extraction areas (quarries and borrows)
- Emissions associated with decommissioning. Details of decommissioning procedures were not available at the time of the assessment. It was assumed that the infrastructure would be made safe and will remain in place for 100 years.

Wherever possible, estimates were used to calculate greenhouse gas emissions. When data was unavailable, reasonable assumptions were made. Table 13-1 provides a summary of assumptions.

**Table 13-1 Greenhouse gas assessment assumptions**

| Source / parameter | Assumptions and emissions factors |
|---|---|
| **Construction and commissioning** | |
| Fuel use | Fuel use for construction was estimated at 2,000 kL and 5,348 kL for Eden Bann Weir and Rookwood Weir, respectively.<br>Equipment included: trucks, excavators, rollers, graders, dozers, loaders, cranes, drills, water carts, compressors and vibrating plates.<br>Fuel consumption rates were based on the Caterpillar® equipment specifications, and from previous assessments.<br>Emissions factors for diesel for stationary energy purposes were sourced from the NGA Factors (July 2010). |
| Blasting | 45 t and 75 t of ammonium nitrate fuel oil explosives may be used at Eden Bann Weir and Rookwood Weir, respectively.<br>Emissions factor for the use of explosives sourced from the NGA Factors (January 2008). |
| Vegetation clearing | Vegetation clearing will be undertaken to accommodate site offices, car parks, laydown and workshop areas, and material stockpiles.<br>Vegetation comprises fully forested areas with local trees species classified as a multilayer forest system.<br>Emissions factor of 3.67 sourced from the NGA Factors (July 2010).<br>A total of 33.5 ha will be cleared for Eden Bann Weir. Average vegetation carbon intensity (FullCAM) for Eden Bann Weir is 40.58 t/ha.<br>A total of 12.4 ha will be cleared for Rookwood Weir. Average vegetation carbon intensity (FullCAM) for Rookwood Weir is 48.35 t/ha. |
| Vegetation loss and inundated land | <u>General:</u><br>• Emissions associated with loss of vegetation as a result of inundation will occur over a period of time, but not over the life of the Project. As such, the emissions are calculated as a one-off total and not as an annual contribution to emissions<br>• Emissions factor of 3.67 sourced from the NGA Factors (July 2012)<br>• Methane ($CH_4$) and carbon dioxide ($CO_2$) emissions from inundated (flooded) land have been estimated using the methodology and emission factors for a warm, temperate dry climate provided in the Intergovernmental Panel on Climate Change 2006 Guidelines for National Greenhouse Gas Emissions. Emissions from inundated land were calculated for a 10 year period post initial fill (IPCC 2007).<br><u>Eden Bann Weir:</u><br>• Total vegetation inundation area calculated at Stage 3 is 628 ha<br>• Average vegetation carbon intensity (FullCAM) is 40.48 t/ha<br>• Vegetation comprises open woodland with weedy understorey; open woodland on rocky hillside; open woodland with grassy understorey and Melaleuca riparian fringe; riparian fringe with agricultural land behind; open woodland on sandy substrate; Melaleuca forest on sandy substrate; and agricultural land. |

| Source / parameter | Assumptions and emissions factors |
|---|---|
| | <u>Rookwood Weir:</u><br>• Total vegetation inundation area calculated at Stage 2 is 1,273 ha<br>• Average vegetation carbon intensity (FullCAM) is 39.94 t/ha<br>• Vegetation comprises Brigalow; open woodland on rocky hillside; open woodland with grassy understorey and Melaleuca riparian fringe; riparian fringe with agricultural land behind and open woodland on sandy substrate. |
| **Operation** | |
| Fuel use | Fuel use during operations at both Eden Bann Weir and Rookwood Weir is estimated to be in the order of 2 kL/annum each to power stand-by (emergency) generators as follows:<br>• One 85 kVa generator used once a year to operate the crest gates<br>• One 85 kVa generator is used twice per year to operate the fish locks<br>• One 100 kVa generator operated crane is used once a year for a week for maintenance purposes.<br>Emission factors for diesel were sourced the NGA Factors (July 2012). |
| Electricity use | Use of electricity from the grid at both Eden Bann Weir and Rookwood Weir is estimated to be in the order of 90,000 kWh/annum each.<br>Power is required for crest gates (20 kW), selector baulks (10 kW), outlets works (10 kW), fish locks (5 kW), lighting (5 kW) and air conditioners (3.5 kW), operating under the following conditions on an annual basis:<br>• All crest gates are operated per event, assuming three events per year<br>• Water extraction levels are adjusted every two weeks (25 times per year)<br>• Either the environmental flow outlets or the low flow outlets are operated once per week<br>• The fishway operates 24/7 for the whole year, with one component always operating at some time<br>• Lights operate only at night when personnel are on site (estimated at once per week)<br>• Air conditioner units operate continuously on an annual basis for cooling of the control equipment, but only operate 18 hours in every 24 hours. |

## 13.2 Description of environmental values

Table 13-2 provides a summary of state and national annual greenhouse gas emissions estimates[3] for sectors relevant to the Project. These estimates were published in 2010 and 2012 by the former Commonwealth Department of Climate Change and Energy Efficiency (DCCEE) and relate to data for the period from to 2008 (DCCEE 2010) and 2009/2010 (DCCEE 2012b), respectively, relative to 1989/90 which is considered to be the base year for greenhouse gas emissions.

**Table 13-2 Annual greenhouse gas emissions**

| Sector | Australia emissions ($MtCO_2$-e/an) | | Queensland emissions ($MtCO_2$-e/an) | | Queensland's contribution to national emissions (%) | |
|---|---|---|---|---|---|---|
| | **2008*** | **2009/10^** | **2008*** | **2009/10^** | **2008*** | **2009/10^** |
| Total net emissions | 575.8 | 560.8 | 160.3 | 157.3 | 27.8 | 28.1 |
| Manufacturing and construction | 48.7 | 40.6 | 12.5 | 8.8 | 25.8 | 21.8 |
| Transport | 80.2 | 83.2 | 19.5 | 19.7 | 24.3 | 23.7 |
| Land use change (deforestation) | 49.3 | 18.1 | 29.5 | 23.1 | 59.8 | 127.5 |

Source: Australian National Greenhouse Accounts – State and Territory Gas inventories (*DCCEE 2010, ^DCCEE 2012b)

## 13.3 Potential impacts and mitigation measures

### 13.3.1 Predicted greenhouse gas emissions

No Scope 1 or Scope 2 greenhouse gas emissions are associated with the design phase of the Project.

Scope 1 emissions during construction include emissions from onsite equipment fuel use, vegetation clearing, and blasting. There are no Scope 2 emissions predicted during construction as onsite electricity would be provided independently of mains power supply and has therefore been incorporated into the calculation of Scope 1 emissions. In total, greenhouse gas emissions during construction are estimated at 28,224 t $CO_2$-e. Emissions from fuel use are the largest contributor (70 per cent) followed by vegetation clearing (30 per cent). Emissions from blasting are negligible at less than one per cent of the total.

Table 13-3 provides a summary of greenhouse gas inventory for the construction phase (two years).

[3] Including land use, land use change and forestry.

**Table 13-3 Construction phase greenhouse gas inventory**

| Emissions source | Value | Unit | Emission factor (t CO2-e/unit) | Emissions* (t CO2-e) | | Proportion of total inventory (%)+ |
|---|---|---|---|---|---|---|
| | | | Scope 1 | Scope 1 | Total | |
| **Eden Bann Weir** | | | | | | |
| Fuel | 2,000 | kL | 2.68 | 5,360 | 5,360 | 20 |
| Blasting | 45 | t | 0.17 | 8 | 8 | <1 (0.03) |
| Vegetation clearing (33.5 ha) | 893 | t C | 3.67 | 4,989 | 4,989 | 18 |
| Sub-total | | | | | 10,357 | 38 |
| **Rookwood Weir** | | | | | | |
| Fuel | 5,348 | kL | 2.68 | 14,333 | 14,333 | 53 |
| Blasting | 75 | T | 0.17 | 13 | 13 | <1 (0.05) |
| Vegetation clearing (12.4 ha) | 1,426 | t C | 3.67 | 2,200 | 2,200 | 8 |
| Sub-total | | | | | 16,546 | 62 |
| Total | | | | | 26,903 | 100 |

Notes

* There are no Scope 2 emissions predicted during construction

+ Rounded

Scope 1 emissions associated with inundation are estimated at 345,294 t $CO_2$-e comprising:

- Eden Bann Weir: 123,466 t $CO_2$-e
- Rookwood Weir: 221,828 t $CO_2$-e.

Scope 1 emissions during operation include fuel use in stand-by emergency generators. Scope 2 emissions will result from use of electricity from the grid during operations. Scope 1 and Scope 2 emissions during operations are estimated at 164 t $CO_2$-e/an comprising:

- Scope 1 emissions (fuel use): 10 t $CO_2$-e/an
- Scope 2 emissions (power consumption): 154 t $CO_2$-e/an.

The weirs have a design life of 100 years. Assuming a Project life of 100 years total greenhouse gas emissions for the life of the Project will be in the order of 388,597 t $CO_2$-e.

Emissions associated with vegetation clearing are not included within the NGERS and are not included in the reporting. Based on the predicted emissions during construction and operation (largely as a result of fuel and electricity usage), it is not expected that the Project will trigger reporting thresholds. Participation will however need to be determined based on actual annual greenhouse gas emissions and energy consumption.

Estimated energy usage through construction is 0.1 PJ/annum and during operations is negligible (0.0008 PJ).

### 13.3.2 Mitigation measures

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

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

Greenhouse gas emissions predicted for the Project during construction are considered to be low and occur over a short period of time. Construction activities do not offer many opportunities for further reduction of Scope 1 emissions (noting there are no Scope 2 emissions for construction). Greenhouse gas emissions during operations are low and not expected to contribute significantly to Queensland's overall greenhouse gas emissions. No offsetting for greenhouse gas emissions is proposed.

Gladstone Area Water Board and SunWater Limited are committed to reducing pollutants, protecting the natural environment and reducing their carbon footprints and already undertake a number of initiatives and participate in a number of programmes to manage their carbon emissions and report in accordance with regulatory requirements. The responsibility of complying with monitoring and reporting requirements during the operational phase will fall to the operator of the weirs.

## 13.4 Summary

The purpose of the greenhouse gas assessment is to calculate the predicted emissions of greenhouse gases associated with the design, construction and operational stages of the Project, and to propose strategies for reducing emissions. The following Scope 1 and Scope 2 emission sources for both weirs were considered:

- Fuel use from on-site equipment during construction
- Emissions associated with the clearance of vegetation (construction footprint and operational inundation areas)
- Emissions from blasting
- Fuel use and power consumption during operations

No Scope 1 or Scope 2 greenhouse gas emissions are associated with the design phase of the Project.

Scope 1 emissions during construction are estimated at 26,903 t $CO_2$-e. There are no scope 2 emissions during construction. Scope 1 emissions associated with inundation are estimated at 345,294 t $CO_2$-e. Scope 1 and Scope 2 emissions during operations are estimated at 164 t $CO_2$-e/an.

Based on the predicted emissions during construction and operation (largely as a result of fuel and electricity usage), it is not expected that the Project will trigger reporting thresholds. Participation will however need to be determined based on actual annual greenhouse gas emissions and energy consumption.

Greenhouse gas emissions predicted for the Project during construction are considered to be low and occur over a short period of time. Construction activities do not offer many opportunities for further reduction of Scope 1 emissions (noting there are no Scope 2 emissions for construction). Greenhouse gas emissions during operations are low and not expected to contribute significantly to Queensland's overall greenhouse gas emissions.

The Proponent is committed to reducing pollutants, protecting the natural environment and reducing their carbon footprint and already undertakes initiatives and participates in programmes to manage their carbon emissions and report in accordance with regulatory requirements.