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18. GREENHOUSE GAS EMISSIONS

This section addresses Section 3.6 of the TOR. The potential greenhouse gas impacts of the Project have been assessed by:

- estimating the direct and indirect greenhouse gas emissions resulting from the Project; and
- identifying mitigation measures to reduce greenhouse gas emissions.

18.1. Regulatory framework

There are several pieces of Commonwealth legislation and policies aimed at identifying and reducing Australia's greenhouse gas emissions. Those most relevant to the water industry include the following:

- the *Energy Efficiency Opportunities Act 2006* (EEO Act) requires large energy-users to identify, evaluate and publicly report cost effective energy savings opportunities;
- the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) establishes a single, national system for reporting greenhouse gas emissions, abatement actions, and energy consumption and production by corporations from 1 July 2008; and
- greenhouse gas reduction measures such as:
 - the proposed Carbon Pollution Reduction Scheme (CPRS), which is being developed and expected to be phased in from 1 July 2012; and
 - Greenhouse Challenge Plus, which aims through partnerships between businesses and the government to accelerate the uptake of energy efficiency and reduce greenhouse gas emissions.

The Queensland Government introduced the Smart Energy Savings Program (SESP) through the *Clean Energy Act 2008*. The program will require participating businesses to undertake an energy audit, develop an Energy Savings Plan and publish their actions for each relevant site.

SunWater is committed to the efficient use of all energy sources to minimise total energy consumption and to reduce the amount of greenhouse gas emissions produced during the construction and operation of water storage facilities and the delivery of water services. SunWater has implemented an Energy Management Standard across all levels and functions of the organisation to:

- conduct energy assessments of SunWater facilities to identify opportunities to improve energy efficiency and to reduce greenhouse gas emissions;
- provide education and training to increase the level of energy management skills and competencies of SunWater staff;
- develop consistent data capture and reporting processes; and
- communicate SunWater performance on energy management.

18.2. Methodology

A preliminary greenhouse gas inventory has been prepared for the construction and operation of the Project. Greenhouse gas emissions attributable to the Project have been considered in terms of three 'scopes' of emission categories in accordance with the Greenhouse Gas Protocol:

- Scope 1: covers direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes;
- Scope 2: covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation; and
- Scope 3: includes all other indirect emissions that are a consequence of the Project but are not from sources owned or controlled by the organisation (also referred to as upstream emissions).

The National Greenhouse Accounts (NGA) Factors (DCC, 2009) were used in the preparation of the greenhouse gas inventory. This document replaces the Australian Greenhouse Office (AGO) Factors and Methods Workbook. The relevant emission factors are presented in **Table 18-1**.

Table 18-1 Greenhouse gas emission factors

| Source | Scope | Emission Factor |
|--|-------|---------------------------------|
| Industrial diesel fuel used for transportation | 1 | 2.7 t CO ₂ -e/ kL |
| Consumption of purchased electricity from the grid (QLD) | 2 | 0.89 kg CO ₂ -e/ kWh |

Note: t CO₂-e = tonnes of CO₂ equivalents

The embodied greenhouse gas emissions (i.e. Scope 3 or upstream emissions) for diesel, concrete and steel are presented in **Table 18-2**.

Table 18-2 Embodied greenhouse gas emission factors for construction inputs

| Source | Emission Factor | Source |
|-------------|--|------------------------------------|
| Diesel fuel | 0.2046 t CO ₂ -e/ kL | NGA Factors (DCC, 2009) |
| Cement | 0.67 t CO ₂ -e/ t | VicRoads Sustainability Toolkit v2 |
| Concrete | 0.258 t CO ₂ -e/ m ³ | VicRoads Sustainability Toolkit v2 |
| Steel | 2.65 t CO ₂ -e/ t | VicRoads Sustainability Toolkit v2 |

Note: t CO₂-e = tonnes of CO₂ equivalents

Clearing of vegetation and subsequent burning or decay will release greenhouse gas emissions. The indicative greenhouse gas emissions from clearing have been estimated using Equation 2.14 in the 2006 IPCC Guidelines for National Greenhouse Gas Emissions. This approach estimates the carbon content in the above ground biomass and assumes it is all released as CO₂. For the purposes of this assessment, the change in above ground biomass is assumed to occur through the clearing of remnant and regrowth woody vegetation. The carbon content of the above-

ground biomass in the inundation area has been estimated by using a default above ground biomass in forests of 60 t d.m.ha⁻¹ (IPCC 2006, Table 4.7) with a carbon fraction of 0.47 t d.m.ha⁻¹.

Inundated areas can emit both CO₂ and CH₄ from the decay of submerged biomass, and the decomposition of inundated soil organic matter and other dissolved organic matter particles. The IPCC provides guidance on estimating greenhouse gas emissions from inundated areas. The IPCC have developed emission factors for CO₂ and CH₄ emissions from inundated areas based on the climatic conditions. The climate of the Project area is considered to be warm, temperate and dry (Chapter 3). The default emission factors CO₂ and CH₄ emissions from inundated areas with a warm temperate and dry climate are presented in Table 18-3. The IPCC (2006) report there is likely to be considerable uncertainty associated with the emission factors because the emission factors do not account for differences in site-specific conditions.

Table 18-3 Level 1 emission factors for CH₄ and CO₂ from inundated areas

| Climate | Emission Factor | Source |
|---------------------|---|-----------------------|
| Warm temperate, dry | 0.044 kg CH ₄ ha ⁻¹ day ⁻¹ | Appendix 3, IPCC 2006 |
| Warm temperate, dry | 5.2 kg CO ₂ ha ⁻¹ day ⁻¹ | Appendix 2, IPCC 2006 |

Source: IPCC 2006

18.3. Greenhouse gas emissions

18.3.1. Construction

Estimates of diesel usage for the construction of the Project are presented in Table 18-4. The corresponding greenhouse gas emissions estimates are presented in Table 18-4. The construction of the Project is estimated to result in approximately 289,379 t CO₂-e.

Table 18-4 Scope 1 greenhouse gas emissions during construction of the Project

| Emission source | Value | Units | GHG Emissions (t CO ₂ -e) |
|----------------------------------|-------|-------|--------------------------------------|
| Diesel for dam construction | 3,000 | kL | 8,100 |
| Diesel for pipeline construction | 6,800 | kL | 18,360 |
| Clearing for water storage | 2,398 | ha | 248,261 |
| Clearing for pipeline | 141 | ha | 14,658 |
| TOTAL | | | 289,379 |

Australia's total greenhouse gas emissions in 2006 were 576.0 Mt CO₂-e (DCC 2008). The greenhouse gas emissions from the construction of the Project represent approximately 0.05% of Australia's greenhouse gas emissions.

18.3.2. Operation

The most significant greenhouse gas emissions associated with the Project's operation will be generated as a result of energy consumption to pump water along the pipeline to Moranbah. The annual energy requirements for the Project are

estimated to be 90,000 MWh. For energy consumption in Queensland, this corresponds with annual greenhouse gas emissions of 80,100 t CO₂-e.

The estimated emissions of CO₂ and CH₄ from the inundation of 5,621 ha are presented in **Table 18-5**. The greenhouse gas emissions are estimated to be approximately 2,000 t CO₂-e/yr. These estimates should be considered as indicative only because as discussed before there is considerable uncertainty around the factors as they do not account for differences in site-specific conditions.

Table 18-5 Indicative estimates of greenhouse gas emissions from inundation area

| Emissions | GHG Emissions |
|--|------------------------------------|
| CO ₂ Emissions from flooded land [#] | 107 t CO ₂ -e/yr |
| CH ₄ Emissions from flooded land | 1,896 t CO ₂ -e/yr |
| Total | 2,003 t CO₂-e/yr |

[#]up to a maximum ten year period after total area of the dam is flooded

18.3.3. Upstream emissions

The upstream greenhouse gas emissions associated with the construction of the Project are presented in **Table 18-6**. The upstream greenhouse gas emissions from construction are 155,434 t CO₂-e.

Table 18-6 Scope 3 greenhouse gas emissions during construction of the Project

| Emission source | Value | Units | GHG Emissions (t CO ₂ -e) |
|------------------------------------|--------|----------------|--------------------------------------|
| Diesel for dam construction | 3,000 | kL | 614 |
| Diesel for pipeline construction | 6,800 | kL | 1,391 |
| Cement for dam construction | 40,000 | t | 26,800 |
| Steel for dam construction | 1,100 | t | 2,915 |
| Concrete for pipeline construction | 7,030 | m ³ | 1,814 |
| Steel for pipeline construction | 46,000 | t | 121,900 |
| TOTAL | | | 155,434 |

18.4. Mitigation measures

18.4.1. Construction

The following management measures are proposed to minimise greenhouse gas emissions from construction of the Project:

- designing a construction works program to source most construction materials from within or close to the Project area to reduce fuel use from transporting materials;
- source natural sand, where available, to minimise greenhouse gas emissions associated with crushing;
- maximising beneficial use of cleared material;
- maintaining construction equipment and haul trucks in good working order so fuel efficiency of equipment is maximised;
- using appropriately sized equipment for construction activities;

- raising awareness of energy efficiency and greenhouse gas emissions through workshops or toolkit talks;
- minimising waste from construction (Section 19); and
- greenhouse reduction initiatives at construction camps.

The construction contractor will be responsible for the efficient use of diesel during construction. The construction methodology is standard practice for the construction of the dam and pipeline and the greenhouse gas emissions will be similar to other projects of this nature.

18.4.2. Operation

The continued implementation of SunWater's Energy Management Standard will minimise greenhouse gas emissions from the operation of the Project by:

- identifying opportunities to improve energy efficiency for operation of the Project and to reduce greenhouse gas emissions; and
- providing education and training to increase the level of energy management skills and competencies of SunWater staff.

SunWater is required to estimate and report annual greenhouse gas emissions under the National Greenhouse and Energy Reporting System. The development of consistent data capture and reporting processes will assist with the ongoing management of SunWater's greenhouse and energy management programs.

The Project is physically closer than other water supply options for mining operations in the Bowen Basin. The greenhouse gas and energy intensity associated with pumping water will be lower than these other water supply options because of the shorter transport distance and lower pressure drop through the Pipeline.

There may be opportunities to develop a forestry sequestration program on the properties surrounding the dam or related to any vegetation offset required for the Project.

18.5. Summary

The greenhouse gas emissions from the construction and operation of the Project represent approximately 0.09% of Australia's greenhouse gas emissions. The construction program will be designed to maximise energy efficiency and minimise greenhouse gas emissions from the works by incorporating a range of management measures. The continued implementation of SunWater's Energy Management Standard will minimise greenhouse gas emissions from the operation of the Project.