The **Coordinator-General**

Connors River Dam and Pipelines project

Coordinator-General's report on the environmental impact statement

January 2012

Queensland Government

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Introduction

This Coordinator-General's report provides an evaluation of the potential impacts of the Connors River Dam and Pipelines project (the project). It has been prepared pursuant to section 35 of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act).

The proponent for the project, Sunwater Ltd (Sunwater), proposes to construct a dam and associated water distribution infrastructure on the Connors River near Mount Bridget, approximately 110 kilometres (km) due east of Moranbah and 70 km south of Sarina. The dam would have a full supply level (FSL) capacity of 373,662 megalitres (ML) and would inundate an area of approximately 5,850 hectares (ha). The dam would comprise a central spillway, an aquatic fauna transfer device and would be constructed using roller compacted concrete.

Water from the dam (49,500 ML per annum) would be transported via pipeline to Moranbah (133 km) and would service coal mines (and associated communities) in the northern Bowen Basin and surrounds[1]. The pipeline component of the project includes a trunk pipeline only and does not include potential future connecting lateral pipes. Water would also be released downstream for purchase and use by irrigators (up to 5 000 ML per annum).

At the time of finalising this report, the capital cost of the project is estimated to be $1.17 billion, of which $587 million is associated with the dam and $584 million is for the pipeline. Subject to relevant approvals being granted for the project, Sunwater anticipate the construction period to occur between April 2012 and mid 2014, with first filling expected to occur during the 2014/2015 wet season. Filling is scheduled to take one year, with the project anticipated to be operational by March 2015.

The project is anticipated to create up to 620 direct jobs during the construction period and up to 8 direct jobs during operation. Construction of the project is estimated to contribute over $700 million in indirect and direct benefits to Gross State Product (GSP), while operations is estimated to contribute an additional $9.5 million in direct and indirect benefits to GSP.

Rationale and alternatives

Rapid recent and planned growth in the coal mining industry has created increased demand for water in Central Queensland, particularly in the Bowen Basin. Over recent years, the Queensland Government has developed a range of strategic planning and policy initiatives to support this mining development. The project is recognised in all relevant planning documents, including the Statewide Water Plan and Central

[1] Sunwater also plan to transport water from the Connors River Dam to service proposed coal mines in the Galilee Basin via a 270 km pipeline from Moranbah to Alpha. This project is the Moranbah to Alpha Pipeline Project and is separate to the Connors River Dam and Pipelines project. Refer to section 2.2.6 of this report for more information

Queensland Regional Water Supply Strategy (CQRWSS), as the preferred water supply option in the northern Bowen Basin.

Alternatives considered included: recycling, system management and water use efficiency; groundwater; coal seam gas water; desalinisation; surface water supplies; 'do nothing' option; and within-project alternatives. A new surface water supply in the form of a dam is the only option that can feasibly satisfy the identified demand for the quantity and quality of water required. Following a staged assessment process undertaken as part of the CQRWSS, the Connors River at Mount Bridget site was selected as the preferred alternative.

Urban demand represents a small component of overall demand, which is strongly related to mining development. It is considered that not proceeding with this project would place a constraint on planned mining activity and forego the potential social and economic benefits likely to be associated with that activity.

Impact assessment process

An Initial Advice Statement (IAS) was lodged with the Coordinator-General on 20 February 2008 and on 7 March 2008, the Connors River Dam and Pipelines project was declared a 'significant project for which an EIS is required' pursuant to section 26(1)(a) of the SDPWO Act.

On 25 September 2008, the project was determined to be a controlled action likely to affect matters of national environmental significance under section 75 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under a bilateral agreement with the Australian Government, this Evaluation Report will be used by the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (Australian Government Minister for Environment) to assess the controlled action for the purposes of the EPBC Act. The final Terms of Reference (TOR) for the project were issued on 16 July 2009. The EIS for the project was advertised for public comment from 6 February 2010 until 22 March 2010. A supplementary EIS (SEIS) was also prepared, which addressed the submissions made on the EIS.

As part of his evaluation of the EIS, the Coordinator-General has considered the EIS, issues raised in submissions, the SEIS, additional information provided by the proponent, and advice received on a range of key issues from State agencies and SEWPaC.

The Coordinator-General is satisfied the requirements of the SDPWO Act have been fulfilled, and that sufficient information has been provided to enable the Coordinator-General to finalise the required evaluation of potential impacts, attributable to the project.

Summary of Environmental Impacts

The key environmental impacts of the project considered in this report are briefly set out below. Further detail can be found in section 5 of this report.

Surface water

The Coordinator-General has considered potential impacts to surface water resources in the context of a catchment which has been degraded by agriculture and industry development, including:

- increased sediment yield to the rivers
- localised degradation of bank and bed stability and direct runoff from road surfaces resulting from existing road and infrastructure crossings
- localised minor physical disturbance of bed and banks from the construction of low level crossings and causeways.

Based on the risk assessment provided in the EIS, the SEIS and measures identified in the draft Environmental Management Plans (EMPs), the Coordinator-General is satisfied that geomorphic processes for the Connors River are likely to be maintained with the dam in place and that the residual impacts to geomorphic processes are minimal.

While sediment supply downstream may be reduced as a result of the dam, this is not considered significant and may be slightly beneficial because current rates of sediment delivery and transport are much higher than pre-development conditions. Although some localised erosion and sedimentation impacts may occur, these can be effectively managed through the implementation of appropriate mitigation measures as part of Sunwater's proposed Sediment and Erosion Control Plan. To address potential sediment and erosion impacts arising from the construction and operation of the project, the Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 4) which will require the inclusion of additional requirements in the Sediment and Erosion Control Plan for both construction and operation of the project.

The Coordinator-General is satisfied with the assessment of risks to surface water hydrology and the mitigation measures proposed to minimise those risks. The Coordinator-General notes that no significant impacts relating to surface water hydrology are expected to remain after mitigation. In particular:

- the possibility of changes to stream bed profiles, channel morphology and local drainage patterns is low, and will be managed through appropriate construction management plans and procedures as set out in the draft Construction EMP (CEMP) for the project
- the risk of impacts to existing users and the environment through an altered flow regime is low. The majority of impacts are limited to the reach between the proposed dam and Funnel Creek (46.1 km downstream of the dam), which will be managed through the dam operational strategy and compensation strategy (subject to approval under the *Water Act 2000*)
- there will be no discernible impacts to flow in the Fitzroy River or downstream, and the dam is not expected to impact on the water quality or sediment input of the Fitzroy Estuary (and therefore the Great Barrier Reef World Heritage area) due to the significant additional river flows that occur between the proposed dam and the Fitzroy Estuary

- overall, the cumulative impacts of the Connors River Dam, Nathan Dam and Lower Fitzroy weirs projects on existing water users and environmental flows in the Lower Fitzroy sub-catchment are not excessive; and Sunwater notes they will be managed through a combination of environmental flow releases and management rules
- given the potential impact of climate change on the region, the proposed dam represents an additional resource. Sunwater will prepare a critical water supply strategy as part of the Operational EMP (OEMP) for the project to manage and prioritise water supply during periods of drought.

The Coordinator-General is satisfied flood risk during construction and operation of the project will be effectively managed through a combination of construction sequencing and timing, the implementation of Flood Management Plans and Sunwater's flood-margin based land purchase strategy.

The Coordinator-General notes the significant demand for future urban water supplies within the Isaac-Connors sub-catchment, driven primarily by population growth arising from new mining activity. In order to increase the security of urban water supplies, the Coordinator-General has recommended Sunwater make available water from the Connors River Dam to supply townships in the region (refer to Appendix 2, Recommendation 3).

Groundwater

The Coordinator-General agrees with DERM that the project may not adequately address potential impacts to groundwater levels downstream of the dam post construction. This is particularly relevant due to the watercourses across the catchment predominantly losing water and the moderate to high degree of connection between groundwater and surface water.

To ensure potential impacts to groundwater levels and groundwater quality are adequately addressed during construction and operation of the project, the Coordinator-General has stated a condition requiring the inclusion of DERM's recommended groundwater monitoring and management terms in both the construction and operational EMPs of the project (refer to Appendix 1, Schedule A, Condition 3).

Terrestrial ecology

The water storage area is situated within the valley formed by Sugarloaf Mountain to the north and the Connors Range to the east. A number of creeks and streams flow into the valley to form the Connors River. The floor of the valley has been substantially modified and thinned of vegetation to allow for cattle grazing. Riparian vegetation generally remains along the banks of the Connors River and its tributaries and represents areas of high regional biodiversity. In particular, riparian vegetation on the banks of Murray, Cattle and Collaroy Creeks within the proposed water storage area provide a near continuous vegetated corridor with significant habitat connectivity value.

While no protected plant species were recorded during field surveys, construction of the project may result in impacts to some protected plant species based on the presence of suitable habitat. Where there is a requirement for clearing protected plant species, clearing must only occur in accordance with a clearing permit under the *Nature Conservation Act 1992* (NC Act). In the event Sunwater's proposed avoidance,

translocation and/or rehabilitation does not fully mitigate adverse impacts to protected plant species, the Coordinator-General has recommended a condition (Appendix 2, Recommendation 2) which requires the provision of offsets for the permanent loss of protected plants to achieve an equivalent, or better overall outcome at a regional scale.

The project has been designed to ensure clearing will be limited to the extent necessary for the project, such as through refinement of the pipeline route to avoid impacts to remnant vegetation and the use of existing cleared easements where possible. The Vegetation Clearance Management Plan proposed as part of the draft CEMP will also ensure vegetation clearing is limited, as far as practicable, during construction of the project.

Nonetheless, the project will result in significant unavoidable impacts to approximately 6,370 ha of vegetation, including 2,200 ha of native remnant vegetation.

Sunwater's revised offset proposal will preserve and enhance in perpetuity approximately 16,650 ha of offset areas that are currently available for agricultural (grazing) purposes. Accordingly, the management of the proposed offset areas will provide a greater area of secure habitat than that lost as a result of the project (approximately 10,280 ha). The Coordinator-General has set a condition (Appendix 1, Schedule E) which will require Sunwater to provide additional information on the offset proposal, including details of the legally binding mechanism to be used to secure and protect the offset areas in perpetuity.

Clearing and/or inundation of vegetation required for the construction of the project will also result in significant impacts to fauna habitat. Fauna populations will be impacted by:

- removing vegetation that provides shelter, food and/or nesting resources
- interrupting movement corridors, which can lead to reduced viability of fauna populations
- possible injury and mortality (for example from fauna falling into the pipeline trench which are then unable to escape, or the unearthing of burrowing fauna during soil disturbance).

Measures outlined in the terrestrial flora and fauna sub-plans of the draft EMP will help to mitigate potential impacts to fauna and their habitats. In accordance with the NC Act, approval from DERM must also be obtained where construction and/or operation of the project is likely to disturb the breeding places of protected fauna. However, impacts to fauna habitat are largely unavoidable given the scale and nature of the project.

Sunwater's offset proposal will provide approximately 16,650 ha of compensatory habitat, with the strategic establishment of offsets to reinstate dispersal pathways at the edge of the water storage area increasing habitat connectivity above Full Supply Level. Management of the offset areas will provide a greater area of secure habitat than that lost as a result of the project (approximately 10 280 ha).

Further, the Coordinator-General notes the strategic conservation benefits that the offset proposal (in particular, the 13 000 ha Ridgeland property offset located to the north of the water storage area) will provide for the region. The Ridgeland property comprises high quality habitat for a variety of protected fauna species, as well as the

potential for natural regeneration in a number of areas. Given the location of Ridgeland between two existing protected areas (Tierawoomba State Forest on the northwest (15 500 ha) and Collaroy State Forest on the northeast (3 860 ha)), the protection, restoration and enhancement of vegetation and habitat on Ridgeland will therefore improve habitat connectivity in the landscape and provide real conservation outcomes for a variety of fauna species by enhancing the health, diversity and productivity of the environment.

Furthermore, given the strategic conservation value of the property, QPWS advises Ridgeland is suitable for possible declaration as a National Park, subject to interim tenure arrangements for that part of the property to be managed by Sunwater for offset purposes. In addition, Tierawoomba State Forest, which DERM considers to be an 'important strategic link for future national park acquisitions', has been transferred to 'Forest Reserve' which is a transitional tenure normally preceding transfer to national park. Accordingly, the Coordinator-General finds the Ridgeland offset has the potential to deliver priority additions to Queensland's protected area estate and thereby assist in addressing higher level policy objectives.

Based on the mitigation measures provided in the draft CEMP, Sunwater's revised offset proposal, and the requirements of the *Vegetation Management Act 1999* and the NC Act, the Coordinator-General is satisfied impacts to terrestrial ecology will be minimal. The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project.

Aquatic ecology

The Coordinator-General notes the high conservation value of the study area with respect to freshwater turtles—in particular the cloacal ventilating Fitzroy River turtle ('vulnerable' listing, NC Act and EPBC Act) and white-throated snapping turtle (a high priority species for conservation and pending 'endangered' under the NC Act). No other threatened aquatic fauna species and no threatened aquatic flora species or communities were recorded from or are considered likely to occur in the project area.

Without mitigation, the proposed dam wall presents a complete barrier to upstream fauna movement and an almost complete barrier to downstream movement. The Coordinator-General notes this to be of particular importance for this project given aquatic fauna within the study area are not currently impacted by impoundments or flow regulation, with the nearest man-made barrier being Tartrus Weir on Mackenzie River approximately 100 km downstream of the proposed dam. This may result in a reduction of genetic variability of aquatic fauna and associated in-breeding issues. An aquatic fauna transfer device (or 'fishway') designed to maintain passage and minimise injury, mortality and entrapment of aquatic fauna has been included in the design of the dam wall. The Coordinator-General has set a condition (Appendix 1, Schedule D) which requires the detailed design of the fishway to be finalised following further consultation with relevant agencies and generally in accordance with the DEEDI (Fisheries Queensland) Fish Passage Design and Implementation Process set out in of this report.

Although unlikely to provide the same efficiency of movement as would be the natural state, opportunity for fish movement will be maximised by ensuring the device operates

from Minimum Operating Volume through to when the dam is spilling. The preliminary operational strategy of dam also overcompensates slightly in the low flow range, with these releases largely passing through the fishway. As a result, fish will be able to pass the dam when the drying river naturally provides barriers.

Fishways have traditionally been less successful in providing adequate passage for turtles. Accordingly, Sunwater commits to continued consultation with DERM as part of developing the detailed fishway design in order to maximise turtle passage opportunities and minimise the potential for physical damage. In the event of ineffective transfer, Sunwater commits to implementing 'catch and carry' techniques to ensure short term transfer and genetic mixing. Both of these commitments have been conditioned in this report (Appendix 3, Condition 2and Appendix 6).

The Coordinator-General acknowledges the range of measures identified in the EIS and the SEIS to mitigate potential impacts to the Fitzroy River turtle and recognises Sunwater's commitment to implement an ongoing research monitoring program to evaluate the effectiveness of mitigation as well as the provision of direct (land-based) and indirect (research-based) offsets. The Coordinator-General has imposed a condition (Appendix 3, Condition 2) to formalise, and in some cases expand upon, measures to mitigate direct and cumulative impacts to the Fitzroy River turtle. Given the pending 'endangered' conservation status of the white-throated snapping turtle and its similarity to the Fitzroy River turtle (i.e. cloacal ventilation), the Coordinator-General requires the mitigation/monitoring programs developed to address the impacts to the Fitzroy River turtle be expanded to address impacts to this species.

In its submission on the SEIS, DERM advised that more baseline information on the presence and abundance of Fitzroy River turtles and white-throated snapping turtles populations (and associated nesting sites) is required to inform the proposed research and monitoring program, and to allow for the adequate protection and enhancement of both species and their habitat during operation of the project. Accordingly, the Coordinator-General requires a comprehensive baseline study of Fitzroy River turtle and white-throated snapping turtle populations in each tributary upstream of the water storage area, within the water storage area, and downstream of the water storage area to the Funnel Creek confluence (46.1 km downstream of the proposed dam).

The Coordinator-General notes changes to the downstream flow regime resulting from operation of the proposed dam will be limited to the confluence of the Connors River and Funnel Creek, approximately 46.1 km downstream of the proposed dam wall. However, the geographical extent of Sunwater's proposed annual species population surveys is limited downstream as far as Cardowan, approximately 16.8 km downstream of the proposed dam wall. Given monitoring results will need to be assessed with respect to (but not limited to) potential impacts associated with flow regime change, the Coordinator-General requires population surveys be extended further downstream, beyond Cardowan, to the Funnel Creek confluence. In addition, the Coordinator-General requires that monitoring form part of a Species Management Program for the Fitzroy River turtle and white-throated snapping turtle, including a reporting and corrective action regime to address impacts to these species' populations, habitat and passage upstream and downstream of the proposed dam.

Limpus et al (2007) [2]suggests that, with a catchment-wide approach, "*it will be possible to reverse the negative impact of not only the new (water) infrastructure developments but to also compensate for cumulative impacts*". Accordingly, to address predicted cumulative impacts in the Fitzroy (River) Basin catchment, the Coordinator-General has imposed a condition which requires Sunwater to prepare, in collaboration with DERM, SEWPaC and the Fitzroy (River) Basin Association, a catchment-wide Conservation Plan for the Fitzroy River turtle and the white-throated snapping turtle pursuant to section 112(2) of the NC Act (Appendix 3, Condition 2).

The Conservation Plan must specify the research and management measures necessary to ensure the survival and natural development of the species' populations in the Fitzroy (River) Basin catchment, and will provide a planned and logical framework for key interest groups and responsible government agencies to coordinate their work to improve the condition of both species in the catchment. A coordinated approach to the research and management of the Fitzroy River turtle and the white-throated snapping turtle is considered to be of particular importance given the other water infrastructure projects proposed in the Fitzroy catchment currently undergoing assessment (Nathan Dam and Pipelines and Lower Fitzroy Weirs projects).

In response to DERM and SEWPaC comments regarding the adequacy of Sunwater's proposed financial commitment to address cumulative impacts, and based on advice from DERM regarding the level of funding required to allow for continuity of staffing for this conservation work, the Coordinator-General requires Sunwater to increase the financial contribution for this project from $100,000 to $250,000 per year for five years into a fund administered by the DERM for the implementation of research and management measures identified in the adopted Conservation Plan.

Based on the mitigation measures provided in the draft CEMP, Sunwater's revised offset proposal, the requirements of the NC Act and Fisheries Act, and the Coordinator-General's additional requirements regarding the Fitzroy River turtle and white-throated snapping turtle, the Coordinator-General is satisfied impacts to aquatic ecology will be minimal.

Social and economic environment

The project will generate a number of short-term social and economic benefits, including direct and indirect employment opportunities and increased industry output through the demand for goods and services. The project will also generate a number of long-term social and economic benefits through the additional water security which would support regional economic development and activity in the mining industry, particularly around Moranbah, agriculture and urban communities.

There will also be social and economic costs borne by the local and regional economy as a result of the project. These social and economic costs include foregone agricultural production due to inundation of, and severance of access to, land

[2] Limpus, C, Limpus, D, Parmenter, C, Hodge, J, Forrest, J, and McLachlan, J, 2007: "Proposal for raising Eden Bann Weir and construction of Rookwood Weir—An Assessment of the Potential Implications and Mitigation Measures for Fitzroy Turtles". Queensland Environmental Protection Agency.

previously used for livestock (cattle) grazing purposes (five properties), disruption to farming operations on the pipeline route during construction and less so during operation as the pipeline will be predominantly buried, changes to recreational uses, property access and traffic conditions, and dislocation of workers from their families.

Sunwater has made a number of commitments to mitigate potential social and economic impacts and maximise social and economic opportunities of the project, which have been included in the Social and Economic sub-plan of the draft CEMP. This includes compliance with the Queensland Government's Local Industry Policy and Indigenous Employment Policy.

To ensure effective communication and complaints resolution with community members directly affected by the construction of the project, the Coordinator-General has set a condition requiring the preparation and implementation of a Community and Stakeholder Management Plan as part of the CEMP for the project (Appendix 1, Schedule A, Condition 10).

The Coordinator-General has also made a general recommendation (Appendix 2, Recommendation 7) regarding the provision of dam recreation facilities for the community. In particular, the Coordinator-General recommends that Sunwater construct, at its cost and to the satisfaction of Isaac Regional Council (IRC), dam community recreation facilities. The nature and extent of the dam community recreation facilities must be informed by a Facilities Options Study, which will be carried out by Sunwater at its cost in consultation with IRC.

Cultural heritage

Indigenous cultural heritage

The EIS and SEIS indicated there is a registered native title claim (file No. QC08/11) registered on 9 October 2009 in the name of the Barada Barna People which captures the entire project area.

SunWater advise the Cultural Heritage Management Plan (CHMP) over the entire dam and pipeline route project area was agreed with the Barada Barna People and registered with DERM on 19 August 2010. The Indigenous land use agreement (ILUA) for the project has been lodged with the National Native Title Tribunal for registration.

No aboriginal cultural heritage places are recorded in the Queensland Aboriginal and Torres Strait Islander Cultural Heritage Register and database around the location of the proposed dam wall and water storage area.

The Coordinator-General is satisfied the registered CHMP and agreed ILUA satisfies the duty of care requirements under the *Aboriginal Cultural Heritage Act 2003* (ACH Act) and will ensure adequate identification and management of cultural heritage places and objects between Sunwater and the relevant aboriginal people as custodians of their cultural heritage.

Based on the mitigation measures provided in the draft EMP and registered CHMP and the legislative requirements of the ACH and *Native Title Act 1993*, the Coordinator-General is satisfied impacts to Indigenous cultural heritage will be minimal.

Non-indigenous cultural heritage

No sites listed on any national, state or local government register will be impacted by construction of the project.

Two homesteads located on properties within the proposed water storage area (Collaroy and Marylands) are considered to be of local significance. Collaroy is considered to be the more important of the two historic homesteads. To mitigate potential impacts Sunwater has committed to undertaking an archaeological surface study at Collaroy with any significant findings to be notified to DERM.

Based on the mitigation measures provided in the draft CEMP and the requirements of the *Queensland Heritage Act 1992*, the Coordinator-General is satisfied impacts to non-indigenous cultural heritage will be minimal.

Transport and traffic

The EIS identified the following potential impacts on principal State controlled roads and local roads within the project area:

- Construction: Increased traffic movements due to equipment and material supply and construction workforce, and altered traffic patterns and journey times due to temporary road closures or diversions.
- Operation: Altered traffic patterns and journey times due to permanent road closures resulting from the inundation of some local roads.

The traffic analysis concluded the increase in traffic generated by the project at the peak construction period would not adversely affect the level of service or road surfaces. It is noted that further traffic and transport analysis is required to address submitter concerns regarding road safety and transport efficiency, road surface and traffic, impact and demand for emergency services response.

Sunwater has committed to reviewing and updating its traffic analysis and accompanying Road Impact Assessment (RIA), Road Use Management Plan (RMP) and Traffic Management Plan (TMP) during detailed design, when additional and more certain trip generation and traffic volume information would be available. The requirement for a RIA, RMP and TMP and other traffic mitigation measures have been included in the Transport and Roads sub-plan of the draft CEMP.

Based on the mitigation measures provided in the draft EMP and the approvals required for the project under the Transport Infrastructure Act (State controlled roads) and Isaac Regional Council local planning scheme (local roads), the Coordinator-General is satisfied that impacts to traffic and transport will be minimal.

Environmental management

There are limited sensitive receivers around the dam and surrounds study area. Three homesteads are located outside the water storage area, namely Doreen, Marylands, Undercliff—which are located approximately 11 km southwest, 6 km east and 20 km north of the proposed dam wall site, respectively. However, in accordance with the land purchase and, where applicable, resale strategy, these homesteads will be vacated prior to the commencement of construction activities.

Existing sensitive receivers near the pipeline route have been identified using aerial imagery. Sensitive receivers consist of residences located at varying distances from the pipeline, with the closest receivers being between 100 m to 200 m from the pipeline.

The project will result in impacts to air quality, greenhouse gas (GHG) emissions, noise and vibration, waste and land contamination. Modelling presented in the EIS shows the project will not cause exceedences of DERM's air quality and noise and vibration goals at the nearest sensitive receivers.

To ensure the effective management of potential impacts, Sunwater has prepared a number of sub-plans as part of the draft EMPs for the project, including: air quality and greenhouse gas; noise and vibration; waste, hazard and risk; land contamination.

Based on the distance between construction activities and sensitive receivers, the mitigation measures contained within the draft EMP, and approvals required for project activities which create air, waste and noise and vibration emissions (environmentally relevant activities, such as resource extraction and concrete batching), the Coordinator-General is satisfied potential air quality, noise and vibration and waste impacts will be minimal.

The Coordinator-General is satisfied Sunwater has appropriately considered ways in which to reduce GHG emissions in the design of the project – in particular, pump design improvements since the release of the EIS will result in a 43 per cent reduction of estimated GHG emissions during the operation of the project. Further, the Coordinator-General is confident that mitigation measures contained in the air quality and GHG sub-plan of the construction EMP will maximise energy efficiency and minimise GHG emissions during construction.

The Coordinator-General is also satisfied with commitments in the contaminated land sub-plan of the draft construction EMP to appropriately manage existing potentially contaminated materials, prevent spills from occurring at the project site, and contain, clean up and if necessary, remediate any spills that do occur.

Hazard and risk

A hazard identification and risk assessment was undertaken as part of the EIS to address the risks which may affect the environment, and the health and safety of the community. Dam safety, natural hazards and extreme weather condition hazards amongst others were considered. The final design, construction and operation of the project will be in accordance with the relevant standards, including the Australian National Committee on Large Dams (ANCOLD) Guidelines and the Queensland Dam Safety Management Guidelines and response plans and actions will be implemented in cooperation with the relevant agencies and authorities.

Sunwater has made a number of commitments in the draft CEMP and OEMP to safely manage risks to the workforce and public and existing environmental values, including surrounding land uses associated with the project. The Coordinator-General has set a condition which requires the inclusion of additional requirements in the Construction and OEMPs (Appendix 1, Schedule A, Condition 8). This includes a dedicated helicopter landing pad at the dam site to facilitate emergency evacuations and the

development of response plans, roles and responsibilities in consultation with local emergency services, including fire, ambulance and police stations.

The Coordinator-General notes Sunwater will manage the land use in the acquired and partially acquired properties that abutt the water storage in the flood margin to ensure public safety and prevent property damage in the event of a flood during construction and operation of the dam.

Based on the mitigation measures contained within the draft EMP, legislative requirements which establish minimum health and safety standards, and the Coordinator-General's conditions, the Coordinator-General is satisfied the construction and operation of the project will involve the appropriate management of hazards and risks.

Construction and Operation Environmental Management Plans

Sunwater has committed to the management of potential impacts of the project through the implementation of a CEMP and OEMP. Since the release of the EIS, Sunwater has updated its draft CEMP and OEMP to ensure all commitments and mitigation measures proposed in the EIS and SEIS have been included in the draft EMPs for the project. The updated draft EMPs are contained within Appendix 4 of this report.

The Coordinator-General is confident that, subject to the additional requirements set by the Coordinator-General for inclusion in the EMPs (Appendix 1, Schedule A, Conditions 3 - 10), the draft EMPs will provide the mechanism to adequately manage and monitor the potential impacts of the project.

The Coordinator-General has set conditions (Appendix 1, Schedule A, Condition 1 and Condition 2), to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Matters of national environmental significance

This report provides a review of the extent to which material supplied by Sunwater as part of the EIS process addresses the actual or likely impacts of the project on each of the matters protected by controlling provisions under the EPBC Act.

The Coordinator-General is satisfied the EIS process conducted for the project adequately meets the requirements for impact assessment in accordance with the provisions of Part 4 of the SDPWO Act and Part 13 of the *State Development and Public Works Organisation Regulation 2010*, as specified in Schedule 1 (Item 2, Class 2) of the Bilateral Agreement.

Conclusion

The project is a key component of the Queensland Government's strategy of increasing the availability and security of water supply in Central Queensland, in particular the Bowen Basin. The project will support planned mining activity in the northern Bowen Basin and the associated social and economic benefits likely to be associated with that activity.

The Coordinator-General considers the potential impacts in the EIS and SEIS to be acceptable having regard to the significance of the project in terms of ensuring security

of water supply for recent and planned mining development in the northern Bowen Basin and the mitigation and offset measures that will be provided by the project.

Accordingly, the Coordinator-General recommends the project, as described in this Evaluation Report, proceed, subject to Sunwater's draft EMPs (Appendix 4), Sunwater's revised Offset Strategy (Appendix 10) and the conditions and recommendations set out in Appendix 1, Appendix 2 and Appendix 3 of this report.

This report will now be provided to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities, pursuant to section 36(2) of the SDPWO Regulation and the Bilateral Agreement between the State of Queensland and the Australian Government to enable a decision on approval of the controlled action for this project pursuant to section 133 of the EPBC Act.

Following this report, the proponent will be required to obtain a number of State and local government approvals, including environmentally relevant activities, an interim resource operations license, operational works approvals for clearing native vegetation and waterway barriers, and the construction of a referable dam.

A copy of this report will be provided to the proponent and advisory agencies and will be made publicly available on the Department of Employment, Economic Development and Innovation website, at http://projects.industry.qld.gov.au

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Keith Davies
Coordinator-General
20 January 2012

1. Introduction

This Coordinator-General's report evaluates the environmental impact statement (EIS) prepared for Sunwater Limited (Sunwater), the project proponent, by Sinclair Knight Merz (SKM) for the Connors River Dam and Pipelines project (the project).

The report evaluates the key issues associated with the project's potential impacts on the physical, social and economic environments at the local, regional, state and national levels. It does not record all matters identified and subsequently settled during the EIS process. Rather, it concentrates on the substantive environmental impacts and related matters identified during the EIS process.

The report represents the conclusion of the Queensland Government's impact assessment process. For information on the EIS process, including a full list of the organisations and individuals who commented on the proponent's EIS, refer to section 1 of the report (Table 3.2).

2. Project description

2.1. The proponent

The proponent for the project is Sunwater Limited (Sunwater). Sunwater is wholly owned by the State of Queensland and was established as a government-owned corporation in 2000 under the *Government Owned Corporations Act 1993* (Qld). Sunwater is incorporated under the *Corporations Act 2001* (Cwlth). Sunwater has over 80 years experience specialising in the investigation, design, construction, ownership, maintenance and operation of bulk water infrastructure in Queensland.

2.2. The project

2.2.1. Location

The project is located in Central Queensland on the Connors River at adopted middle thread distance (AMTD) 95.7 kilomettres (km) (measured from the junction with the Isaac River), some 5 km downstream of the junction of Murray and Collaroy Creeks, approximately 110 km due east of Moranbah and 70 km south of Sarina.

The project is contained wholly in the Isaac-Connors (River) sub-catchment area of the Fitzroy (River) Basin catchment. A regional locality plan is shown in Figure 2.1.

The dam site (latitude 22:1:58S, longitude 147:7:57E) is approximately 274 km upstream of the junction of the Connors/Isaac/Mackenzie River system with the Fitzroy River and is 618.7 km from the mouth of the Fitzroy River. The Connors/Isaac/Mackenzie River system drains the western slopes of the Connors Range, which is part of the mountain range that separates the area from the coastal plains around Sarina. The location of the dam is shown in Figure 2.2.

The trunk water distribution pipeline from the dam to Moranbah initially follows the Connors River and the Connors River-Collaroy Road until it crosses the Connors River where it continues west to the Marlborough-Sarina Road. From there, it extends north-west and follows the BHP Billiton Mitsubishi Alliance (BMA) pipeline alignment until it reaches the Peak Downs Highway at the junction with the Fitzroy Development Road. The pipeline then largely follows the Peak Downs Highway to Moranbah. The trunk water distribution pipeline route alignment is shown in Figure 2.3.

2.2.2. Components

The project consists of the construction and operation of the Connors River Dam, Trunk Water Distribution Pipeline and associated infrastructure.

Connors River Dam

The dam will have a maximum water storage capacity of 373 662 megalitres (ML) at Full Supply Level (FSL) 169.1 metres Australian Height Datum (AHD) and a minimum water storage capacity (dead storage) of 14 863 ML at elevation level 154 metres AHD. The dam will inundate an area of approximately 5,850 hectares (ha). The extent of inundation is shown in Figure 2.4.

In addition to the inundation area, 2122 ha of flood margin, based on a 1 in 100 Annual Exceedence Probability (AEP) flood, will be provided and a further 56 ha will be required for the dam construction area. However, the dam is not intended to serve a flood mitigation role and as such does not include gates that would mitigate flood flows.

The dam will yield 54 500 megalitres per annum (ML/a) of water, of which 49 500 ML/a of high priority water will service water users in the northern Bowen Basin coal region and surrounds[3] (largely coal mines and associated urban communities) and 5000 ML/a of medium priority water will be available for downstream irrigated agricultural use.

The 602-metre-long dam wall will be constructed using roller compacted concrete (RCC) and includes the following associated facilities:

- a 250-metre-long uncontrolled fixed crest, smooth, central spillway
- an aquatic fauna transfer device
- offtake and outlet works
- one pump station with three pumps.

At FSL the spillway crest will be 32 metres above the river bed and the water level difference between the upstream reservoir and the downstream tail water will be 29 metres.

The dam has an expected design life of 100 years.

[3] Sunwater also plan to transport water from the Connors River Dam to service proposed coal mines in the Galilee Basin via a 270 km pipeline from Moranbah to Alpha. This project is the Moranbah to Alpha Pipeline Project and is separate to the Connors River Dam and Pipelines project and is subject to a separate assessment and approvals process. Refer to section 2.2.6 of this report for more information

An artist's impression of the proposed dam is shown in Figure 2.5.

The dam wall, water storage and flood margin areas, associated infrastructure such as access roads, and related vegetation or biodiversity offsets requirements will impact seven properties. The majority of affected properties are used for livestock (cattle) grazing purposes. Real property descriptions of the properties affected by the dam are set out in Table 2.1. The affected properties are shown in Figure 2.6.

Table 2.1 Properties affected by the dam

Real Property Description	Property Name	Property use
Lot 7 on K 190, Lot 1 on KL 155, Lot 6 on K 194	Undercliff	cattle grazing
Lot 4974 on PH 1462	Ridgeland	cattle grazing
Lot 10 on SP 112044, Lot 11 on K 196, Lot 28 on FTY 313	Collaroy	cattle grazing
Lot 4 on KL 209	Marylands	cattle grazing
Lot 1 on KL 163	Doreen	cattle grazing
Lot 1 on SP 112044		Telstra repeater tower
Lot 12 on KL 204		Council reserve
Lot 8 on KL 1		Unallocated State Land

Five grazing properties (Undercliff, Ridgeland, Collaroy, Marylands and Doreen) and three small lots (Telstra repeater tower, Council reserve and Unallocated State Land) are directly impacted by the construction and operation of the dam and/or associated infrastructure.

Sunwater's mitigation of affected properties is to acquire land which is directly impacted by the proposed dam, including the storage area, the flood margin, the construction footprint and for vegetation and biodiversity offsets purposes.

Sunwater has acquired all grazing properties directly impacted by the dam. Grazing properties Deacey and Mountain View (refer to Figure 2.6) were also purchased on the basis that these properties were indirectly impacted through the loss of road access. However, since the release of the EIS, Sunwater has proposed a new access road through Marylands (refer to section 2.2.4 of this report for more information). This will ensure the viability of the farming operations and will allow the resale of these properties for grazing purposes.

With the exception of Ridgeland, which will be exclusively managed for environmental offset purposes (refer to section 5.3 and Appendix 10 of this report for more information on Sunwater's Offset Proposal) Sunwater's property acquisition strategy provides for the resale of parts of acquired properties not required for the project (for example, for the water storage area, flood margin and associated infrastructure) as grazing properties. Proposed vegetation offset areas on these properties (including Marylands, Undercliff and Collaroy) will be protected through an appropriate form of tenure or protected area status under the *Nature Conservation Act 1992.*

Operation of the dam involves routine inspection of the water storage to manage water quality, vegetation, landscape stability, weed control, land, property and asset management, and mechanical and electrical maintenance.

Pipeline

A 133-kilometre, 1200 to 1500 millimetre (mm) diameter mild steel cement lined pipe (MSCL) trunk water distribution pipeline will transport water from the dam west to Moranbah.

The pipeline diameter will be 1500 mm from the dam to the five-megalitre concrete ring tank balancing storage and 1200 mm from the five-megalitre concrete ring tank balancing storage to Moranbah.

The pipeline will be predominantly buried with a 900 mm cover in a 15-metre-wide easement and include the following associated water distribution facilities:

- one pump station with three pumps
- one five-megalitre concrete ring tank balancing storage, 35 metres in diameter and 5.2 metres high
- 330 air release valves
- two control and reflux valves
- three surge tanks and 18 air cushion standpipes
- 100 scour outlets
- nine swab isolation valves and four pigging stations
- cathodic protection systems
- approximately 346 thrust blocks
- mechanical and electrical works
- fibre optic cable in or adjacent to the pipeline to provide telecommunications for operating the pipeline
- a 3-metre wide vehicle access track for inspections and maintenance.

The pipe and concrete foundations and supports for the above-ground pipe have an expected design life of 80 years, while other associated infrastructure such as pumps, valves and motors have an expected design life of 40 years.

The trunk water distribution pipeline component of the project includes a trunk pipeline only and does not include connecting lateral pipes to water customers.

The trunk water distribution pipeline and associated infrastructure will impact 75 properties and/or land tenures. These affected properties are primarily rural and agricultural. Sunwater's mitigation of affected properties is to acquire the tenure for the balancing storage and pump station, and put in place easements for the remaining impacted properties.

The pipeline will generally operate automatically; however, there will be a requirement for periodic monitoring of the pipeline for leaks and maintenance of mechanical equipment.

Associated infrastructure

Infrastructure requirements associated with the construction and operation of the dam component of the project include:

- constructing a new 14.2-kilometre, single-lane, unsealed, rural access road, which connects the Connors River-Collaroy Road (just south of the dam wall) with the Killarney-Collaroy Road, near the Marylands homestead, providing construction access to the dam wall from the north and continued access to grazing properties Deacey and Mountain View
- a 4.5-metre-wide bridge over Collaroy Creek, five causeways, three major culvert crossings and 13 minor culvert crossings as part of the new 14.2-kilometre northern access road
- upgrade approximately 20 km of the Connors River-Collaroy Road from the Marlborough-Sarina Road to the proposed dam site and recreation area, to two-lane, unsealed, high quality pavement surface standard,
- upgrade the Marlborough-Sarina Road/Connors River-Collaroy Road intersection to accommodate all construction and operational traffic generated by the project
- closure of sections of the Connors River-Collaroy Road, Collaroy-Tierawoomba Road and Killarney-Collaroy Road
- removing existing Ergon low voltage electrical transmission infrastructure
- relocation to near the dam wall and upgrade to 3G coverage of a Telstra telecommunications tower and repeater station
- constructing new 66 kilovolt (kV) supply lines, likely from Nebo to the dam (the precise location of which will be determined by the electricity providers) to service the pump stations and dam
- a temporary dam construction site office at the dam site
- a 250-person temporary dam construction camp located approximately 10 km downstream of the dam site on the Connors River-Collaroy Road near the intersection with the Marlborough-Sarina Road
- potable water (30 000 litres per day) and wastewater treatment plants at the dam site and the construction camp
- installing telephone and data services for construction camp accommodation, dam site office and permanent dam facilities
- installing new gauging stations at headwater and tail water of the new dam and at major tributaries upstream of the dam
- a three-hectare recreation area adjacent to the dam water storage, incorporating a boat ramp, car park, picnic facilities, septic toilet facilities, rainwater tanks and general landscaping
- resource extraction areas, for hard rock, sand and road base near the right abutment of the dam wall.

Infrastructure requirements associated with the dam component of the project are shown in Figure 2.7.

Infrastructure requirements associated with the construction and operation of the pipeline component of the project, include:

- a permanent, very low level concrete causeway crossing of the Connors River approximately six km downstream from the dam
- temporary pipeline construction crossings of Funnel Creek and Denison Creek
- new shallow water bores and associated turkeys nest storages at a number of pipeline watercourse crossings
- construction of 66 kV power lines from Nebo to the pump stations
- a pipeline construction project office located with one of the temporary pipeline construction camps
- two 150-person temporary pipeline construction camps, one located at the eastern end of the pipeline route at or about the Hamilton Park property and accessed from Waitara Road, and one located at the western end of the pipeline route at or about the five-megalitre concrete ring tank balancing storage, 20 km from Moranbah and adjacent to the Peak Downs Highway
- wastewater treatment plants at the construction camps
- six lay-down areas of varying footprints, ranging from four ha to nine ha, along the pipeline route
- resource extraction areas, including sand for pipe bedding located within the water storage area and from a number of watercourses along the pipeline route, road base or gravel for access tracks located near the dam wall, and clay for the five-megalitre concrete ring tank balancing storage located approximately five km east of Moranbah.

Infrastructure requirements associated with the pipeline component of the project are shown in Figure 2.3.

2.2.3. Key environmental design features

The project includes the following key environmental design features:

- a multi-level off-take tower, screened to prevent aquatic fauna entrapment and designed to operate at minimum storage level to enable best quality water to be extracted
- outlet facilities that provide flexibility with respect to environmental flow releases and re-aeration of water released downstream
- an aquatic fauna transfer device that operates to very low water levels, and is designed to maintain passage and minimise injury, death and entrapment of aquatic fauna
- provision of structural habitat for aquatic fauna
- use of land, including land management practices, in the dam catchment for environmental offset purposes
- community recreational facilities at the dam
- a predominantly buried water distribution pipeline
- dam operating procedures, which addresses water quality, ecology and human use.

At the time of finalising this report, the capital cost of the project is estimated to be $1.17 billion, of which $587 million is associated with the dam and $584 million is for the pipeline. The project is expected to create a peak workforce of 620 during the 26-month construction period and up to eight jobs over the 80–100 year operational life of the project.

2.2.4. Project changes

Since the release of the EIS, Sunwater has further developed the design of the project as a result of further investigations, issues raised in submissions on the EIS and ongoing consultation with landowners. Changes to the project scope as described in Part C of the SEIS, include:

- a new 14.2-kilometre, single-lane, unsealed rural access road, which connects the Connors River-Collaroy Road, just south of the dam wall, with the Killarney-Collaroy Road, near the Marylands homestead, providing construction access to the dam wall from the north and continued access to grazing properties Deacey and Mountain View
- refinement to the pipeline route resulting in the deletion of alignment options 'Eastern B', 'BMA A', 'BMA B' and 'Moranbah', splitting of pump station 1 into two separate stations, relocation of pump station two and the 600-megalitre balancing storage. The pipeline refinement has reduced impacts on 11 small lots and resulted in impacts to one additional large lot
- replacement of the originally proposed stepped spillway with a smooth spillway
- revision of the proposed vegetation and biodiversity offsets strategy to specifically address ecological equivalence and functioning RE impacts in response to submitter comments.
- identification of additional suitable hard rock quarry sites on the west of Marylands property and on the east of Doreen property, confirmation that the original Marylands property and right abutment of the dam wall sites were suitable and that the Mount Bridget site was not suitable, with the preferred site being the right abutment of the dam wall
- refinement to land acquisition strategy to take account of the revised vegetation and biodiversity offsets strategy.

Since the release of the SEIS, Sunwater has further progressed the design of the project resulting in the following changes to the scope of the project:

- removal of pump station two and the five-megalitre balancing storage
- an increase in the size of the pumps at the dam pump station and a reduction in the number of pumps from seven to three
- replacement of the 600-megalitre balancing storage with a five-megalitre concrete ring tank balancing storage, 35 metres in diameter and 5.2 metres high
- an increase in the pipeline diameter from 1200 millimetres to 1500 millimetres and from 1125 millimetres to 1200 millimetres from the dam to the balancing storage and from the balancing storage to Moranbah, respectively
- no need for clay extraction for the five-megalitre concrete ring tank.

Further details of these project changes can be found in Appendix 8.

The project changes noted above are included in the description of the project, as set out in this section 2.2.4. Impacts of the changes have been assessed by the Coordinator-General in preparing this report.

2.2.5. Development stages

Sunwater proposes to construct and operate the Connors River Dam and associated water distribution infrastructure (pipeline) in Central Queensland.

The dam and pipeline will be constructed simultaneously and Sunwater anticipates that early construction works (access road, quarry material, construction camp) for the project will commence in April 2012, with main construction works, including river bed works, commencing July 2012. Construction of the dam is scheduled to be completed by mid 2014, with first filling expected to occur during the 2014/2015 wet season. Filling is scheduled to take one year, with the project expected to be operational by March 2015.

Construction of the dam is anticipated to include the following major activities in the following sequence:

- early construction works/establishment
- diversion works (dam abutments stripped, diversion channel excavated, temporary access bridges over diversion channel constructed, diversion channel constructed, small coffer dam for Chinaman Creek constructed
- foundation excavation and preparation (temporary low level diversion bunds constructed across the Connors River to divert low flow through the diversion channel to allow coffer dam foundation stripping and embankment construction, upstream and downstream coffer dams constructed and Connors River diverted through diversion channel, well point dewatering system installed and commissioned)
- foundation grouting (dam foundations excavated and treated)
- RCC dam (outlet monolith, main spillway monoliths and abutment monoliths constructed)
- spillway stilling basin
- tower intake structure
- conduit outlet works
- completion works (coffer dams removed and water diverted through the outlet works, mass concrete closure plug placed in the diversion channel, complete dam wall and outlet works, place crest to spillway)
- dam community recreational facilities.

Construction of the trunk water distribution pipeline is anticipated to include the following major activities, which will be carried out simultaneously on three separate fronts:

- balancing storage and pump station
- vegetation clearing

- river crossings
- pipe laying, including trench opening and backfilling
- general pipeline fittings (above ground infrastructure)
- electrical and mechanical fit out.

Dam construction activity is planned to take place on a 10 hours per day shift schedule (7 am to 5 pm), and 10 days on and 4 days off work roster. The exception will be the placement of the RCC dam wall, which will occur on a 24 hours per day, 7 days per week cycle over a five month period, due to the critical nature of the RCC placement.

Pipeline construction activity will occur on a continuous basis during the dry season on a 10 hours per day shift schedule (7am to 5pm). The construction schedule for the pipeline has been structured such that limited works will occur during the 2012/2013 and 2013/2014 wet seasons (December to April) to avoid anticipated wet weather delay costs.

2.2.6. Dependencies and relationships with other projects

The Connors River Dam and Pipelines project is dependent upon proposed mines proceeding in the northern Bowen Basin, around Moranbah.

As noted in subsection 1.6 of the EIS (alternatives to the project) and subsection 1.3 of the SEIS (alternatives to the project), proposed mine developments in the northern Bowen Basin are dependent on the Connors River Dam and Pipelines project as there is insufficient water available from other sources to service the proposed mine developments.

Other water infrastructure proposed in the Fitzroy (River) Basin catchment to meet the shortfall in water demand, include:

- Glebe Weir Raising on the Dawson River
- Nathan Dam and Pipeline project on the Dawson River
- Lower Fitzroy River Infrastructure project, on the Fitzroy River
- Gladstone to Fitzroy Pipeline project.

However, these proposed water infrastructure projects are significantly remote from the demand centres in the northern Bowen Basin. Accordingly, they are unlikely to be a viable source of supply to meet the demand requirements in the northern Bowen Basin and consequently have no affect on the delivery of the Connors River Dam and Pipelines project.

In addition to existing and planned water infrastructure in the Fitzroy (River) Basin, there is numerous distribution infrastructure supplying water to the northern Bowen Basin from the Burdekin (River) Basin catchment, including the Eungella Water Pipeline and the Burdekin to Moranbah pipeline. However, these pipelines do not have spare capacity to provide additional water to the northern Bowen Basin.

However, there are a number of proposed water distribution projects in the northern Bowen Basin under consideration at various stages of planning and development (refer to Figure 2.8). These proposed projects, if they proceed, would result in a water pipeline grid, which would enable the supply of additional water to the northern Bowen

and Galilee Basins from multiple sources, including the Burdekin Falls Dam and proposed Connors River Dam, to meet the anticipated increase in demand. These proposed water pipelines, include:

- duplication of the Southern Eungella pipeline
- Burdekin to Moranbah pipeline augmentation (currently under construction)
- Gorge Weir to Byerwen Coal Mine pipeline
- Bingegang Weir to Middlemount pipeline
- Moranbah to Alpha pipeline.

These pipelines would access existing water storages and/or the proposed Connors River Dam to redistribute existing water allocations – that is, they do not involve the diversion of additional water from their supply sources or the construction of any in-stream infrastructure.

The Connors River Dam and Pipelines project would be an integral part of such a water pipeline grid and would play a key role in supplying water to proposed mining development in the north Bowen and Galilee Basins, given the project's advanced planning status.

Figure 2.1 Project regional locality plan

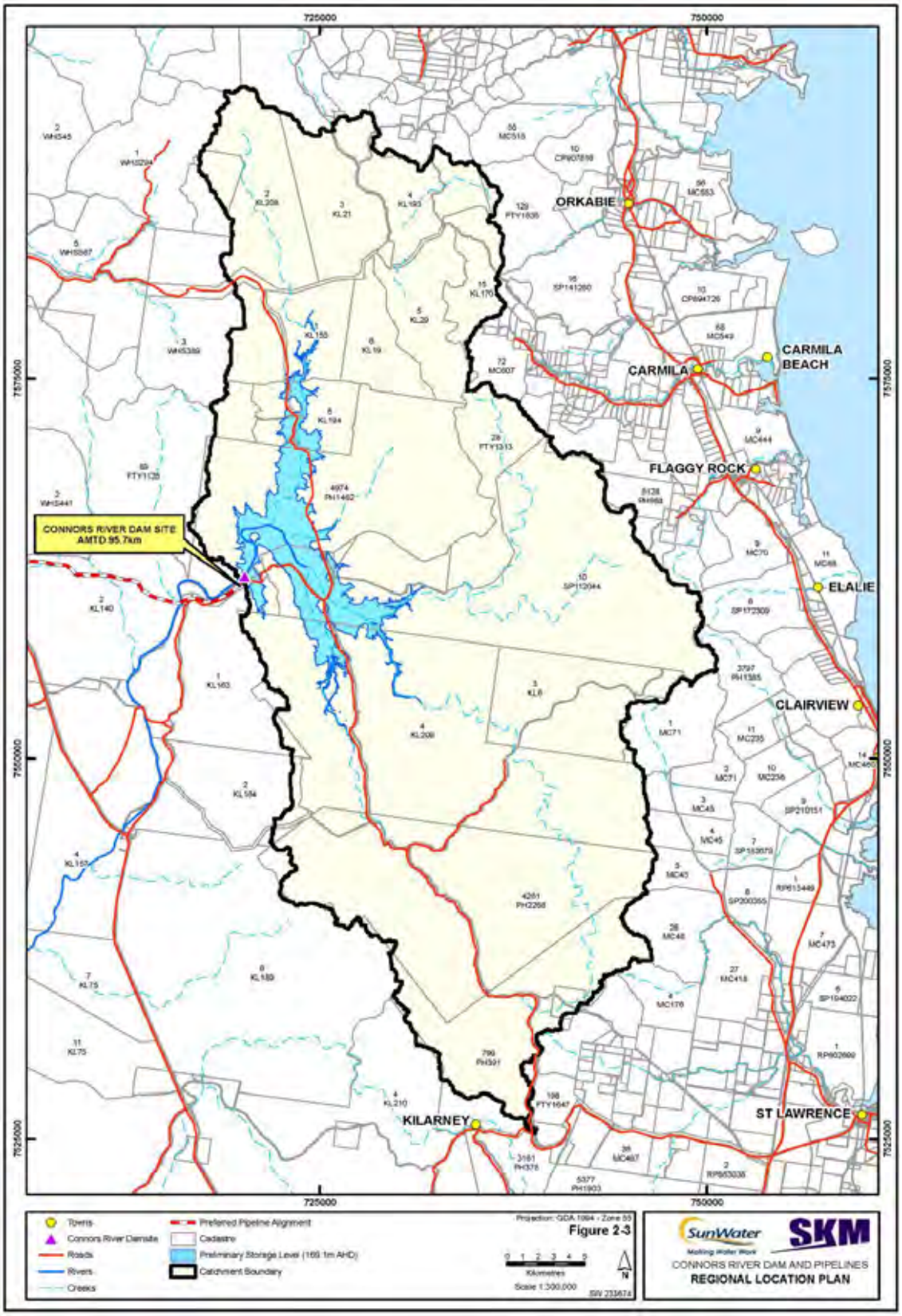

Figure 2.2 Dam site locality plan

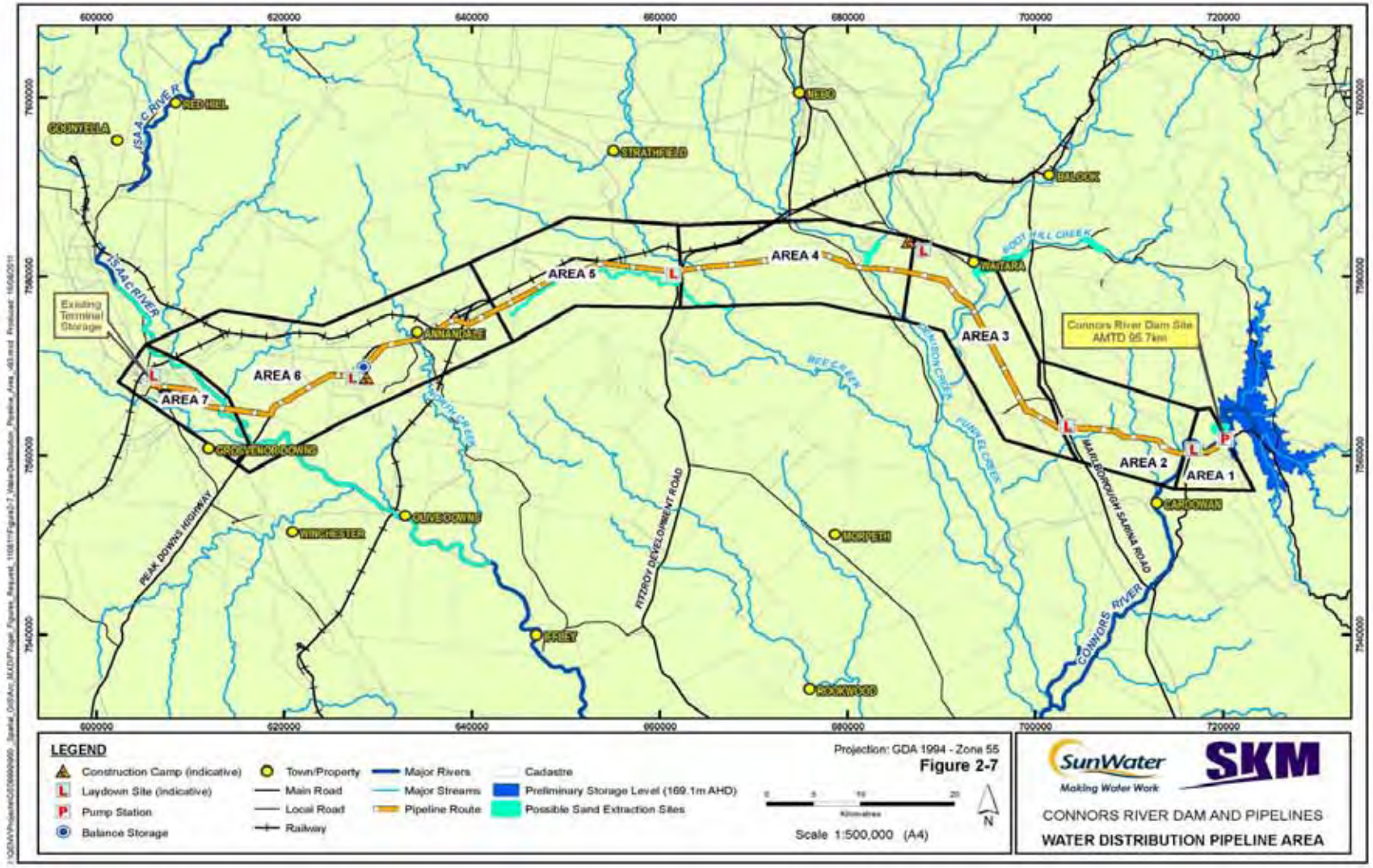

Figure 2.3 Pipeline route alignment locality plan

Figure 2.4 Extent of inundation

Figure 2.5 Artists impression of the proposed Connors River Dam

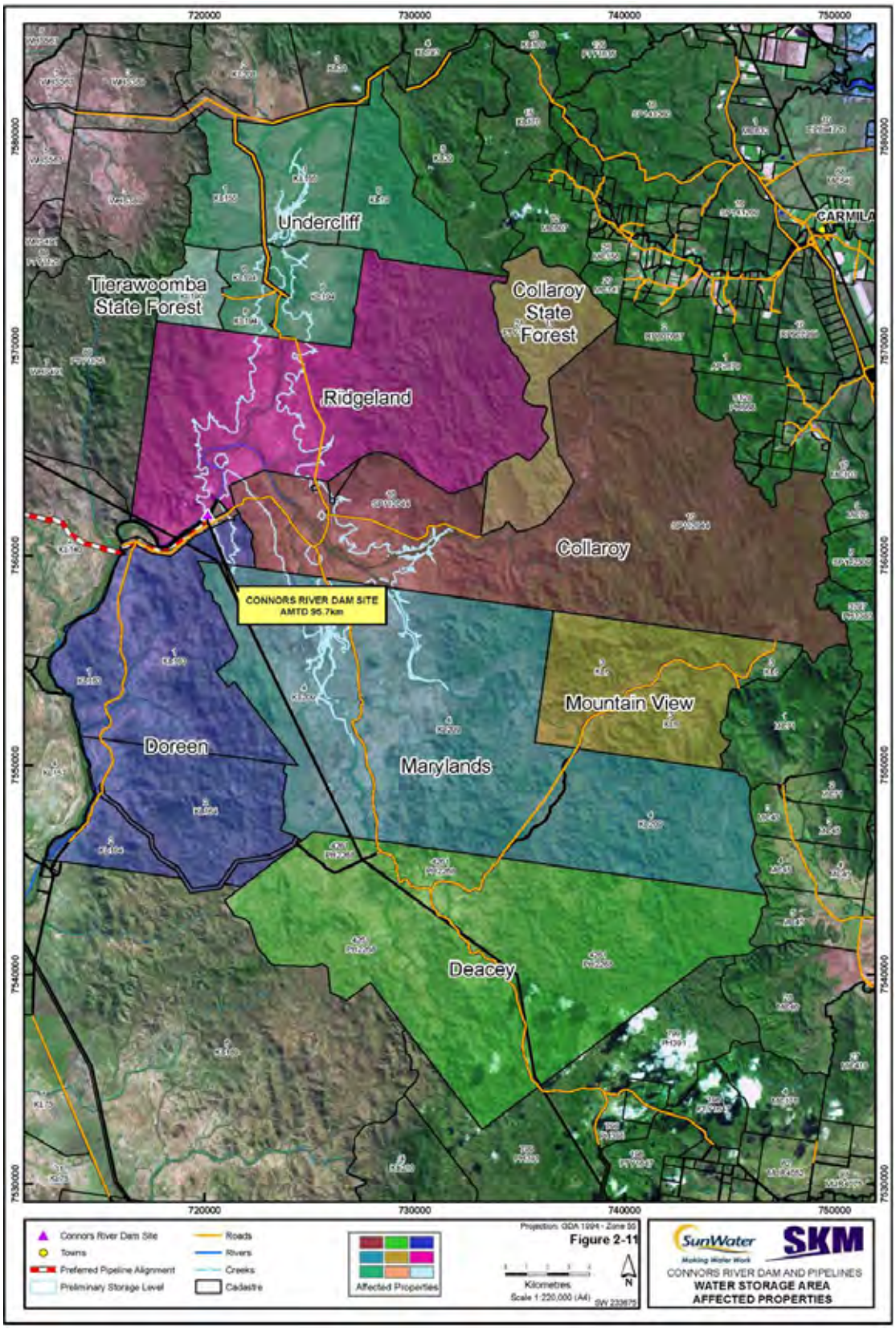

Figure 2.6 Properties affected by the water storage area

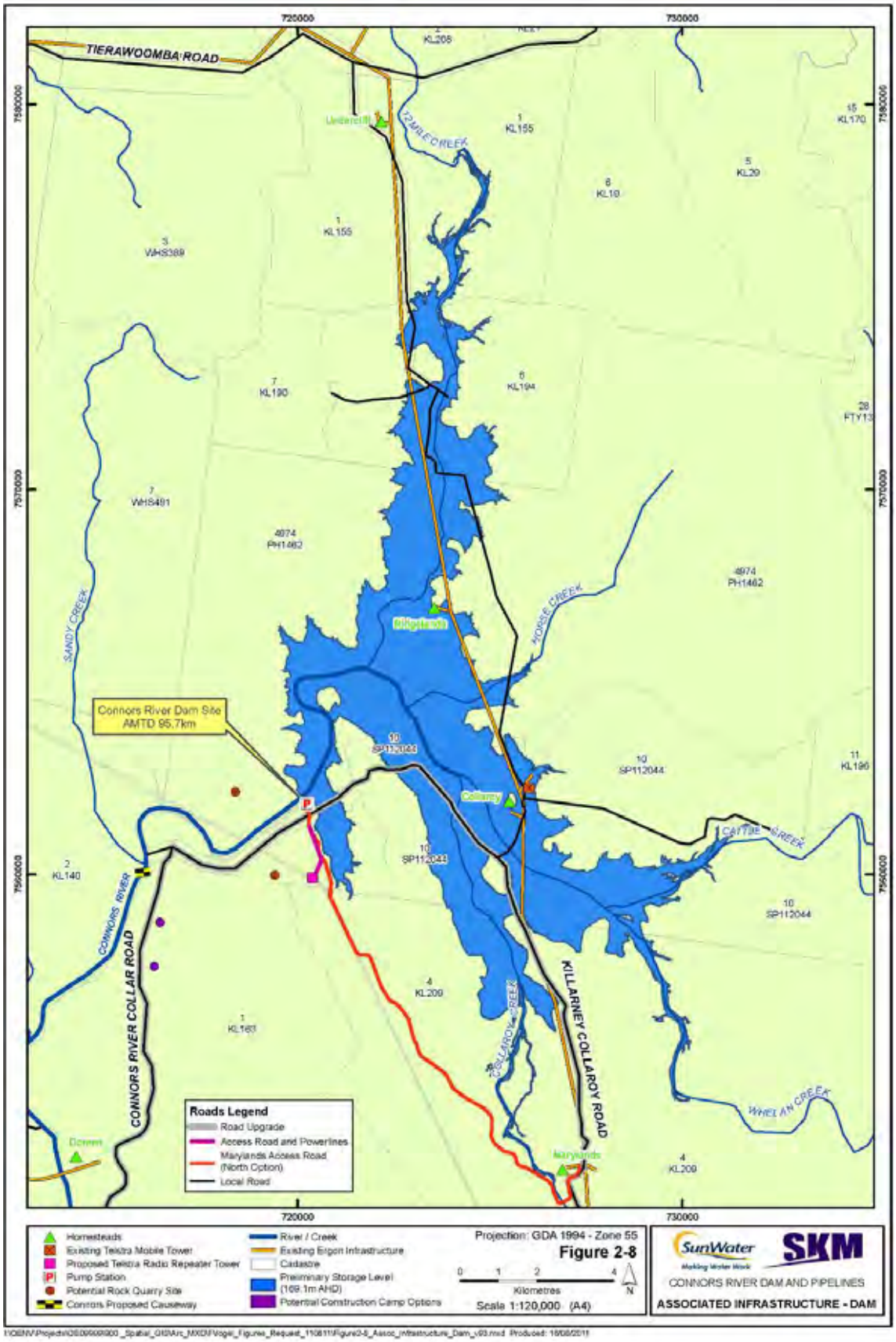

Figure 2.7 Project infrastructure requirements

Figure 2.8 Sunwater's proposed water pipeline grid

2.3. Project rationale

In 2005, the Queensland Government released the *Coal Infrastructure Program of Actions*[4] (CIPA), which outlined the likely demand for a range of coal-related infrastructure (including ports, rail and rolling stock, energy, water and skills, housing and planning) to meet the growing needs of the coal industry.

With respect to water infrastructure demands, the CIPA recognised the Connors River Dam and Pipelines project, amongst others, as a key water resource development to service demand for water in the northern Bowen Basin.

In 2006, the Queensland Government released the Statewide Water Policy[5] (SWP), which highlighted the increasing demand from urban communities, industry and rural users in regional and rural Queensland and noted water security and supply issues as critical to addressing this increasing demand. The SWP identified the provision of new infrastructure, such as a statewide water grid, examination of new sources of supply, such as the Connors River Dam and water distribution pipeline, and encouraging greater water conservation as a means to address the water security and supply issues.

The SWP, with respect to the Fitzroy (River) Basin, based on the *Central Queensland Regional Water Supply Strategy*[6] (CQRWSS). The CQRWSS identified future water needs for the sub-regions and the preferred water supply option for meeting these needs. Within the Isaac-Connors sub-catchment area, the Connors River Dam was identified as a key piece of infrastructure in meeting the short- to medium-term water needs within the sub-region which could not be met by the Burdekin to Moranbah Pipeline.

Subsequent to development of the SWP, the Connors River Dam and Pipelines project was included in the *Program of Works, Statewide Water Grid Regional Water Infrastructure projects* approved by the Governor in Council under Part 3 of the SDPWO Act on 13 December 2007. This program directs the designated proponents of the projects (Sunwater in the case of the Connors River Dam and Pipelines project) to undertake all necessary investigations in order to obtain environmental approvals and prepare a business case for their respective designated regional water projects.

In 2007, the Coal Infrastructure Task Force commissioned a report to assess water demand and supply options for coal mining in the Bowen and Surat Basins for the period 2007 to 2027. The report forecast both a low and high case of water demand for the Bowen Basin at the base year of 2006. The peak demand forecast for the Bowen Basin was 52 000 ML/a of high priority water and 43,000 ML/a of low priority water, with maximum demand for both reached around 2020.

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[4] Department of Infrastructure and Planning, Coal Infrastructure Program of Actions, Department of Infrastructure and Planning, Brisbane, 2005 (updated 2008 and 2010).
[5] Department of Infrastructure and Planning, Statewide Water Policy, Department of Infrastructure and Planning, Brisbane, 2006.
[6] Department of Natural Resources and Water, Central Queensland Regional Water Supply Strategy, Brisbane, 2006.

In 2009, Sunwater undertook an assessment of the demand from mining customers in the Bowen Basin and surrounds, which updated the findings of the Coal Infrastructure Task Force 2007 report. The Sunwater assessment confirmed adequate water supply is a critical factor for coal industry growth in the northern Bowen Basin region and noted the medium- to long-term expansion of the coal sector remains unaffected by recent economic events, with growth being driven by a long-term commodities demand 'super-cycle' due largely to the urbanisation of developing countries.

A number of alternatives to the Connors River Dam and Pipelines project were considered in meeting the demand for water in Central Queensland, including:

- trading of existing water allocations
- improving water management systems
- increasing water use efficiency
- increasing the use of groundwater
- using coal seam gas (CSG)-associated water
- increasing the release of unallocated surface water and constructing additional water storages.

Water savings from improved water efficiency are unlikely to be sufficient to meet the forecast supply shortfall. Groundwater sources across the region are fully committed and in light of concerns about aquifer levels, additional groundwater supply is not considered a viable supply source. CSG associated water quality and supply yields are variable and when combined with the high cost of treating the water, CSG-associated water is similarly not considered a viable supply source. Desalination was also considered; however, the high cost of production is a significant barrier.

Accordingly, increasing the use of unallocated surface water through the construction of additional water storages was determined to be the preferred option in meeting the anticipated demand for water in the region.

Sunwater's assessment (2009) estimated an ultimate demand for Connors River Dam water of over 50 000 ML/a of high priority water allocation for coal mining and industry, taking into account the supply now available from the Burdekin to Moranbah Pipeline (completed August 2007), and confirmed the findings of the CQRWSS that the Connors River Dam and Pipelines project was the preferred medium- to long-term surface water supply option for the Bowen Basin.

The proposed dam site, lis considered to be hydrologically, geotechnically and geologically more favourable than other potential sites on the Connors River.

In determining the dam storage volume, Sunwater considered a number of factors, including demand and yield, flow regime, water resource plan (WRP) requirements, environmental flow objectives (EFOs), water allocation security objectives (WASOs), evaporation levels, environmental impacts such as inundation area and dam wall height, and financial considerations, such as capital and operating costs.

A number of submitters to the EIS commented on the need for larger storage. However, larger storage could not be justified taking into consideration the factors noted above.

In summary, rapid recent and planned growth in the coal mining industry has created increased demand for water in the Isaac-Connors sub-catchment. Over recent years, the Queensland Government has developed a range of strategic planning and policy initiatives to support this mining development. The Connors River Dam and Pipelines project is recognised in all the relevant planning and policy initiatives above as the preferred alternative water supply in the region.

3. Impact assessment process

3.1. Overview

This section of the report details the steps involved in the project's EIS assessment process. For a detailed explanation of the EIS process, refer to **www.deedi.qld.gov.au**

In undertaking this evaluation, the Coordinator-General has considered the following:

- initial advice statement (IAS)
- EIS
- issues raised in submissions relating to the EIS
- supplementary information
- technical reports
- advice from:
  - Department of Environment, and Resource Management (DERM)
  - Isaac Regional Council (IRC)
  - Department of Employment, Economic Development and Innovation (DEEDI)
  - Queensland Health
  - Queensland Police Service
  - Department of Communities
  - Department of Community Safety
  - Department of Transport and Main Roads (DTMR)
  - Queensland Conservation Council
  - Powerlink
  - QR National
  - Construction, Forestry, Mining and Energy Union
- comments and properly made submissions[7] from members of the public.

Table 3.1 shows the steps taken in the project's EIS process.

[7] For a definition of a 'properly made submission', refer to the Glossary at page 426 this report.

Table 3.1 Overview of EIS process

Date	Process	Report section no.
20 February 2008	Final IAS and request for project declaration received	3.2
7 March 2008	Project declared 'significant project' by Coordinator-General	3.2
25 September 2008	Australian Government determined project is a 'controlled action'	3.3
31 January 2009	Submission period on draft terms of reference (TOR) commenced	3.4
9 March 2009	Submission period on draft TOR closed	3.4
16 July 2009	TOR finalised	3.4
16 October 2009	EIS provided to Coordinator-General for evaluation	3.5
6 February 2010	EIS released for public and agency comment (6-week period)	3.5
22 March 2010	Submission period on EIS closed	3.5
23 January 2011	Supplementary EIS provided to Coordinator-General for evaluation	3.6
19 March 2011	Supplementary EIS available for agency and nearby affected landowners comment (4-week period)	3.6
18 April 2011	Submission period on supplementary project information closed	3.6

3.2. Significant project declaration

The Coordinator-General has declared this project to be a 'significant project' under section 26(1)(a) of the SDPWO Act. This declaration initiated the statutory environmental impact evaluation procedure of Part 4 of the Act, which requires the proponent to prepare an EIS for the project.

3.3. Controlled action

On 25 September 2008, the Australian Government Minister for the Sustainability, Environment, Water, Population and Communities (Australian Government) determined the project to be a 'controlled action'[8] under the EPBC Act due to the likely potential impacts on matters of national environmental significance (reference number EPBC 2008/4429).

[8] For a definition of 'controlled action' refer to the Glossary at page 426 of this report

The controlling provisions of Part 3, Division 1 of the EPBC Act for the proposed action are:

- sections 12 and 15A (World Heritage properties)
- sections 15B and 15C (National Heritage places)
- sections 16 and 17B (wetlands of international importance)
- sections 18 and 18A (listed threatened species and communities) and
- sections 20 and 20A (listed migratory species).

A bilateral agreement exists between the Australian and Queensland governments that allows the Queensland Government to conduct the EIS assessment process to meet the needs of both jurisdictions. Section 7 of this report (Matters of national environmental significance), lists each controlling provision under the EPBC Act and explains the extent to which the Queensland Government EIS process addresses the actual or likely impacts of the project on the matters covered by each provision.

The Australian Government Environment Minister will use the information in section 7 of this report to assess the project under the EPBC Act.

3.4. Terms of reference

A total of 22 submissions were received on the draft terms of reference (TOR). Eighteen came from advisory agencies, two from non-government organisations and two from private submitters.

3.5. Review of the EIS

Table 3.2 provides an outline of the public and agency submissions on the EIS. For the Coordinator-General's assessment of the environmental impacts of this project, refer to section 5 of this report (Evaluation of environmental impacts).

Table 3.2 Public and agency comments received on the EIS

Agency	No. submissions	Issue summary
Queensland Government		
Department of Transport and Main Roads	1	Transport, road and rail corridor, land use and infrastructure
Department of Infrastructure and Planning	1	Urban water supply
Department of Community Safety	1	Climate and natural disasters, hazard and risk
Qld Health	1	Land contamination, surface water quality, social values and management of Impacts
Department of Environment and Resource Management	1	Surface water
Department of Communities	1	Social values and management of impacts, land use and infrastructure
Qld Police	1	Traffic & transport, hazard & risk, social values and management of impacts
Department of Employment, Economic Development and Innovation	1	Surface water, aquatic fauna
Local Government		
Isaac Regional Council	1	Surface water, transport, economies and management of impacts
Stakeholder and community groups		
Construction, Forestry, Mining and Energy Union	1	Surface water, social values and management of impacts
Qld Conservation Council	1	Surface water, surface water quality, climate and natural disasters
Powerlink	1	Land use and infrastructure
QR Network	1	Rail infrastructure
Private individuals	2	Surface water, surface water quality
TOTAL	**15**	

3.6. Supplementary information

The Coordinator-General requested that Sunwater submit a supplementary EIS (SEIS) to address public and agency comments received on the EIS, and some of the key elements of the project which have changed since the release of the EIS. Key changes, as described in the SEIS, include:

- A new 14.2 km section of construction access road
- Refinement to the pipeline route
- Refinement to land acquisition requirements
- Replacement of the originally proposed stepped spillway with a smooth spillway.
- Refinement to the proposed vegetation and biodiversity offset strategy
- Inclusion of additional quarry investigation areas.

Table 3.3 provides an outline of the submissions received on the SEIS. For the Coordinator-General's assessment of the projects' key issues and potential impacts, refer to section 5 of this report (Evaluation of environmental impacts).

Table 3.3 Public and agency comments received on supplementary project information

Agency	No. submissions	Issue summary
Queensland Government		
Department of Community Safety	1	No further information required
Qld Police	1	Transport and traffic, hazard and risk
Department of Employment, Economic Development and Innovation	1	Aquatic fauna, surface water, cumulative impacts, geology and soil
Department of Communities	1	Satisfied with SEIS
Qld Health	1	Land contamination, surface water quality
Department of Transport and Main Roads	1	Traffic and transport, proposed pipeline
Department of Employment and Training	1	Satisfied with supplementary EIS
Department of Environment, Resource Management and Innovation	1	Water resources, environmental management plans, flora and fauna (including Fitzroy river turtle), vegetation offsets, environmentally relevant activities
Stakeholder and community groups		
Macarthur Coal Limited	1	Pipeline route
QR National Network Services	1	Land use and infrastructure
TOTAL	**10**	

4. Project approvals

The SDPWO Act establishes the framework for environmental assessment of declared significant projects in Queensland and coordinates the relevant state development assessment jurisdictions for the project.

The planning and approvals framework applicable to the project's development is the *Sustainable Planning Act 2009* (Qld) (SPA). SPA is accompanied by the Sustainable Planning Regulation 2009 (Qld) SPR. The SPA and SPR provide for the assessment of certain development against local government planning schemes and policies and state government legislation.

Under SPA, any 'assessable development' requires a development permit. The following components of the project are assessable development under the Belyando, Nebo and/or Broadsound Planning Schemes.

The State and local government approvals or permits anticipated as being required for the project are identified in Tables 4.1 and 4.2 below.

Table 4.1 identifies approvals or permits which have been addressed as part of this Evaluation Report, whilst Table 4.2 identifies other approvals or permits which have not been addressed as part of this Evaluation Report and will subsequently be required following the release of this Evaluation Report.

Table 4.1 Approvals and permits anticipated as being required for the project and addressed as part of this report

Approval Type and Activity	Legislation	Agency	Report section
Local Government			
Material change of use (MCU) for: • Utility (Public) (being the dam) • Utility (Public) and Major Utility (being the pipeline)	*Sustainable Planning Act 2009*	Isaac Regional Council	Stated conditions pursuant to section 39 of the SDPWO Act (refer to Appendix 1, Schedule A)
State Government			
MCU for an environmentally relevant activity (ERA): • ERA 8 (Chemical storage) • ERA 14 (Electricity Generation) • ERA 16 (Extractive and screening activities) • ERA 17 (abrasive blasting) • ERA 38 (Surface coating) • ERA 43 (Concrete batching) • ERA 47 (Timber milling and woodchipping) • ERA 63 (Sewerage treatment) • ERA 64 (Water treatment)	*Sustainable Planning Act 2009; Sustainable Planning Regulation 2009; Environmental Protection Act 1994; Environmental Protection Regulation 2008*	Department of Environment and Resource Management	Stated conditions pursuant to section 39 of the SDPWO Act (refer to Appendix 1, Schedule B)
Development permit: for a referable dam	*Sustainable Planning Act 2009; Sustainable Planning Regulation 2009; Water Supply (Safety and Reliability) Act 2008*	Department of Environment and Resource Management	Stated condition pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule C)
Development Permit: operational works for clearing native vegetation	*Sustainable Planning Act 2009; Sustainable Planning Regulation 2009; Vegetation Management Act 1999*	Department of Environment and Resource Management	Stated condition pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule E)

Approval Type and Activity	Legislation	Agency	Report section
Water Permit: to authorise taking water for a temporary purpose, such as construction	*Water Act 2000*	Department of Environment and Resource Management	Coordinator-General Recommendation 4 (Appendix 2, Part 2)
Development Permit: for the removal of quarry material from a watercourse.	*Sustainable Planning Act 2009,* Sustainable Planning Regulation 2009*, Water Act 2000*	Department of Environment and Resource Management	Coordinator-General Recommendation 6 (Appendix 2, Part 2)
Development Permit: for waterway barrier works	*Sustainable Planning Act 2009; Sustainable Planning Regulation 2009; Fisheries Act 1994*	Department of Employment, Economic Development and Industry	Stated condition pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule D)
Riverine Protection Permit: to excavate, place fill or destroy vegetation in a watercourse	*Water Act 2000*	Department of Environment and Resource Management	Recommendation pursuant to section 52 of the SDPWO Act (Appendix 2)
Interim Resource Operations Licence: to authorise the interference with water necessary to operate infrastructure on an interim basis	*Water Act 2000*	Department of Environment and Resource Management	Coordinator-General Recommendation 5 (Appendix 2, Part 2)
Clearing Permit: to take protected plans, subject to certain exceptions	*Nature Conservation Act 1992*	Department of Environment and Resource Management	Recommendation pursuant to section 52 of the SDPWO Act (Appendix 2)

Table 4.2 Approvals and permits anticipated as being required for the project which have not been addressed as part of this Evaluation Report

Approval Type and Activity	Legislation	Agency
Local Government		
MCU for: • Extractive Industry (being quarry and sand extraction sites) • Industry (General) (being the concrete batching plant) • Works Camp (being the construction camps) • Local Utility otherwise Utility (Public) (being the water treatment plant) • Local Utility (where ancillary to a construction camp), otherwise Utility (Public) and Special Purpose (being the waste water treatment plants) • Utility (Public) and Major Utility (being the transmission lines) • Open Space (being the recreation area) • Storage Facility and Other (not defined use) (being the laydown areas) Telcommunications Facility where not Utility (Local) (being the telecommunications tower and repeater station)	*Sustainable Planning Act 2009*	Isaac Regional Council
Road licence: for alterations or improvements to local-government-controlled roads, required for pipeline crossings and road upgrades/closures	*Local Government Act 2009; Broadsound Shire Council Local Law No. 21; Nebo Shire Council Local Law No. 4 and Belyando Shire Council Local Law No. 21*	Isaac Regional Council
Flammable and combustible liquids licence: storage of flammable and combustible liquids on site during construction	Dangerous Goods Safety Management Regulation 2001	Isaac Regional Council
Notification of Large Dangerous Goods Location 2001: Storage of flammable and combustible liquids on site during construction	*Dangerous Goods Safety Management Regulation 2001*	Isaac Regional Council

Approval Type and Activity	Legislation	Agency
Building works: may be assessable or self-assessable	*Sustainable Planning Act 2009, Sustainable Planning Regulation 2009, Building Act 1975*	Isaac Regional Council/private certifier
Reconfiguration of a lot: for excisions or long-term leases for ancillary infrastructure such as balance storages	*Sustainable Planning Act 2009, Sustainable Planning Regulation 2009; Land Titles Act 1994*	Isaac Regional Council
Plumbing or drainage works compliance permit: required for new buildings/ onsite sewerage treatment systems	*Plumbing and Drainage Act 2002, Sustainable Planning Act 2009*	Isaac Regional Council/ private certifier
Development permit: for carrying out operational work for not associated with: • an MCU– excavating, filling • reconfiguring a lot • other operational works	*Sustaonable Planning Act 2009, Sustainable Planning Regulation 2009*	Isaac Regional Council
Advertising device: signage may be assessable development; permit for placing an advertising device on premises	*Local Laws* *Nebo Plan 2008*	Isaac Regional Council
State Government		
Registration Certificates	*Environmental Protection Act 1994*	Department of Environment and Resource Management
Failure impact assessment: required for referable dams	*Water Supply (Safety and Reliability) Act 2008*	Department of Environment and Resource Management

Approval Type and Activity	Legislation	Agency
Disposal permit: to remove and treat or dispose of contaminated soil from land on the Environmental Management Register (EMR) or Contaminated Land Register (CLR)	*Environmental Protection Act 1994*	Department of Environment and Resource Management
Allocation Notice: to authorise the taking of quarry material from a watercourse	*Water Act 2000*	Department of Environment and Resource Management
Forestry Act Permit: to interfere with quarry material and forest products on Crown Holdings and Crown Land.	*Forestry Act 1959*	Department of Environment and Resource Management
Road Corridor Permit: certain ancillary works and encroachments on state controlled roads must be authorised in writing by the CEO	*Transport Infrastructure Act 1994*	Department of Transport and Main Roads
Approval to interfere with state-controlled roads	*Transport Infrastructure Act 1994*	Department of Transport and Mains
Approval to interfere with a railway	*Transport Infrastructure Act 1994*	Queensland Rail
Public Utilities Plan: coordination of utility relocation	*Electricity Act 1994; Telecommunications Act 1997*	Public utility providers

Part 4, Division 7 of the SDPWO Act applies to the Coordinator-General's evaluation of the project. This Coordinator-General's report may state conditions under section 39 or 47C of the SDPWO Act, may make recommendations under section 52 of the SDPWO Act and may impose conditions under Part 4, Division 8 of the SDPWO Act, for undertaking the project.

Appendix 1 contains the Coordinator-General's stated conditions that must attach to development approval/s issued under SPA for the project, pursuant to section 39 of the SDPWO Act. The conditions are taken to be concurrence agency conditions under SPA. The conditions do not limit the assessment manager's (IRC's) power to assess the development application and set conditions not inconsistent with the conditions in Appendix 1.

The development approvals under SPA, for which the Coordinator-General has set conditions are:

- Schedule A: Making a material change of use of premises
- Schedule B: Making a material change of use of premises for an environmentally relevant activity
- Schedule C: Operational work that is the construction of a referable dam as defined under the *Water Supply (Safety and Reliability) Act 2008*
- Schedule D: Operational works that is constructing or raising waterway barrier works—*Fisheries Act 1994*
- Schedule E: Operational work that is the clearing of native vegetation (.

Appendix 2, Part 1 contains the Coordinator-General's recommendations for other approvals, made under section 52 of the SDPWO Act. The recommendations relate to Acts other than SPA or the *Environmental Protection Act 1994* (Qld) (EP Act), chapter 4A or 5, which require the preparation of an EIS, or a similar statement to address environmental effects, for the project.

While the recommendations guide the assessment managers in assessing the development applications, they do not limit their ability to seek additional information nor power to set conditions on any development approval required for the project.

Appendix 3 contains conditions imposed by the Coordinator-General under section 54B of the SDPWO Act. These conditions take effect from the date of this Coordinator-General's report and do not relieve the proponent of the obligation to obtain all approvals and licences from all relevant authorities required under any other Act.

Appendix 2, Part 2 contains the Coordinator-General's general recommendations for the project.

5. Evaluation of environmental impacts

5.1. Surface water

5.1.1. Introduction

This section addresses potential impacts to surface water including hydrology, flood risk and fluvial geomorphology. Impacts to aquatic fauna, including barriers to aquatic fauna movement, are addressed under subsection 5.5 (Aquatic ecology). Impacts to surface water quality are addressed under subsection 5.2 (Surface water quality).

Some submissions on the EIS raised issues in relation to surface water. The Coordinator-General has considered each of the submissions and how the SEIS has responded to the issues raised in those submissions. Submitter issues that the Coordinator-General considered warranted particular elaboration in his evaluation included:

- provision of town water supplies
- modification of the downstream flow regime
- environmental flows
- impacts to existing water users
- sediment and nutrient changes related to land use changes.

These matters are discussed further in this section of the report.

5.1.2. Context

The proposed dam site is located on the Connors River at AMTD[9] 95.7 km (measured from the junction with the Isaac River), with a catchment area of 1284 square km. The Connors River is located in the north of the Fitzroy (River) Basin, within the Isaac-Connors (River) sub-catchment. The Fitzroy (River) Basin comprises six major sub-catchments, including Isaac-Connors, Mackenzie, Dawson, Nogoa, Comet and Fitzroy, and has a total catchment area of approximately 142 600 square km.

Below the proposed dam site the Connors River flows south, joining the Isaac River at AMTD 49.6 km, upstream of Yatton. The Isaac-Connors sub-catchment has a total area of approximately 22 370 square km, 16 per cent of the total Fitzroy (River) Basin. The Isaac River is a tributary of the Nogoa-Mackenzie, which is itself a tributary of the Fitzroy River. The total river distance from the dam site to the Fitzroy River mouth is approximately 618.7 km. An overview of the catchment, watercourses and existing water storages is presented in Figure 5.1.

The catchment has a predominantly dry tropical climate with warm to hot, wet summers and mild dry winters. Surface water flows in the Fitzroy (River) Basin are highly

[9] For a definition of AMTD, refer to the Glossary at page 426 of this report.

seasonal, with the majority of flows occurring from December to April and high flow events occurring in late summer/early autumn.

There are two existing water storages within the Isaac-Connors sub-catchment: Burton Gorge Dam and Teviot Dam, located approximately 40 km north of Moranbah. Both dams are privately owned and operated, supplying 1700 ML/a and 1500 ML/a of high priority water, respectively, for coal mining. There are no significant impoundments on the Connors River.

There are no existing surface water supply schemes in the Isaac-Connors sub-catchment. Water is supplied to the sub-catchment (servicing the mining industry and/or several towns) from a number of sources including:

- Bowen Broken Water Supply Scheme
- Burdekin Haughton Water Supply Scheme
- Bingegang Weir
- Braeside Borefield
- Burton Gorge and Teviot Dams.

Eight major water supply pipelines are located within the Isaac-Connors sub-catchment. These pipelines primarily lie on the western side of the catchment, with the exception of the Braeside Borefield – Riverside Pipeline which extends east into the centre of the sub-catchment.

Existing water use in the Isaac-Connors sub-catchment is dominated by the coal mining industry, although there is some urban town water supply and stock and domestic usage. There are no major urban or agricultural water supply schemes in the sub-catchment and minor amounts of unsupplemented water are diverted for agricultural use.

Within the Isaac-Connors sub-catchment there are six major towns with a combined population of approximately 15 800. Of these towns, four (Moranbah, Middlemount, Dysart and Glenden) source their water from mine pipelines while two (Coppabella and Nebo) are supplied from groundwater. Water use in these towns in 2005–06 was estimated to be 4616 ML/a.

The *Central Queensland Small Communities Water Study: Community Demands Report*[10] identified a significant demand for future urban water supplies within the Isaac-Connors sub-catchment. Many communities in this region are under water stress and cannot grow without further water supplies. Water demand in the region is primarily driven by the population growth arising from new mining activity.

[10] Parsons Brinckerhoff, Central Queensland Small Communities Water Study: Community Demands Report, 2008.

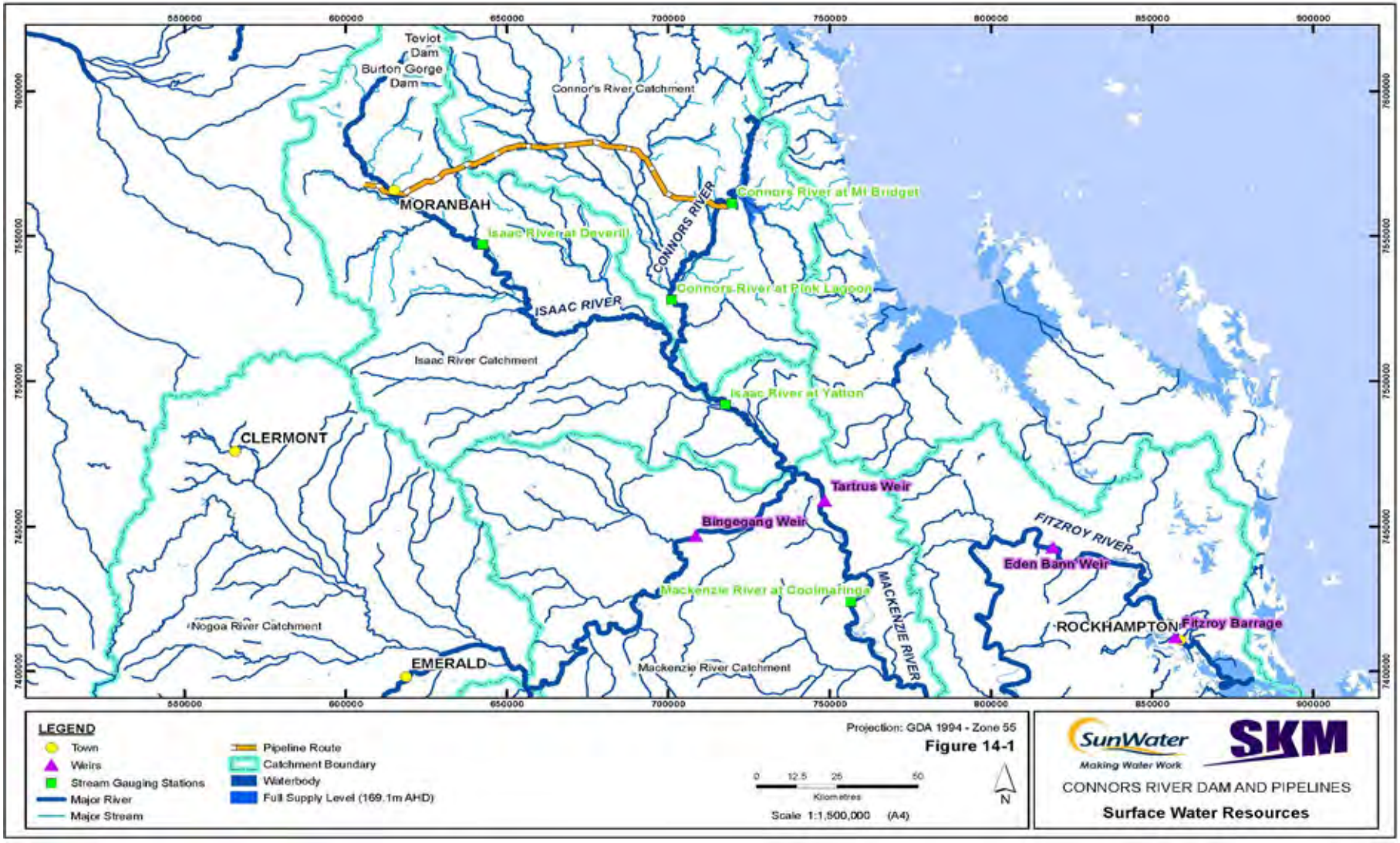


Figure 5.1 Surface water resources

5.1.3. Hydrology

Context

The water resource planning process is designed to plan for the allocation and sustainable management of water to meet Queensland's future water requirements and is governed by the *Water Act 2000*. Water resource plans (WRPs) provide a strategic framework for allocating and sustainably managing water at a catchment scale, and establish two sets of objectives:

- EFOs, which set out a series of mandatory and non-mandatory flow objectives for key locations in a catchment. In the Fitzroy (River) Basin, EFOs cover a range of flow conditions including base flow, a first post-winter flow event (FPWFE) and medium to high flow events.
- WASOs, which establish the performance of supplemented and unsupplemented water products. In the Fitzroy (River) Basin, water is available as high priority and medium priority supplemented water (which is supplied from a water storage) or as unsupplemented water (which is accessed via run of river flows).

The EIS and the SEIS for the project were developed based on the *Water Resource (Fitzroy Basin) Plan 1999* (Fitzroy WRP 1999). The Fitzroy WRP 1999 has since been repealed and replaced by the new *Water Resource (Fitzroy Basin) Plan 2011* (Fitzroy WRP 2011) which commenced on 9 December 2011. The provisions of the Fitzroy WRP 2011 accommodate the Connors River Dam.

Several methodologies were used in assessing the existing surface water environment and the potential impacts of the proposed dam. Water resource modelling, using the integrated quantity quality model (IQQM), was undertaken in order to assess streamflow and water usage, as well as compliance with the Fitzroy WRP 1999 specified WASOs and EFOs. IQQM is the standard tool used in Queensland to simulate the impacts of water resource management on flows and has been subject to rigorous and widespread scientific reviews.

Recorded gauge data at seven primary stream flow reporting sites was used to characterise the existing flow regime, including:

- Mount Bridget on Connors River (AMTD 95.3 km), 700 metres downstream of the proposed dam site
- Pink Lagoon on Connors River (AMTD 46.8 km), 47.5 km downstream of the proposed dam site and incorporating the Upper Connors tributary inflows
- Deverill on Isaac River (AMTD 174.7 km), upstream of the confluence of the Isaac and Connors Rivers
- Yatton on Isaac River (AMTD 43 km), downstream of the Connors River confluence and 116.4 km downstream of the proposed dam site
- Coolmaringa on Mackenzie River (AMTD 376 km), 230.7 km downstream of the proposed dam site
- Eden Bann Weir on Fitzroy River (AMTD 143 km), 469.7 km downstream of the proposed dam site

- Fitzroy River Barrage (AMTD 59.6 km), 562.8 km downstream of the proposed dam site. The Fitzroy River End of System is located downstream of the Fitzroy Barrage, with modelled flows representing the freshwater flows into the estuary.

The assessment of the existing surface water environment has been based on a full entitlement scenario, which incorporates all surface water resource development within the catchment existing at the time the model was developed, and assumes full utilisation of all existing water entitlements, regardless of the actual degree of utilisation. This provides information on the committed entitlements and represents the approved level of surface water resource use in the catchment.

When compared with a pre-development scenario, modelling presented in the EIS (Table 14-7) shows a reduction in mean annual flow of 0.6 per cent to 13.3 per cent across the catchment, with generally higher impacts in the lower reaches of the basin demonstrating the cumulative impacts of development.

Modelling undertaken for the EIS and SEIS showed mandatory Fitzroy WRP 1999 WASOs largely being achieved under the full entitlement scenario for existing supplemented and unsupplemented users. The exception lies with some unsupplemented irrigator groups located further downstream in the Lower Fitzroy catchment—the mandatory WASO is not being met in six instances (Table 14-20 of the EIS).

The assessment of Fitzroy WRP 1999 EFOs shows the achievement of all mandatory and non-mandatory EFOs, with one exception—the non-mandatory seasonal base flow objective is not met in September to December at the Fitzroy Barrage location (Table 14-25 of the EIS).

Potential impacts—construction

Dam and surrounds

Potential impacts resulting from the construction of the proposed dam include:

- reduced flow levels and volumes downstream of the dam
- changed stream bed profile, channel morphology and local drainage patterns.

The draft construction EMP (CEMP) (Appendix 4, section 29.9.5 of this report) contains a surface water hydrology sub-plan which aims to maintain waterway flows during construction, and outlines mitigation and monitoring, reporting and corrective action measures to achieve this.

A reduction in flow levels and volumes downstream of the dam during construction is considered unlikely as flows will be diverted around the dam construction site via a diversion channel. The diversion channel will accommodate up to 500 cubic metres per second, maintaining the water access of existing downstream users as well as downstream environmental flows. During construction, the foundations will require dewatering in order to excavate and construct in dry conditions. This water will be pumped into sedimentation ponds and re-used for dust suppression, haul roads and rehabilitation. The EIS reports dewatering will have a negligible impact on downstream flow.

Changes to stream bed profile, channel morphology and local draining patterns are considered unlikely as all drainage structures will be designed to the appropriate standard to maintain existing flow regimes and disturbed areas will be returned to their original profile on the completion of construction works.

Subsection 5.1.4 of this report addresses potential flooding impacts resulting from the construction and operation of the project.

Pipeline

The pipeline will cross several major and minor streams (refer to Figure 5.1), including:

- Connors River
- Funnel Creek
- Denison Creek
- Bee Creek
- Swamp Creek
- Devlin Creek
- North Creek
- Isaac River.

These watercourses support a number of farmers who use small volumes of unsupplemented water, predominantly for irrigation, stock and domestic purposes.

Although the larger watercourses such as Connors River, Funnel Creek and Bee Creek contain permanent water, the smaller watercourses flow intermittently or are ephemeral. As such, works in these areas will be scheduled for the dry season when most crossings are expected to be dry. The preferred crossing method is by trench, minimising the width of clearing of the riparian zone as much as possible, thereby minimising any impacts to the downstream flow regime.

Although the natural flow regime at watercourse crossings may be interrupted for a short period during the construction phase, the EIS anticipates there will be minimal impacts after the pipeline has been finalised.

Sunwater will develop and implement a range of management strategies to mitigate potential impacts of the pipeline construction on surface water hydrology. The surface water hydrology sub-plan contained within the draft CEMP (refer to Appendix 4, section 29.9.5 this report) includes the following mitigation measures:

- as far as practical, construction work in creeks will be undertaken during periods of dry weather and/or minimal rain and conditions of minimal or no flow
- in the event construction becomes necessary through a water body other than when dry, the water body will be contained by levee banks, the trench dug, the pipe laid and the area rehabilitated in the shortest practical time to minimise disturbance
- the construction of temporary waterway barriers during pipeline installation will include the provision to transfer flows from upstream of the works to the downstream channel without passing through the disturbed construction site
- the pipeline trench will be open for a minimal period of time during construction

- all construction works within the bed and banks will be undertaken in accordance with relevant management requirements as detailed in the following:
  - sediment and erosion control plan (SECP) (Appendix 4, section 29.9.3)
  - water quality management plan (Appendix 4, section 29.9.7)
  - vegetation clearance strategy (Appendix 4, section 29.9.8).

Associated infrastructure

All drainage structures for roads, short and temporary haul roads will be designed to the appropriate standard, depending on the relevant regulatory jurisdiction being either local government or TMR. Designs will incorporate an appropriate level of flood immunity, minimisation of impacts to upstream landholders and mitigation of the impacts of velocity and scour.

As part of the pipeline infrastructure a low level causeway crossing of Connors River will be constructed approximately six km downstream of the proposed dam (refer to Figure 2.7: Project infrastructure requirements). The causeway crossing will be very low level, will not require culverts and would be overtopped when the river was flowing, thereby not impeding fish movement or existing water access.

Two temporary waterway crossings will also be constructed at Funnel Creek and Denison Creek using a series of parallel pipes overtopped with compacted fill material. The pipes will be sized to pass the expected baseflow during the construction period, with floods and higher intensity flows passing over the top of the crossings. The EIS identified potential impacts to the downstream flow regime from the temporary waterway crossings to be negligible. The temporary waterway crossings will be removed on completion of construction and the sites will be rehabilitated so there are no permanent changes to the stream bed or channel morphology.

Several resource extraction areas will be established during construction, including a rock quarries, sand extraction and road base extraction areas near the dam site and sand extraction areas in or adjacent to watercourses in the region. These areas, as well as any stockpile areas, will be managed to control sediment runoff during rainfall events through a SECP, an outline of which has been provided in the draft EMP (Appendix 4, section 29.9.3).

Excavated material will be stockpiled away from gully heads, active creek banks, bank erosion or other unstable areas, and sedimentation fences and bunds will be used to contain excavated material during construction. On completion of construction, the resource extraction areas will either be transferred to another user or closed, demobilised and restored in accordance with permit conditions. The areas will be remediated to minimise long-term impacts on local drainage and surface water flows.

Construction water supply

The EIS identified the following potential water sources to address water demand during construction:

- take from Connors River or other surface water
- sedimentation ponds that will hold water from site runoff and foundation dewatering
- bores

- turkeys nests[11] and dams constructed along the route of the pipeline.

Impacts to local water resources are expected to be minor and restricted to the construction period.

Potential impacts—operation

Chapter 14 of the EIS identified the following potential impacts resulting from the operation of the project:

- impacts to downstream flow regime
- potential to reduce water access of existing water users
- potential to affect the volume and timing of key environmental flows
- cumulative impacts of the project (when combined with other proposed water infrastructure) on existing water users and environmental flows in the Lower Fitzroy sub-catchment
- potential for climate change to reduce dam yield
- potential for the dam and associated infrastructure to create barriers to fish movement
- potential to increase the flood risk to upstream existing infrastructure and residences

Potential for the dam and associated infrastructure to create barriers to fish movement has been addressed in section 5.5 of this report. Potential flooding impacts from the construction and operation of the project are addressed in section 5.1.3 of this report.

Modelling of the dam operations and hydrologic impacts incorporates a preliminary operational strategy for the dam, comprising the following:

- high priority and medium priority water products supplied by the dam
- low flow release and fishway operation
- FPWFE release
- revision of the modelling of unsupplemented irrigation licences downstream of the dam
- preliminary compensation strategy for impacted irrigators.

As described in section 2 (Project description), water products to be supplied by the proposed dam include 49 500 ML/a of high priority water and 5000 ML/a of medium priority water. The high priority water is intended for predominantly mining uses and will be supplied directly from the dam via pipeline, with a constant daily demand. The medium priority water is intended for irrigated agriculture on the Mackenzie River and is modelled as being extracted at Big Bend, near Tartrus Weir.

The low flow release was based on the 30-centimetre flow depth at the Mount Bridget gauge site (700 metres downstream of the dam site—refer to Figure 5.1), equivalent to a flow rate of 55 ML per day.

[11] a small earth dam adjacent to, and higher than, a larger earth dam, to feed water by gravity to a cattle trough, etc.

The FPWFE release was based on the principles used in the Nogoa Mackenzie water supply scheme, providing for the first high flow event between 1 October and 30 April. The event is triggered by flows into the dam equivalent to one metre above where water ceases to flow at Mount Bridget. Inflows to the dam are then released for 14 days (capped at the maximum outlet capacity of 1300 ML per day).

The following section identifies potential impacts to flow regime, WASOs and EFOs as a result of dam operation, including the abovementioned preliminary operational strategy.

Impacts to flow regime

Impacts from changes in flow regimes will be most pronounced immediately downstream of the proposed dam. The nearest streamflow gauge site to the dam is Connors River at Mount Bridget, approximately 700 metres downstream of the proposed dam site. Currently, the streamflow record shows that flow at the Mount Bridget gauge occurs in large flow pulses, with long periods of zero flow between events. There are no apparent baseflow trends or long periods of sustained flow.

With the proposed dam in place, these large flow pulses (less than 65 ML per day) will continue relatively unchanged. Accordingly, river connectivity downstream of the proposed dam will be maintained at its current level in the low flow range. Further, in order to compensate downstream irrigators, low flows released from the dam will be slightly higher than those currently experienced. This is likely to reduce the long periods of zero flow currently experienced within this section of the Connors River.

As demonstrated in Figure 5.2, the flow regime at Mount Bridget will be primarily impacted in the medium flow range (from 65 ML per day to 1000 ML per day), which are the main flows captured by the dam. This will reduce the number and frequency of floods during spring and early summer. These impacts are reduced through downstream tributary inflows, with the majority of impacts limited to the reach between the proposed dam and Funnel Creek (46.1 km downstream of the dam). Impacts downstream of Coolmaringa (Mackenzie River—212 km downstream of the proposed dam) are almost indistinguishable from the current flow regime. Consequently, changes at the Fitzroy River estuary (588 km downstream of the proposed dam) are also indistinguishable from the existing flow regime.

Impacts to the high flow range, above 10 000 ML per day, are expected to be minimal. Flows above 10 000 ML per day usually occur as part of a large flood event, when the proposed dam would receive enough inflow to fill. The larger flows will therefore pass through the storage with minimal loss of volume.

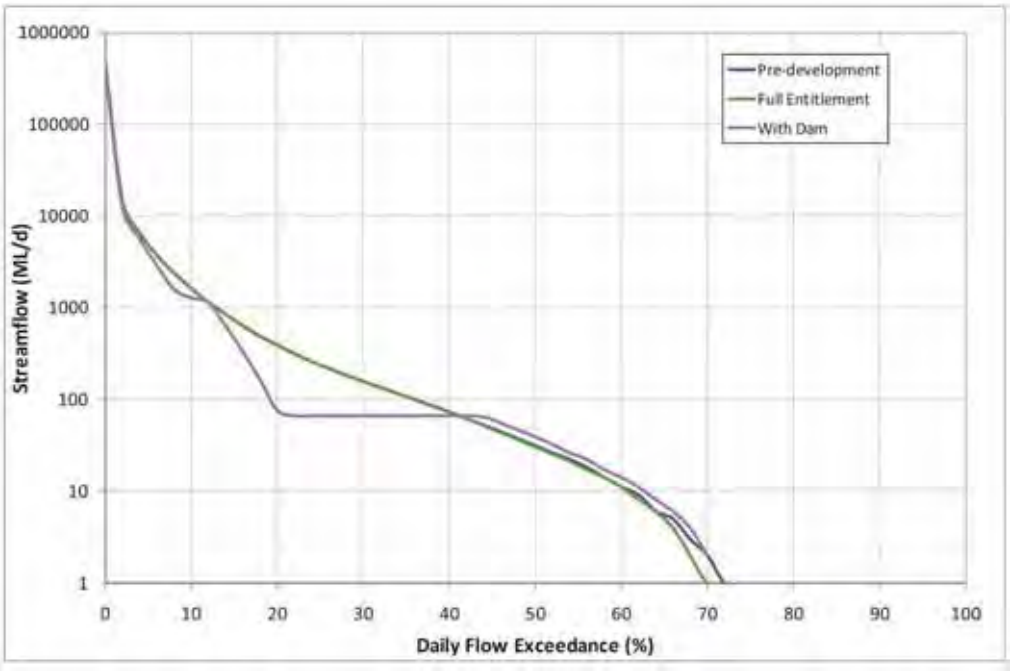


Figure 5.2 Connors River at Mount Bridget—daily flow duration curve (with proposed dam) (reproduced from Figure 14-14 of the EIS)

Impacts to existing water users

Modelling results presented in the EIS and SEIS show that, with one exception, mandatory Fitzroy WRP 1999 WASOs will be achieved for existing supplemented and unsupplemented water users.

This includes the achievement of mandatory WASOs for supplemented user groups in the Isaac-Connors, Nogoa, Mackenzie and Lower Fitzroy sub-catchments (Table 14-31 of the EIS), and mandatory WASOs (days of water harvesting opportunity) for unsupplemented irrigator groups located in the Nogoa and Mackenzie sub-catchment (Table 14-32[12] of the SEIS).

However, when compared with baseline conditions (full entitlement scenario), a mandatory WASO will not be achieved (albeit marginally) in one additional instance for one Lower Fitzroy unsupplemented irrigator (46 days of water harvesting opportunity for Class 7D unsupplemented irrigator group in the seventy-fifth percentile year, against a Fitzroy WRP 1999 objective of 47 days).

This irrigator is located on a tributary, although the irrigator's licence conditions refer to flows on the main trunk. The irrigator's location means that compensation water cannot be delivered to the irrigator under existing infrastructure arrangements. Sunwater notes other forms of compensation may need to be investigated for this irrigator, and that the issue may resolve with finalisation of the project's environmental and compensation strategies, or with variation of operational arrangements within the LFWSS.

[12] Tables 14-19 and 14-32 of the SEIS represent an updated version of tables presented in the EIS, in response to a Department of Environment and Resource Management submission

Mean annual diversions will generally be maintained at their existing levels when the preliminary operational strategy is implemented. However, unsupplemented irrigators in the Lower Fitzroy will experience a small reduction (–1 per cent change) in their mean annual diversions. Sunwater notes that this will be addressed as the environmental releases and compensation strategies for the project are refined.

Impacts to key environmental flows

The EIS presents the 'with dam' performance against the Fitzroy WRP 1999 EFOs, including seasonal base flow (non-mandatory), FPWF (mandatory) and medium to high flows (mandatory and non-mandatory).

Mandatory FPWFE performance indicators will be achieved for all locations (Yatton on Isaac River, Tartrus on Mackenzie River, and Eden Bann Weir and Fitzroy Barrage on Fitzroy River).

However, seasonal base flow results show that the base flow objective will not be met in September to December for two locations—Tartrus on Mackenzie River and Fitzroy Barrage (70 per cent and 60 per cent respectively in comparison to the seasonal base flow objective range of 80 per cent to 120 per cent).

Sunwater advises that a baseflow compensation strategy was investigated but ultimately not adopted as it resulted in negative impacts on existing supplemented irrigators in the Nogoa-Mackenzie. There may be scope for Sunwater to revisit a baseflow compensation strategy in the later stages of the project, once other release and compensation strategies have been finalised.

Mandatory and non-mandatory medium to high flow event objectives will be met for all locations, with one exception—the upper riparian zone statistic fails the non-mandatory objective at Fitzroy Barrage, but does meet the mandatory objective.

Cumulative impacts

Section 2 of this report and section 14.2.4 of the EIS describe the modelling results of a cumulative impacts scenario that represents operation of existing water infrastructure and water infrastructure currently proposed for the Fitzroy Basin, including:

- Connors River Dam
- Nathan Dam on the Dawson River
- Lower Fitzroy River Infrastructure on the Fitzroy River (Eden Bann Weir Stage 3 and Rookwood Weir Stage 2 in a staged development, hereafter referred to as the 'Lower Fitzroy weirs').

Nathan Dam and the Lower Fitzroy weirs are in the early approvals phase and require a business case to be developed and approved before they can proceed. It is therefore not assured that the proposed water infrastructure will progress.

The cumulative impact scenario presented in the EIS is only intended to give a preliminary assessment of the likelihood that the proposed infrastructure projects can be developed in a sustainable manner. Modelling for the Nathan Dam and Lower Fitzroy weirs does not include compensation strategies for unsupplemented irrigators, low flow environmental release strategies or any other strategies to address flow issue

specifically related to those projects. These strategies are expected to be developed as the projects progress. As such, there is substantial future scope to address WRP compliance, amongst other issues.

Cumulative impacts are predicted to occur in the Lower Fitzroy sub-catchment (the Connors River Dam and Nathan Dam projects are located upstream in separate sub-catchments) and as such, the Lower Fitzroy sub-catchment has been the focus of the cumulative impact assessment (i.e. downstream of the confluence of the Dawson River and in the reaches affected by the proposed Lower Fitzroy weirs). The following section presents potential cumulative impacts on WASOs and EFOs.

Cumulative impacts to existing water users

Table 14-48 of the EIS presented a summary of the medium and high priority WASOs for supplemented user groups in the Lower Fitzroy sub-catchments. The Fitzroy WRP 1999 targets are achieved for each group under the cumulative impacts scenario, with the reliability of medium priority entitlement increasing. This is due to the increased water storage capacity of Eden Bann and Rookwood Weirs. The reliability of the existing high priority entitlement has decreased, however it is still receiving a very high reliability above the Fitzroy WRP 1999 specified WASO.

Table 14-49 of the EIS presents the number of days of water harvesting opportunity for the Lower Fitzroy unsupplemented irrigators (mandatory WASO). Under the full entitlement scenario the objectives are not met in six instances, and an additional instance occurs under the cumulative scenario—this is the same irrigator as identified in the Connors 'with dam' scenario. While there is increased impact relative to the full entitlement and Connors River Dam scenarios, the water harvesting groups are still receiving water in accordance with the Fitzroy WRP 1999 objectives.

Table 14-50 of the EIS presented the mean annual diversions for the unsupplemented irrigators groups in the Lower Fitzroy sub-catchments. The mean annual diversions show some impact under the cumulative ompacts scenario. However, the Nathan Dam and Lower Fitzroy models are preliminary and therefore do not include compensation strategies for unsupplemented irrigators or low flow environmental release strategies. Sunwater expects that these effects can be adequately addressed by developing appropriate strategies in the future.

Cumulative impacts to key environmental flow objectives

Results show that the seasonal baseflow objective was not met under the cumulative impacts scenario in September to December at the Eden Bann Weir or Fitzroy Barrage (Table 14-45 of the EIS). However, Sunwater noted that specific baseflow strategies have yet to be developed for each infrastructure project and it is expected that these effects can be adequately addressed.

The FPWFE performance indicators were achieved at both Eden Bann Weir and Fitzroy Barrage, with one exception: the number of flows within four weeks of a pre-development event does not pass the objective at the Fitzroy Barrage. However, Sunwater expects that these effects can be adequately addressed by developing appropriate strategies in the future, based on the substantial buffer between the target

and the achieved flow for most statistics, which suggests there is scope to optimise operational strategies.

Although the majority of FPWFE performance indicators were achieved, there was still some change from the performance under the 'full entitlement' (existing condition) scenario, particularly at the Fitzroy Barrage. The overall number and volume of the FPWFEs has decreased, reducing the average peak flow and duration.

The medium to high flow event objectives at the Fitzroy Barrage were met, with the exception of the upper riparian zone statistic, which fails the non mandatory objective, but still passes the mandatory objective.

Climate change impacts on dam yield

Section 14.2.2.6 of the EIS presented an analysis of the 2050 climate change projection under the highest emissions scenario (A1FI) for three modelled percentiles (fiftieth percentile representing the most likely case, while the ninetieth and tenth percentiles represent the confidence limits of the estimates) for both the full entitlement (i.e. existing situation) and 'with dam' (including a preliminary operational strategy) cases.

The 2050 climate change projection assumes a high reliance on fossil fuels, most closely follows current actual emissions levels, and represents a timeframe close enough to have some certainty around the estimates, while still allowing enough time for climate change impacts to develop.

Modelling shows climate change is likely to result in reduced annual average rainfall, change in seasonal rainfall or an increase in average potential evaporation.

While the Connors River Dam will provide additional storage capacity and yield in comparison to the existing situation, climate change does have the potential to reduce the yield from the dam.

A critical water supply strategy will be developed as part of the Management of the water storage and pipeline sub-plan of the draft OEMP (refer to Appendix 4, section 29.10.2) to manage and prioritise water supply during drought periods.

Coordinator-General's conclusions—hydrology

The Coordinator-General is satisfied with the assessment of risks to surface water hydrology, as provided in section 14 of the EIS and in the SEIS, and the mitigation measures proposed to minimise those risks. The Coordinator-General notes that no significant risks relating to surface water hydrology are expected to remain after mitigation. In particular:

- the possibility of changes to stream bed profiles, channel morphology and local drainage patterns is low, and will be managed through appropriate construction management plans and procedures as set out in the draft CEMP for the project
- the risk of impacts to existing users and the environment through an altered flow regime is low and will be managed through the dam operational strategy and compensation strategy

- overall, the cumulative impacts of the Connors River Dam, Nathan Dam and Lower Fitzroy weirs projects on existing water users and environmental flows in the Lower Fitzroy sub-catchment are not excessive; and Sunwater notes they will be managed through a combination of environmental flow releases and management rules
- given the potential impact of climate change on the region, the proposed dam represents an additional resource. Sunwater will prepare a critical water supply strategy as part of the OEMP for the project to manage and prioritise water supply during periods of drought.

The Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

The Coordinator-General notes that the EIS and the SEIS were developed based on the Fitzroy WRP 1999, which has since been repealed and replaced by the new Fitzroy WRP 2011 which commenced on 9 December 2011. Accordingly, the project must compy with the Fitzroy WRP 2011.

DERM advises an Interim Resource Operations Licence (IROL) under the *Water Act 2000* will be required to authorise interference with the flow of water and allow the construction of the Connors River Dam to proceed. Under section 176 of the *Water Act 2000*, the Fitzroy Basin ROP will be amended to state a process for the granting of the IROL to the proposed owner of the infrastructure.

DERM advises the preliminary operating strategies associated with the impact of the proposed dam on the downstream flow regime (as proposed in the EIS and the SEIS) will need to be further developed by Sunwater and provided to DERM as part of Sunwater's application for an IROL. DERM will consider the strategies when establishing the conditions for an IROL for the dam construction, and will amend the Fitzroy Basin ROP to include ongoing operational arrangements for the dam and the subsequent granting of a ROL.

Operational strategies associated with requirements for releasing or passing water through the dam will be required to meet sub-catchment scale EFOs specified in the Fitzroy WRP 2011, as well as other possible requirements for operation of the dam to mitigate impacts of the modified flow regime. For example, the EIS assessments and preliminary strategies for passing low flows are based on fishway passage and stream connectivity in the vicinity of the proposed dam (section 14.4 SEIS). However consideration will also need to be given to other factors for passing low flows through or from the dam storage, including:

- connectivity further downstream of the dam
- downstream flow losses
- final fishway management arrangements
- requirements for downstream users
- objectives of the Fitzroy WRP 2011.

The Coordinator-General acknowledges the issues raised by DERM regarding the need to further develop preliminary operating strategies associated with the impact of the proposed dam on the downstream flow regime.

Based on this information, the Coordinator-General has made general recommendations (refer to Appendix 2.Recommendation 5) regarding the information required to be provided by the owner of the dam as part of any application for an IROL:

- Complete assessments of the impacts of the dam on the water supplies available to existing water entitlement holders on the Connors and Isaac Rivers downstream of the dam
- Complete any necessary negotiations with any holders of impacted water entitlements for proposed arrangements to ensure the provision of water supplies equivalent to those provided under the current water entitlements, or suitable negotiated outcome
- Provide to the chief executive administering the *Water Act 2000* the proposed arrangements for addressing impacts of the dam on existing holders of water entitlements for review and approval
- Install and maintain infrastructure to determine inflows to the dam and releases from the dam for the operation and management of environmental flows

With regard to water supply for construction, DERM advises that authorisations for the take of water for construction water supply under the *Water Act 2000* are dependent on availability from potential sources and ensuring minimal impact on other users. Further, DERM advised water permits under the *Water Act 2000* will be required for securing water supplies from existing groundwater bores or pumps (with consent of the landholder) and from a watercourse. A water permit for the take of water from a watercourse may contain flow conditions and/or minimum take levels to ensure water users are not adversely affected.

The Coordinator-General notes the significant demand for future urban water supplies within the Isaac-Connors sub-catchment, being driven primarily by the population growth arising from new mining activity.

Expanding mining operations in the Bowen Basin will increase urban populations with towns including Nebo, Middlemount, and Dysart expected to require additional water supply to meet future demand. Additional water demand for urban areas in the IRC area is expected to approach 2800 ML of high security water by 2031[13].

The issue of town water security was raised by IRC in its submission on the EIS. In particular, IRC requested Sunwater:

- clearly commit to the provision of urban water supplies to Nebo to ensure the sustainability of the community
- consider the requirement to meet future water needs of the coastal region within close proximity to Greenhill and Carmila.

Sunwater identified in section 24.2 of the SEIS that the supply of water to the coastal region within proximity to Greenhill and Carmila is not feasible given the relatively

[13] Psi Delta, 2009: *Connors River Dam Agricultural and Urban Market Assessment Report, prepared for Sunwater, Brisbane*

minimal volumes of water required and the high associated costs for construction and operations of a pipeline passing through the Great Dividing Range.

Since the release of the EIS, Sunwater has been involved in negotiations with the IRC, potential foundation customers of the project and DERM regarding future supplies to townships from the Connors River Dam. Section 24.2 of the SEIS noted that at the time of writing, discussions were ongoing; however, a future Connors River Dam supply to the townships of Nebo and Moranbah is probable.

The Coordinator-General acknowledges the water stress of towns in the region. In order to increase the security of urban water supplies in the region, the Coordinator-General recommends Sunwater make available water from the Connors River Dam to supply townships in the region (Appendix 2.Recommendation 3).

5.1.4. Flood risk

Context

Flooding within the Fitzroy Basin typically occurs in summer or early autumn in association with tropical cyclones or intense monsoonal depressions. These weather systems can produce very high rainfall over a short period of time.

Due to the size of the catchment and its major tributaries, the Fitzroy Basin frequently experiences flooding following high rainfall events, particularly in the lower catchment.

Peak annual flow records at the Mount Bridget gauge (located directly downstream of the proposed dam) show a range of major, moderate and minor flood events over the past 40 years. Compared with other Queensland catchments, the Connors River catchment at Mount Bridget has a very high runoff-generating capacity, with river levels rising and falling fairly quickly due to the relatively small catchment area.

Hydrologic and hydraulic modelling using the Urban Runoff and Basin System (URBS) and MIKE 11[14] has been undertaken to assess potential flood impacts for the proposed dam and surrounds. The flood modelling assessed the peak flood volumes and peak flood levels for historical flood events as well as a range of design events.

Potential impacts—construction

During construction, works may be damaged and construction may be delayed as a result of flood events.

As identified in section 2 (Project description), the dam will be of RCC construction. This means the dam can be overtopped safely by flood waters with minimal risk of damage. The construction phase would also be shorter with RCC construction, reducing the amount of time the site will be exposed to flood risk.

As the RCC dam can pass major floods prior to completion, the main requirement for diversion works will be during the foundation excavation and preparation for the central

[14] For a definition of MIKE 11, refer to the Glossary at page 426 of this report

spillway section of the dam and subsequent construction of the works below the river bed level. Once the concrete construction of this section rises above the river bed level the potential risk due to flooding will reduce significantly. Accordingly, work below the river bed level is planned to take place in the drier months of the year.

All other construction activities will be scheduled to avoid the wet season as far as practicable. A flood management plan will also be prepared for the construction of the project.

With these mitigation measures in place, the residual impact of flooding on the construction of the project is expected to be low.

Potential impacts—operation

The proposed dam will reduce peak flood levels directly downstream, particularly in the minor to moderate flood range. The dam is ungated and as such will have little control over flood flows. The proposed dam will act as a detention basin for flood flows, increasing the duration of downstream flood events but generally lowering the peak flood levels.

Table 14-42 of the EIS presented the peak flood levels at Mount Bridget and Cardowan for the 1 in 100 AEP for the pre- and post-dam scenarios, and the corresponding duration of the critical event. This assessment shows a reduction of peak flow due to the dam and an increase in the critical duration event from 18 to 48 hours. The difference in peak flood level between the two scenarios shows a decrease of 1.47 metres directly below the dam wall, tapering to 0.76 metres approximately 19.5 km downstream of the dam (five km downstream of Cardowan).

There is no significant infrastructure on the Connors River directly downstream of the proposed dam site. The closest residences within the flood model are slightly downstream of Cardowan and are situated above the existing 1 in 100 AEP flood level. However, there are several farm buildings in the area that may be below the existing flood level. As flood levels are reduced, the impact on these structures is expected to be positive.

The downstream frequency of overbank flows or floodplain inundation will decrease once the dam is in place. This will primarily affect the reach directly downstream of the dam to the Funnel Creek confluence. The impact of the dam will be reduced beyond this point through tributary inflows. Impacts to wetlands and floodplains is further discussed in subsection 5.1.5 of this report.

Upstream, the dam will inundate several reaches and tributaries. This will reduce the travel time of flood waters compared to existing conditions. Figure 2.4 shows the extent of the reservoir at FSL and the 1 in 100 AEP flood level. The flood extent for the 1 in 100 AEP extends north 23 km upstream towards Undercliff (1.5 km short of the Undercliff homestead) and south-west 19.5 km upstream towards Marylands (2.7 km short of the Marylands homestead).

An assessment of upstream flooding (a comparison of the modelled 1 in 100 AEP flood with and without the dam) produced the flood margin that was used in Sunwater's land purchase strategy (refer to section 2: Project description). Accordingly, Sunwater will own land to the flood margin and will not allow inappropriate development in that area.

The flood margin has also been used to assist in determining the extent of impact on a property and if full purchase should be considered over partial purchase.

In accordance with the draft operational EMP for the project (refer to Appendix 4, section 29.10.2 of draft EMP) a flood management plan will also be prepared to manage flood events during operation of the dam.

Coordinator-General's conclusion—flooding

The Coordinator-General is satisfied that flood risk during construction and operation of the project will be effectively managed through a combination of construction sequencing and timing, preparing and implementing construction and operation flood management plans and the flood-margin based land purchase strategy.

The Coordinator-General has stated a condition (Appendix 1, Schedule A, Condition 2) to ensure the safe operation and maintenance of the dam in accordance with the current versions of guidelines issued in Queensland under the *Water Supply (Safety and Reliability) Act 2008*.

The Coordinator-General has also set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

5.1.5. Fluvial geomorphology

Context

Development of the catchment since European settlement, mainly for agriculture and industry, has resulted in a number of impacts to the Connors River and its tributaries, including:

- increased sediment yield to the rivers
- localised degradation of bank and bed stability and direct runoff from road surfaces resulting from existing road and infrastructure crossings
- localised minor physical disturbance of bed and banks from the construction of low level crossings and causeways.

Mines (particularly underground coal mines) are present within the upper reaches of some streams/rivers crossed by the proposed pipeline, including the upper reaches of Funnel, Dennison, Bee and North creeks and throughout the Isaac River catchment. Numerous mines are located immediately adjacent to stream channels, which would impact on delivery of runoff to the channel, and in cases where stream diversions have been required (e.g. Goonyella Mine), have resulted in localised and dissipating downstream impacts on natural hydrology and resulting geomorphic integrity (e.g. bank and bed stability, sediment transport).

Sand and gravel extraction from the Connors River and Isaac River was observed during field inspections; however, these were noted to have minor and localised impacts only.

As indicated in subsection 5.1.1, there are no significant impoundments on the Connors River. The existing unsupplemented extraction was noted to have a minimal impact on the geomorphology of rivers/streams because their impacts on the higher flows of significance for fluvial geomorphology would be minor.

Potential impacts—construction

Potential impacts arising from the construction of project (dam, pipeline and associated infrastructure) are likely to be of a site-specific and short-term nature and may include:

- increased total suspended solids (TSS) and bed sedimentation in channels and waterbodies due to construction disturbance, exposure of erodible soils and stockpile runoff
- increase in bank erosion (gullying) due to inadequate drainage control from exposed areas
- bank mass failures in incised stream types due to trenching at stream crossings during pipeline construction
- creek bed and bank instabilities caused by extraction of bedding sand from waterways
- exacerbated erosion of within channel bars and benches where vegetation has been removed (particularly complex stream types)
- interruption to low flow and sediment conveyance during construction of the Connors River causeway.

Considering the ephemeral or intermittent nature of most watercourses within the region, most impacts relate to increased delivery of sediment to the channel which can be mitigated by avoiding construction during wetter months.

As indicated in subsection 5.1.2, construction of the project will occur during periods of low average monthly rainfall. Rainfall and climatic records and historic flood frequency data suggest that construction works resulting in high levels of soil disturbance would be best carried out between April and November.

To further mitigate potential impacts, a SECP will be prepared and implemented as part of the draft CEMP (refer to Appendix 4, section 29.9.3). The SECP will mitigate the impacts of spoil removal, haulage and placement in spoil retainment areas, and soil erosion from all work areas where vegetation is removed or soil is disturbed during construction in accordance with International Erosion Control Association (IECA) *Australasia Best Practice Erosion and Sediment Control* (IECA guidelines).[15]

The draft CEMP also requires *in situ* construction monitoring at the geomorphic monitoring sites immediately downstream of the proposed dam wall to assess the impact on both channel integrity and sediment entrainment (refer to Appendix 4, section 29.9.5).

[15] International Erosion Control Association, *Australasia Best Practice Erosion and Sediment Control*, International Erosion Control Association, Australia, 2008.

The degree of impact at sand extraction sites will depend on stream type and volume of sediment extracted. Due to their more confined nature, incised streams will be more susceptible to bank instabilities following extraction. The EIS identified several streams with suitable material for extraction, with complex streams (Funnel, Denison creeks) considered to contain greater volumes than incised streams (Bee Creek). The EIS concluded impacts to bank and bed stability will be localised to reach-scale on the proviso that a riverine sediment extraction management plan based on good-industry practice guidelines is implemented and enforced (refer to Appendix 4, section 29.9.5). The management plan will include restoration and stabilisation plans post extraction and will:

- set sustainable limits for each extraction point that considers sediment supply, stream condition and downstream requirements
- monitor allocations to ensure they are not exceeded
- establish safe buffer distances between extraction and stream banks
- provide a surveyed site plan that identifies hydraulic habitats, riparian vegetation location, extent and species present and planned area of extraction
- detail extraction operation plans, including any vegetation removal, staging, mitigation measures and buffer zones between extraction areas and stream banks
- develop a monitoring plan that establishes sites upstream, downstream and within the area of extraction
- develop a rehabilitation plan.

In response to DERM's submission on the EIS, Sunwater commissioned further investigation of sand replenishment rates at the proposed sand extraction sites including Boothill Creek, Funnel Creek, Denison Creek and Isaac River (Appendix D-3 of the SEIS). DERM staff were consulted directly on the methodology and accompanied the consultant on field inspections. The results of those inspections showed that ample resource exists at the nominated sites and the excavated pits would be in-filled by natural sand movement within 1–2 years.

By implementing the proposed mitigation measures during construction, sediment-related and fluvial geomorphological impacts are expected to be mostly minor or negligible.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Potential impacts—operation

Key impacts resulting from the operation of the project include:

- sediment and nutrient changes related to land use changes
- impacts to channel and floodplain morphology.

Sediment and nutrient changes related to land use changes

Over 22 300 ha of predominantly grazing land will be taken out of agricultural production by the footprint of the project (including approximately 5700 ha for the water

storage area and 16 600 ha of land for preservation as part of Sunwater's revised offset strategy). Some areas of additional surrounding land will be managed for environmental purposes, which will also reduce sediment and nutrient runoff from the Connors River catchment. Of the reduced sediment that does run off, the impoundment will trap approximately 247 000 tonnes per year (representing approximately 0.05 per cent sediment inflow per year).

The project allows for 5000 megalitres per annum of medium priority water to be purchased for irrigated agriculture downstream of the proposed dam. Section 14.5.1.2 of the EIS noted that a maximum of 833 ha of land could be developed for new cropping land, most likely to irrigate cereal and fodder crops (this figure is based on an assumed usage rate of six megalitres per annum, the irrigation rate used in the Fitzroy WRP 1999). However, a significant proportion of the additional water is more likely to be used for improving the security of existing users rather than establishing new cropping land.

Even if new land is converted to irrigation, the large amount of upstream land removed from grazing (over 22 300 ha) would far outweigh any possible increase in the erosion and nutrient runoff rates from the change in downstream land use. Accordingly, in the context of the proposed dam reducing current rates of sediment delivery and transport in the catchment, which are much higher than pre-European conditions, no measures are proposed or required to mitigate sediment and nutrient changes related to the potential expansion of irrigated agriculture.

Impacts to channel and floodplain morphology

The following potential impacts to channel and floodplain morphology have been identified as a result of the dam operation:

- *Within-channel sediment build-up in the inundation area, particularly within the upstream reaches, resulting from dam backwater effects*. It is likely that the proposed dam will trap all coarse sediment entering the reservoir and the majority of suspended sediment, resulting in an infill rate of approximately 0.05 per cent per year. The majority of this infilling will occur in the upper sections of the inundation area where inflows meet the backwater created by the dam. Deposition will occur both within the channels (coarse sediment) and on floodplains (fine sediment). The EIS noted this depositional effect occurs to some degree for most water storages and is largely unavoidable but is unlikely to result in the loss of significant geomorphological features. Further, this sediment would be transported downstream into the reservoir by inflows when the reservoir water level is low.
- *Drowning of hydraulic habitats within the inundation area leading to reduction in geomorphic variability*. As no geomorphic features were identified in the impoundment area, the impact of drowning hydraulic habitats is considered negligible.
- *Shoreline and subsurface erosion processes within the inundation area*. This may occur due to the action of waves and/or water level fluctuation, or human/livestock activities on susceptible areas of shoreline. This can be managed using vegetation buffers on areas of steep bank and/or erodible soil types, managed access for both human and recreation stock, and by restricting recreational boating.

- *Reduced sediment supply to the coast*. Significant changes are not expected due to the significant additional river flows that occur between the proposed dam and the coast. Flow statistics indicate that the impact on flows in the Fitzroy Estuary and to the coast resulting from the Connors River Dam are negligible when compared with existing conditions and, while flow is not the sole factor that determines sediment load, it suggests similar negligible impacts on sediment delivery.
- *Clearwater scour and associated bank erosion due to sediment trapping by the dam*. Scouring of sediments downstream from the proposed dam wall may be expected to occur due to the sediment trapping effect of the dam. This effect will be limited by bed and bank rock outcropping, particularly closer to the dam wall, and the presence of gravels and cobbles in the bed material. Available sand particles will be transported downstream, likely creating a bed-armouring effect rather than significant vertical scour. Given that Connors River has an oversupply of sediment compared with pre-development conditions, this represents a return to a more natural state.
- *Channel contraction downstream due to a reduced frequency of channel-forming flows*. Analysis of the IQQM flow results for Connors River indicates that flow statistics post-dam will generally be similar to the 'existing' and 'pre-development' case for medium to high flows. Further, model results indicate that indicators for channel maintenance (as set out in the Fitzroy WRP 1999) would be met for Connors River nodes at Mount Bridget (immediately downstream of the dam wall) and Pink Lagoon. Therefore, geomorphic processes for the Connors River are likely to be maintained for the post-dam case and the residual risk is generally low.
- *Reduction in connectivity with floodplain and associated waterbodies due to reduction in flooding extent*. Lake Plattaway located 65 km downstream of the proposed dam may be affected—the flow threshold to inundate Lake Plattaway will be confirmed as part of the dam operational strategy and compensation strategy.

Section 29.10.2 of the draft operational EMP (Appendix 4) specifies measures to mitigate sediment-related and fluvial geomorphological impacts, including:

- continued monitoring of geomorphic assessment sites for potential change that adheres to the relevant guidelines
- bed and bank stabilisation as required in the area immediately below the dam, should vertical scour be observed.

By implementing the proposed mitigation measures, potential impacts are expected to be mostly minor or negligible.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 2) to ensure the effective implementation of the OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Cumulative impacts (fluvial geomorphology)

The EIS reported that, from a Fitzroy (River) Basin perspective, cumulative impacts associated with the project are expected to be minimal. IQQM flow statistics, taken as an index of flow and sediment processes (and thereby geomorphic processes) and discussed in section 5.1.2 indicate there is minimal difference between the existing and

post-dam scenarios for nodes downstream from the Connors River. Moreover, as the Fitzroy (River) Basin is highly regulated, degraded and overloaded with sediment, any reduction in sediment supply to the coast could be beneficial.

Coordinator-General's conclusions

Based on the risk assessment provided in the EIS, the SEIS and measures identified in the revised draft EMP (Appendix 4), the Coordinator-General is satisfied that geomorphic processes for the Connors River are likely to be maintained with the dam in place, and that the residual risks to geomorphic processes are acceptable.

While sediment supply downstream may be reduced, this is not considered significant and may be beneficial because current rates of sediment delivery and transport are much higher than pre-development conditions. Although some localised erosion and sedimentation impacts may occur, these can be effectively managed by implementing appropriate mitigation measures.

The Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

To address potential sediment and erosion impacts arising from the construction and operation of the project, the Coordinator-General has stated a condition (Appendix 1, Schedule A, Condition 4) which will require the inclusion of additional requirements in the SECP for both construction and operation of the project.

To ensure potential impacts associated with sand extraction in waterways are effectively managed and mitigated, the Coordinator-General has made a recommendation (Appendix 2, Part 2, Recommendation 6), which specifies detailed requirements regarding the removal of quarry material.

To address potential impacts arising from construction in watercourses, the Coordinator-General has also recommended specific mitigation measures for inclusion in the SECP of the draft CEMP (Appendix 1, Schedule A, Condition 4).

5.2. Surface water quality

5.2.1. Introduction

The following section provides an analysis of surface water quality values that may be affected by the project. Some submissions on the EIS raised issues in relation to surface water quality, including:

- impacts to downstream water quality during construction and operation
- impacts to water quality within the dam during operation
- stratification.

These matters are discussed further below.

5.2.2. Context

Section 16 of the EIS reported the existing surface water quality environment was indicative of a slightly disturbed system, somewhat impacted by grazing land use and pasture improvement. In general, water quality appears to deteriorate with distance downstream from the Connors River towards the mouth of the Fitzroy River.

Raw water sampled at Mount Bridget gauging station (located 700 metres downstream of the dam wall) was determined to be suitable for most current uses. Drinking water is the primary environmental value that would not be met under the current water quality conditions and would therefore require treatment. The degree and type of treatment is well within the capacity of common water treatment plants. The suitability of water for industrial purposes is dependent on the industry and their specific quality requirements. Coal washing does not require high quality water, and water at Mount Bridget would be suitable without treatment.

5.2.3. Potential impacts—construction

During construction, water flowing from the construction site (including the dam, pipeline and associated infrastructure) following precipitation within the catchment could potentially have elevated turbidity and hydrocarbon contamination.

Construction activities that may lead to increased turbidity include sand and gravel extraction, clearing of vegetation, excavation and earthworks, pipeline stream crossings, dewatering of foundations, temporary or permanent road construction and related drainage, wastewater from concrete batch plants, vehicle and equipment wash-down activities and foundation clearing and grouting.

Construction activities that may lead to contaminant pollution include vehicle and equipment wash-down activities, equipment leaks, runoff from paved areas and accidents or spillage.

The EIS identified measures to mitigate potential impacts to downstream water quality, including:

- timing of construction (during the dry season as far as reasonably practicable)
- diversion of the Connors River channel around the ‘disturbed’ construction zone
- deployment of floating booms supporting silt curtains downstream of the proposed dam site
- directing all water used in the construction of the dam to sedimentation ponds prior to discharge
- pipeline trench will be open for a minimal period of time during construction.

In addition, impacts associated with runoff and related erosion will be addressed by a SECP and waste management plans, detailed in the CEMP for the project (refer to Appendix 4 of this report). The SECP will be designed in accordance with the IECA

guidelines[16] (an internationally recognised standard) to significantly reduce potential for additional sediment to enter the watercourse.

Despite these mitigation measures, the EIS identified that elevated turbidity levels can be expected downstream of the proposed construction site during times of high flow—particularly when the capacity of the dam diversion channel is exceeded. However, as elevated turbidity levels are naturally high in local watercourses under such conditions, the potential impact upon water quality will likely be mitigated to some extent.

The surface water quality sub-plan of the draft CEMP also specifies the development and implementation of a project water quality monitoring program to monitor compliance with the project's water quality objectives. Sites will be identified upstream and downstream of priority project activities with the potential to impact upon water quality, with parameters to be tested including (but not limited to):

- temperature, conductivity, dissolved oxygen, pH and turbidity
- nuisance algae and chlorophyll-a
- total phosphorus, total nitrogen.

By implementing the proposed mitigation measures potential impacts are expected to be manageable and the residual risks acceptable.

5.2.4. Potential impacts—operation

The EIS identified the following key surface water quality impacts during the operation of the project:

- nutrient and sediment input into the dam resulting in the potential for algal blooms—while sedimentation is expected to be low, total nitrogen and phosphorus levels may exceed guidelines and cause increased growth of aquatic plants and algae
- poor water quality during filling phase—rapid filling of the dam may cause large amounts of nutrients and metal in the water from sediments and vegetation, leading to low dissolved oxygen levels
- poor water quality during normal operating conditions—stratification and turnover events are possible, potentially resulting in the release of poor quality water
- poor downstream water quality during operation—changes in water quality in the water storage may have localised effects downstream, with the highest potential risk being during periods of drought.

The surface water quality sub-plan contained in the draft OEMP (section 29.10.5 of the EIS and updated in Appendix 4) outlines a number of measures to mitigate potential impacts to surface water quality, both within the dam and downstream during operation. To mitigate potential impacts relating to turbidity and nutrients, Sunwater has committed to:

[16] International Erosion Control Association, *Australasia Best Practice Erosion and Sediment Control*, International Erosion Control Association, Australia, 2008.

- ensure buffer zones are well vegetated, particularly in areas that contain dispersive soils
- where possible, revegetate agricultural land to minimise potential erosion and runoff
- place signage regarding speed limits relating to recreational boating
- within operational constraints, maintain shoreline water levels so that fringing wetlands and macrophyte beds can persist
- manage upstream inputs where possible, such as rehabilitating riparian vegetation and restricting access by cattle and recreational users to the riparian zone to decrease bank erosion and turbid inputs into the river.

Sunwater will also develop and implement a first-release strategy to minimise the risk of poor water quality impacting on environmental values downstream of the dam. This is likely to include monitoring water quality in the water storage and in the receiving environment. Water release during the initial filling phase will be withheld if water quality is determined to be poor.

An appropriate monitoring program will be developed and implemented as part of the dam's operation, and will include cyanobacteria sampling in addition to other parameters such as nutrients, temperatures and the occurrence of stratification. Sunwater may also implement event-based monitoring to better understand the inflow of contaminants into the proposed dam site and to monitor the success of catchment management practices.

As identified in section 2 of this report, the dam will utilise a multi-level offtake tower to source the most appropriate water. The multi-level offtake will allow water, of appropriate quality, to be drawn from a suitable level within the dam to maintain existing conditions downstream.

In its submission to the SEIS, Queensland Health highlighted potential issues regarding the quality of water stored within the dam in relation to its end use, including recreational use of the water and providing water to be purchased by water service providers. Queensland Health requested Sunwater undertake a water quality risk assessment (point and non-point sources) to identify and assess water quality risks arising from the catchment and storage, which would inform the monitoring program in a water quality management plan.

In response to Queensland Health's submission, Sunwater has updated the surface water quality sub-plan of the draft OEMP (refer to Appendix 4, section 29.10.5 of this report) to:

- include a water quality risk assessment (point and non-point sources) to identify and assess water quality risks arising from the catchment and storage
- utilise the risk management framework contained in the *Australian Drinking Water Guidelines (2011)*[17].

[17] National Health and Medical Research Council, Australian Drinking Water Guidelines, Canberra, 2008.

Queensland Health's submission on the SEIS also highlighted action required to ensure contaminated land (particularly land which will be inundated) does not adversely affect human health. This issue has been addressed in subsection 5.9 (Environmental management).

5.2.5. Coordinator-General's conclusions

Based on the risk assessment provided in section 16 of the EIS and the mitigation, monitoring and reporting measures identified in the revised draft CEMP and OEMP (Appendix 4 of this report), the Coordinator-General is satisfied that impacts relevant to surface water quality can be effectively managed and the residual risks are acceptable.

The Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

5.3. Groundwater

5.3.1. Introduction

The following subsection provides an analysis of groundwater values that may be affected by the project. Two submissions raised concerns regarding the impact of the project on groundwater values, including groundwater-dependent ecosystems (GDEs), and groundwater during the operation of the project. These matters are discussed below.

5.3.2. Context

Three types of aquifers exist within the study area, including a shallow alluvial aquifer, tertiary basalt aquifer and a basement rock aquifer. The alluvial aquifer is the uppermost aquifer (overlying and adjacent to outcrop areas of the tertiary basalt and basement rock aquifer) and is considered susceptible to impacts.

Direct vertical recharge occurs in the alluvial aquifer via rainfall, leakage from surface water systems and overbank flow and through-flow from the underlying basement rock aquifer. Recharge in the basement rock and tertiary basalt aquifer is from rainfall in outcrop areas or, if in hydraulic connection, from the overlying or adjacent alluvial aquifer.

Groundwater discharge in the alluvial aquifer occurs primarily as down-valley through-flow or discharge into watercourses. Groundwater discharge in the basement rock and tertiary basalt aquifer is expected to occur as seeps along the base of slopes or by through-flow to the alluvial aquifer where they are in hydraulic connection.

There is a moderate to high degree of connection between groundwater and surface water. At a catchment scale, watercourses are predominantly losing water; however, it is likely that some reaches of the Funnel Creek and Connors River are gaining water for at least some of the time.

Allocated groundwater in the Isaac-Connors sub-catchment (13 272 ML/a) is dominated by use for irrigation (70 per cent) and mining (28 per cent) as well as small allocations for urban, industrial and domestic purposes. Over 90 per cent of allocated groundwater used within the sub-catchment is sourced from the alluvial aquifer.

The Braeside borefield provides potable and process water to Riverside Coal Mine, South Walker Creek Coal Mine and Peak Downs Coal Mine. The borefield also provides water supply to the townships of Coppabella and Moranbah and to a number of rural properties along the pipeline from the borefield to the mine. On average groundwater use at the borefield is approximately 90 per cent of licensed allocation (SKM, 2008)[18].

Groundwater extraction by the Braeside borefield is currently being undertaken at the junction of Nebo and Denison Creeks. Extraction at the borefield is likely to have lowered the water table in the alluvial aquifer associated with Denison and Nebo Creeks.

5.3.3. Potential impacts—construction

The dam component of the project will not extract groundwater for use during the construction or operational phases. Although extraction of groundwater has not been proposed for the dam construction, groundwater extraction bores may be required to facilitate dewatering activities.

Approximately 140 ML of groundwater is proposed to be extracted for use during the construction of the pipeline. Groundwater extraction bores will be placed in the alluvial aquifer associated with a number of creeks.

An application will be required for a development permit to construct the extraction bores and for a water permit to temporarily extract water.

Potential construction impacts include:

- falling groundwater levels associated with dewatering activities (for pipeline construction associated with creek crossings where groundwater is intersected, and potentially for dam construction)
- off-site disposal of groundwater as a result of dewatering
- contamination of groundwater.

It is anticipated that extraction of groundwater by the project will be temporary—i.e. for the construction phase only and of relatively low volume (approximately 1 per cent of the current entitlement in the Isaac-Connors sub-catchment). As such, the groundwater system will recover once the construction phase is complete. Therefore, impacts will not interfere with the objectives of the Fitzroy WRP 1999.

It is considered that most of the identified groundwater impacts arising from the construction of the project can be addressed by implementing appropriate

[18] Sinclair Knight Merz (SKM), Isaac Connors Groundwater Project Part A: Conceptual Model for Groundwater (Draft). Technical Report for the Fitzroy Basin Water Resource Plan Amendment, August 2008.

management activities, as outlined in the groundwater sub-plan of the draft CEMP (refer to Appendix 4, section 29.9.6 of this report). Key mitigation measures are outlined below.

Dam and surrounds

- No off-site disposal of extracted groundwater.
- If significant yields of groundwater are intersected during construction, intersected groundwater will be pumped into a sedimentation basin and then released back to the river to facilitate the return of water into the groundwater system.
- Groundwater level monitoring downstream of the dam to identify any impacts as a result of reduced downstream surface water flows prior to, during and post construction phase.

Pipeline

- Construction works at watercourse crossings will be undertaken during the dry season.
- Water dewatered during pipeline trench excavation will be returned to the watercourse to facilitate return to the groundwater system.
- Vertical low permeability barriers (bulkheads or trenchstops) sourced from clayey material derived from pipeline trench excavation will be placed at set intervals along the length of the trench where the trench is at a slope.
- Appropriate storage, handling, transport and spill clean-up of any chemicals, hazardous substances or any materials capable of impacting groundwater quality.

The Queensland Conservation Council's submission on the EIS raised concerns that no specific investigations has been undertaken to identify GDEs and that potential impacts to GDEs were not addressed. In response, Sunwater advised that as risks to groundwater levels are low, the risks to GDEs are also low; and that proposed groundwater level monitoring programs will ensure impacts to groundwater will be appropriately identified and addressed (discussed in section 15.1 of the SEIS).

5.3.4. Potential impacts—operation

Potential impacts associated with the operation of the project include:

- falling groundwater levels downstream of the dam—a reduction in downstream flow as a result of the dam may adversely affect the surface water–groundwater connectivity in areas downstream of the dam wall
- rising groundwater levels associated with inundation—rises in the water table within the vicinity of the dam may result in soil salinisation
- changes in groundwater quality from seepage loss from the dam to the underlying aquifer, and reduced in-stream recharge downstream of the dam
- rising groundwater levels and changes in groundwater quality from pipeline rupture.

Section 15.2.4 of the EIS identified the risk to groundwater levels and groundwater quality as low and that impacts can be addressed by implementing appropriate management activities and monitoring. Key mitigation measures specified in the groundwater sub-plan of the draft EMP (refer to Appendix 4 of this report) are discussed below.

Dam and surrounds

- Annual review of downstream groundwater data to identify any impacts and whether ongoing monitoring is required.
- Periodic monitoring in the form of visual and field assessments to identify evidence of salinisation, including salt scalding and dying vegetation.

Pipeline

- Monitoring pipeline integrity and regular maintenance to prevent pipeline rupture. In the unlikely event of a rupture, sufficient shutdown or cut-off mechanisms will be put in place to prevent continued spillage of water.

DERM's submission on the SEIS noted the proposed mitigation identified in the EIS does not adequately deal with the impacts to groundwater levels downstream of the dam post-construction, particularly given the importance of high and low flows in the rivers to groundwater recharge and likely impacts on flood frequencies after the dam is constructed.

Accordingly, DERM recommended including specific groundwater management terms in the construction and OEMPs for the project, including:

- preparing and implementing a groundwater monitoring plan during the construction and operation of the project
- if it is demonstrated that adjacent landholders are experiencing adverse groundwater impacts (falling or rising water table, or adverse changes to water quality) due to the project, Sunwater must investigate, and if the observations are reasonably attributable to the project, implement strategies to make good those impacts
- report annually to DERM, assessing the impacts of the dam on groundwater, and include a summary of the monitoring data collected, an assessment of impacts, recommended mitigation methods and any 'make good' measures that have been undertaken in that year.

5.3.5. Coordinator-General's conclusions

The Coordinator-General agrees with matters raised by DERM, that the project may not adequately address potential impacts to groundwater levels downstream of the dam post-construction, particularly in the context of watercourses across the catchment predominantly losing water and the moderate to high degree of connection between groundwater and surface water.

To ensure potential impacts to groundwater levels and quality, and to GDEs are adequately addressed during construction and operation of the project, the Coordinator-General has stated a condition requiring the inclusion of DERM's recommended groundwater monitoring and management terms in both the construction and operational EMPs of the project (refer to Appendix 1, Schedule A, Condition 3).

5.4. Terrestrial ecology

5.4.1. Introduction

This subsection provides an analysis of terrestrial ecological values of state significance that may be affected by the project. For further discussion on matters of national environmental significance (MNES), see section 7 of this report.

Some submissions on the EIS raised issues in relation to terrestrial ecology. The Coordinator-General has considered each of the submissions and how the SEIS has responded to the issues raised. Submitter issues which the Coordinator-General considered warranted particular elaboration in his evaluation included:

- impacts on protected flora and fauna species
- mitigation measures for habitat fragmentation, animal safety and welfare during construction
- weed and animal pest management
- the need for environmental offsets, in accordance with applicable offset requirements.

These matters are discussed below.

5.4.2. Assessment methodology

An assessment of terrestrial ecological values of state significance is provided in section 10: Terrestrial Flora and section 11: Terrestrial Fauna of both the EIS and SEIS. Two terrestrial flora surveys were undertaken of the proposed dam and surrounds study area. An initial phase of post-summer field surveys was completed in April 2008, during which the bulk of the floristic data from within the proposed dam area was collected. This allowed a preliminary assessment of the extent, condition and significance of vegetation within the area. A secondary winter survey was undertaken in July 2008, which targeted specific information gaps and any seasonally specific flora which had potential to occur within the area. One terrestrial flora survey was undertaken of the pipeline study area over an eight-day period in July 2008.

Two terrestrial fauna surveys were conducted within the proposed dam and surrounds study area during the summer/autumn (11–18 March 2008) and winter (12–16 June 2008) periods. Portions of the pipeline route were surveyed in June and October 2008, with non-accessible areas being assessed remotely using satellite imagery and/or vegetation mapping data.

As noted in subsection 2.2.4 of this report, Sunwater has further developed the design of the project since the release of the EIS, including (but not limited to) refining the

pipeline route and proposing a new access road to the Marylands property. Further terrestrial flora and fauna assessment was therefore undertaken as part of the EIS. This included a field survey in January 2011 of the new access road route.

Sunwater commissioned 3D Environmental to undertake a further summer season targeted survey on the pipeline route in May 2011. The scope of this survey was to determine the condition and floristic composition of grassland and grassy woodland ecosystems potentially impacted by the proposed pipeline route, including a targeted survey for listed threatened species or communities (state and federal) within grassland and grassy woodland habitats.

The following sections provide a summary of the most up-to-date information available for all project components.

5.4.3. Context

The water storage area is situated within the valley formed by Sugarloaf Mountain to the north and the Connors Range to the east. A number of creeks and streams flow into the valley to form the Connors River, which flows between Gins Leap and Mount Bridget (refer to Figure 5.3).

The floor of the valley has been substantially modified and thinned of vegetation to allow for cattle grazing. Cleared areas comprise a range of improved pasture species and legume species. Field surveys indicate the majority of vegetation within the water storage area is subject to some form of degradation due to grazing, mechanical disturbance, exotic species invasion, and/or natural cycles.

The valley floor is surrounded by steep slopes of relatively unmodified vegetation, which rise 200 metres to 400 metres towards the ridgelines, limiting the extent of potential grazing. Tierawoomba State Forest and Collaroy State Forest are located to the north-west and north-east of the water storage area.

Riparian vegetation generally remains along the banks of the Connors River and its tributaries. Riparian vegetation is viewed as a key interface between terrestrial and aquatic systems and represents areas of high regional biodiversity (Naiman et al 1993)[19]. Under DERM's Biodiversity Planning Assessment[20] (BPA), all areas of riparian habitat have been afforded a very high corridor value within the water storage area. In particular, riparian vegetation on the banks of Murray, Cattle and Collaroy Creeks (identified in Figure 5.3) provides a near continuous vegetated corridor with significant habitat connectivity value. An assessment of the condition of this riparian vegetation indicates light to moderate disturbance, subject to selective timber extraction, and a light to moderate infestation of exotic species.

[19] Naiman, RJ, Décamps, H and Pollock, M 1993, 'The role of riparian corridors in maintaining regional biodiversity.' Ecological Applications, 3: 209-212.

[20] DERM has generated BPAs for each of Queensland's bioregions based on Biodiversity Assessment and Mapping Methodology (BAMM) which provides a consistent approach for assessing biodiversity values at the landscape scale in Queensland. The BPAs are used by DERM staff, other government departments, local governments or members of the community to advise on a range of planning or decision making processes.

The condition of stream channel habitat can be compared to that of the adjacent river terraces (typically RE 11.3.4) which are choked with invasive weeds, most notably *Lantana camara*, and have been subject to extremely heavy timber extraction and grazing pressure. In some locations, lantana dominates the shrub layer to almost total exclusion of native shrubs and ground cover is dominated by introduced grasses and herbs.

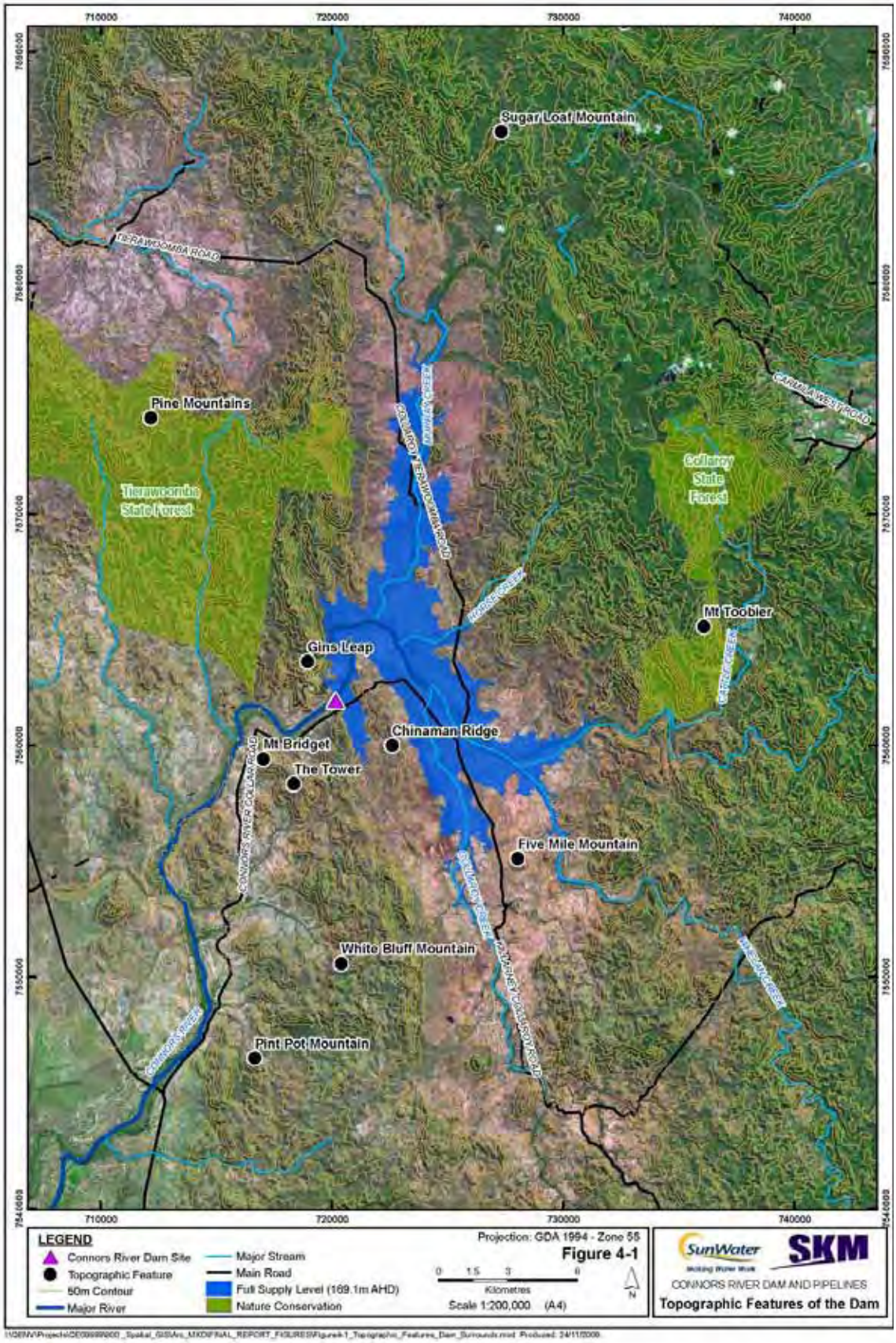


Figure 5.3 Topographic features of the water storage area

5.4.4. Flora

Context

Table 5.1 identifies flora species protected under the *Nature Conservation Act 1992* (Qld) (NC Act) that are known or likely to occur in the project area. For completeness, EPBC Act listings have been identified as appropriate.

Table 5.1 NC Act-listed flora species 'known,'[21] or 'likely'[22] to occur in the project area

Species name*	Conservation status		Likelihood of occurrence
	NC Act[23]	EPBC Act	
Cerbera dumicola	Near threatened	Not listed	**Known**: recorded from vine thicket (RE 8.12.16) on rhyolite at dam wall site. Patch size is approximately 6.7 ha and the species occupies approximately 1.92 ha of the impacted patch.
Bertya pedicellata	Near threatened	Not listed	**Known**: A number of specimens were recorded within a single small patch of RE 11.7.2 along the pipeline alignment.
Persoonia amaliae	Near threatened	Not listed	**Known**: A number of specimens were recorded from RE 11.7.2 and RE 11.5.9 along the pipeline alignment.
Eucalyptus raveretiana (Black Ironbox)	Vulnerable	Vulnerable	**Likely**: Potential habitat (RE 11.3.25) exists along Denison, Funnel, Boothill, Nebo and Bee creeks which will be intersected by the pipeline route, however no records from within the 30 m pipeline easement. Not observed within the inundation area despite potentially suitable habitat in riparian open forests and woodlands of RE 11.3.25.
Actephila sessiliflora	Near threatened	Not listed	**Likely**: likely to occur in vine thickets (RE 8.12.16) on steep hill slopes within eastern margin of mapped buffer area (east of the inundation area) and possibly in vine thicket understorey in riparian forests of major eastern tributaries (RE 11.3.25)
Marsdenia hemiptera	Near threatened	Not listed	
Rourea brachyandra	Near threatened	Not listed	

*NB: While assessed in the EIS, it is important to note that *Aponogetum queenslandicum* was delisted from the NC Act on 21 May 2010 and, as such, is no longer a protected flora species.

Cerbera dumicola was recorded in the dam and surrounds as an occasional shrub in semi-deciduous vine thicket dominated on steep rocky rhyolite slopes at the dam wall site. The habitat is consistent with the of-concern RE 8.12.16. Inspection of an

[21] 'Known': Remnant vegetation or sites are known to support the species because there are a significant number of individuals present that are self-maintaining.
[22] 'Likely': Remnant vegetation or sites likely to support the species because there is habitat containing essential resources of a size capable of supporting a significant number of individuals. Available habitat which is proximal to and buffering a known occurrence of a population.
[23] The Nature Conservation (Wildlife) Regulation 2006 (Qld) provides and defines five classes of protected plants of state environmental significance: extinct in the wild, endangered, vulnerable, near-threatened and least concern.

extensive number of vine thicket sites (RE 8.12.16) in the dam and surrounds did not locate the species in similar habitats. While it is known from one site only within the dam and surrounds, all other patches of RE 8.12.16 represent possible habitat. Counts of individuals within a 50 × 50 m plot produced population estimates of 300 plants per hectare. The species is however restricted to the upper slopes and crests of the vine thicket patch and parts of the habitat do not support the species. The location of known habitat for this species is shown in Figure 5.4.

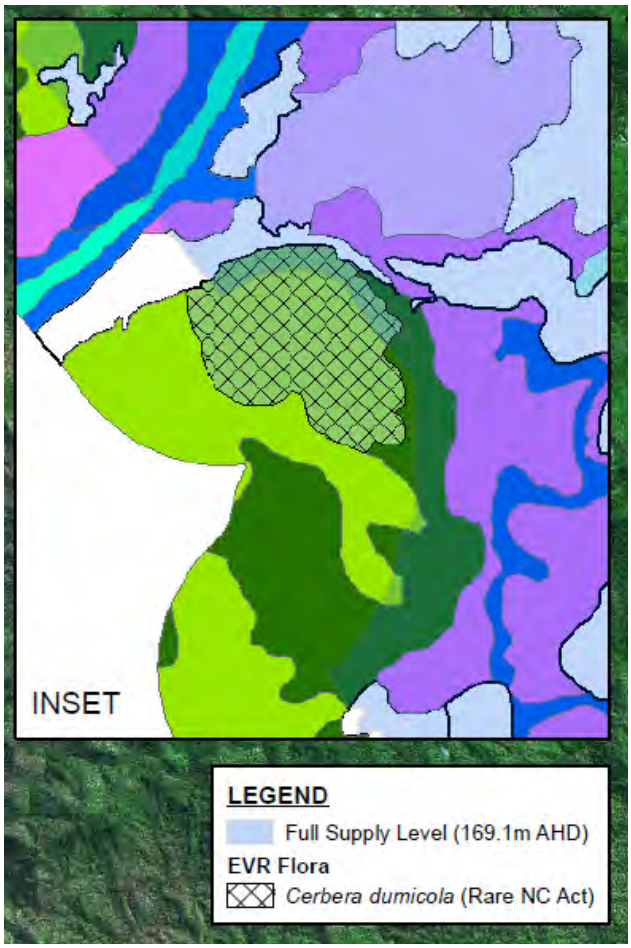


Figure 5.4 Location of known habitat for *Cerbera dumicola*

The SEIS considered the grass species *Digitaria porrecta* (near-threatened), *Dicanthium queenslandicum* (vulnerable) and *D setosum* (near-threatened) as potential occurrences within a single 4.1-hectare patch of RE 11.4.13. This occurs along the pipeline route between Funnel and Denison creeks, and the SEIS recommended a supplementary seasonal survey to confirm the presence of these species. The May 2011 field survey failed to identify these grass species, which are subsequently considered to be unlikely occurrences along the pipeline route.

Potential impacts

While not actually recorded from within the dam or pipeline easement, construction of the project may result in potential impacts to the following protected plant species based on the presence of suitable habitat.

Water storage area

- Loss of 1.92 ha of known habitat (RE 8.12.16) for the *Cerbera dumicola* (out of a total patch size of 6.7 ha)
- loss of 719 ha of potential habitat (RE11.3.25) for the *Eucalyptus raveretiana*
- loss of 3 ha of potential habitat (REs 8.12.6 and RE 11.3.25b) for the rainforest vines *Marsdenia hemiptera* and *Rourea brachyandra*, and rainforest shrub, *Actephila sessiliflora*.

Pipeline easement

- Loss of 4.5 ha potential habitat (RE 11.3.25) for the *Eucalyptus raveretiana*
- loss of 5.69 ha of potential habitat (REs 11.7.2 and 11.10.7) for *Bertya pedicellata*
- loss of 13.2 ha of potential habitat (REs 11.7.2, 11.5.9 and 11.10.7) for *Persoonia amaliae.*

Clearing vegetation for both the water storage area and pipeline may also result in the proliferation of weeds into cleared and disturbed areas, including newly created edges of the FSL and pipeline easement.

Mitigation measures

The terrestrial flora sub-plan of the revised draft CEMP (Appendix 4, section 29.9.8) identifies a range of mitigation measures to minimise the impacts on, and provide protection to, identified protected flora species. Key mitigation measures relate to preparing and implementing a vegetation clearance management plan, rehabilitation plan and a weed management plan (WMP).

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Vegetation clearance management plan

Key measures of the proposed vegetation clearance management plan include (but are not limited to):

- species-specific pre-construction surveys for *Eucalyptus raveretiana*, *Persoonia amaliae, Bertya pedicellata* and *Cerbera dumicola*
- identify areas of vegetation to be retained, which are to be clearly marked by tape and/or pegs
- avoid impact on vegetation outside the inundation area by clearly identifying the FSL, and directing staff contractors and others working on the construction of the project to avoid these areas
- implement mitigation recommendations in the design of the final pipeline route to minimise impacts on significant vegetation communities, including ensuring the maximum possible width of existing cleared easements is utilised for construction, avoiding large habitat trees and locating the pipeline route within cleared/disturbed areas wherever possible
- limit vegetation clearing within the riparian zones to within 1.5 metres of FSL

- require the clearing contractor to monitor vegetation clearing to ensure only approved areas are cleared
- clearing for the pipeline easement will be restricted to a width of 30 metres and further reduced in riparian zones
- a qualified botanist will be on site prior to any vegetation clearing works within remnant vegetation communities to inspect the area for significant flora. If any species of conservation significance are confirmed as present, suitable management measures will be implemented, such as development of translocation programs and associated management plans. The details of translocation and/or propagation plans will be developed when the footprint of impact (in particular the pipeline alignment) is confirmed following detailed design, including the identification of suitable relocation sites and the development of protocols.

Specific measures to protect the population of *Cerbera dumicola* located near the dam wall site include:

- fencing off and protecting the patch of RE 8.12.16 from dam construction activities
- further surveys of vine thickets adjacent to the water storage area to determine if the species is present in other areas around the project
- ongoing management of the known habitat of this species, including fire, weed and pest management and monitoring in order to increase the security of the local population.

Rehabilitation plan

A rehabilitation plan will be prepared to progressively rehabilitate the construction site in areas that will not be inundated or used for permanent infrastructure (this includes the majority of the construction easement for the pipeline apart from the maintenance track and area directly over the buried pipeline).

The plan will support the replacement of topsoil, contouring of the landform and revegetation as soon as possible after disturbance, and will contain, at a minimum, the following information:

- method and species to be used in revegetation (including seeds of local provenance). This will include topsoil stabilisation.
- spatial configuration of plantings (if tube stock are used), seed mixes for direct seeding and hydro mulching and watering requirements.
- benchmark rehabilitation criteria, including requirements for final landform (slope, aspect), vegetation cover, vegetation species composition and depth of topsoil (amongst other parameters).

Weed management plan

A WMP will be prepared and implemented for both construction and operational phases of the project.

Specific mitigation measures relate to weed management (for example, minimising soil disturbance within retained vegetation to avoid weed recruitment), weed removal and the use of ‘wash down’ facilities and clean plant.

The distribution of known declared weeds will be monitored and, where feasible, a plan made to eradicate or contain these infestations in accordance with the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld).

Employees/contractors working on site will also be required to receive appropriate weed identification training and report the presence of declared weeds by the end of the working day.

Coordinator-General's conclusions—protected flora

While no protected plant species were recorded during field surveys, project construction may result in impacts on some protected plant species based on the presence of suitable habitat.

As indicated in section 1 of this report, where there is a requirement for clearing protected plant species, clearing must only occur in accordance with a clearing permit under the NC Act.

In the event avoidance, translocation or rehabilitation does not fully mitigate adverse impacts to protected plant species, the Coordinator-General has recommended a condition (Appendix 2.Recommendation 2, Recommendation 2) which requires the provision of offsets for the permanent loss of protected plants to achieve an equivalent, or better overall outcome at a regional scale, in accordance with the *Queensland Government Biodiversity Offsets Policy 2011*[24].

The Coordinator-General also notes that vegetation and habitat offsets proposed as part of the Sunwater's revised offset strategy (the full document is contained within Appendix 10) will assist in enhancing the habitat for any protected plants within the project area. This will be achieved through active weed and feral animal control, fire management and the exclusion of cattle grazing within approximately 16 650 ha of land that is currently available for agricultural purposes. Management and strategic plantings in areas of non remnant habitat will enhance natural regeneration, and the proposed strategic in-filling of non-remnant habitat areas will improve connectivity.

Based on the mitigation measures contained within the draft EMP, the legislative requirements of the NC Act, and the requirement to provide offsets to fully mitigate adverse impacts to protected plant species, the Coordinator-General is satisfied impacts to protected plant species will be minimal.

5.4.5. Weeds and pest animals

The project area and surrounding areas suffer from weeds and feral animal infestations.

A total of 79 naturalised exotic species were identified during EIS field surveys of the project area, including 12 species declared as weeds under the *Land Protection (Pest and Stock Route Management) Act 2002*:

[24] The State of Queensland (Department of Environment and Resource Management), Queensland Biodiversity Offsets Policy (Version 1), Brisbane, October 2011.

- Rubbervine (*Cryptostegia grandiflora*)—class 2
- Lantana (*Lantana camara*)—class 2
- Cat's Claw Creeper (*Macfadyena unguis-cati*)—class 3
- Prickly Pear (*Opuntia tomentosa*)—class 2
- Tree Pear (Opuntia spp.)—class 2
- Parthenium (*Parthenium hysterophorus*)—class 2
- Sicklepod (Senna spp.)—class 2
- Rats Tail Grass (Sporobolus spp.)—class 2
- White Thunbergia (*Thunbergia fragrans*)—class 1
- Dutchman's Pipe (*Aristolochia elegans*)—class 3
- Harissia Cactus (*Eriocereus martinii*)—class 2
- Parkinsonia (*Parkinsonia aculeata*)—class 2

Declared weeds have infested remnant, non-remnant and cleared sites.

Besides being declared under State legislation, Lantana, Rubbervine and Parkinsonia are also listed as a Federal Government Weed of National Significance (WONS).

There is potential for the spread of weeds into cleared and disturbed areas from construction of the project and associated vegetation clearing activities. There is also potential for increased proliferation of weeds from the presence of the water storage area. In particular, weeds may proliferate around the banks of the water storage area.

The implementation of a WMP, as described in section 5.4.4 of this report and contained within the draft CEMP and OEMP for the project (refer to Appendix 4), will ensure weeds are effectively controlled during the construction and operation of the project.

EIS surveys also recorded four class 2 declared pests, these being:

- feral cat (*felis catus*)
- wild dog (*canis familiaris*)
- rabbit (*Oryctolagus cuniculus*)
- feral pig (*Sus scrofa*).

The construction of the project is unlikely to significantly increase the distribution or abundance of vertebrate pests as these species will lose habitat. However, wild dogs may be attracted to work sites if food or scraps are available. Operation of the project is not expected to increase the presence or distribution of feral species within the project area due to the loss of suitable habitats. Pigs are an exception as this species forages at the edges of wetlands and waterbodies, including water storages.

The implementation of a pest management plan (refer to Appendix 4) during construction and operation will ensure pests are controlled as part of the project. Mitigation measures include ensuring personnel do not create environmental conditions favourable to pest species (for example, through appropriate waste management), active pest control measures (such as the deployment of traps for pigs, destruction of rabbit warrens and placement of poisoned bait) and monitoring.

As identified in section 5.4.4 of this report, the Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

5.4.6. Vegetation communities

Context

Queensland's *Vegetation Management Act 1999* (VM Act) regulates the clearing of remnant vegetation as shown on a regional ecosystem (RE) map or remnant map.

REs are vegetation communities that are consistently associated with a particular combination of geology, land form and soil in a bioregion. The Queensland Herbarium has mapped the remnant extent of REs for much of Queensland using a combination of satellite imagery, aerial photography and on-ground studies. Each RE has been assigned a conservation status which is based on its current remnant extent (how much of it remains) in a bioregion.

Regional vegetation management codes set out performance requirements for clearing remnant vegetation as well as certain non-remnant or regrowth vegetation.

The relevant regional vegetation management code for this project is the *Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions 2009*[25] (RVMC). A land-based offset, consistent with the *Policy for Vegetation Management Offsets version 3*[26] (PVMO) may be proposed for particular development activities as a solution to meet specific performance requirements that require a development to maintain the current extent of a particular RE.

However, this may only occur if it has been demonstrated the development has first avoided and minimised the impacts of the development on vegetation prior to proposing an offset.

In accordance with the PVMO and the RVMC performance requirements, this subsection examines project impacts to vegetation communities (e.g. clearing, inundation) which may impact upon the following applicable performance requirements (PR):

- 'endangered' and 'of concern' REs (PR S.7—reflects the need to maintain the current extent of these REs given their threatened status)
- watercourse vegetation (PR S.3—important for bank stability by protecting against bank erosion, water quality by filtering sediments, nutrients and other pollutants, and maintaining aquatic and terrestrial habitat)
- connectivity of vegetation (PR S.4—to prevent the loss of biodiversity and maintain ecological processes)

[25] http://www.derm.qld.gov.au/vegetation/pdf/brigalow_code_nov_2009.pdf
[26] http://www.derm.qld.gov.au/environmental_management/environmental-offsets/pdf/policy-for-vegetation-management-offsets.pdf

- vegetation that is 'essential habitat' for protected wildlife (PR S.8—important to prevent the loss of biodiversity by maintaining the current extent of essential habitats).

Potential impacts

The project will impact on approximately 6370 ha of vegetation from 18 REs,[27] of which approximately 2200 ha is native remnant[28] vegetation.

The project has been designed to ensure clearing will be limited to the extent necessary for the project (PR S.1: Limits of Clearing), for example by refining the pipeline route to avoid impacts to remnant vegetation and use existing cleared easements where possible. The vegetation clearance management plan, a requirement of the draft CEMP for the project (Appendix 4), will also ensure vegetation clearing is limited as far as practicable during construction.

Soil erosion (PR S.5) will be managed in accordance with the requirements of the draft CEMP—in particular the SECP. An assessment of potential soil erosion impacts arising from the project is addressed at section 5.1 of this report.

Sunwater's revised Offset Strategy (Appendix 10 of this report) notes the remaining performance requirements of the PVMO (including PR S.2, PR S.6, PR S.9 and PR S10) are not applicable to this project.

Endangered and 'of concern' regional ecosystems (PR S.7)

The project will impact on approximately 990 ha of vegetation classified as 'of concern' or 'endangered' REs under the *Vegetation Management Act 1999* (VM Act). Of this 990 ha, approximately 907 ha will be impacted within the inundation area (Table 5.2), 45 ha will be impacted by the construction of the pipeline (Table 5.3), and 38 ha will be impacted by the construction of associated infrastructure (Table 5.4). In accordance with the PVMO, impacts on 'of concern' and 'endangered' REs do not include impacts which are less than 0.5 ha.

[27] REs are declared in the Vegetation Management Regulation 2000 and are classified as:
(a) Endangered if: the area of remnant vegetation for the RE is less than 10 per cent of the pre-clearing extent of the RE; or the area of remnant vegetation for the RE is 10–30 per cent of the pre-clearing extent of the RE and less than 10 000 ha.
(b) Of concern if: the area of remnant vegetation for the RE is 10–30 per cent of the pre-clearing extent of the RE; or the area of remnant vegetation for the RE is more than 30 per cent of the pre-clearing extent of the RE and less than 10 000 ha.

[28] Remnant vegetation is vegetation that meets the following criteria: 50 per cent of the predominant canopy cover that would exist if the vegetation community were undisturbed; and 70 per cent of the height of the predominant canopy that would exist if the vegetation community were undisturbed; and composed of the same floristic species that would exist if the vegetation community were undisturbed.

Table 5.2 Impacts of the inundation area on 'endangered' and 'of concern' REs

Regional Ecosystem ID (description in brackets)	VM Act status	Broad Vegetation Group (BVG[29])	Impact area (ha)
11.12.8 (*Eucalyptus shirleyi* woodland on igneous rocks)	Of concern	13c	1.57
11.3.2 (*Eucalyptus populnea* woodland on alluvial plains)	Of concern	17a	176.31
11.3.4 (*Eucalyptus tereticornis* and/or *Eucalyptus spp*. tall woodland on alluvial plains)	Of concern	16c	186.57
11.3.4a (*Corymbia tessellaris* woodland)	Of concern	9e	539.30
8.12.16 (*Eucalyptus drepanophylla* +/- *E. platyphylla* +/- *Corymbia clarksoniana* woodland on low to medium hills, on Mesozoic to Proterozoic igneous rocks)	Of concern	7a	3.00
Total			**906.75**

Table 5.3 Impacts of the pipeline easement on 'endangered' and 'of concern' REs

Regional Ecosystem ID (description in brackets)	VM Act status	Broad Vegetation Group (BVG)	Impact area (ha)
11.3.1 (*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains)	Endangered	25a	0.90
11.9.5 (*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks)	Endangered	25a	1.31
11.3.4 (*Eucalyptus tereticornis* and/or *Eucalyptus spp*. tall woodland on alluvial plains)	Of concern	16c	5.02
11.3.4a (*Corymbia tessellaris* woodland)	Of concern	9e	12.76
11.3.2 (*Eucalyptus populnea* woodland on alluvial plains)	Of concern	17a	25.30
Total			**45.29**

[29] Broad vegetation groups (BVGs) are a higher-level grouping of vegetation units or regional ecosystems. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid to arid climatic zones. In order to provide an overview and/or map vegetation across the state or a bioregion and allow comparison with other states, the vegetation units and regional ecosystems are amalgamated into the higher-level classification of BVGs.

Table 5.4 Impacts of associated infrastructure on 'endangered' and 'of concern' REs

Regional Ecosystem ID (description in brackets)	VM Act status	Broad Vegetation Group (BVG)	Impact area (ha)
11.12.8 (*Eucalyptus shirleyi* woodland on igneous rocks)	Of concern	13c	19.32
11.3.2 (*Eucalyptus populnea* woodland on alluvial plains)	Of concern	17a	2.14
11.3.4 (*Eucalyptus tereticornis* and/or *Eucalyptus spp*. tall woodland on alluvial plains)	Of concern	16c	1.17
11.3.4a (*Corymbia tessellaris* woodland)	Of concern	9e	9.22
8.12.16 (*Eucalyptus drepanophylla* +/- *E. platyphylla* +/- *Corymbia clarksoniana* woodland on low to medium hills, on Mesozoic to Proterozoic igneous rocks)	Of concern	7a	5.75
Total			**37.60**

Watercourses (PR S.3)

The project will impact on approximately 1411 ha of vegetation classified as watercourse vegetation. Table 5.5 outlines the impacts of the inundation area, pipeline and associated infrastructure based on stream order classification[30].

Table 5.5 Watercourse vegetation impacts of the project

Stream order	Inundation area (ha)	Pipeline (ha)	Associated infrastructure (ha)	Total (ha)
1	103.82	8.95	11.97	124.74
2	76.89	3.74	2.60	83.23
3	139.05	4.60	1.54	145.19
4	161.78	2.86	2.24	166.88
5	683.72	2.44	-	686.16
6	187.65	6.00	10.20	203.85
7	-	1.30	-	1.30
Total	**1,352.91**	**29.89**	**28.55**	**1,411.35**

Connectivity (PR S.4)

The scale and location of the project will result in the fragmentation of vegetation, particularly as a result of the inundation of the proposed dam area and clearing of the pipeline corridor. The total impact on connectivity has been estimated to be 2373 ha (based on the assessment requirement of the RVMC for the project).

[30] Refer to the Glossary at page 426 of this report for a definition of stream order

Essential habitat (PR S.8)

The project will impact on approximately 62 ha of vegetation classified as essential habitat for the little pied bat (*Chalinolobus picatus*), listed as 'vulnerable' under the NC Act.

Mitigation measures

As described above, the terrestrial flora sub-plan of the revised draft CEMP (Appendix 4, section 29.9.8) identifies a range of mitigation measures to minimise the impacts on, and protect, terrestrial flora. Key mitigation measures relate to preparing and implementing a vegetation clearance management plan, rehabilitation plan and WMP.

However, impacts to vegetation are largely unavoidable given the scale and nature of the project. Accordingly, Sunwater has committed to providing land-based offsets to offset residual adverse impacts to vegetation communities.

Vegetation offsets

In response to submitter comments on the EIS, Sunwater provided a draft environmental offset strategy as Appendix D-4 of the SEIS and, in response to DERM and SEWPaC requests for additional information, later submitted a more detailed strategic offset proposal for agency review in April 2011.

The strategic offset proposal was based on a 'strategic' approach to meeting State and Australian Government offset requirements, with the exception of some requirements of the VM Act. The intent of the strategic approach was to protect and enhance large tracts of remnant and non-remnant vegetation containing the same or similar values as those impacted by the project and to expand the existing protected area estate.

As part of DERM's review of the strategic offset proposal, DERM advised:

- there was insufficient information in the draft environmental offset strategy to identify the extent of the offsets necessary for the project
- the requirements, as described in the VM Act, may be underestimated
- the properties identified as potential offset properties are not necessarily suitable to meet the requirements of the relevant PVMO.

To address DERM's concerns and, in particular, meet VM Act requirements based on the PVMO, Sunwater submitted a revised offset proposal on 11 November 2011 (refer to Appendix 10 of this report). Aspects of the strategic offset proposal have been retained in order to satisfy offset requirements under the EPBC Act (refer to section 7 of this report).

In order to satisfy State Government (VM Act) requirements, the revised offset proposal involves securing approximately 3430 ha of vegetation across three properties. These properties include two Sunwater-owned properties which will be directly impacted by the water storage area (Ridgeland and Marylands—refer to Figure 5.5) and one unidentified privately owned property located on the Connors River downstream of the dam (referred to as 'Property A'). The offset proposal adopts a 1:1 ratio in order to meet State offset requirements.

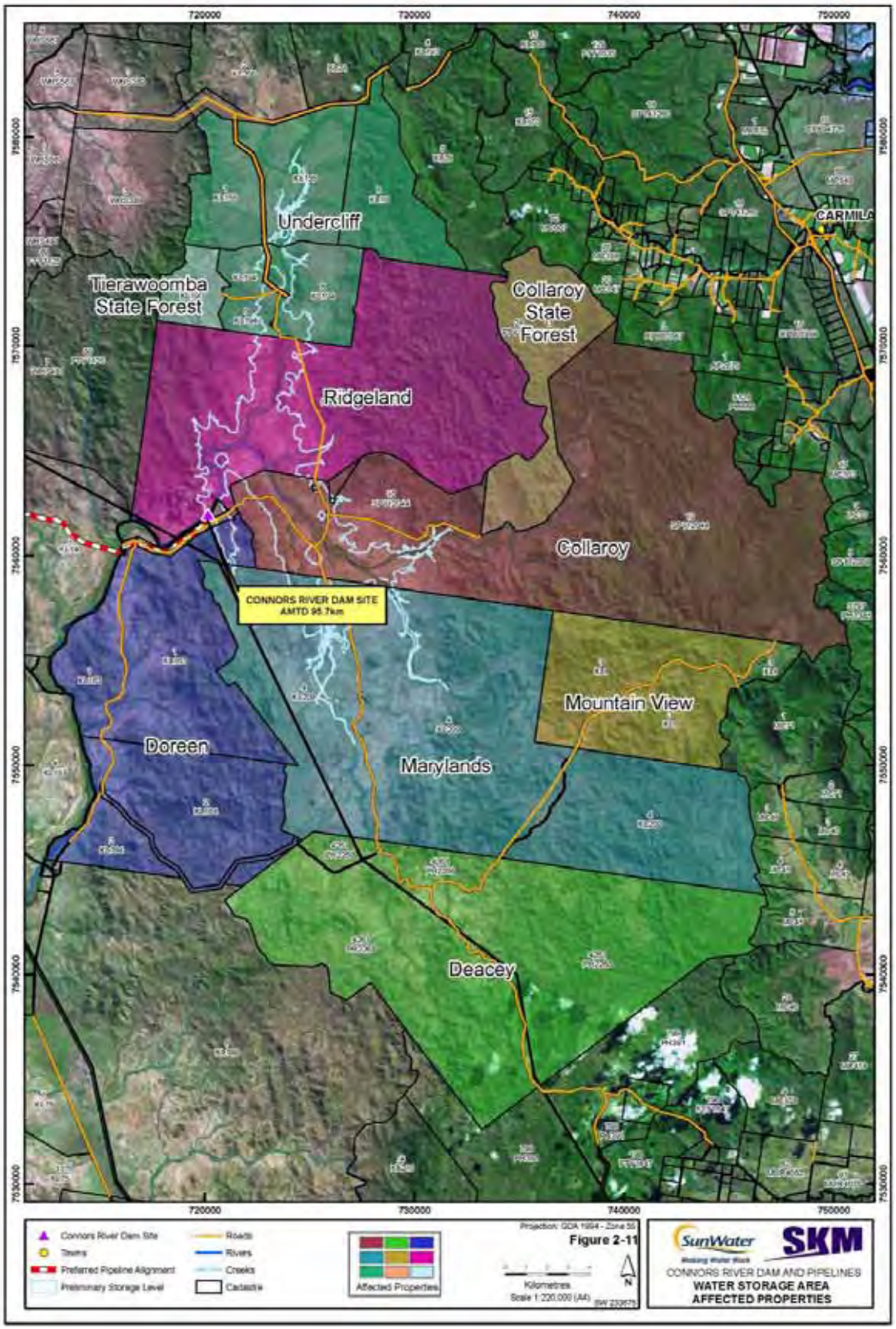


Figure 5.5 Properties affected by the water storage area

Ridgeland

Ridgeland is a 15 600 hectare grazing property containing areas of remnant, high value regrowth (HVR) and non-remnant vegetation and stream orders[31] ranging from one to six. Approximately 950 ha of non-remnant and HVR vegetation is proposed to be secured on Ridgeland to help meet offset requirements:

- PR S.7: Endangered and Of Concern REs (675.90 ha of BVG 9e/16c) (refer to Figure 5.6);
- PR S.3:Watercourses (950.76 ha) (refer to Figure 5.6);
- PR S.4: Connectivity (112.55 ha) (refer to Figure 5.8); and
- PR S.8: Essential Habitat (for the little pied bat—62.36 ha).

Marylands

Marylands is a 21 500-hectare grazing property located at the southern end of the inundation area. The property borders the Collaroy and Mountain View properties to the north and contains areas of remnant, HVR and non-remnant vegetation and stream orders ranging from 1 to 5.

It is proposed that approximately 2260 ha of non-remnant and HVR vegetation will be secured on Marylands to help meet offset requirements for:

- PR S.7: Endangered and Of Concern REs (107.78 ha) (refer to Figure 5.7);
- PR S.3:Watercourses (460.59 ha) (refer to Figure 5.7); and
- PR S.4: Connectivity (2,260.45 ha) (refer to Figure 5.8).

Offsets for connectivity have been identified on both Ridgeland and Marylands and are located within identified BPA corridor buffers. It is proposed that 2373 ha of vegetation will be secured to offset impacts on connectivity.

Connectivity between existing remnant patches and along riparian corridors will be increased by restoring and managing non-remnant areas until they achieve remnant status. This will be done through actively managing natural regeneration and implementing land management practices (e.g. grazing management, exclusion of livestock, weed control, fire management). The Coordinator-General has stated a condition (Appendix 1, Schedule E) which requires Sunwater to prepare and implement an offset area management plan for each offset area. The plans will identify those management measures required to ensure vegetation communities achieve ‘remnant’ status.

[31] Refer to the Glossary at page 426 of this report for a definition of stream order

‘Property A’

‘Property A’ is a large grazing property located on the Connors River downstream of the proposed dam, which contains areas of remnant, HVR and non-remnant vegetation and stream orders ranging from one to seven. Sunwater propose to secure approximately 215 ha of non-remnant and HVR vegetation on ‘Property A’ to fully satisfy offset requirements of PR S.7: Endangered and Of Concern REs.

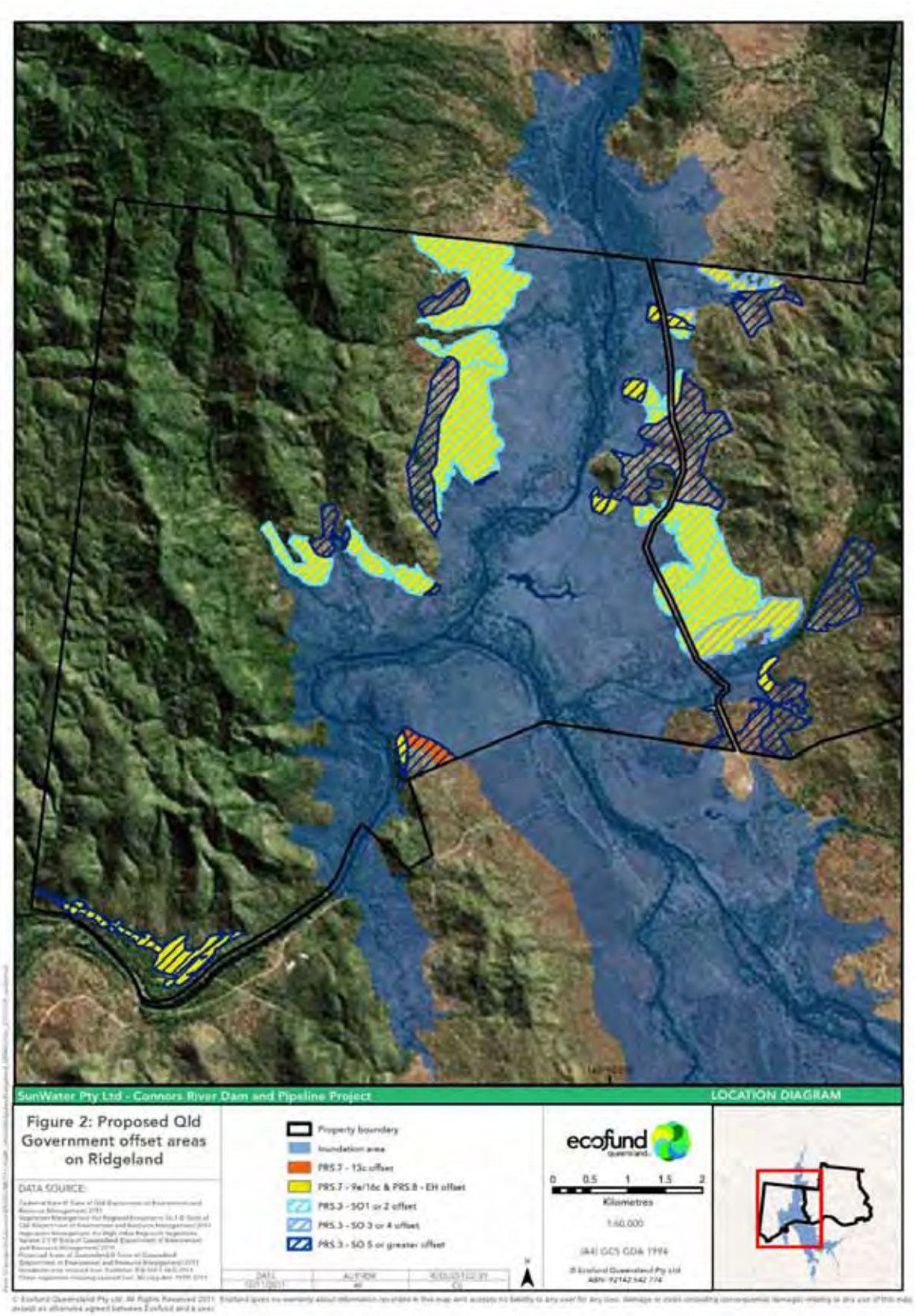


Figure 5.6 Proposed Queensland Government offset areas on Ridgeland

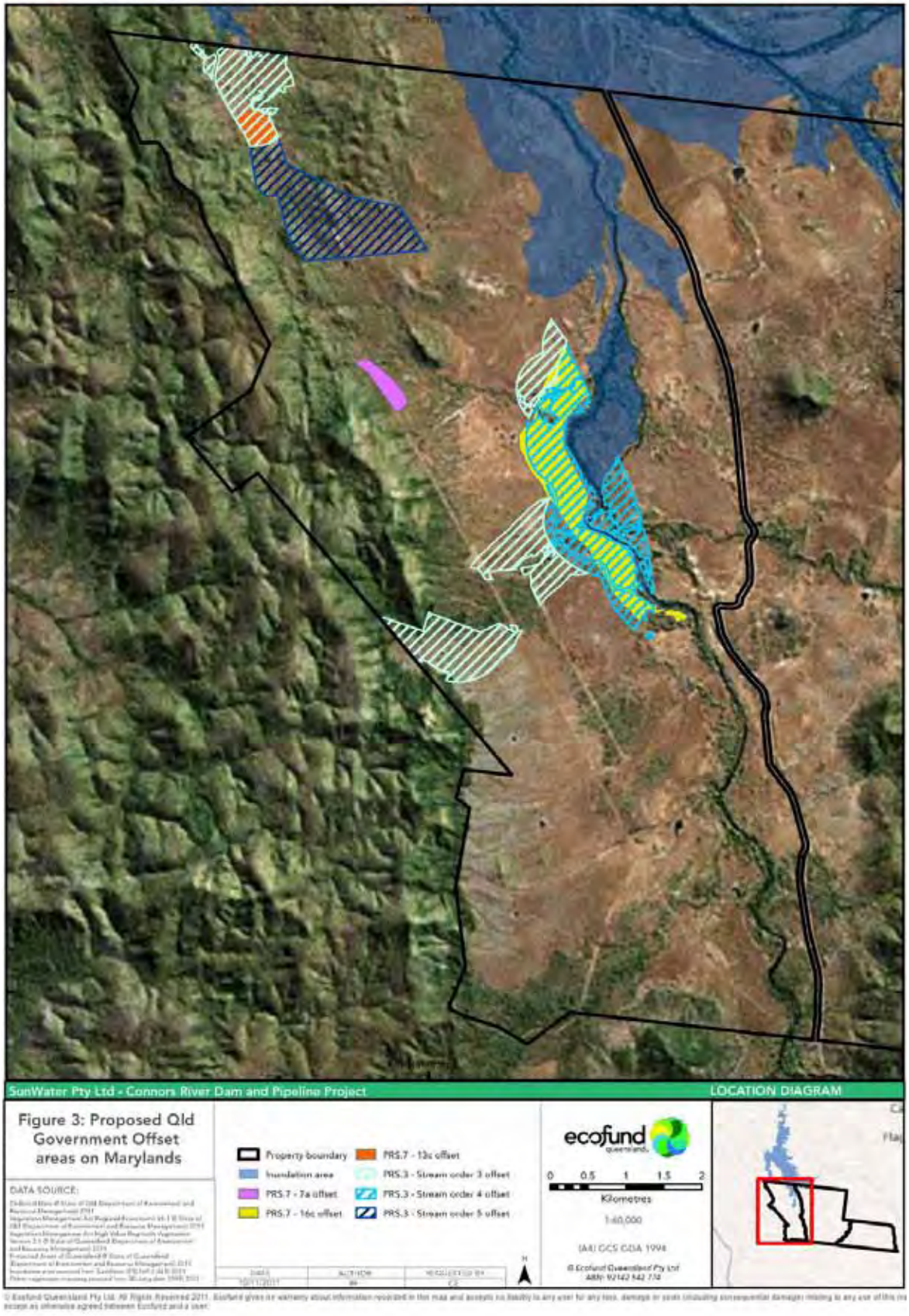


Figure 5.7 Proposed Queensland Government offset areas on Marylands

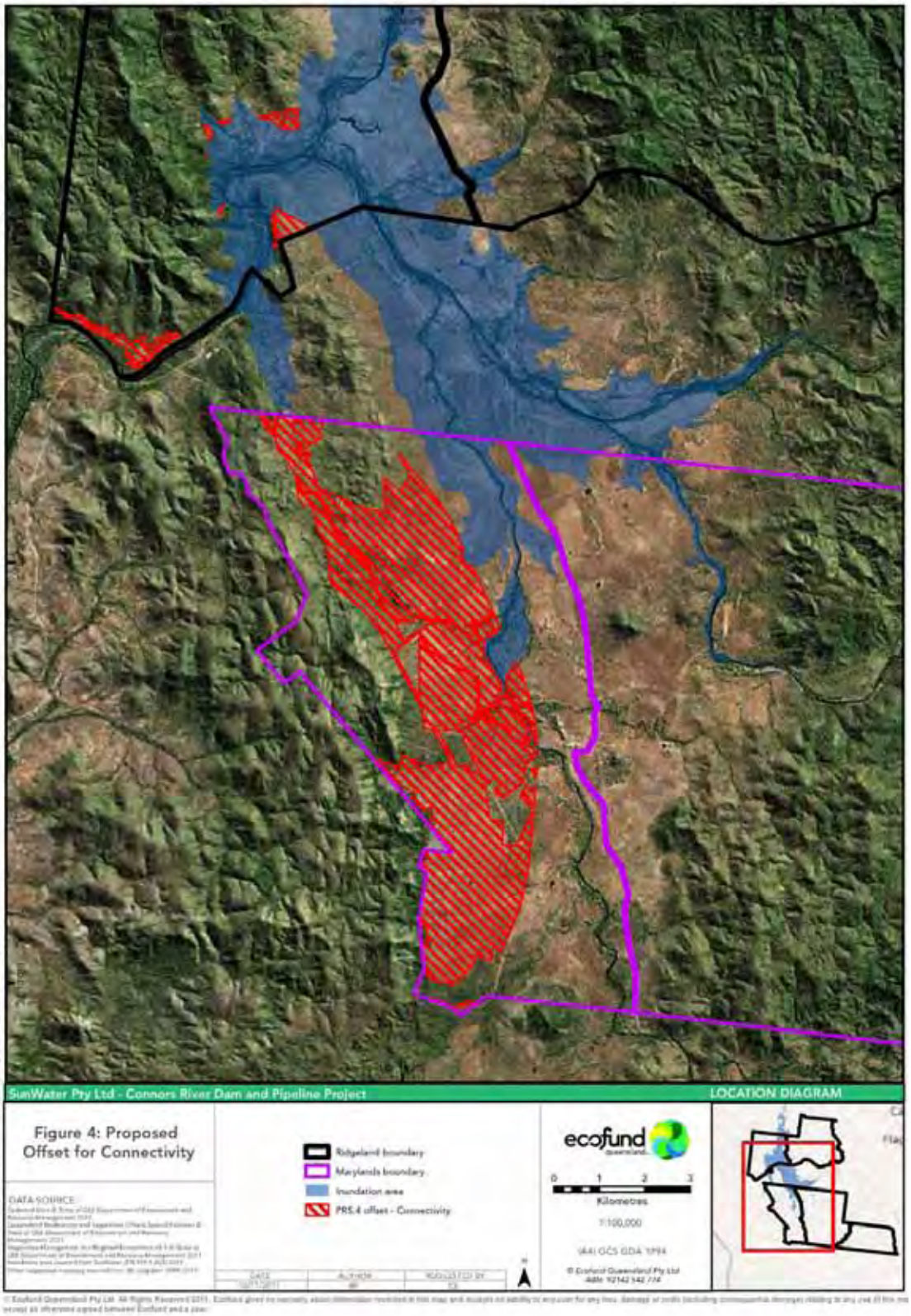


Figure 5.8 Proposed offset for PR S.4: Connectivity on Marylands and Ridgeland

Adequacy of the revised offset proposal

DERM advises the revised offset proposal lacks sufficient information to enable full assessment of both the proposed clearing areas and proposed offset areas against the requirements of the PVMO. Further, DERM is unable to determine if the proposed offset areas fully discharge Sunwater's obligations under the PVMO as there are requirements that have not been addressed which could significantly alter the amount of offset areas that will be required for the project. Key concerns relate to:

- the ecological equivalence (cleared compared with offset) requirements of the PVMO, including the need for site inspections
- the requirement for offset areas to have a functioning RE
- availability of contingency offset areas should a ratio of greater than 1:1 be needed, or should the offset areas proposed on properties yet to be acquired by the Sunwater become unavailable.

In response to DERM's concerns, Sunwater provided additional information to demonstrate the availability of contingency offset areas, should they be required. Contingency offset areas, which are in addition to offset areas identified in the revised offset proposal, are potentially available on Ridgeland and Marylands; and offset areas are also potentially available on other properties within the bioregion. Based on this information, DERM considers it likely that offsets for the clearing associated with the construction and operation of the project, consistent with the requirements of the PVMO, can be provided by Sunwater within a reasonable time period following release of this report. However, additional information is still required (for example, ecological equivalence and functioning RE assessments) to enable DERM's full assessment of both the proposed clearing areas and proposed offset areas against the requirements of the PVMO.

Accordingly, the Coordinator-General has stated a condition (Appendix 1, Schedule E) which will require Sunwater to:

- obtain a development approval for operational work that is clearing of native vegetation prior to clearing assessable vegetation
- as part of the application for a development permit, provide an ecological equivalence assessment of the areas to be cleared and the offset areas, and information to demonstrate the offset areas are functioning ecosystems
- provide details of the legally binding mechanism to be used to secure and protect the offset areas in perpetuity.

Coordinator-General's conclusions—vegetation communities

The project has been designed to ensure clearing will be limited to the extent necessary for the project, including refining the pipeline route to avoid impacts to remnant vegetation and using existing cleared easements where possible. The proposed vegetation clearance management plan will also ensure vegetation clearing is limited as far as practicable during construction of the project.

Nonetheless, the project will result in significant unavoidable impacts to vegetation, including endangered and of concern REs, watercourse vegetation, connectivity of vegetation and vegetation that is essential habitat for the little pied bat.

Sunwater's offset proposal involves securing approximately 3430 ha of vegetation—largely across two properties affected by the inundation area: Ridgeland and Marylands—and adopts a 1:1 ratio to meet all offset requirements. The Coordinator-General also notes Sunwater will be securing an additional 13 220 ha of offsets to satisfy Federal offset requirements (refer to section 7 of this report for more information).

Overall, the revised offset proposal will therefore preserve and enhance in perpetuity approximately 16 650 ha of offset land that is currently available for agricultural (grazing) purposes. When compared with the expected loss of approximately 6370 ha of vegetation from the construction and operation of the project, the management of the proposed offset areas will provide a greater area of secure habitat than that lost as a result of the project (approximately 10 280 ha).

Based on the assessment provided in the EIS and SEIS, Sunwater's revised offset proposal, DERM advice and the Coordinator-General's conditions, the Coordinator-General is satisfied Sunwater can sufficiently offset unavoidable impacts to vegetation, including endangered and of concern REs, watercourse vegetation, connectivity of vegetation and vegetation that is essential habitat for the little pied bat.

5.4.7. Fauna

Context

Nine species (five birds and four mammals) listed under the NC Act and/or the EPBC Act were recorded within the dam and surrounds study area, including three threatened species:

- cotton pygmy-goose (near threatened, NC Act and Migratory, EPBC Act)
- squatter pigeon (southern subspecies) (vulnerable, NC Act and EPBC Act)
- little pied bat (near threatened, NC Act).

Six bird species listed under the NC Act and/or EPBC Act were recorded from the pipeline route study area. This included one additional threatened species which was not recorded from within the dam and surrounds study area—the black-necked stork (near threatened, NC Act).

An additional thirteen species and forty-five species listed under the NC Act and/or EPBC Act are considered likely to occur within the dam and surrounds study area and pipeline route study area, respectively, based on the presence of suitable habitat and local records. For the pipeline route, this includes reptiles restricted to, or mostly recorded from, brigalow communities, including brigalow scaly-foot, yakka skink, ornamental snake and Dunmall's snake (vulnerable, EPBC Act).

Habitat type is a significant factor in determining the composition of the fauna species assemblage of a certain area. The habitats within and immediately surrounding the project area (water storage area and pipeline) can be assigned to six broad categories,

as described in Table 5.6. In general terms, much of the assessment for areas within the water storage area is applicable to habitats along the pipeline route.

Table 5.6 Fauna habitat types within the project area

Fauna habitat type	Habitat description and assessment
Woodland and open forest on alluvial soils (Corresponding REs: 11.3.4, 11.3.9, 11.3.25)	These habitats are characterised by a tall eucalypt-dominated canopy, little or no shrub layer and a grassy ground cover. Other than open pasture, this is the dominant habitat type within the dam and surrounds study area and was the habitat type in which the majority of fauna trapping was conducted. The pipeline route traverses several patches of this habitat including extensive tracts on either side of Connors River, Funnel Creek and Bee Creek. On the slopes flanking the riparian strip of such watercourses the landscape is typically dominated by very large *Eucalyptus tereticornis* many of which act as 'habitat' trees for arboreal mammals, hollow-dependent birds and micro-bats. Overall, this habitat provides good resources for frogs, reptiles, birds and both arboreal and terrestrial mammals despite the likely deleterious impacts of weed infestations and grazing by livestock.
Woodland and open forest on non-alluvial soils (Corresponding REs: 8.12.5, 8.12.31, 11.12.1, 11.12.2)	This habitat type is less common and more likely to be found above the proposed water storage area. Vegetation is similar in structure to the previous habitat type although the canopy is not as tall and hollows are much less common. Grazing impacts and less fertile soils contribute to less grass cover than found elsewhere in the study area. The Squatter Pigeon (vulnerable, NC Act and EPBC Act) was recorded within ironbark woodland. Although most individuals recorded during both survey periods were recorded in grassland, the species does roost in trees at night and is likely to be dependent on some presence of this open forest and woodland in the local landscape, even if the habitat is heavily degraded by livestock.
Rivers and creeks, both permanent and ephemeral including billabongs (Corresponding RE: 8.3.3)	Aside from Connors River itself, the study area encompasses ephemeral waterways (e.g. Cattle Creek) and several ephemeral drainages. Riparian vegetation within the study area is narrow and degraded (light to moderate disturbance) however it still serves as a route by which species traverse the landscape or as a stepping stone habitat for some migratory bird species that require more dense vegetation such as Rufous Fantail and Satin Flycatcher. Larger waterbodies also serve as important foraging areas for several bird predators such as White-bellied Sea-Eagle. Arboreal mammals such as Koala and Greater Glider use some of the larger trees for movement and as habitat for shelter and breeding hollows. The creeks also provide important watering sites for macropods and birds. In a landscape that has suffered the loss of many trees (e.g. historical clearing for grazing) riparian vegetation is likely to be of increased importance for arboreal mammals and micro-bats. The creeks also provide habitat for Water Rat and Platypus, both of which were recorded during field surveys.

Fauna habitat type	Habitat description and assessment
Semi-evergreen vine thicket (water storage area only) (Corresponding REs: 8.12.16, 11.9.4)	This habitat is distributed throughout the general area but is restricted to rocky slopes that are above the water storage area. Only the site of the dam wall corresponds (in part) to this habitat type within the study area (refer to Figure 5.4). This habitat provides suitable resources for a range of reptiles and small mammals that utilise the many rocky crevices for shelter. Trees in this habitat are generally not as suitable for arboreal mammals, however micro bats do utilise the area. Little Pied Bat is the only protected species recorded from this habitat, however it is not restricted to vine thickets. The culturally significant Koala and Short-beaked Echidna were both recorded.
Brigalow communities (pipeline easement only) (Corresponding REs: 11.3.1, 11.4.8, 11.4.9, 11.9.5, 11.12.21)	Much of this habitat along the pipeline route has been disturbed, though an example of better quality habitat can be found east of the intersection of Peak Downs Highway and Fitzroy Development Road. Patches of brigalow extant within the pipeline route are small and often isolated within cleared land. This habitat is particularly important for several protected fauna species listed under the EPBC Act which are either restricted to, or most frequently recorded from, this vegetation community. These include Ornamental Snake and brigalow Scaly-foot. These two species will occur in small and/or narrow brigalow remnants, including roadside vegetation.
Grasslands	Much of the study area has been cleared and is dominated by grasslands, featuring both introduced pasture and native grass species. Birds are a conspicuous component of the fauna assemblage of the grasslands. The only protected species encountered in the grassland was the Squatter Pigeon, recorded on several occasions associated with clearings. Other than micro-bat species which may forage above the grasslands but roost and breed elsewhere, the mammal assemblage is quite small. Native mammals recorded include Eastern Grey Kangaroo and Agile Wallaby, though the latter is dependent on some dense cover nearby. Areas still dominated by native grasses are likely to have some native rodents and dasyurids, such as Common Planigale.

Potential impacts, mitigation measures and offsets

Loss of fauna habitat—construction of dam wall and clearing/filling of water storage area

Construction of the dam wall will disturb 56 ha of land, including a range of habitat types for fauna. The footprint extends over open forest and woodland within the Connors River valley and a small patch of vine thicket (consistent with the 'of concern' RE 8.12.16) on the southern hill slope. This habitat will be cleared for construction works and is not considered to significantly impact on local fauna populations given the large habitat patches located outside the dam construction footprint.

Clearing of habitat within the water storage area will result in the loss of 2398.8 ha of habitat for fauna (excluding pasture and grasslands), which is likely to impact on a range of common fauna species—particularly those of low mobility (e.g. amphibians, small reptiles and mammals) and those that exhibit fidelity to specific habitat types or areas (e.g. species in the riparian zone such as platypus). A summary of the habitat

types lost to the pipeline easement is presented in Table 5.7. Fauna populations will be impacted by:

- removing vegetation that provides shelter, food and/or nesting resources
- interrupting movement corridors, which can lead to reduced viability of fauna populations.

Table 5.7 Area of fauna habitat lost within the water storage area (ha)[32]

Remnant status	Woodlands and open forest on alluvium	Woodlands and open forest on non-alluvium	Semi-evergreen vine thickets	Rivers and creeks	Pasture and grasslands	Total area
Remnant	1616.9	392.1	3.0	61	-	2072.9
Non-remnant	236.3	89.7	-	-	3628.5	3954.5
Total						6027.4
Total (excluding pasture and grasslands)						2398.8

In accordance with the terrestrial flora and fauna sub-plans of the draft EMP (refer to Appendix 4 of this report), habitat clearing for the dam construction and within the water storage area will be conducted to minimise impacts to fauna as far as practicable. Vegetation clearing will be staged so that only the area required for dam construction works is initially cleared. The remainder will be cleared progressively, commencing at the dam site and continuing upstream of the dam, so that it is only fully cleared immediately prior to the water storage area being ready to fill. This will ensure that fauna move of their own volition away from impact areas and into habitats within the upper reaches of impacted waterways.

Other mitigation measures include relocating tree hollows to suitable un-impacted habitat and engaging a spotter-catcher during the construction phase to provide fauna relocation and rescue services and ensure habitat trees are identified and felled in a manner which minimises injury to fauna.

In addition, where construction and/or operation of the project is likely to disturb the breeding places of protected fauna (as defined in the *Nature Conservation (Wildlife Management) Regulation 2006*), the approval of DERM must be obtained before activity commences. A species management program must be submitted to DERM as part of the approval, detailing how the population and habitat of a protected animal listed under the NC Act will be managed during construction and operation (including, but not limited to, listed threatened species either already identified through the EIS process or found prior to or during construction within the project area).

[32] For the purposes of this impact assessment it has been assumed that all vegetation within the water storage area will eventually be lost. This is considered to be a worst-case scenario, given that vegetation not cleared initially will take some time to die, depending on the rate of filling, and the water storage area will create islands of vegetation (included in calculations as habitat lost) which are likely to be used by flying species such as birds and bats.

As part of its offset proposal, Sunwater will preserve and enhance in perpetuity approximately 16 650 ha of offset land that is currently available for agricultural purposes, with the majority of this offset being located on properties surrounding the water storage area—in particular Ridgeland (13 000 ha) and Marylands (2260 ha). This includes 2373 ha of offsets on the Ridgeland and Marylands properties, specifically to address unavoidable impacts on habitat connectivity (refer to Figure 5.8) and 1411 ha of watercourse (including riparian) vegetation (PR.S 3 – refer to Figure 5.6 and Figure 5.7).

The strategic establishment of offsets around the water storage area will reinstate dispersal pathways at the edge of the water storage will result in increased permeability of habitats above FSL. Management of the offset areas will provide a greater area of secure habitat than that lost as a result of the project.

Loss of fauna habitat—pipeline construction

Pipeline construction will result in the loss of 141.63 ha of habitat for fauna (excluding pasture and grasslands). For assessment of impacts associated with pipeline construction an easement of 30 metres has been assumed. This is the maximum easement width required, but depending on terrain it will be possible to reduce this to approximately 10 metres either side of the centreline (20 metres in total). A summary of the habitat types lost to the pipeline easement is presented in Table 5.8.

Table 5.8 Habitat types lost from the pipeline easement

Remnant status	Woodlands and open forest on alluvium	Woodlands and open forest on non-alluvium	Brigalow communities	Rivers and creeks	Pasture and grasslands	Total area
Remnant	41.51	94.09	1.57	0.2	0	137.37
Non-remnant	0.18	4.00	0.08	-	255.93	260.19
Total						397.56
Total (excluding pasture and grasslands)						141.63

The pipeline easement avoids all habitat areas within state forests and other conservation areas and most of the significant habitats such as brigalow and vine thickets. However, some habitat will be lost and these are primarily within open forest and woodland habitats on non-alluvium adjacent to state forests and within riparian zones where the pipeline crosses the Connors and Isaac rivers and major tributaries including Kennedy Creek, Funnel Creek and Denison Creek. The impacts on fauna associated with pipeline construction include:

- clearing habitat along the easement including loss of nests within trees and hollow-bearing trees and disturbing microhabitat features such as rocks, logs and other woody debris
- unearthing burrowing fauna during soil disturbance and trenching

- injury and mortality from fauna falling into the trench ('trenchfall') which are then unable to escape.

The construction impacts associated with clearing habitats within the water storage area are similar with respect to clearing the pipeline easement. Within the pipeline easement there is scope to reduce the amount of vegetation cleared by trimming branches of significant trees (e.g. hollow-bearing or large resource trees) rather than felling and reducing the clearing width to 20 metres in sensitive areas depending upon local topography. The terrestrial flora and fauna sub-plans of the draft EMP (refer to Appendix 4 of this report) provides mitigation measures for impacts of clearing for the pipeline construction on fauna, including:

- using alternative clearing measures such as pushing significant trees rather than cutting and felling vegetation
- stockpiling of felled vegetation to provide compensatory shelter sites for terrestrial fauna
- the pipeline will be constructed progressively and the open trench will be the minimum practicable at any time
- the open pipeline will be plugged at the completion of each work day and backfilled so that the maximum distance of open trench will be less than 50 metres
- an escape ramp will be provided for fauna at the end of the trench at the completion of each day
- using a spotter-catcher during pipeline construction to work ahead of tree clearing to 'flag' significant trees and microhabitat, ensure that clearing of such features is conducted in a way which minimises impacts to fauna, and clear any open trench every morning and remove trapped fauna during work times.

Loss of fauna habitat—operation of project

Project operation involves temporary and infrequent inundation of the flood margin. Given the nature of these flood events, impacts on terrestrial fauna are not considered to be significant and vegetation will not be cleared in this area. By their very nature, floodplain and riparian habitats are adapted to seasonal flood events and are considered unlikely to be adversely affected by infrequent inundation. No habitat loss is expected downstream of the dam as the operational flow regime will maintain the riparian environment through the provision of environmental flows (refer to subsection 5.1.3 of this report for more information on downstream surface water hydrology).

As the pipeline will be generally buried and rehabilitation of the pipeline easement will progressively occur once construction is complete (refer to the rehabilitation plan described in section 5.4.4 of this report), there will be minimal impacts on fauna during operation.

Habitat fragmentation

Filling of the water storage area will fragment habitats at the periphery of the water storage. Fragmentation results in a number of negative impacts on habitat patches and fauna assemblages, including edge effects. Fauna may be impacted by increased penetration of native and exotic predators and competitors, changes in floristic composition resulting in loss of food resources and reduction in habitat size making the habitat unable to support populations.

An example of habitat fragmentation at the periphery of the water storage area (Murray Creek) is provided in Figure 5.9. As most habitats within the lower-lying areas of the Connors River valley have been subject to historical clearing and fragmentation of habitats, further impacts on fauna populations from fragmentation are expected to be minor. Some areas shown in Figure 5.9 (above FSL) are fragments irrespective of the dam and are not impacts of the project.

Filling the water storage area will fragment existing habitats within the Connors River valley and impact on dispersal pathways within open forest and woodland habitats on alluvium within the Connors River and tributaries. As much of the habitats within the low-lying areas of the Connors River valley have been cleared, the riparian corridors are the only dispersal pathway available to less mobile species. Severing such corridors within the water storage area is therefore considered to have a significant impact on local fauna populations. Protected fauna species potentially impacted include seasonal migrants such as rufous fantail and spectacled monarch.

As described above, Sunwater's offset proposal will provide compensatory habitat areas, with the strategic establishment of offsets to reinstate dispersal pathways at the edge of the water storage area increasing the permeability of habitats above FSL. Management of the offset areas will provide a greater area of secure habitat than that lost as a result of the project.

Construction of the pipeline also has the potential to create a barrier to fauna movement by restricting access for some species across cleared land. In addition, clearing vegetation within in-tact habitat patches can produce edge effects. Edge effects are greatest within patches containing structurally complex vegetation such as vine thickets, brigalow communities and riparian zones, and can produce changes to plant species composition (including resources for fauna), prevent the movement of some species across the cleared easement and provide access for pest species that would otherwise not occur within the habitat type.

As identified in Table 5.8, the majority of the alignment is in pasture/grassland, which is the habitat least affected by connectivity or fragmentation issues. Much of the remainder of the alignment has been collocated with existing cleared easements where the fragmentation impacts have already occurred. The terrestrial flora sub-plan of the draft EMP (Appendix 4 of this report) contains measures to mitigate fragmentation impacts, including:

- detailed design of the pipeline alignment to minimise edge effects by touching one edge of existing habitat patches, rather than passing directly through in-tact patches

- re-spreading of cleared vegetation (in the form of mulch or stockpiled woody debris) over the pipeline easement immediately post-construction to provide cover for small terrestrial fauna species attempting to traverse the easement
- progressive rehabilitation to ensure the pipeline easement remains permeable for dispersing fauna thereby maintaining movement corridors.

Operational impacts of the pipeline are considered to be minimal due to the rehabilitation and revegetation (where appropriate) of the majority of the pipeline easement width.

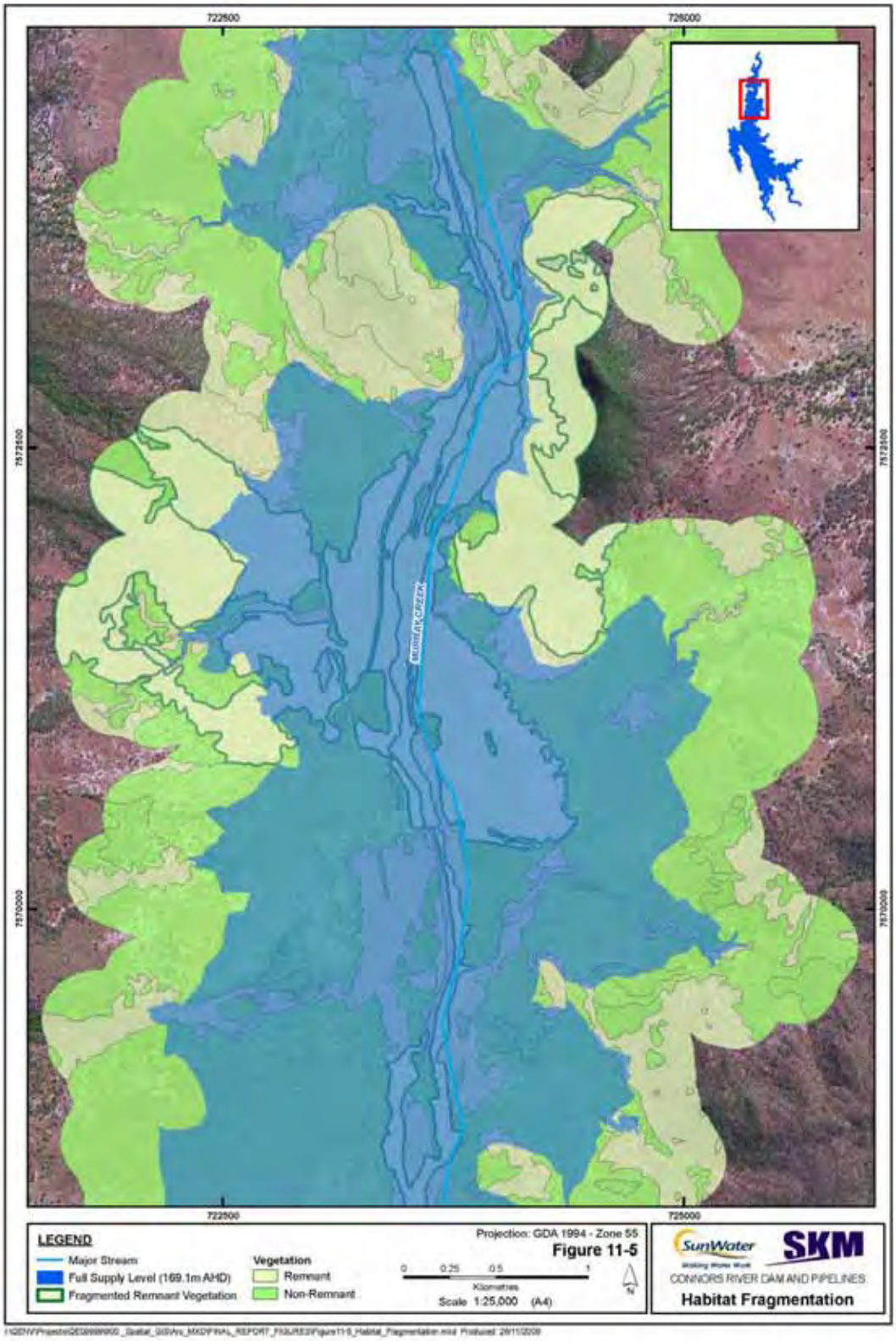


Figure 5.9 An example of habitat fragmentation at the periphery of the water storage area (Murray Creek)

Noise, dust, vibration and artificial night lighting

Temporary, localised, minor impacts are expected to terrestrial fauna associated with the construction phase of the project, including a temporary increase in artificial night lighting, vibration, dust and noise impacts. The temporary nature of these impacts and their limited geographic extent indicate that significant and enduring impacts on terrestrial fauna are unlikely. In addition, the draft CEMP (in particular the air quality and noise and vibration sub-plans—refer to Appendix 4 of this report) contains measures to mitigate impacts associated with noise, dust and vibration.

Impacts on species of conservation significance

The majority of potential impacts are likely to occur to species of conservation significance known or likely to occur within the water storage area. Table 5.9 summarises the potential impacts of the water storage area on species of conservation significance.

The loss of trees and shrubs across the pipeline easement is considered unlikely to create a significant barrier to the movement of species of conservation significance. Reptile species of brigalow communities predicted to occur along the pipeline route (including brigalow scalyfoot, Dunmall's snake, yakka skink and ornamental snake) may be impacted by the pipeline construction due to unearthing of burrowing species or those species that shelter in soil cracks.

The EIS considers mitigation strategies contained within the terrestrial flora and fauna sub-plans of the draft EMP (as outlined in the previous sections) as adequate in minimising impacts to fauna species of conservation significance.

Overall, the EIS found the risks to species of conservation significance resulting from the construction and operation of the project to be low. As described above, Sunwater's offset proposal will provide approximately 16 650 ha of compensatory fauna habitat, which exceeds the expected loss of approximately 6370 ha of habitat from the construction and operation of the project. In addition, the offset proposal identifies specific offsets to address impacts to the following fauna species of conservation significance:

- squatter pigeon, by securing the entire Ridgeland property above the water storage area as an offset, which equates to approximately 13 000 ha
- reptiles of the brigalow endangered ecological community (EEC) (brigalow scalyfoot, Dunmall's snake, yakka skink and ornamental snake), by securing a property containing 11.05 ha of brigalow EEC
- little pied bat, by securing approximately 63 ha of suitable habitat to counterbalance the impact of the project on 'essential' little pied bat habitat

Table 5.9 Potential impacts on species of conservation significance 'known,'[33] or 'likely'[34] to occur in the water storage area

Listed fauna species (common name in brackets)	Conservation status		Likelihood of occurrence	Potential impact
	NC Act[35]	EPBC Act[36]		
Birds				
Nettapus coromandelianus (Cotton Pygmy-goose)	NT	M	**Present**: Species recorded on the Connors River below the dam wall. Prefers freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water.	It is likely that inundation will provide suitable habitat areas for this species.
Geophaps scripta scripta (Squatter Pigeon (southern subspecies))	V	V	**Present**: Frequently recorded throughout the project area, particularly along roadsides and around cattle yards.	Project will result in the loss of 1830 ha of woodland and open forest habitat. However, there is almost 3 million ha of suitable habitats within the region. 13,000 ha of compensatory habitat will be provided for this species on the property.
Haliaeetus leucogaster (White-bellied Sea-Eagle)		S	**Present**: Recorded flying over the Connors River during surveys, however project area does not provide significant habitat for this species.	Species is known to occur within other impoundments and is expected to utilise the project area post-inundation.
Merops ornatus (Rainbow Bee-eater)	S	M	**Present**: Species occurs throughout the project area in a variety of habitats.	Inundation is unlikely to significantly impact on this species.
Rhipidura rufifrons (Rufous Fantail)	S	M	**Present**: Species occurs within riparian vegetation within the project area.	61 ha of habitat will be lost within the water storage area. The loss of connectivity within the water storage will also impact on this species. Environmental offsets will provide compensatory habitat for this species and strategic replacement of habitat along the edge of the water storage

[33] 'Known': Remnant vegetation or sites are known to support the species because there are a significant number of individuals present that are self-maintaining

[34] 'Likely': Remnant vegetation or sites likely to support the species because there is habitat containing essential resources of a size capable of supporting a significant number of individuals. Available habitat which is proximal to and buffering a known occurrence of a population

[35] The Nature Conservation (Wildlife) Regulation 2006 provides and defines five classes of protected plants of state environmental significance: extinct in the wild, endangered (E), vulnerable (V), near-threatened (NT), least concern (LC), Culturally Significant (CS)

[36] EPBC Act status: E = Endangered, V = Vulnerable, M = Migratory Species

Listed fauna species (common name in brackets)	Conservation status		Likelihood of occurrence	Potential impact
	NC Act[35]	EPBC Act[36]		
				area will partly restore connectivity to the project area.
Ephippiorhynchus asiaticus (Black-necked Stork)	NT		**Likely**: Previously recorded from the project area	Inundation will create wetland areas within the upper reaches of the water storage area, including shallow areas that are likely to provide suitable feeding areas for this species.
Erythrotriorchis radiatus (Red Goshawk)	E	V	**Likely**: Previously recorded from the project area	Inundation of riparian areas will result in the loss of potential hunting areas. Establishment of vegetation offsets, including riparian vegetation, will provide compensatory habitat areas for this species.
Rostratula australis (Australian Painted Snipe)	V	V	**Likely**: Previously recorded from the project area	Any loss of habitat due to inundation is likely to be offset by the creation of additional habitat on the edges of the impoundment
Migratory Wetland Birds				
Gallinago hardwickii (Latham's Snipe)	S	M	**Likely**: These species are highly mobile and are likely to occur within the project area depending upon seasonality and in response to rainfall.	The impoundment will create suitable feeding and roosting habitat for these species, particularly at the edges of the inundation. Accordingly, potential impacts on these species are considered minimal and potentially positive in as much as the shallow edges of the impoundment will provide habitat for these species which exceeds the area of habitat currently available.
Numenius minutus (Little Curlew)	S	M		
Ardea alba (Great Egret)	S	M		
Bubulcus ibis (Cattle Egret)	L	S		
Pandion haliaetus (Osprey)	L	S		
Migratory terrestrial birds				
Hirundapus caudacutus (White-throated Needletail)	S	M	**Likely**: These species are highly mobile and are likely to occur within the project area depending upon seasonality and in response to rainfall.	Each of these species is likely to continue to utilise the impoundment margins or the aerial space above the impoundment over the longer term. 'Important populations'[37] of these species (within the meaning of the EPBC Act) are
Monarcha trivirgatus	S	M		

Listed fauna species (common name in brackets)	Conservation status		Likelihood of occurrence	Potential impact
	NC Act[35]	EPBC Act[36]		
(Spectacled Monarch)				not present within the water storage area. Therefore, potential impacts on these species are considered minimal. Further, the establishment of vegetation offsets, including riparian vegetation, will provide compensatory habitat areas for this species.
Monarcha melanopsis (Black-faced Monarch)	S	M		
Hirundo rustica (Barn Swallow)	S	M		
Mammals				
Chalinolobus picatus (Little Pied Bat)	NT	Not listed	**Present**: Species occurs in a variety of dry habitat types	The project will impact on approximately 62 ha of vegetation classified as essential habitat for the Little Pied Bat. The loss of this habitat is not expect to create a significant impact as this species occurs in a variety of dry habitat types and large habitat areas will not be affected by the water storage area. Further, the establishment of vegetation offsets will provide compensatory habitat areas for this species.
Ornithorhynchus anatinus (Platypus)	CS	Not listed	**Present**: Considered a resident of the project area	Species will be displaced by the inundation of aquatic habitats within the Connors River and tributaries. However the species is likely to utilise the upper reaches of the storage and rehabilitation of riparian vegetation along upstream habitats will ensure the species continues to persist within the upper Connors River catchment
Tachyglossus aculeatus (Short-beaked Echidna)	CS	Not listed	**Present**: species present in a variety of habitats within the project area.	Species will be temporarily impacted by the loss of habitat areas, however, will be able to disperse to adjacent habitats not impacted by the project construction and operation.
Phascolarctos cinereus (Koala)	CS	Not listed	**Present**: species present within open forest and woodland habitats on alluvium	Species will be impacted by habitat lost from project construction and operation. Establishment of vegetation offsets and associated offset area management will provide compensatory habitat areas in the medium term.

Coordinator-General's conclusions—fauna

Clearing and/or inundation of vegetation required for the construction of the project will result in significant impacts to fauna habitat. Fauna populations will be impacted by:

- removing vegetation that provides shelter, food and/or nesting resources
- interrupting movement corridors, which can lead to reduced viability of fauna populations
- possible injury and mortality (for example from fauna falling into the pipeline trench and being unable to escape, or the unearthing of burrowing fauna during soil disturbance).

Measures outlined in the terrestrial flora and fauna sub-plans of the draft EMP will help to mitigate potential impacts to fauna and their habitats. The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance. In accordance with the NC Act, approval from DERM must also be obtained where construction and/or operation of the project is likely to disturb the breeding places of protected fauna (as defined in the *Nature Conservation (Wildlife Management) Regulation 2006* (Qld)).

However, impacts to fauna habitat are largely unavoidable given the scale and nature of the project. Sunwater's offset proposal will provide approximately 16 650 ha of compensatory habitat, with the strategic establishment of offsets to reinstate dispersal pathways at the edge of the water storage area increasing the permeability of habitats above FSL. Management of the offset areas will provide a greater area of secure habitat than that lost as a result of the project (approximately 10 280 ha).

Further, the Coordinator-General notes the strategic conservation benefits that the offset proposal will provide for the region (in particular, the 13 000 ha Ridgeland property offset to compensate for the loss of squatter pigeon habitat).

The Ridgeland property comprises high-quality habitat for a variety of protected fauna species, as well as the potential for natural regeneration in a number of areas. Ridgeland is directly connected to large tracts of remnant vegetation of a viable size in the landscape and will sustain populations of fauna species. The Ridgeland offset will also improve habitat connectivity along watercourses to existing tracts of remnant riparian vegetation and large tracts of remnant vegetation to the east and west (Tierawoomba and Collaroy State Forests).

The property encompasses a range of land zones, consequently the vegetation varies from woodlands on alluvial plains to eucalypt forests on ridge lines. The property will also provide connectivity from one ridge to another. The diversity of vegetation and characteristics therefore make Ridgeland well suited for use as a conservation reserve.

Given the location of Ridgeland between two existing protected areas (Tierawoomba State Forest on the north-west (15 500 ha) and Collaroy State Forest on the north-east (3860 ha)), the protection, restoration and enhancement of vegetation and habitat on Ridgeland will therefore improve habitat connectivity in the landscape and provide real

conservation outcomes for a variety of fauna species by enhancing the health, diversity and productivity of the environment.

Furthermore, given the strategic conservation value of the property, the QPWS advises Ridgeland is suitable for possible declaration as a National Park, subject to interim tenure arrangements for that part of the property to be managed by Sunwater for offset purposes. In addition, Tierawoomba State Forest, which DERM considers to be an 'important strategic link for future national park acquisitions', has been transferred to 'Forest Reserve' which is a transitional tenure normally preceding transfer to national park.

Accordingly, the Coordinator-General finds the Ridgeland offset has the potential to deliver priority additions to Queensland's protected area estate. This would assist in addressing higher level policy objectives such as the Australian Government's goal of increasing the size of the National Reserve System to 125 million ha (a 25 per cent increase) by 2013[38] and the Queensland Government's target of expanding the protected area estate to 20 million ha by 2020[39].

Based on the mitigation measures contained within the draft EMP, the legislative requirements of the NC Act, and the provision of compensatory fauna habitat as part of Sunwater's Offset Proposal, the Coordinator-General is therefore satisfied impacts to fauna species will be minimal.

5.5. Aquatic ecology

5.5.1. Introduction

This section of the report addresses aquatic flora and fauna matters that fall under Queensland state jurisdiction. Matters of national environmental significance that are controlling provisions under the EPBC Act relevant to aquatic ecology are discussed further in section 7 of this report.

Submissions on the EIS raised several issues in relation to aquatic ecology. The Coordinator-General has considered each of the submissions and how the SEIS responded to the issues in those submissions. Key issues raised in submissions which the Coordinator-General considered warranted particular elaboration in his evaluation included:

- potential changes in aquatic flora and fauna habitat in the inundation area
- potential changes in aquatic flora and fauna habitat downstream of the dam
- potential impacts to aquatic fauna movement/migration due to the dam wall
- design of the proposed fishway and spillway
- colonisation of exotic aquatic flora and fauna
- impacts to the Fitzroy River turtle and white-throated snapping turtle
- cumulative impacts.

These matters are discussed below in this section of the report.

5.5.2. Aquatic flora

Context

Two field surveys undertaken pre- and post-wet season (5–12 December 2007 and 27 May – 3 June 2008) conducted at sites upstream of, within, and downstream of the proposed dam identified a diverse aquatic flora community, with 17 genera of macrophytes (between 2 and 14 species at any site) recorded in the pre-wet season. Macrophyte coverage was highest at off-stream waterbodies (including off-stream natural wetlands and constructed farm dams) during both pre- and post-wet season surveys, with *Cyperus* spp. sedges (emergent) the most common or widespread macrophyte. In a regional context, chapter 12 of the EIS noted aquatic flora communities within the Connors River are diverse compared with other waterways in the Fitzroy (River) Basin.

For the pipeline study area, one field survey was undertaken in the post-wet season (27–31 October 2008) to describe the aquatic flora present in the freshwater habitats crossed by the pipeline route. Fewer genera (nine) were recorded in the pipeline study area.

No aquatic flora species or communities listed under NC Act or the EPBC Act were recorded from, or are likely to occur in, the study area (dam and pipeline).

Paragrass (*Urochloa mutica*) was the only exotic macrophyte recorded in the dam study area. No exotic macrophytes were observed within the pipeline study area. Exotic terrestrial species were recorded on the lower banks within the study area—these are discussed further in subsection 5.4.5 of this report.

Phytoplankton species richness and abundance is generally low in the Fitzroy Basin. However, cyanobacteria (blue-green algae) blooms regularly occur, particularly in late winter to summer. Conditions favourable to cyanobacterial growth in the region include a range of turbidity levels, high pH, high nutrients, and lower flows towards the end of the year.

The EIS concluded the current state of aquatic flora in the study area of the dam and pipeline is likely to be essentially similar to the natural (pre-settlement) state. This is in contrast to aquatic flora elsewhere in the Fitzroy (River) Basin, which is currently impacted by existing impoundments, flow regulation, and non-water resource developments.

Potential impacts—construction

Dam and surrounds

Aquatic flora may be lost from the inundation area due to:

- direct physical disturbance during construction
- inundation of macrophytes by deep water during the filling phase
- sedimentation and turbidity caused by construction activities (reducing the amount of light entering the water and thereby inhibiting the aquatic flora growth)
- changes in water quality in the inundation area during the filling phase

- introduction of weeds and contaminant spills during construction.

The aquatic flora and fauna sub-plan of the draft CEMP (Appendix 4, section 29.9.10) contains a range of measures to mitigate potential impacts, including the implementation of current best practice sediment and erosion control measures to reduce risks associated with the spillage of fuels and other contaminants.

In particular, detrimental impacts to macrophyte growth during the filling phase will be reduced by:

- physically removing vegetation from within the footprint before filling
- preventing stock from accessing the inundation area and waterways in the upstream catchment
- identifying and prioritising areas of erosion in the dam's catchment, and rehabilitating these areas by replanting and restoring vegetation.

While disturbing aquatic flora during construction and filling is unavoidable, large areas of aquatic flora habitat will remain within the project area post-construction.

Aquatic flora to be lost during construction of the dam is comprised of common species with widespread distribution (refer to Table 12-1 of the EIS). These species are expected to colonise the inundation area, and no species of conservation significance will be affected. Accordingly, with mitigation measures in place, residual impacts to aquatic flora resulting from the construction of the dam component of the project are expected to be minimal.

Pipeline and associated infrastructure

Construction of the pipeline and associated infrastructure has the potential to impact aquatic flora through:

- the direct loss of a small proportion of aquatic flora at waterway crossings
- changes to water quality, erosion and sedimentation and flow regimes surrounding pipeline and causeway crossings
- fuel and oil spills

The EIS identifies the impact of pipeline placement and causeways on aquatic flora communities to be low, as crossings constitute a relatively small total area of waterways, existing macrophyte cover is scarce, and much of the habitat comprises intermittent dry areas with occasional intermittent or perennial pools.

Potential impacts will be effectively managed and mitigated by implementing the project's CEMP, including:

- erosion and sediment control (Appendix 4, section 29.9.3)
- rehabilitating both temporary and permanent watercourse crossings (Appendix 4, section 29.9.8)
- implementing best practice fuel handling and storage in accordance with the Australian Standard AS 1940 (2004) (Appendix 4, sections 29.9.7 and 29.9.16).

Resource extraction, particularly sand extraction, may reduce habitat availability for marcrophytes through the direct removal of habitat. Such impacts are expected to be localised, temporary and therefore minimal. Impacts will be further reduced by

undertaking extraction during the dry season and implementing appropriate stormwater, erosion and sediment control measures.

With mitigation measures in place, residual impacts to aquatic flora resulting from the construction of the pipeline and associated infrastructure are expected to be low.

Potential impacts—operation

Key potential impacts on aquatic flora arising from the operation of the project (dam and pipeline) include:

- change in aquatic flora community composition in, and downstream of, the water storage area
- blue-green algae bloom in the water storage area
- colonisation of exotic aquatic flora within the water storage area
- translocation of aquatic flora through the operation of the pipeline.

Filling of the water storage area, fluctuating water levels and a change in the downstream flow regime are expected to change the community composition of aquatic flora. As mentioned above, species present in the dam study area are likely to colonise the water storage area as each of the species currently present can live in a range of habitats. However, the relative abundance of each species in the community may change due to the altered environmental conditions (for example, floating species may be relatively more abundant than they are currently as the dam will moderate flushing effects relative to those floating macrophytes that typically are abundant in/inhabit downstream riverine environments).

Potential impacts will be reduced by implementing the draft OEMP (Appendix 4, section 29.10.2), which includes:

- minimising fluctuations in water levels
- releasing water to meet requirements of the Fitzroy ROP and otherwise mimicking natural patterns of flow
- avoiding sudden changes in the volume of water discharged from the dam.

The trapping of nutrients and thermal stratification in the inundation area may result in blue-green algae blooms. As indicated in Section 5.2, Sunwater will manage upstream inputs to decrease nutrient and turbid inputs into the dam where possible, such as the rehabilitation of riparian vegetation and restricting cattle and recreational user access to the riparian zone. An appropriate monitoring program will be developed and implemented as part of dam's operation and will include cyanobacteria (blue-green algae) sampling in addition to other parameters such as nutrients, temperatures and the occurrence of stratification. Sunwater may also implement event-based monitoring to better understand the inflow of contaminants into the dam and to monitor the success of catchment management practices.

The likelihood and severity of blue green algae blooms is not expected to increase downstream of the dam as flow releases from the dam will maintain low flows in order to meet relevant Fitzroy WRP EFOs.

Creating a large open body of water has the potential to facilitate the colonisation of exotic aquatic flora in the dam. The inundation area will provide suitable habitat for exotic species. Once introduced, exotics can out-compete native species. Only one exotic macrophyte (Paragrass) was recorded in the study area, however a range of other introduced macropyhtes are present in the catchment. Seeds may be introduced into the catchment by extreme weather events or by attachment to waterfoul, boats or fishing gear.

The risk of colonisation of the dam by exotic species will be reduced by implementing the draft OEMP which includes the preparation of a WMP (Appendix 4, section 29.10.8). Specific operational management measures include:

- weed inspection across the project area, targeting vegetation management options and water storage area edges, to identify the density and distribution of weed infestations
- weed control of new and existing weed infestations. Control methods may include physical (e.g. machinery), chemical (e.g. herbicides) or cultural (e.g. replanting of native species) controls. Specific control methods for all identified weeds in the project area will be identified in the WMP
- weed monitoring (density and distribution) of weeded areas to determine effectiveness of treatments and identify areas requiring additional controls.

Operation of the pipeline could also result in exotic aquatic flora being drawn into the pipeline and transferred along its length into the receiving environment. Sunwater commits to regular monitoring and developing management measures (such as the screening of offtakes) in the event that exotic flora species colonise the dam (Appendix 4, section 29.10.2).

With mitigation measures in place, residual impacts to aquatic flora resulting from the operation of the project are expected to be minimal.

Cumulative impacts

As discussed in subsection 5.1.3 of this report, the cumulative impacts of existing and proposed (Connors River Dam, Nathan Dam and Lower Fitzroy Weirs) water infrastructure on flows in the Fitzroy (River) Basin have been modelled and assessed. Fitzroy WRP 1999 EFOs (including seasonal baseflow, first post-winter flow and medium to high flows) will be met in most cases, and where they are not met initially, dam operational strategies will be revised to ensure that they are met (at least in the case of mandatory flow objectives).

Accordingly, no discernable cumulative impacts to flow are expected in the Fitzroy River or downstream, and the proposed dam is not expected to impact on the water quality or sediment impact of the Fitzroy Estuary. Significant cumulative impacts on estuarine and marine flora, including the Great Barrier Reef and the Shoalwater and Corio Bays Area Ramsar site, are not expected (refer to section 7.7 of this report for more information).

Construction of the proposed water infrastructure will result in a greater proportion of pool habitat in the Fitzroy (River) Basin, at the expense of habitat such as runs, glides, riffle and backwater. This is likely to result in a shift in community composition in the

affected reaches and a reduction in the extent of these habitat types within the Fitzroy (River) Basin, perhaps significantly reducing the extent of available habitat for habitat-specialist species. However, the EIS concluded that cumulative impacts of these developments are not expected to result in an overall reduction in aquatic flora diversity in the Fitzroy (River) Basin (through, for example, regional extinctions).

Coordinator-General's conclusions

Based on the risk assessment provided in the EIS, the Coordinator-General is satisfied that impacts relevant to aquatic flora can be effectively managed and the residual impacts are acceptable.

To ensure the implementation of appropriate sediment and erosion controls, the Coordinator-General has stated a condition (Appendix 1, Schedule A, Condition 4) which will require the inclusion of additional requirements in the SECP for both construction and operation of the project.

5.5.3. Aquatic fauna

Context

The Connors River and the major tributaries in the proposed dam and surrounds study area are characterised by run and pool habitat, with occasional glide, backwater and riffle habitat. Isolated pools of the river and tributaries within the proposed water storage area provide refuge habitat for aquatic fauna in the dry season.

Baseline surveys conducted for the EIS determined the aquatic fauna community in the project study area to be diverse, comprising primarily common and widespread taxa. No introduced or exotic fauna species were recorded from within the proposed dam and surrounds study area, although they are known to occur elsewhere in the Fitzroy (River) Basin. While the composition of fauna communities in the study area is likely to be altered from the natural state, in the context of the Fitzroy (River) Basin, the degree of alteration is considered to be minor.

Aquatic fauna in the study area is currently not impacted by impoundments or flow regulation but is impacted by non-water resource development (land clearing and cattle grazing). However based on the results of a literature review[40] and baseline surveys, the EIS found the magnitude of such impacts within the study area to be lower than for other more highly developed catchments in the Fitzroy (River) Basin.

The Fitzroy (River) Basin has high conservation value with respect to freshwater turtles, due to the high degree of biodiversity endemism[41]. Accordingly, freshwater turtles were the subject of a targeted survey effort to inform the EIS, comprising three surveys to identify freshwater turtles upstream, within and downstream of the proposed water storage area (the first survey during the 2007 dry season, the second during a post-wet season event in November 2007 and the third in August 2008 during the pre-wet season).

Four of the six freshwater turtles species known to occur in the Fitzroy catchment were recorded within the study area, including *Emydura krefftii* (Krefft's river turtle), *Chelodina longicollis (*eastern long-necked turtle), *Wollumbinia latisternum*

*(*saw-shelled turtle*) and Elseya albagula (w*hite throated snapping turtle). The white-throated snapping turtle is a high priority for conservation in DERM's species prioritisation framework. Although listed as 'least concern' in Queensland under the *Nature Conservation (Wildlife) Regulation 2006*, the species is currently being prepared for listing as an endangered species under the NC Act.

In response to DERM and SEWPaC comments on the EIS and the SEIS, additional freshwater turtle surveys were undertaken in August 2010 and October 2011. The August 2010 survey was undertaken during a period of better water clarity which allowed snorkelling, spotlighting and the use of underwater video. This survey confirmed the presence of the Fitzroy River turtle (*Rheodytes leukops*), listed as 'vulnerable' both in Queensland and nationally under the EPBC Act, within and downstream of the proposed inundation area. While no species were recorded upstream of the inundation area, suitable habitat (including nesting banks) was identified within many of the more substantial reaches surveyed (stream order[42] 4 or greater).

The October 2011 survey was undertaken from the base of the proposed dam wall on the Connors River, to the Funnel Creek confluence approximately 46.1 km downstream of the proposed dam wall. This survey found significant numbers of Fitzroy River turtle (92 captured and a further 90 sighted), comprising a large number of females in breeding condition. The increased survey effort has resulted in the expanded known distribution of the Fitzroy River turtle.

During the wet season, the Fitzroy River turtle and white-throated snapping turtle use cloacal ventilation to undertake long dives in productive shallow flowing waters to feed upon plant material (macrophytes, algae and fallen material from the riparian zone) to build energy reserves for reproduction. During the dry season both species retreat to deeper sections of pool habitats, or even isolated water holes, adjacent to riffle zones[41]. Nesting of the Fitzroy River turtle generally occurs between September and March (coinciding with the wet season), while nesting of the white-throated snapping turtle occurs between March and September. Nest disturbance and predation by feral pigs, foxes and goannas represents the biggest threat to both species, along with pollution and modification of riparian vegetation.

No other aquatic fauna species or communities listed under the NC Act or EPBC Act were recorded from, or are considered likely to occur in, the project study area.

Platypus (*Ornithorhynchus anatinus*) was observed during the terrestrial fauna surveys at the Connors River near the proposed inundation area. Impacts to platypus are addressed in section 5.4.7 of this report.

A total of 25 fish species and 15 families (11 148 fish) were caught during pre- and post-wet season surveys. The most diverse families were gudgeons, eel-tailed catfishes, and grunters, while the most abundant species (accounting for 83 per cent of the total catch) were small-bodied fishes including Midgley's carp gudgeon, eastern rainbowfish, Agassiz's glassfish and fly-specked hardyheads.

Potential construction impacts

Key potential impacts to aquatic fauna likely to arise during construction of the project include:

- direct physical impacts to fauna and/or habitat
- degraded downstream water quality
- creation of mosquito and biting midge breeding sites.

Direct physical impacts to fauna and/or habitat

All aquatic fauna habitat between and under the coffer dams and the dam construction area will be lost upon commencement of construction. The diversion channel will connect to the river both upstream and downstream of the coffer dams and construction of the links will disturb the banks of the watercourse. While the diversion channel will not be designed specifically to allow for fauna movement, the draft construction EMP (Appendix 4, section 29.9.10) specifies that physical structures such as boulders or logs must be included within the channel to provide rest areas for fauna that may use the channel as a movement conduit.

During dam wall construction, aquatic fauna may also be impacted by falling water levels (and therefore available habitat) through the extraction of water from the Connors River upstream of the construction site. Fauna may also become trapped in the inlet pipe if approach velocities exceed the swimming capability of the fauna present. The impact of water extraction from the Connors River will be minimised by implementing the following mitigation measures identified in the draft construction EMP (Appendix 4, section 29.9.10):

- storing water during the wet season to reduce the effects of drawdown in Connors River during the dry season (the spoil from the diversion channel could potentially construct an off-stream storage in the proposed inundation area)
- extracting water from the largest pool possible
- extracting water at a slow and steady rate
- fitting floating booms to the water supply inlet pipe with a protective cage to prevent fauna entrapment.

Physical disturbance will also occur within the inundation area, with the felling of all trees and shrubs in riparian zones with the exception of those within 1.5 metres vertical of full supply level (FSL).

The overall impact of pipeline placement on aquatic fauna communities is considered to be low, as pipeline crossings constitute a relatively small total area of the watercourses and much of the habitat consists of intermittent dry areas with occasional intermittent or perennial pools. As indicated in subsection 5.1, pipeline crossings and rehabilitation will predominantly occur in the dry season before significant flows occur.

Sand extraction for the pipeline will directly remove sand from the stream bed, thereby removing habitat. Under the provisions of the *Water Act 2000*, Sunwater must obtain a Quarry Material Allocation Notice (QMAN) and a development permit (operational works) for the removal of quarry material from a watercourse. The Coordinator-General has recommended conditions of approval for inclusion in a future development

permit (Appendix 2, Part 2, Recommendation 6). In particular, no quarry material shall be removed from nesting areas used by the Fitzroy River turtle and white-throated snapping turtle.

Each sand extraction site will also disturb the riparian zone for access track plus clearing of stockpile and works areas on nearby land. By implementing appropriate sediment and erosion controls, including dry bed extraction, re-shaping the stream bed to minimise slope change and angles, and managing sand extraction to prevent impacts to all turtle nesting sites, impacts are expected to be localised and relatively minor.

Direct impacts to larger aquatic fauna (fish, turtles, platypus) will be minimised through the capture and translocation of these species within the dam construction footprint prior to works commencing (refer to Appendix 4, section 29.9.10: aquatic flora and fauna sub-plan).

Translocation of fish will be in accordance with QPIF fish salvage guidelines[43] and traps used to capture turtles will be designed to allow turtles access to the surface to breath. Macroinvertebrates present in the area will essentially be lost, however any prawns or shrimp captured in nets will be relocated along with the larger fauna.

Degraded downstream water quality

Vegetation clearing, earthworks, pipeline watercourse crossings and constructing other associated infrastructure near watercourses may cause a temporary increase in suspended sediment loads entering adjacent and downstream watercourses. Unmanaged, this could result in increased turbidity and smothering of benthic habitat. High turbidity is directly harmful to some aquatic fauna, as fine suspended sediments in the water column can clog the gills of fish and filter feeding invertebrates, preventing respiration, and visual foragers can have difficulty feeding. Turbidity can also indirectly impact aquatic fauna by reducing the amount of light entering the water, which inhibits the growth of aquatic flora (refer to section 5.5.2 of this report).

As outlined in subsection 5.1, Sunwater will implement a SECP, which will be detailed in the CEMP for the project (refer to Appendix 4, section 29.9.3). The SECP will be designed in accordance with IECA guidelines[44] to significantly reduce the potential for additional sediment to enter watercourses.

Creation of mosquito and biting midge breeding sites

The draft CEMP (Appendix 4, section 29.9.10) provides for the following measures to minimise the creation of mosquito and biting midge habitat during construction:

- minimising the area of standing water, and ensuring drainage within four days, where practical
- profiling to ensure sufficient drainage
- routinely filling incidental depressions and holes that may hold standing water
- regularly cleaning drainage lines to ensure the continued flow of water
- constructing dams and water storages, intended to contain stormwater and wastewater, with steep edges in order to minimise the extent of shallow water (potential breeding habitat).

Potential impacts—operation

This section provides an evaluation of the following potential impacts which may result from the operation of the proposed dam and pipeline:

- degraded water quality during the filling phase
- change in aquatic fauna habitat in the water storage area
- impacts to aquatic fauna movement/migration due to the proposed dam wall
- change in aquatic fauna habitat downstream of the water storage
- indirect impacts to aquatic fauna due to changes in water quality
- colonisation of exotic aquatic fauna
- cumulative impacts to aquatic fauna (Connors River Dam combined with existing water infrastructure and the proposed Nathan Dam and Lower Fitzroy Weirs projects).

Impacts to aquatic fauna listed as rare, threatened or endangered, or high priority conservation species—namely the Fitzroy River turtle and white-throated snapping turtle—have been addressed, where appropriate, in this section.

Degraded water quality during the filling phase

As discussed in subsection 5.2, water quality is likely to be temporarily degraded as the dam fills. The greatest risk to aquatic fauna is likely to be low levels of dissolved oxygen in the water storage area, which could impact on aquatic fauna populations and potentially lead to fish kills. Sunwater advises the operational strategy for the filling phase will be developed with the aim of maximising the potential for a rapid fill—ecological impacts will be minimised if the storage fills rapidly and reaches its 'mature' operational state as quickly as possible.

Change in aquatic fauna habitat in the water storage area

Operation of the dam will result in the inundation of approximately 9.7 km of the Connors River (to the junction of Collaroy and Whelan creeks) and the inundation of 41.6 km of major watercourses. Inundation will reduce habitat diversity, including the loss of run and pool habitat, with occasional glide, backwater, and riffle habitat. Once the water storage area is filled, the current coarse sediment (boulders, cobbles, pebbles and gravel) will be smothered in fines and sands, though some will remain in the shallow delta areas where streams enter the storage.

The majority of macroinvertebrates recorded from within the study area are not habitat specialists. Accordingly, few species are expected to be lost from the inundation area, other than riffle zone specialists, such as blackfly larvae and some caddisflies.

Similarly, as fish species recorded from within the water storage area are not habitat specialists, no fish species are expected to be lost due to operation of the dam. However, a change in habitat and sediment type may result in a shift in community composition and have a negative impact on some species typically associated with rocky substrates (such as marbled eels and sooty grunter). It may also result in the loss of spawning habitat for species which deposit eggs on gravel or hard surfaces, such as eel-tailed catfish, gudgeons and sleepy cod.

Inundation of riffle-pool habitat may reduce the area of foraging and nesting habitat available for the listed Fitzroy River turtle and white-throated snapping turtle. Limpus *et al.* (2007) identifies less diverse impounded habitat to have a lower carrying capacity for the species than un-flooded riffle-pool habitat. Notwithstanding this, both species are known to occur in existing impoundments in the Fitzroy River where only flooded pool habitats are available and nesting occurs on the banks of the water storage areas (Limpus et al. 2007). Accordingly, the proposed water storage area may be used by these species along with others which have been recorded in the study area.

Whilst a reduction in aquatic fauna habitat diversity within the proposed dam inundation area is unavoidable, the draft CEMP will require implementation of the following measures to minimise impacts:

- limiting vegetation clearing within riparian zones to within 1.5 metres (vertical) of the new FSL (refer to Appendix 4, section 29.9.8)
- minimising impacts on upstream riparian habitat to allow for recolonisation (refer to Appendix 4, section 29.9.10)
- salvaging appropriate material (e.g. trees) during vegetation clearing for use as 'large woody debris' (LWD) aquatic fauna habitat within the proposed dam inundation area (refer to Appendix 4, section 29.9.10). LWD provide important habitat for freshwater turtles (Limpus et al. 2007), support more diverse and abundant macroinvertebrate communities (which are prey for many of the fish found in the study area) and provide shelter for native fish species.

Sunwater will also manage the terrestrial zone around the impoundment to enhance nesting opportunities for freshwater turtles (particularly the Fitzroy River turtle and white-throated snapping turtle). Measures include:

- effective management of animal pests to reduce the loss of turtle eggs from predation (management of animal pests is further discussed in section 5.4.5 of this report)
- reduced grazing by stock to avoid damage to nesting habitat from trampling
- managing weeds to prevent them from blocking access to suitable nesting habitat for turtles (weed management is discussed in section 5.4.5).

With mitigation measures in place, the residual risk of changes in aquatic fauna habitat in the water storage area is expected to be low.

Impacts to aquatic fauna movement/migration due to the dam wall

Without mitigation, the dam wall presents a complete barrier to upstream fauna movement and an almost complete barrier to downstream movement. This may result in a reduction of genetic variability of aquatic fauna and associated in-breeding issues.

As indicated in section 2, an aquatic fauna transfer device (or 'fishway') designed to maintain passage and minimise injury, death and entrapment of aquatic fauna has been included in the design of the dam wall. In accordance with a condition stated by the Coordinator-General regarding a development permit required for waterway barrier works (Appendix 1, Schedule D), the detailed design of the fishway will be finalised following further consultation with relevant agencies and will generally be in

accordance with the DEEDI (Fisheries Queensland) Fish Passage Design and Implementation Process set out in of this report.

Although unlikely to provide the same efficiency of movement as would be the natural state, opportunity for fish movement will be maximised by ensuring the device operates from Minimum Operating Volume through to when the dam is spilling. As the preliminary operational strategy of dam overcompensates slightly in the low flow range with these releases largely passing through the fishway, greater opportunity will be also provided for fish movement in terms of times the river flows. This means fish will be able to pass the dam when the drying river naturally provides barriers.

Fishways have traditionally been less successful in providing adequate passage for turtles, which prefer to walk upstream rather than use fishways and as such, are unlikely to use the fishway in significant numbers. Notwithstanding this, recent monitoring data from Paradise Dam on the Burnett River (QPIF, 2009[45]) shows that the upstream fishway is catering for significant numbers of some turtle species. This potential impact is of importance given the habitat requirements of cloacal ventilating turtles such as the Fitzroy River turtle, which move between riffle and pool habitats during the dry and wet seasons.

The current downstream preliminary design of the fishway has incorporated advice from DERM experts. Sunwater commits to continued consultation with DERM experts as part of developing the detailed fishway design in order to maximise turtle passage opportunities and minimise the potential for physical damage (refer to Appendix 4, section 29.10.2). The fishway will include pit tag readers to easily monitor turtle movement.

Sunwater notes in section 13.1.2 of the SEIS that while it is likely effective transfer will result from the detailed fishway design process outlined above, if monitoring shows this is not the case, effective short term transfer and genetic mixing could be achieved by simple catch and carry techniques.

If monitoring indicates the species are aggregating near the dam wall but are not using the fish transfer device in significant numbers, or in the event the fishway is non-operational for a period of greater than two weeks during the nesting or egg hatching season of the Fitzroy River turtle, the Coordinator-General has imposed a condition (Appendix 3, Condition 2 and the Fitzory River turtle Species Management Program rquirements set out in Appendix 6) requiring the capture and transfer of Fitzroy River turtles to release points to be determined in consultation with DERM. The number of individuals to be transferred, their sex and condition must also be determined in consultation with DERM. Transfer must continue on one day per fortnight during these periods.

In addition to the operation of the fishway, water will also exit the dam via the multi-level offtake structure or over the spillway when the volume in storage exceeds FSL.

Operation of offtake structures may result in the entrapment of aquatic fauna in the offtake and outlet works. Screens covering the multi-level offtake will direct large fish and turtles towards the fishway entrance, however some small fish may still enter the offtake. Some of these fish may survive if returned to the river with environmental flows, but fish will die if diverted to the pumping station.

High volume water releases may also result in injury or death to turtles passing through, or aggregated at, or within the downstream side of outlet structures. To mitigate potential impacts, Sunwater commits to excluding turtles from outlet structures which produce high velocities, reducing the velocity of high volume water release events and gradually increasing the rate of water release from outlet structures.

In its submission on the EIS, DEEDI (Fisheries Queensland) argued against the use of stepped spillways due to the risk of injury and mortality to fish, and requested Sunwater identify measures to mitigate stepped spillway impacts and prevent fish contact with dissipaters and the stilling basin.

In response, Sunwater replaced the originally proposed stepped spillway with a smooth spillway and, as part of detailed design, will develop the design of the stilling basin and energy dissipation device, cognisant of advice provided by DEEDI and DERM to reduce potential impacts to aquatic fauna.

With mitigation measures in place, the residual risk of impacts to aquatic fauna movement/migration due to the dam wall is expected to be minimal. The exception lies with freshwater turtle species. Sunwater has offered a direct offset to compensate for residual impacts to freshwater turtles—specifically the Fitzroy River turtle (refer to page 118 below).

Change in aquatic fauna habitat downstream of the water storage area

The most significant changes in aquatic fauna habitat are expected immediately downstream of the dam wall. As described in section 5.1.3, a slight overcompensation in low flows is expected immediately downstream of the dam wall, extending the period of time riffle zones downstream of the dam will be available to aquatic fauna for foraging purposes. The low flows will also help contribute to maintaining water quality within the deeper pools which, during zero flows, will become a refuge for both fish and turtles (in particular, the Fitzroy River turtle and white-throated snapping turtle).

The predicted reduction in the number and frequency of floods during spring and early summer has the potential to influence migratory or breeding cues for some aquatic fauna (particularly fish). The EIS notes this is a typical impact of water storages and the FPWFE release was included in WRP's to mitigate this impact.

As described in section 5.1.3, the FPWFE for this project will occur between 1 October and 30 April and will be triggered by flows into the dam equivalent to 1 metre above 'cease to flow' at Mount Bridget. Inflows to the proposed dam will then be released for 14 days (capped at the maximum outlet capacity of 1300 ML/day). The flow level of the FPWFE is such that it will only affect the lower levels of sand banks. Accordingly, the FPWFE is unlikely to impact on nesting habitat for freshwater turtles (in particular, Fitzroy River turtles which lay eggs predominantly in September/October). Along with the block release strategy for irrigation allocations, the two strategies are expected to substantially mitigate potential impacts to aquatic fauna.

As identified in section 5.1.3, the downstream extent of this impact is likely to be limited to the confluence of the Connors River with Funnel Creek (approximately 46.1 km downstream of the proposed dam wall), with impacts to existing flow regimes beyond this point predicted to be minimal. Further, all mandatory and most non-mandatory

EFOs specified within the Fitzroy WRP 1999 can be met with the proposed dam in place. In particular, mandatory FPWFE performance indicators will be achieved for all locations (Yatton on Isaac River, Tartrus on Mackenzie River, and Eden Bann Weir and Fitzroy Barrage on Fitzroy River).

EFOs play an important role in ensuring the survival of aquatic fauna in the Fitzroy (River) Basin, including movement and migration cues. An evaluation of the performance of the Fitzroy WRP 1999 EFOs over a ten year period (DERM, 2010[46]) shows the EFOs are effective in achieving their ecological intent in the Fitzroy (River) Basin, including:

- top-up flows for downstream pools and waterholes
- connectivity for many fish and other aquatic species
- provision of flows for riffle-dependent taxa
- maintenance of good water quality during periods of low flow
- delivery of food and nutrients
- fish spawning and recruitment
- dispersal of fish and other organisms
- mixing and flushing of waterholes
- temporal diversity in aquatic habitats

Accordingly, no significant impacts are expected on estuarine and marine fauna (or fisheries productivity) beyond the Funnel Creek confluence, including in the Great Barrier Reef and Corio Bays Area Ramsar site (located approximately 619 km downstream of the proposed dam site – refer to section 7.7 of this report for more information).

With respect to Fitzroy River turtle nesting, while a reduction in the number and frequency of floods during spring/early summer will reduce the natural loss of nests, it may also potentially prevent the natural rejuvenation of nesting banks by allowing the establishment of vegetation. However, the SEIS also notes that as large flows will still pass the dam on a generally annual basis (refer to section 5.1.3), the rejuvenation of sand bars will still occur.

In the event nesting banks have not rejuvenated due to the expected reduction in the number and frequency of floods during spring and summer, as a precautionary measure Sunwater commits to monitoring changes in nesting banks downstream from the proposed dam, and where necessary, rehabilitating nesting banks which have not rejuvenated at significant nesting banks between the proposed dam and Cardowan (a known Fitzroy River turtle nesting site located approximately 16.8 km downstream of the dam).

The Coordinator-General has imposed a condition (Appendix 3, Condition 2 and the Fitzory River turtle species management program requirements set out in Appendix 6) which formalises and expands upon Sunwater's commitment. In particular, weeds or seedlings (including aquatic weeds which may prevent bank access) must be physically removed (without the use of herbicides) from significant nesting banks prior

to the Fitzroy River turtle nesting season each year in tributaries upstream, within and downstream of the water storage area to the Funnel Creek confluence (46.1 km downstream of the dam wall). Significant nesting banks has been defined as banks at which multiple nest sites are confirmed during the baseline and annual population surveys as conditioned by the Coordinator-General in Appendix 3, Condition 2. The nesting areas at which this occurs may not be the same each year, depending on the results of the annual population surveys.

With mitigation measures in place, the residual risk of adverse impacts to aquatic fauna habitat downstream of the water storage is expected to be minimal.

Indirect impacts to aquatic fauna due to changes in water quality

Construction, filling and operation of the proposed dam may result in changes to water quality which could indirectly result in the loss of and/or injury to aquatic fauna. The quality of water received downstream from a dam is dependent on whether the impoundment is stratified, whether there are blue-green algal blooms in the impoundment, and existing management measures to manage water releases.

As identified in section 5.2 of this report, the Surface Water Quality sub-plan contained in the draft OEMP (section 29.10.5 of the EIS and updated in Appendix 4) outlines a number of measures to mitigate potential impacts to surface water quality both within the dam and downstream during operation. Of particular relevance is vegetation clearing prior to filling, managing stratification in the water storage area and the use of a multi-level offtake tower to allow water of appropriate quality to be drawn from a suitable level within the dam to maintain existing conditions downstream.

With mitigation measures in place, the residual risk of indirect impacts to aquatic fauna due to changes in water quality is expected to be minimal.

Colonisation of exotic aquatic fauna

In response to comments on the EIS, section 13.3 of the SEIS acknowledges a risk of transfer of exotic fish species from boats using the water storage into the water storage area, when used as live bait by fishers or simply through the release of aquarium fish into the storage by members of the public.

As the catchment is currently free of pest fauna with very limited introduced aquatic flora, Sunwater has amended the draft EMP to strengthen surveillance and include educational signage to encourage thoughtful usage of the dam (Appendix 4, section 29.10.8). The SEIS notes it is practically impossible to stop deliberate release of aquarium specimens or the use of introduced fish species as live bait, despite these activities being illegal.

Cumulative impacts to aquatic fauna

As discussed in subsection 5.1.3 of this report, the assessment of cumulative impacts of existing and proposed water infrastructure (Connors River Dam, Nathan Dam, and Lower Fitzroy Weirs) on flows in the Fitzroy (River) Basin shows the Fitzroy WRP 1999 EFOs will be met in most cases, and where they are not met initially, operational strategies will be revised to ensure they are met (at least in the case of mandatory objectives).

Therefore the assessment of impacts to movement and migration cues for fauna in the Fitzroy River (downstream of the confluence of the Dawson River, and in the reaches affected by the proposed weirs) is consistent with that described for the Connors River Dam project in isolation—that is, no major disruption of cues or impacts to estuarine and coastal fisheries productivity are expected due to the cumulative impacts of proposed water infrastructure.

Construction of the proposed water infrastructure will result in a reduction of run, glide, riffle and backwater habitat for aquatic fauna. Whilst this is likely to result in a reduction of biodiversity and a shift in community composition in affected reaches, the cumulative impacts of these developments is not expected to result in an overall reduction in aquatic fauna diversity in the Fitzroy Basin (through, for example, regional extinctions).

Construction of the proposed water infrastructure will also result in a greater number of physical barriers to aquatic fauna movement and migration in the Fitzroy (River) Basin. Where each barrier is fitted with an effective fishway, the cumulative impacts to most aquatic fauna are expected to be minimal and acceptable. This will need to be confirmed by the impact assessment process for each project (e.g. Nathan Dam and Lower Fitzroy Weirs) as details of design and operation become available.

However, as identified above freshwater turtles are unlikely to use fishways in significant numbers. Accordingly, Sunwater has proposed an indirect offset to compensate for potential for cumulative residual impacts on the species (refer below).

Monitoring program and offsets—Fitzroy River turtle

Monitoring

Sunwater commits to monitor the above-mentioned potential impacts to the Fitzroy River turtle (i.e. changes in habitat structure, flow regime, population fragmentation) and the effectiveness of corresponding mitigation strategies. Final design of the monitoring program will be developed in consultation with DERM and SEWPaC, and as a minimum monitoring will include:

- recording the sex and number of individuals moved, and where they were moved to, during the translocation from the construction area. Individuals will be pit tagged using DERM approved techniques
- annual population surveys will be undertaken during the nesting season in each tributary which supports suitable habitat upstream of the inundation area, within the inundation area, and downstream as far as Cardowan (approximately 16.8 km downstream of the dam wall) to assess the population and likelihood of nesting. All individuals captured will be pit-tagged. Results will be assessed with respect to the monitored flow regime, dam water levels, fishway evaluations and changes over time
- if nesting is observed within the dam catchment, the nests will be protected from predators using mesh cages (as used in the Fitzroy Barrage and Mary River) and the site will be inspected for evidence of hatching at the appropriate time
- use of the fishway and any other specific turtle movement process will be monitored and reported

- offtakes, outlet structures and the spillway will be inspected for evidence of injury to or death of turtles. If evidence suggests the design of screens, stilling basin or outlet structures can be improved to avoid or minimise such instances, feasible and practical modifications will be undertaken as corrective action.

Direct offsets

In recognition of potential residual impacts to the Fitzroy River turtle, Sunwater is offering a direct offset in two geographically distinct areas—upstream and downstream of the proposed dam. The offset involves the protection and management of 70 km (500 ha) of riverine and riparian habitat downstream of the proposed dam wall along the Connors River (within 50 metres of the high water mark) which is known or likely to support the species. The offset areas are restricted to substantial reaches (watercourses classified as stream order[47] 4 or higher) as the species has not been found in smaller watercourses in this area and is generally acknowledged as a species that requires permanent watercourses.

Upstream of the dam, suitable habitat for the species was found on the Ridgeland, Undercliff and Collaroy properties (Appendix D6 of the SEIS). Offsets are proposed on these properties are shown in Table 5.10 and Figure 5.10, Figure 5.11, and Figure 5.12. The length of river upstream of the dam at FSL included in this offset is approximately 24 km. As identified in section 2 of this report, Sunwater has already acquired these properties.

Sunwater is also proposing to provide an additional 45 km of offsets at a privately owned property (referred to as 'Property A') located on the Connors River downstream of the dam—preferably located within reasonable proximity to the Funnel Creek confluence with the Connors River. Offsets in this location would be contiguous to the 70 km of offsets immediately downstream of the dam wall and extend the length of river within which habitat protection and/or management actions will be undertaken. Fitzroy River turtles have been found at most sites sampled as far downstream as Funnel Creek and also at Tartrus Weir on the Mackenzie River[48].

Management measures would include reduction of grazing pressure (primarily through seasonal exclusion of cattle from nesting areas), weed and feral animal control.

Table 5.10 Stream order lengths associated with direct offsets for Fitzroy River turtle

Stream Order	Undercliff (km)	Ridgeland (km)	Collaroy (km)	'Property A'* located on the Connors River downstream of the proposed dam (km)
4	6.96	5.48	2.20	To be determined
5	5.43	-	3.71	To be determined
6	-	-	-	To be determined
7	-	-	-	To be determined
Total	12.39	5.48	5.91	Approximately 45

* yet to be identified, negotiated and agreed with landowner

Figure 5.10 Proposed Fitzroy River turtle offsets on Undercliff

Figure 5.11 Proposed Fitzroy River turtle offsets on Ridgeland

Figure 5.12 Proposed Fitzroy River turtle offset on Collaroy

Indirect offsets

In recognition of the potential for residual cumulative impacts to the Fitzroy River turtle, and given Sunwater is the proponent or joint proponent for three proposed projects in the Fitzroy catchment (Connors River Dam, Nathan Dam and Lower Fitzroy Weirs), Sunwater has committed $100,000 per annum per project for five years ($500,000 per project) towards a catchment wide research and monitoring program. Program research would be directed at both ecological parameters (e.g. distribution, abundance, location of nesting areas) and at practical means to reduce the impact of existing and proposed water infrastructure. The design of the program would be formulated via discussion with SEWPaC, DERM and relevant researchers, and would be linked with the funding to the existing Fitzroy (River) Basin Association regional Natural Resource Management plan and Central Queensland University research programs.

Sunwater has also approved $4 million from the State Government's dividend reinvestment scheme towards the design, construction and monitoring of a turtleway prototype to facilitate turtle movement through man-made barriers. Tartrus Weir will be used to develop a turtleway prototype, which will be followed by a two year period of monitoring. The approved project is not specific to Fitzroy River turtles but will be undertaken in the Fitzroy catchment.

Whilst not directly relevant to this project, the results will be used to inform the design of turtle transfer facilities on any further dams or weirs within the Fitzroy (River) Basin and enable informed retrofitting to existing water infrastructure.

Coordinator-General's conclusions

The Coordinator-General notes the high conservation value of the study area with respect to freshwater turtles—in particular the cloacal ventilating Fitzroy River turtle ('vulnerable' listing, NC Act and EPBC Act) and white-throated snapping turtle (a high priority species for conservation which may soon be listed as 'endangered' under the NC Act).

The Coordinator-General recognises water infrastructure such as dams and weirs, as well as non-water infrastructure such as road crossings, can impede the upstream and downstream movement of freshwater turtles—particularly as these species move between habitats during the dry and wet seasons. Further, Limpus et al[49] finds cloacal ventilating turtles are the most negatively impacted by impoundments as they have life histories linked with well-oxygenated riffle zones, which become inundated by impoundments. The Coordinator-General notes this to be of particular importance for this project given aquatic fauna within the study area are not currently impacted by impoundments or flow regulation, with the nearest man-made barrier being Tartrus Weir on Mackenzie River approximately 100 km downstream of the proposed dam.

The Coordinator-General acknowledges the range of measures identified in the EIS and the SEIS to mitigate potential impacts to the Fitzroy River turtle and recognises Sunwater's commitment to implement an ongoing research monitoring program to

evaluate the effectiveness of mitigation as well as the provision of direct (land-based) and indirect (research-based) offsets.

The Coordinator-General has imposed a condition (Appendix 3, Condition 2) to formalise, and in some cases expand upon, measures to mitigate direct and cumulative impacts to the Fitzroy River turtle. Given the pending 'endangered' conservation status of the white-throated snapping turtle and its similarity to the Fitzroy River turtle (i.e. cloacal ventilation), the Coordinator-General requires the mitigation/monitoring programs developed to address the impacts to the Fitzroy River turtle be expanded to address impacts to this species.

In its submission on the SEIS, DERM indicated that more baseline information on the presence and abundance of Fitzroy River turtle and white-throated snapping turtle populations (and associated nesting sites) is required to inform the proposed research and monitoring program, and allow for the adequate protection and enhancement of both species and their habitat during operation of the project.

Accordingly, the Coordinator-General requires a comprehensive baseline study of Fitzroy River turtle and white-throated snapping turtle populations in each tributary upstream of the inundation area, within and downstream of the inundation area. The baseline study must: be conducted prior to the commencement of operation (for a period of at least one year prior to the closure of the dam wall); establish a tagged population of both species; and document:

- estimates of annual nesting and recruitment
- evidence of injury and disease
- known or likely nesting areas, including nesting microhabitat, distance from and height above the water to nest
- estimates of predation and other losses of eggs at nesting areas.

The Coordinator-General notes changes to the downstream flow regime resulting from operation of the proposed dam will be limited to the confluence of the Connors River and Funnel Creek, approximately 46.1 km downstream of the proposed dam wall. However, the geographical extent of Sunwater's proposed annual population surveys is limited downstream as far as Cardowan, approximately 16.8 km downstream of the proposed dam wall.

Given monitoring results will need to be assessed with respect to (but not limited to) potential impacts associated with flow regime change, the Coordinator-General's condition requires that population surveys extend further downstream, beyond Cardowan, to the Funnel Creek confluence. In addition, the Coordinator-General requires that monitoring form part of a Species Management Program for the Fitzroy River turtle and white-throated snapping turtle (requirements of the Species Management Program are detailed in Appendix 6 of this report), and must include a reporting and corrective action regime to address impacts to these species' populations, habitat and passage upstream and downstream of the proposed dam.

Limpus et al suggests that, with a catchment-wide approach, "*it will be possible to reverse the negative impact of not only the new (water) infrastructure developments but to also compensate for cumulative impacts*".

Accordingly, to address predicted cumulative impacts in the Fitzroy (River) Basin catchment, the Coordinator-General has imposed a condition which requires Sunwater to prepare, in collaboration with DERM, SEWPaC and the Fitzroy Basin Association, a catchment-wide Conservation Plan for the Fitzroy River turtle and the white-throated snapping turtle pursuant to section 112(2) of the NC Act (Appendix 3, Condition 2(b)). The Conservation Plan must specify the research and management measures necessary to ensure the survival and natural development of the species' populations in the Fitzroy (River) Basin catchment, and will provide a planned and logical framework for key interest groups and responsible government agencies to coordinate their work to improve the condition of both species in the catchment.

A coordinated approach to the research and management of the Fitzroy River turtle and the white-throated snapping turtle is considered to be of particular importance given the other water infrastructure projects proposed in the Fitzroy catchment currently undergoing assessment (Nathan Dam and Pipelines and Lower Fitzroy Weirs projects).

In response to DERM and SEWPaC comments regarding the adequacy of Sunwater's proposed financial commitment to address cumulative impacts, and based on advice from DERM regarding the level of funding required to allow for continuity of staffing for this conservation work, the Coordinator-General requires Sunwater to increase the financial contribution for this project from $100,000 to $250,000 per year for five years into a fund administered by the DERM. The funding must commence on the date of adoption of the Conservation Plan and shall be used to implement the research and management measures identified in the adopted Conservation Plan (Appendix 3, Condition 2(b)(iii)).

The Coordinator-General acknowledges Sunwater's financial commitment of $100,000 per year for five years is also applicable to other water infrastructure projects proposed in the Fitzroy (River) Basin catchment, including Nathan Dam and Lower Fitzroy Weirs. However, given both projects are undergoing assessment and are therefore yet to receive the necessary approvals, there is no certainty that these projects will proceed. In addition, in the event of all projects proceeding, the Connors River Dam, Nathan Dam and Lower Fitzroy Weirs projects will not be constructed simultaneously. Accordingly, Sunwater's identified financial commitment for a single project does not ensure adequacy or continuity of staffing.

Under the provisions of the *Water Act 2000*, Sunwater must obtain a development permit (operational works) for the removal of quarry material from a watercourse. The Coordinator-General has also recommended a condition (Appendix 2, Part 2, Recommendation 6) to ensure no quarry material is removed from Fitzroy River turtle and white-throated snapping turtle nesting areas, and that adequate information is provided with an application for a development permit to demonstrate no impact of turtle nesting areas.

Based on measures to mitigate impacts to aquatic fauna identified in the revised draft CEMP and OEMP for the project (Appendix 4), the proposed research and monitoring program, and offsets (direct and indirect) to address Fitzroy River turtle impacts, and the additional requirements imposed by the Coordinator-General to address direct and cumulative impacts to both the Fitzroy River turtle and the white-throated snapping turtle, the Coordinator-General is satisfied that impacts to aquatic fauna can be effectively managed and that the residual risks are acceptable.

5.6. Social and economic environment

5.6.1. Introduction

This section of the report addresses the social and economic impacts of the project on the local and regional communities that will be affected by the project. The social and economic impacts of the project include potential impacts to:

- levels of income and employment
- the distribution of income and wealth
- quality of life and the way people behave
- land use
- the landscape and visual amenity.

Submissions to the EIS raised a number of issues in relation to the social and economic impacts of the project, including:

- employment and training
- accommodation affordability
- land use and property management
- social infrastructure and community services.

The Coordinator-General has considered each of the submissions and how the SEIS responded to the issues raised in those submissions in evaluating the environmental effects of the project.

The social and economic impacts of the project and the issues raised by submitters are discussed in further detail below in this section of the report.

Context

Located in the northern Bowen (sedimentary) Basin, the area immediately surrounding the proposed project (the ‘project area’—which is a sub-area of the broader IRC local government area) is rural in nature and is characterised by a number of cattle grazing properties and coal mines, with the mining activity centred primarily around Moranbah to the west of the dam. The project area is shown in Figure 5.13.

Mining is the largest industry in the IRC local government area, with the Bowen Basin, supporting 47 operating coal mines that produce all of Queensland's high-

grade coking coal, and much of the export-traded thermal coal. These mines produced 180 million tonnes of saleable coal in 2009–10, representing 87 per cent of the state's total output, and directly employ around 29 550 full-time equivalent (FTE) positions (as at 30 June 2011).[50]

Settlement of the project area is characterised by the influence of the agricultural and mining industries, with the population dispersed over a number of property homesteads and centred around the project area's main towns of Nebo and Coppabella.

Nebo, the closest town located north-west of the proposed dam site, is a key service centre of the IRC and has a diverse range of community services and facilities which provide for the needs of the residents in the project area. Coppabella, which is on the pipeline route, has a limited range of community services and facilities, and largely caters for the surrounding mining industry.

The project area is located within the broader IRC local government area, which includes the towns of Moranbah, Clermont, Dysart, Glenden and Middlemount. While Moranbah is excluded from the project area, it is included in various discussions about socio-economic factors and influences as data for the project area is limited.

Nebo, Coppabella and Moranbah, with resident populations of 299, 538 and 7632 persons respectively in June 2007, provide a number of services and facilities that support the surrounding properties and mines within the project area. The town populations are supplemented by large, in comparison to the resident population, non-resident worker populations of 690, 712 and 1700 persons, respectively. The EIS estimated the non-resident population of the geographic area to be 27 per cent of the resident population. This non-resident worker population is engaged exclusively in the mining industry.

A demographic profile of the project area community undertaken in the EIS indicated that the resident population decreased by 21 per cent between 2001 and 2006, while the population in the towns of Nebo and Moranbah increased by 17 per cent over the same period, reflecting the influence of the mining industry in the region. This influence is also evident in population age and gender distributions, with Moranbah having a lower median age and a higher proportion of males to females compared to Queensland as a whole.

The EIS noted that the project area displays lower levels of education (19.5 per cent, 2006) (represented by proportions of students attaining Year 12 or with tertiary qualifications) compared to Queensland as a whole (41.3 per cent, 2006). However, the study area displayed higher proportions of people with trade based certificates compared with Queensland as a whole, which is reflective of the predominance of trade based employment within the project area.

5.6.2. Local employment and local industry

Context

The rate of unemployment of 2.1 per cent in the geographic region is well below that for Queensland as a whole of 4.7 per cent. The lower unemployment rate is due to the employment opportunities provided by the mining industry as evidenced by employment statistics, which indicate that 39 per cent of the labour force is engaged in the mining industry, with agriculture, forestry and fishing the next largest industry employer at 10 per cent.

In the geographic region, mining represents 80 per cent of the regional output, while agriculture represents 7 per cent. The EIS noted that households in the study area had a higher median weekly income ($1198) than Queensland as a whole ($1033).

Potential impacts and mitigation measures

The project will have a number of positive impacts (direct and indirect) on employment with the generation of local and regional employment and business opportunities through the demand for labour and goods and services. However, these impacts will be temporary in nature as they are largely limited to the construction period.

It is estimated the project will generate direct employment opportunities for 620 workers during the 20-month construction period and up to eight workers over the 80–100 year operational life of the project. In addition, it is estimated that 4000 indirect jobs during construction and up to 19 indirect jobs during operations will be created as a result of the project.

The EIS estimated that construction of the project will contribute over $700 million in direct and indirect benefits to Gross State Product (GSP), while operation of the project will contribute an additional $9.5 million per annum in direct and indirect benefits to GSP.

Of the peak 620 construction jobs, 250 are estimated to be engaged in the dam construction, 300 in the pipeline construction, 35 in road construction, 25 in quarry activities (including site clearing and establishment) and 10 in sand extraction and early works.

These jobs require a range of skills, including professional staff (engineers, clerks, supervisors, foremen, soil technicians, environmental officers), plant and machinery operators, transport operators, form workers, reinforcement setting, concrete pouring and finishing, general labouring and trades (welding, electrical, plumbing, dogmen, riggers and drillers).

While the construction workforce will be sourced locally where possible, due to the low unemployment rate and the low availability of skilled workers, it is expected that the majority of the construction workforce will need to be sourced from outside the geographic region. Accordingly, Sunwater has assumed that 40 per cent of the total construction workforce (248 persons) would be employed on a fly-in fly-out basis, 40 per cent (248 persons) would be drawn from the nearby east coast region, primarily

around Mackay, and 20 per cent (124 persons) would be sourced from the immediate geographic region around Nebo and Moranbah.

To address the skills shortage and maximise local employment opportunities, Sunwater has committed to providing local training opportunities and meeting the requirements of the Queensland Government Building and Construction Contracts Structured Training Policy (10 per cent training policy) as part of the Social and Economic sub-plan of the draft CEMP (refer to Appendix 4 of this report).

The Queensland Government's Indigenous Employment Policy (IEP), which requires a minimum 20 per cent of total labour hours to involve Indigenous training, will apply to the project[51] and Sunwater has committed to preparing and implementing the IEP as part of the social and economic sub-plan of the draft construction EMP. However, due to the low level of cultural diversity in the project area (2.4 per cent of the 2006 population), Sunwater has committed to extending the application of the IEP to Mackay, a primary source of workers, where there is a larger Indigenous population.

Local and regional industries and businesses will benefit from the construction of the project through the supply of goods and services, such as construction materials, vegetation management, transport, agricultural land reinstatement and plant hire. However, due to the short construction period (20 months), the proposed use of temporary construction accommodation for the majority of the workforce, and the constraints imposed by a high employment rate and limited skills availability, the flow-on effects to the local economy are expected to be minor.

The Queensland Government's Local Industry Policy (LIP) is applicable to the project[52] and Sunwater has committed to preparing and implementing a local industry participation plan (LIPP) as part of the social and economic sub-plan of the draft construction EMP. The LIPP will provide fair and reasonable opportunity to local businesses to tender for the supply of goods and services to the project. Sunwater proposes to source construction materials locally, where possible.

5.6.3. Accommodation availability and affordability

Context

The EIS noted that in 2006 there were 375 occupied private dwellings in the project area, of which the majority were separate, detached houses.

The EIS indicated the housing and accommodation characteristics of the project area comprise a higher proportion of other dwellings (caravans, cabins, mine camp 'dongas' etc) and rented dwellings and a conversely lower level of owner occupiers when compared to Queensland as a whole. This is reflective of the two 950-person accommodation villages servicing the mining industry in Nebo and Coppabella.

Based on a private housing analysis undertaken by the Queensland Government in 2008, the EIS noted that the median house price in the geographic region is generally affordable, but housing affordability has been declining since 2003.

Potential impacts and mitigation measures

Sourcing the majority of the construction workforce from outside the geographic region will have a consequential impact on the demand for accommodation and accommodation affordability.

To address these impacts, Sunwater proposes accommodating most of the workers in temporary construction accommodation, to be located in close proximity to the major work fronts and are remote from large population centres. Three temporary accommodation camps are proposed for the construction of the project:

- a 250-person temporary dam construction camp located approximately 10 km downstream of the dam site on the Connors River-Collaroy Road, near the intersection with the Marlborough-Sarina Road
- two 150-person temporary pipeline construction camps, one located at the eastern end of the pipeline route at or about the Hamilton Park property and accessed from Waitara Road, and one located at the western end of the pipeline route at or about the five-megalitre concrete ring tank balancing storage, 20 km from Moranbah and adjacent to the Peak Downs Highway.

Each of the construction camps would be provided with a range of services and facilities to cater for the day-to-day needs of workers, including sleeping areas, showers and toilets, laundry, rest area, kitchen/dining areas and limited recreation facilities. It is expected that the majority of short-term visiting staff will also be accommodated within one of the three construction camps. As such, the project is not expected to impact on short-term visitor accommodation in the project area.

While it has been assumed that the majority of the construction workforce will be accommodated in temporary construction camps, Sunwater anticipates that five per cent of the construction workforce (i.e. 10 workers) and their families would relocate to the project area and therefore be seeking accommodation. Furthermore, seven households will need to relocate as a consequence of the acquisition of properties for the project. This increase in demand for accommodation is not expected to adversely impact on accommodation availability or affordability in the project area or in the broader geographic region given the relatively small number of households that would be seeking accommodation.

Sunwater has proposed (in section 24.3.4 of the EIS) to consider relocating acquired houses to towns such as Nebo for workers looking to use private accommodation. The SEIS stated this remains Sunwater's preferred alternative as some of the houses, such as Collaroy Homestead which is of local heritage significance, will then survive and be maintained for local heritage conservation purposes. Refer to section 5.7.3 of this report for the Coordinator-General's assessment of non-Indigenous cultural heritage.

5.6.4. Land use and property management

Context

Agriculture (primarily livestock (cattle) grazing) represents the second largest industry (measured in regional output 2001 and employment) in the geographic region. However, agriculture represents over 90 per cent of the total land use in the geographic region.

Land uses in the water storage area are wholly attributable to cattle grazing. Land uses along the pipeline route include mining tenements, road reserves, railway lines and loops, stock routes, cattle grazing and easements for infrastructure such as power supply, water and gas.

Potential impacts and mitigation measures

Five cattle grazing properties (Undercliff, Ridgeland, Collaroy, Marylands and Doreen) representing approximately 75 000 ha will be directly impacted as a result of the project (wholly or partially inundated, required for flood margin, associated infrastructure and/or for vegetation and biodiversity offsets purposes).

The affected cattle grazing properties have been acquired by Sunwater and will be taken out of production. However, the loss of these cattle grazing properties will be mitigated to some extent by the resale of parts of the properties (including Undercliff, Collaroy, Marylands and Doreen), which are not required for the dam inundation area, flood margin and/or ancillary infrastructure, for grazing purposes. Vegetation offset areas on these properties will be protected through an appropriate form of tenure or protected area status under the NC Act.

As described in section 2 of this Report, Sunwater is providing a new access road to the Marylands property, which will allow continued access to Deacey and Mountain view (properties which would otherwise by indirectly affected through the severing of property access) and thereby minimise impacts to Good Quality Agricultural Land (GQAL).

The water storage area will inundate approximately 5850 ha of Class C (pastoral land) GQAL as defined in State Planning Policy 1/92: Development and Conservation of Agricultural Land (SPP 1/92). In addition, the pipeline route will impact GQAL; however, the impact is temporary as the pipeline will be predominantly buried and disturbed land will be rehabilitated following pipe laying.

Sunwater notes the loss of GQAL is unavoidable and considers the loss of GQAL would be offset by creating a water supply that would support the mining industry, downstream agriculture and other potential uses (e.g. recreation use). It is the view of the Coordinator-General that, from a regional perspective, the loss of GQAL would be minor and is adequately offset by the benefits for the noted users.

Given that the pipeline route will be located wholly or partly within, or adjacent to, existing infrastructure easements it is anticipated that impacts on land use and property management will be minimal in the long term. There will be some short-term property access issues during construction. However, Sunwater has committed to

minimising the period of access changes and providing alternative access during these periods as part of the social and economic sub-plan of the draft CEMP (refer to Appendix 4 of this report). Where the pipeline is located above ground in areas of currently utilised GQAL, Sunwater will negotiate appropriate arrangements with landholders to maintain access across the pipeline for stock and equipment.

5.6.5. Social infrastructure and community services

Context

Community infrastructure and services are centred around the towns and regional centres in the project area and include the following facilities and services:

- Council business office (Nebo)
- State School (Nebo and Coppabella)
- emergency services (Nebo)
- sport, recreation and leisure, such as swimming pool, tennis courts, basketball courts, skate parks, bowls club, library museum (Nebo and/or Coppabella)
- shopping and entertainment, such as hotel, general store, post office, service station (Nebo and/or Coppabella)
- accommodation (Nebo).

Both Nebo and Coppabella have 950-person accommodation villages (privately owned and operated) to service the mining industry.

Higher level and a broader range of community facilities and services, such as specialist health and medical (hospital and allied health), higher education (secondary and tertiary), government services (e.g. Centrelink), community support (disability services, youth support, emotional support) and some entertainment and leisure are only available in Mackay and/or Moranbah.

Potential impacts and mitigation measures

Increased demand on community infrastructure and services is anticipated during the construction period as a result of the influx of construction workers to the project area. The influx of construction workers is also likely to increase safety and security concerns in the local population.

However, the increase in demand is anticipated to be more than manageable as the temporary construction accommodation camps will be self contained, offering a level of community infrastructure and services, which would minimise the impact on local and regional community infrastructure and services, and limit the interaction with the local community.

Medical services will be provided at the construction camps, including first aid officers and a nurse/doctor to respond to primary health and medical needs. This will help to reduce demand for health services by construction workers and potential impacts on existing health services. Health and safety plans will be developed and implemented for each construction camp, including communication with all site-based workers. This will assist in reducing the number of project-related emergencies. Emergency response plans will also be developed in consultation with local emergency services, to ensure the effective response to construction-related incidents.

While the potential impacts on health and emergency services are expected to be minimal, with no significant increases on services required, Sunwater has committed to ongoing consultation with Queensland Police Service (QPS), Queensland Fire and Rescue Service (QFRS) and Queensland Health to ensure that services are able to accommodate the project and any associated impacts are addressed.

As the majority of construction workers will reside in temporary construction camps during their shift roster there may be an impact on some workers and their families in terms of isolation and increased stress. These impacts will be managed by ongoing consultation and communication with workers, providing access to specialist counselling-type services and providing high quality communication services in construction camps to ensure construction workers can maintain contact with their families.

The loss of properties as a result of Sunwater's property acquisition policy may result in the displacement of residents who may move away from existing family and friend support bases and experience a loss of family history and linkage to the local area. Due to the relatively small number of properties impacted by Sunwater's property acquisition strategy (7 in total), these impacts are not expected to be significant.

Other impacts include temporary changes to local property access, changes to local roads and increased traffic due to construction activities. Traffic and transport impacts are discussed in subsection 5.8.2 of this report. Access to properties will be managed through consultation with property owners and operators through a community consultation and communication program and by planning disturbances to minimise impact. To ensure effective communication and complaints resolution

with community members directly affected by the construction of the project, the Coordinator-General has set a condition requiring the preparation and implementation of a community and stakeholder management plan as part of the construction EMP for the project (Appendix 1, Schedule A, Condition 10).

A section of the Australia Bicentennial National Heritage Trail will be inundated by the proposed dam water storage area. Sunwater has committed to relocating the bicentennial trail affected by the dam to an alternative route which will be agreed with the National Bicentennial Trail Organisation.

In the longer term, the establishment of a dam community recreation area, adjacent the dam water storage, will provide long lasting recreational pursuits and tourism opportunities which will benefit the local and regional community. The location of the proposed dam community recreation area is shown in Figure 5.14.

As noted in section 2 of this report, the dam community recreation facilities are likely to include at least three ha of land with dedicated community recreation facilities, incorporating a boat ramp (two lanes), picnic facilities, toilet facilities, car park, rainwater tanks and landscaping.

Further consultation with IRC and the community is required to determine the final make-up and layout of the facilities to be provided as part of the dam community recreation area.

The Coordinator-General has made a general recommendation pursuant to the evaluation of the environmental effects of the project under section 35(3) of the SDPWO Act regarding the provision of the dam recreation facilities for the community (Appendix 2, Part 2, Recommendation 7).

5.6.6. Landscape and visual amenity

Context

The proposed water storage area is rural in nature and has been substantially cleared of native vegetation in the lower lying parts to facilitate cattle grazing, while the steeper escarpments surrounding the lower lying areas remain closer to the natural vegetated environment. The proposed water storage area is characterised by a broad, undulating landform with scattered remaining strands of vegetation, the Connors River valley floor, water courses, broad flat grasslands and vegetated ridge lines and slopes (200 to 400 metres high).

The Connors River valley is formed by Sugarloaf Mountain to the north, the Connors Range to the east, White Bluff Mountain and Pint Pot Mountain to the south and the confluence of Oaky Creek and the Connors River and Gins Leap and Pine Mountains State Forest to the west.

Other distinctive visual features in the area include homesteads, roads, a telecommunications tower, elevated areas including Tierawoomba and Collaroy State Forests and the Australia Bicentennial National Heritage Trail which runs north-south through the centre of the Connors River valley floor.

The visual character of the pipeline route varies over its 133 km and is rural in nature with remaining vegetation that has been partially cleared to allow for cattle grazing. Distinctive visual features over the pipeline route include roads, power lines, rail lines, homesteads and the Dipperu National Park.

In summary, the proposed water storage area and pipeline route are rural in character with a balance of natural elements, productive uses (low intensity cattle grazing) and structures (farm buildings and community infrastructure), which is underpinned by the enduring dominance of the natural rather than the built environment. The visual catchment of the Connors River Dam is remote and largely contained within a relatively closed valley surrounded by mountainous terrain. Access to this area is limited and there are very limited visually sensitive receptors.

Potential impacts and mitigation measures

During construction, there will be no significant visual impact in the immediate vicinity of the water storage area as there will be no public access to the area. However there will be visual impacts during operation when visitors will be attracted to the area to view the dam and undertake recreational activities. For these people, the view of the dam and water storage area will be a positive experience. The addition of water as a visual element and its association with the surrounding land and topography is likely to increase the visual amenity perceived by visitors to a moderately high scenic value level.

Views will be restricted from the ridgelines and slopes surrounding the dam and water storage area due to lack of access. There are also no sensitive receptors within these elevated areas.

As the pipeline will be buried for the majority of its length, the permanent visual impacts are limited to those areas of above-ground pipe near the dam wall and the supporting infrastructure, such as the five-megalitre concrete ring tank balancing storage and various valves and inspection points. The visibility of above-ground pipe will be limited by the undulating nature of the land and surrounding vegetation.

Figure 5.13 Project (dam and preferred pipeline alignment) area

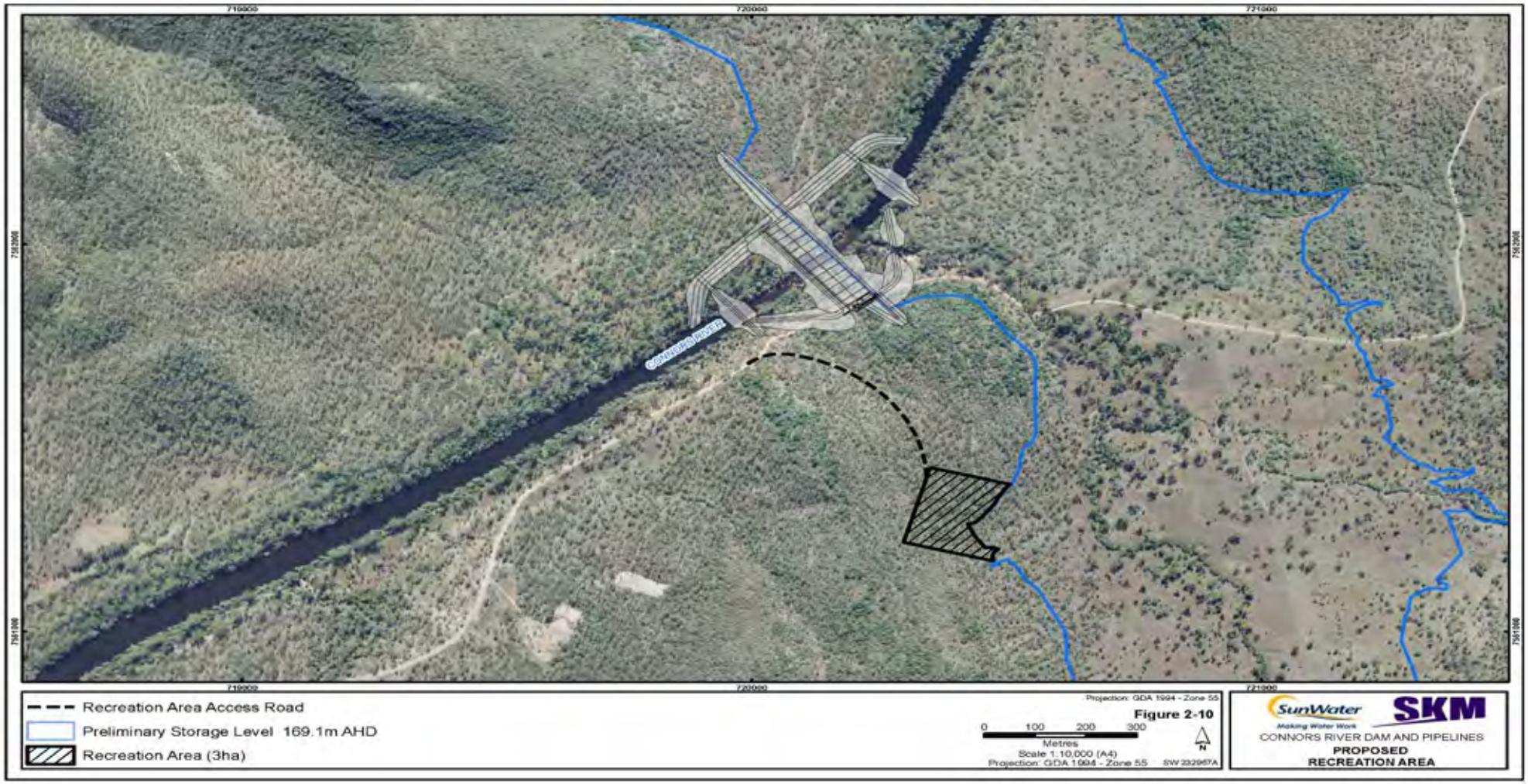


Figure 5.14 Dam community recreation area

5.6.7. Coordinator-General's conclusions

The project will generate a number of short-term social and economic benefits, including direct and indirect employment opportunities and increased industry output through the demand for goods and services. The project will also generate a number of long-term social and economic benefits through the additional water security which would support regional economic development and activity in the mining industry, particularly around Moranbah, agriculture and urban communities.

There will also be social and economic costs borne by the local and regional economy as a result of the project. These social and economic costs include foregone agricultural production due to inundation of, and severance of access to, land previously used for livestock (cattle) grazing purposes (five properties), disruption to farming operations on the pipeline route during construction and less so during operation as the pipeline will be predominantly buried, changes to recreational uses, property access and traffic conditions, and dislocation of workers from their families.

Sunwater has made a number of commitments to mitigate potential social and economic impacts and maximise social and economic opportunities of the project, which have been included in the social and economic sub-plan of the draft construction EMP (refer to Appendix 4 of this report). The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

To ensure effective communication and complaints resolution with community members directly affected by the construction of the project, the Coordinator-General has set a condition requiring the preparation and implementation of a community and stakeholder management plan as part of the construction EMP for the project (Appendix 1, Schedule A, Condition 10). In particular, the community and stakeholder management plan shall be prepared by Sunwater, at its cost, in consultation with community members (for example, landowners, tenants, business owners, community groups, relevant state agencies and councils), directly affected by the construction of the project, and shall include:

- a detailed communication strategy to ensure that community members are informed of the project status in a timely manner and on a regular basis
- written notification to community members, a minimum of 5 business days prior to any construction or investigative activities or changed traffic conditions
- consultation with and written notification to relelvant community members a minimum of 5 business days prior to any landowner access issues
- the availability of project contact details (free call) where more information can be sought and feedback provided
- a complaints management system which responds to complaints within 2 business days

Sunwater must implement, comply with and regularly review the Community and Stakeholder Management Plan for the duration of the project construction phase.

The Coordinator-General has also made a general recommendation (Appendix 2, Part 2, Recommendation 7) pursuant to the evaluation of the environmental effects of the project under section 35(3) of the SDPWO Act, regarding the provision of dam recreation facilities for the community. Prior to making a development application for material change of use for the project, the Coordinator-General recommends that Sunwater execute a Dam Community Recreational Facilities Agreement with Isaac Regional Council (IRC) for the delivery of the proposed dam recreational facilities. The nature and extent of the Dam Community Recreational Facilities must be informed by a Facilities Options Study to be carried out by the proponent at its cost in consultation with IRC and will include the following facilities as a minimum:

- an area of at least 3 ha adjacent the dam water storage dedicated to community recreation facilities located generally in accordance with Figure 5.14
- a boat ramp (two lanes), picnic facilities, toilet facilities, car park and landscaping
- an all weather, two-lane, high quality gravel pavement surface (minimum class 4B(AARB 2009)) access road from the Connors River-Collaroy Road to the dam community recreation area.

5.7. Cultural heritage

5.7.1. Introduction

This section of the report evaluates potential impacts to Indigenous and non-Indigenous cultural heritage.

Two agency submissions to the EIS (DERM and DEEDI) raised issues in relation to Indigenous cultural heritage, including:

- inundation or isolation of Collaroy and Marylands homesteads
- archaeological surface study at Collaroy
- reporting of discoveries.

No submissions to the EIS were received regarding non-indigenous cultural heritage matters.

The Coordinator-General has considered each submission and how the SEIS has responded to the issues raised in those submissions in evaluating the environmental effects of the project.

5.7.2. Indigenous cultural heritage

Context

All Indigenous cultural heritage in Queensland is protected under the *Aboriginal Cultural Heritage Act 2003* (Qld) (ACH Act). To comply with the duty of care provision under section 23 of the ACH Act, proponents of projects which require an EIS are required to prepare a recognised cultural heritage management plan (CHMP) which provides for the management of Indigenous cultural heritage.

The Commonwealth *Native Title Act 1993* provides for Indigenous land use agreements (ILUAs) between native title holders or claimants and other interested parties about how land and waters in the area covered by the agreement will be used and managed in the future. DERM advises it strongly supports these agreements, as ILUAs provide a framework for resolving native title issues through negotiation rather than costly and time consuming litigation.

Section 22 of the EIS and section 2 of the SEIS indicated there is a registered native title claim (file No. QC08/11) registered on 9 October 2009 in the name of the Barada Barna People, which captures the entire project area. Accordingly, the Barada Barna People are the sole Aboriginal party for the water storage area and surrounds and the pipeline route for the purposes of section 34 and 35 of the ACH Act. Woora Consulting Pty Ltd is the registered Aboriginal cultural heritage body for the proposed water storage area and a part of the pipeline route, and is authorised to act on behalf of the Barada Barna People.

The majority of the land area affected by the inundation area is held in leasehold tenure and subject to the native title claim. Parts of the Underhill property are held in freehold tenure where native title has been extinguished.

Sunwater advise the CHMP over the entire dam and pipeline route project area was agreed with the Barada Barna People and registered with DERM on 19 August 2010. The CHMP details the management of Aboriginal cultural heritage which was identified during cultural heritage surveys and details agreed specific management strategies to mitigate potential adverse impacts. Section 22.2.1 of the EIS presented an outline of the CHMP.

Sunwater publicly notified the proposed ILUA process for the project in June 2010, completed negotiations with the Barada Barna People native title claimants, conducted a public authorisation of the negotiated ILUA on 27 November 2010 and has lodged the ILUA with the National Native Title Tribunal for registration.

No Aboriginal cultural heritage places are recorded on the Queensland Aboriginal and Torres Strait Islander Cultural Heritage Register and Database (the register) around the location of the proposed dam wall and water storage area. DERM advise this may reflect the absence of previous surveys rather than the absence of Aboriginal cultural heritage. The register contained numerous cultural heritage place types recorded within the pipeline route 500-metre study area, including: 25 artefact, 4 isolated finds, 9 tree and 2 resource.

Under the agreed methodology in the CHMP, Woora Consulting Pty Ltd on behalf of the Barada Barna People have completed cultural heritage surveys of the project area and have submitted survey reports to Sunwater. Pursuant to the terms of the agreed CHMP, the content of the survey reports is confidential.

Potential impacts and mitigation measures

Potential impacts to Indigenous cultural heritage resulting from construction and operation of the project will be based on the archaelogist's report of (confidential) cultural heritage surveys for the project area undertaken by Woora Consulting Pty Ltd.

Pursuant to the terms of the agreed CHMP, specific tailored management strategies will be adopted to mitigate potential impacts. These will be developed from the management recommendations set out in the cultural heritage survey reports. These recommendations will be discussed, further developed and ultimately determined at CHMP 'agreed recommendations' meetings between Sunwater and the Barada Barna People as the endorsed Aboriginal Party.

Under the CHMP development process, construction of the project cannot proceed until Sunwater and the respective Aboriginal parties have reached formal agreement on impact to Indigenous cultural heritage and potential mitigation measures.

Sunwater's proposed measures during the construction phase, to mitigate potential impacts to indigenous cultural heritage issues, are set out the Indigenous and non-Indigenous cultural heritage sub-plan of the EMP, including conducting operations in accordance with the CHMP, cultural heritage awareness training for personnel and ceasing work in the immediate area of should an artefact be found.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Coordinator-General's conclusions

The Coordinator-General is satisfied the registered CHMP and agreed ILUA satisfy the duty of care requirements under the ACH Act, and will ensure adequate identification and management of cultural heritage places and objects between Sunwater and the relevant Aboriginal people as custodians of their cultural heritage.

Based on the mitigation measures provided in the draft EMP and registered CHMP and the legislative requirements of the ACH Act and *Native Title Act 1993,* the Coordinator-General is satisfied impacts to Indigenous cultural heritage will be minimal.

5.7.3. Non-Indigenous cultural heritage

Context

Section 23 of the EIS reported the Connors River valley, in which the dam is proposed, has aesthetic significance and is an important cultural landscape for non-Indigenous people. The valley had an important role in the movement of people in search of land for grazing from the 1850s and the taking up of pastoral leases. The EIS described the strong sense of local and regional history with people residing in the valley over the last 160 years.

Potential impacts and mitigation measures

No sites listed on any national, State or local government register will be impacted by project construction.

An assessment of unlisted sites, according to criteria in the *Queensland Heritage Act 1992,* finds the project area in general may have significance at state level, given the valley is of aesthetic significance and demonstrates the evolution or patter of Queensland history. However, the assessment notes there are no particular landmarks

within the storage area and existing structures that will be impacted by the water storage are unlikely to meet the threshold of state significance in regard to historic significance.

Two homesteads located on grazing properties within the proposed water storage area (Collaroy and Marylands) are considered to be of local significance as they demonstrate the evolution of a pastoral property within its regional context. However, there is no observed significant technical achievement in regard to the structures at these properties. Collaroy is considered to be the most important historic property as it has evidence of the structural development of a pastoral property over a long period of time. In the absence of an archaeology surface study, it is unknown whether the archaeology of the Collaroy property would meet the threshold for entry into the Queensland Heritage Register.

The Collaroy homestead will be isolated by the water storage area and several outbuildings may be inundated, while the Marylands homestead and associated structures will be inundated. As indicated in section 2 of this report, Sunwater has acquired all grazing properties directly impacted by the water storage area, including Collaroy and Marylands.

There are no known potential impacts for the pipeline or associated infrastructure. As a possibility exists that unknown sites may be present within the project area, section 89 of the Queensland Heritage Act will apply in regard to the requirement to give notice about discovery of archaeological artefacts, in the event they are found within the project area.

To mitigate potential impacts, section 23.2.4 of the EIS recommended an archaeological surface study be undertaken within the homestead complex of Collaroy, with emphasis on the sites of the original stables and blacksmith's shop, the 'saw mill' and associated pits, the area around the homestead and early domestic dump site(s). This would facilitate:

- an understanding of the extensive surface scatter in the area immediately below the rocky outcrop upon which the homestead stands and at the domestic dump(s), including analysis of china and glass in relation to lifestyle at varying periods
- completing the documentation of the development of the Collaroy homestead complex through its time of operation
- better understanding of changing lifestyles at Collaroy homestead
- undertaking a duty of care in regarding to section 60 of the Queensland Heritage Act.

DERM and DEEDI submissions on the EIS raised the following issues regarding Sunwater's assessment of potential impacts to non-Indigenous cultural heritage:

- lack of clarity on mitigation measures to manage loss, caused by inundation, of structures of local cultural heritage significance at the Marylands and Collaroy homestead complexes
- the recommendation to undertake an archaeological surface study of the homestead complex of Collaroy Station is not included in the draft construction

EMP—the results of the study should be provided to DERM and inform any mitigation measures

- the likelihood of deterioration and vandalism of unoccupied buildings in the project area, which are not subject to inundation, is assessed as unlikely in EIS while the consequence is minor with no mitigation measures proposed.

In its response to these matters (section 23 of the SEIS), Sunwater committed to undertake the surface study at Collaroy and notify DERM of significant findings. The Indigenous and non-Indigenous cultural heritage sub-plan of the draft construction EMP has been updated accordingly. The draft construction EMP has also been amended to note that the project archaeologist will be on call to determine the significance of discovered items, and if formal reporting to DERM is required, pursuant to section 89 of the Queensland Heritage Act.

With regard to unoccupied houses, Sunwater notes Marylands homestead is likely to remain occupied in accordance with its property acquisition strategy (refer to section 2 of this report), which provides for the resale of parts of acquired properties not required for the project as grazing properties. Collaroy homestead, if left on site, would be on an island at FSL and only accessible by boat. This, along with the lack of road access to the area in general, was the basis of Sunwater's conclusion that risk of vandalism was low if the homestead were to be left on site. Sunwater also refers to the mitigation measure identified in section 24.3.4 of the EIS to relocate unoccupied houses to Nebo for worker accommodation. Sunwater advise that this remains its preferred option as the structures would then survive and be maintained.

Coordinator-General's conclusions

Based on the mitigation measures provided in the draft CEMP and the requirements of the Queensland Heritage Act, the Coordinator-General is satisfied impacts to non-Indigenous cultural heritage will be minimal.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

5.8. Infrastructure and services

5.8.1. Introduction

This section of the report discusses impacts of the project on essential infrastructure and services, including existing or proposed infrastructure and essential services and traffic and transport systems.

Project impacts on existing land uses and property management have been addressed in section 5.6.4 of this report.

Submissions on the EIS raised a number of issues in relation to infrastructure and services, including:

- pipeline crossing of, and intersection with, the rail corridor and power lines
- disruption to, and increase in local road traffic

- road surface impact
- road safety and transport efficiency
- increased demand for emergency services response
- stock routes
- the supply of water for urban and agricultural use.

The Coordinator-General has considered each of the submissions and how the SEIS responded to the issues raised in those submissions in evaluating the environmental effects of the project.

The impacts of the project on infrastructure and services, and the issues raised by submitters, are discussed in further detail in this section of the report.

5.8.2. Traffic and transport

Context

The road network in the vicinity of the project area comprises roads that are controlled either by TMR—hereafter referred to as 'state-controlled roads') or by the local authority (IRC—hereafter referred to as 'local-government-controlled roads').

The principal state-controlled roads within the project area include the:

- Bruce Highway
- Peak Downs Highway
- Fitzroy Development Road
- Marlborough-Sarina Road
- Oxford-Sarina Road
- St. Lawrence-Croydon Road.

All of these roads are two-way, two-lane roads, sealed to two widths varying from approximately 8 metres to 10 metres, with the exception of the St Lawrence-Croydon Road. The general rural speed limit of 100 km per hour applies to these roads, as they are mostly level, with the exception of St Lawrence-Croydon Road, which is unsealed and traverses undulating terrain.

A number of road/bridge construction and maintenance projects for the state-controlled roads have been completed or are planned as part of the TMR *Roads Implementation Program 2009–2010 to 2013–2014* in the vicinity of the project. The key objectives of these projects include upgrading key freight and passenger routes such as the Peak Downs Highway, reducing accident-prone areas and the continually upgrading heavy vehicle stopping areas to combat driver fatigue.

Key local roads within the project area include:

- Water storage area:
  - Connors River-Collaroy Road
  - Collaroy-Tierawoomba Road
  - Killarney-Collaroy Road
- Pipeline:

- Joe Lodge Road, connects the Marlborough-Sarina Road
- Cockenzie Road, to the west of Denison Creek and Hamilton Park
- Daunia Road, south of Annadale
- Poitrel Road, south of Annadale.

The EIS provided existing annual average daily traffic volumes on state-controlled roads, but did not provide similar data for local roads relevant to the project, as no traffic data was available. The EIS noted that usage of local roads is highly seasonal depending on rural activities (e.g. cattle and grain movement).

The assessment of transport and traffic impacts has been based on the *TMR Guidelines for Assessment of Road Impacts of Development* (GARID).[53] The assessment has been based on worst-case scenario assumptions regarding traffic generation and distribution, as a detailed construction and operation plan for the project has not been fully developed. Accordingly, detailed traffic management plans will need to be developed and submitted for approval as required for each element of the project during the detailed design phase.

The *Transport Infrastructure Act 1994* (Qld) (TI Act) is the relevant state legislation concerning the management of transport infrastructure, including roads and railways. Where construction and/or maintenance access to state-controlled roads is required for this project, Sunwater must obtain approvals under section 62 of the TI Act and construction approval under section 33 of the TI Act.

A road licence/consent will also be required from IRC for proposed alterations/improvements to local-government-controlled roads required for pipeline crossings and road upgrades/closures.

Proposed alterations to transport-related infrastructure

The assessment of transport and traffic impacts has taken into account the following proposed alterations to transport-related infrastructure, as described in section 2 of this report.

- Water storage area:
  - the upgrade (to a two-lane rural road, unsealed, high quality pavement surface standard) of a 20-kilometre section of the Connors River-Collaroy Road, from the Marlborough-Sarina Road to the proposed dam site and proposed community recreation area
  - other associated improvements to the Connors River-Collaroy Road, including the construction of the Marlborough Sarina Road/Connors River Collaroy Road intersection to the appropriate intersection standards to accommodate all construction and operational traffic generated by the project, reduction of approach and exit angles to two creek crossings and the installation of larger pipes or culverts to increase flood immunity
  - construction of a new 14.2-kilometre, single-lane, unsealed, rural access road, which connects the Connors River-Collaroy Road, just south of the dam wall, with the Killarney-Collaroy Road, near the Marylands homestead, providing construction access to the dam wall from the north (hereafter referred to as the Marylands access road)

  - construction of a 4.5-metre wide bridge over Collaroy Creek, five causeways, three major culvert crossings and 13 minor culvert crossings, as part of the Marylands access road.
- Pipeline:
  - new temporary access tracks from existing state and local roads to facilitate construction access to the pipeline corridor. Some tracks on private property will remain as maintenance access tracks during operation of the pipeline
  - eight pipeline crossings, including three state-controlled roads (Marlborough-Sarina Road, Fitzroy Developmental Road, Peak Downs Highway) four local-government-controlled roads (Joe Lodge Road, Cockenzie Road, Daunia Road and Poitrel Road), and one railway corridor crossing (Millennium rail loop to the south-west of Coppabella).

Potential impacts and mitigation measures

The EIS identified the following potential impacts of the project on traffic and transport:

- Construction:
  - increased traffic movements due to equipment and materials supply and construction workforce
  - altered traffic patterns and journey times due to temporary road closures or diversions.
- Operation:
  - altered traffic patterns and journey times due to permanent road closures resulting from the inundation of some local roads.

Construction

The EIS provided the results of construction traffic operation analysis undertaken with respect to moving equipment and materials to and from the project area at peak construction activity. The analysis assumed all construction would be transported by road using standard and over-dimensional loads (with the requirement for escorts), with 80 per cent of service vehicles travelling to and from Mackay and the balance to and from Moranbah and Nebo, via the Peak Downs Highway.

Peak construction transport activity for the dam component of the project will occur during the construction of the roller compacted concrete (RCC) dam wall (18-month period) when the raw materials requirement is increased to nearly threefold to that of the pre- and post-dam wall construction periods (36 months in total).

Equipment and materials to be transported during the construction of the dam component of the project include plant, fuel, camp facilities, raw materials (aggregates, pavement material, cement, fly ash) concrete from two temporary on-site batch plants (at yet-to-be-determined locations) and sundry items. Concrete, aggregates and pavement material will be sourced locally and will use the Connors-Collaroy Road, while all other equipment and materials will be transported from remote sources with the Peak Downs Highway being the primary haulage route.

Peak construction transport activity for the pipeline will occur after vegetation clearing of lay down areas, and will comprise the delivery of the majority of bedding material to the lay down areas prior to the construction teams arriving to the three work fronts. Equipment and materials to be transported during the construction of the pipeline component of the project, include plant, fuel, pipes and fittings, above ground structures, camp facilities, raw materials (bedding sand, gravel, clay, road base, waste excavated trench material), concrete from batching plants in Moranbah and Nebo, and sundry items. Bedding material will be sourced locally from suitable areas, including Connors River, Funnel, Boothill, Denison, Bee and Herrybrandt Creeks, and Isaac River, subject to further investigation and approval. All other equipment and materials will be transported from remote sources with the Peak Downs Highway being the primary haulage route.

The EIS stated that pipeline equipment and materials will be delivered as soon as laydown areas are established and in advance of pipe trenching and laying. This scheduling will reduce construction and delivery traffic conflicts and spread traffic demand over time.

The EIS set out daily trip generation and total trip estimations from various construction activities. The EIS also presented estimated traffic volumes which would be generated by the project, considering underlying projected growth rates and the percentage increase the project is expected to have on existing traffic levels.

The analysis also considers the three temporary construction accommodation camps proposed for the project (refer to sections 2 and 5.6.3 of this report), which are to be located in close proximity to the major work fronts—one 250-person construction camp located 10 km downstream of the dam site, and two 150-person construction camps located at both ends (east and west) of the pipeline route.

The analysis assumes the peak number of trips will occur at the start and end of the work schedule (11 days on, 3 days off) with 100 per cent of workers arriving at and departing from the construction accommodation camps by bus. Buses will transport construction workers from the temporary construction accommodation camps to the work sites and to and from Mackay airport for recreation leave.

It has been assumed, for the purposes of the traffic analysis, that all workers will be transported to and from the temporary construction accommodation camps and Mackay at the beginning and end of their shifts by bus. However, the EIS acknowledged that some fly-in fly-out workers may not choose to use the company-provided buses and that drive-in drive-out workers will travel to and from the temporary construction accommodation camps by private transport. Accordingly, Sunwater has committed to implement a fatigue management plan as part of its traffic management plan (TMP) for the project, to address potential road safety issues.

The traffic analysis concluded that increases in traffic generated by the project during the peak construction period would not affect the level of service experienced by other users of the roads likely to be affected by the project.

Notwithstanding this, Sunwater has proposed a range of mitigation measures, as part of the transport and roads sub-plan of the draft CEMP for the project (refer to Appendix

4 of this report) to minimise project impacts on state-controlled roads, local-government-controlled roads and railway corridors. This includes (but is not limited to):

- preparing a TMP in consultation with TMR and IRC to minimise adverse effects on the road network and ensure the safety and convenience for all road users
- implementing a road-use management plan (RMP) to address the use of safety vehicle signs and qualified flagmen where pipeline construction works impinge on any road reserve, in particular, access points to the pipeline easement and pipeline crossings.

A number of submitters to the EIS raised concerns about road safety and transport efficiency, road surface and traffic impact, and demand for emergency services response.

TMR expressed concerns that the traffic analysis did not fully detail the nature and extent of the traffic impact, particularly the construction-generated traffic impact on state-controlled roads. TMR requested further detailed road impact assessment (RIA) to be undertaken and finalised in accordance with the GARID to ensure all impacts are identified and appropriate mitigation measures are put in place. TMR noted that no analysis had been undertaken of the Equivalent Standard Axles (ESAs) to determine whether the increase in traffic would be no more than five per cent of existing traffic levels.

TMR noted that no information had been provided in support of the proposed upgrade of the Marlborough-Sarina Road/ Connors River-Collaroy Road intersection and the standard of any such upgrade.

Sunwater responded by advising its traffic analysis had been conducted in accordance with GARID and committed to implementing best practice mitigation measures in consultation with TMR during detailed design, to minimise project road impacts and to comply with applicable policies. However, Sunwater acknowledged that its traffic analysis was limited at this preliminary stage of the project and committed to prepare a detailed RIA during detailed design, when additional and more certain trip generation and traffic volume information would be available. The detailed RIA will identify likely generated ESAs, road segments where 5 per cent of baseline ESAs will be exceeded and include a pavement assessment, as required.

The Department of Community Safety and QPS raised concerns about the potential increased demand for emergency services and ability to respond in a timely manner as a result of the increased traffic generated by the project over the construction period. QPS also expressed concern about the level of detail provided in the traffic analysis and the reliance on 2007 traffic data.

Sunwater responded by advising that its proposed RMP and TMP, which will be reviewed and updated during detailed design in consultation with relevant agencies, would address potential traffic conflicts.

Operation

The EIS noted that parts of the Collaroy-Tierawoomba and Killarney-Collaroy Roads will be inundated by the proposed dam and water storage, resulting in terminal roads. While these local-government controlled roads will not be reinstated, the proposed

Marylands access road will provide some level of continuity of access for the Marylands, Deacey and Mountain View properties, which are the primary users of these roads.

Operational traffic demand associated with the dam operators is expected to be minimal, with the operator fleet comprising a small number of vehicles comprising utilities, four-wheel-drive vehicles and tractors/slashers.

Public visitation to the dam is likely, and will be highest during weekends and holiday periods. Therefore, traffic demand to and from the proposed community recreation area by visitors is anticipated to have minimal impact during the weekday traffic periods, as is the experience in similar existing operational dam sites. Traffic demands associated with the pipeline will be in relation to regular inspection traverses, maintenance and repair, and is accordingly not expected to have any significant impact on the surrounding road network.

Coordinator-General's conclusions—traffic and transport

While the traffic analysis concluded that the increase in traffic generated by the project at peak construction period would not adversely affect the level of service or road surfaces, it is noted that further traffic and transport analysis is required to address submitter concerns and ensure impacts are identified and addressed.

Sunwater has committed to reviewing and updating its traffic analysis and accompanying RIA, RMP and TMP during detailed design, when additional and more certain trip generation and traffic volume information would be available. The requirements for a RIA, RMP and TMP and other transport and traffic mitigation measures have been included in the transport and roads sub-plan of the draft construction EMP (refer to Appendix 4 of this report). The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the construction EMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Based on the mitigation measures provided in the draft EMP and the approvals required for the project under the TI Act (state-controlled roads and railways) and the IRC local planning scheme (local-government-controlled roads), the Coordinator-General is satisfied that impacts to traffic and transport will be minimal.

5.8.3. Other essential infrastructure and services

Context

Existing infrastructure and services within the water storage area includes:

- a telecommunications tower located near Collaroy Homestead
- low voltage Ergon powerlines
- rural property infrastructure such as houses, fences, gates, cattle grids and stock yards.

The Australian Bicentennial Trail (bicentennial trail) is a non-motorised, self-reliant, multi-use trekking route, stretching 5300 km from Cooktown in North Queensland to Healesville in Victoria. The bicentennial trail runs directly through the water storage area from north to south and is situated within horse trails, private roads and road reserves.

The pipeline will be located largely within or adjacent to existing easements through mostly grazing properties and areas used for industry (extractive industry) and rural residential purposes. Infrastructure and services adjacent to the pipeline includes:

- mining infrastructure such as haul roads and stockpiles of spoil and coal
- Ergon and Powerlink electricity infrastructure
- gazetted stock routes and watering points
- quarries
- rural property infrastructure such as fences, gates, cattle grids and stockyards
- existing pipelines of the Eungella water extension, telecommunications and other pipeline licences including Arrows recent gas pipeline.

Existing transport and traffic-related infrastructure and services in the vicinity of the project is described in section 5.8.2 of this report.

Potential impacts and mitigation measures

The water storage will inundate and sever road and power access (Ergon Energy low voltage power lines) to five grazing properties. These properties have been acquired by Sunwater and will be taken out of production. As such, there is no requirement to restore road access or electricity supply to these properties. The Ergon Energy low voltage power lines will be decommissioned and removed.

An assessment of social and economic impacts relating to impacts of the project on existing land uses is provided in section 5.6 of this report.

A section of the bicentennial trail will be inundated by the water storage area. Sunwater has committed to relocate the bicentennial trail affected by the dam to an alternative route, which will be agreed with the National Bicentennial Trail Organisation.

The Telstra telecommunications tower and repeater station located near Collaroy homestead will be relocated and upgraded to 3G status. The final location of the telecommunications tower is yet to be determined. However, initial consultation with Telstra suggests the preferred location is near the proposed community recreation area

near the proposed dam. Telstra and Sunwater are obligated to provide levels of service to customers who remain serviced by the relocated facility as mandated under Telstra's universal service obligations.

The pipeline will be located within or contiguous with a number of existing easements, roads and rail corridors, minimising the potential impact on land uses, and the need for new or full-width easements. The co-location of services will be managed through continuing consultation with the infrastructure providers that may be potentially impacted (e.g. Powerlink, Ergon, Arrow Energy, affected freehold and leasehold landowners). Infrastructure and services that may be impacted by the pipeline will not suffer any long-term impacts and any short-term impacts will be minimal, as the pipeline is predominantly buried and will be located wholly or partly within, or adjacent to, existing infrastructure easements.

A number of stock routes are potentially impacted by the pipeline route. As part of the social and economic sub-plan of the draft construction EMP, Sunwater commits to consult with the relevant representatives from DERM and the IRC to provide safe realigned or replacement stock routes, including any affected infrastructure and watering points, and rehabilitate impacted stock routes including revegetation with native pastures.

There will be a need to amend the IRC local planning scheme to reflect the change in land use at the proposed community recreation area. The amendment of the planning scheme may also need to include the resource extraction sites if the use of any of these areas is to be made permanent by IRC. Due to the temporary nature of the construction camps and resource extraction sites, and the isolated nature of the sites, mitigation measures are limited. Rehabilitation plans will be developed and the areas rehabilitated after cessation of work.

Section 1 of this report identifies a range of Local Government and State Government approvals required for the project, to manage potential land use impacts associated with the construction and/or operation of associated infrastructure required for the project. For example, the following approvals are required under SPA:

- the MCU for the quarry and sand extraction sites, concrete batching plants, construction camps, water treatment plants, wastewater treatment plants, transmission lines, dam recreation area, pipeline laydown areas, telecommunications tower and repeater station
- the reconfiguration of a lot for excisions or long-term leases for ancillary infrastructure such as balancing storages
- MCU for the following ERAs:
  - chemical storage
  - electricity generation
  - extractive and screening activities
  - abrasive blasting
  - surface coating
  - concrete batching
  - timber milling and woodchipping

  - sewerage treatment
  - water treatment.
- the removal of quarry material from a watercourse.

The Coordinator-General has set conditions pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule B) regarding MCU for ERAs required for the project.

Specific mitigation measures in relation to construction impacts on adjoining land uses (e.g. dust, noise) are addressed in section 5.9 of this report. Landscape and visual amenity impacts are addressed in section 5.6 of this report.

Some submitters to the EIS raised concerns about water stress in urban communities, such as Nebo and Moranbah, which support the mining industry and suggested the Connors River Dam should supply water to these urban areas. Refer to section 5.1 of this report for the Coordinator-General's assessment of urban water supply.

Coordinator-General's conclusions—other essential infrastructure and services

Based on the mitigation measures provided in the draft EMP, the approvals required for the project under the SPA, and conditions set by the Coordinator-General regarding ERAs, the Coordinator-General is satisfied that impacts to other essential infrastructure and services will be minimal.

5.9. Environmental management

5.9.1. Introduction

This section addresses the following environmental management matters:

- air quality
- greenhouse gas (GHG) emissions
- noise and vibration
- waste
- land contamination.

Two submissions received on the EIS related to this section—one submission regarding the scope of the GHG emissions assessment, and one submission regarding potential land contamination impacts.

No submissions were received regarding the assessment provided in the EIS for waste, air quality, noise or vibration impacts.

5.9.2. Local setting and sensitive receivers

As described in section 2 of this report, existing land uses within the proposed water storage area are predominately grazing, with some areas previously used for irrigated pastures. Existing land use of the pipeline route is predominantly grazing and coal mining, including a number of major roads and a railway line.

There are limited sensitive receivers around the dam and surrounds study area. Three homesteads are located outside the water storage area—namely Doreen, Marylands and Undercliff—which are located approximately 11 km south-west, 6 km east and 20 km north of the proposed dam wall site, respectively. In accordance with the land purchase and, where applicable, resale strategy, these homesteads will be vacated before construction commences. Accordingly, these sensitive receivers have not been considered any further in this section of the report.

A temporary sensitive receiver will consist of a 250-person construction camp, located approximately 10 km downstream of the proposed dam wall site on the Connors River-Collaroy Road near the intersection with the Marlborough-Sarina Road. A post-construction sensitive receiver will be a proposed recreation area located to the south of the dam wall.

Existing sensitive receivers near the pipeline route have been identified using aerial imagery. Sensitive receivers consist of residences located at varying distances from the pipeline, with the closest receivers being between 100–200 metres from the pipeline. A temporary receiver will consist of two 150-person temporary pipeline construction camps, one located at the eastern end of the pipeline route at or about the Hamilton Park property and accessed from Waitara Road, and one located at the western end of the pipeline route at or about the five-megalitre concrete ring tank balancing storage, 20 km from Moranbah and adjacent the Peak Downs Highway. Sensitive receivers along the pipeline route are shown in Figure 5.15.

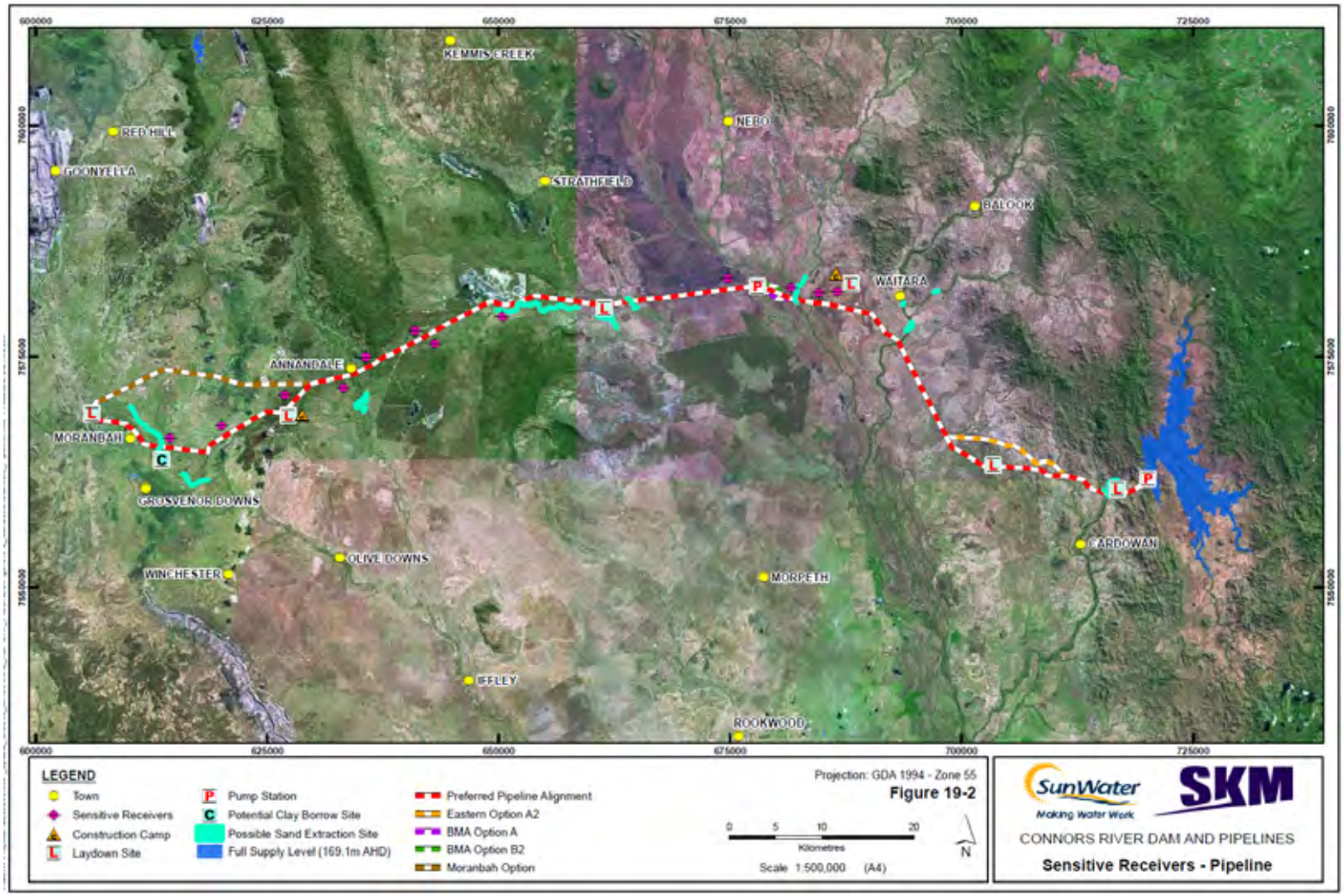


Figure 5.15 Sensitive receivers along the pipeline route (the preferred pipeline alignment)

5.9.3. Air quality

Context

Air quality within the project area is primarily influenced by agricultural and natural sources. The EIS identified the main local contributors to existing air emissions to be a combination of agricultural activities such as grazing, bushfires and controlled burns, vehicle exhaust emissions, dust blown from inland areas and dust generation from vehicles travelling on local unsealed roads. Along the proposed pipeline route, the land uses also include major roads and a railway line. Therefore, additional air emissions include coal dust from the coal trains on the Queensland Rail line and dust emissions from mining activities.

Potential impacts and mitigation measures

Air emissions will result from project activities, particularly diesel exhaust and dust for an ongoing two-year construction period around the dam and for periods of up to a few months at sites along the pipeline route, as sections of pipe are laid. Diesel exhaust will be emitted from haulage trucks, worker vehicles and excavation equipment across all components of the project area during construction, and from maintenance vehicles during operations.

During construction there will also be dust and particulate emissions from vegetation clearing, excavation, blasting, drilling, quarrying, crushing aggregate and spoil handling activities and the associated wind erosion from the resulting exposed ground surfaces, concrete batching and construction vehicles travelling over unsealed surfaces. A stationary fuel burning plant will release carbon monoxide, hydrocarbons and nitrogen oxides into the atmosphere.

Dispersion modelling was used in the EIS to predict particulate matter (PM_{10}) and total suspended particulates (TSP) concentrations and dust deposition rates at the nearest sensitive receivers, with results showing that the project will not cause exceedences of DERM air quality goals in Schedule 1 of the Queensland Environment Protection (Air) Policy 2008.

In particular, modelling indicates no residence will experience exceedences of the goals during project construction; however, it is noted that the modelling took into account the use of dust emission controls stated in Tables 17.4, 17.9 of the EIS. The distance to sensitive receivers along the pipeline is a minimum of 100 metres and section 17.2.2.2 stated that there is a low potential for air quality impacts at the nearest sensitive receiver. The impact on air quality of operations at the quarry, the road upgrades and the sand extraction areas for the dam and the pipeline have been assessed as not being significant at sensitive receivers.

Operational impacts are likely to be minor, given low vehicle speeds at the proposed recreation area. However, the proposed recreation area will result in a change in the areas affected by motor vehicle exhaust.

Sunwater has developed performance criteria to minimise the potential to generate air quality impacts at sensitive receivers and reduce dust deposition impacts. Outcomes in accordance with the performance criteria are to be achieved by implementing impact

mitigation measures tied to an ongoing PM_{10} and dust deposition monitoring program within the air quality and greenhouse gas sub-plan contained within the draft construction EMP (refer to Appendix 4 of this report). This includes measures to minimise dust from crushing and concrete batching, transportation and wheel-generated dust, excavation and stockpiling, drilling and blasting, such as:

- regular watering of construction sites, excavation activities, haul roads, and exposed areas, such as stockpiles, blasted areas and conveyor belts, with consideration of chemical stabilisation should water use prove inefficient
- enclosures installed on conveyor belts, crushing plants and batching plants
- restricting vehicle movements to dedicated sealed or watered haul roads and speed limits to minimise dust
- detailed optimising of blast design (size and timing) and stockpile locations to minimise dust emissions and wind blow
- stabilising worked areas, including revegetation, paving, gravel or mulch as soon as possible after earthworks have been completed.

Further, it is noted that specific project activities which create air emissions, such as electricity generation, extraction, abrasive blasting, concrete batching, timber milling and woodchipping are ERAs. To operate, Sunwater will be required to comply with air quality conditions and produce a site-based management plan identifying sources of environmental harm, impacts and actions taken to prevent environmental harm. Sunwater will need to apply for a development approval from DERM for each ERA if the activity does not meet a code of environmental compliance.

Coordinator-General's conclusions—air quality

Based on the distance between construction activities and sensitive receivers, the temporary nature of impacts, the mitigation measures contained within the draft EMP, and approvals required for project activities that create air emissions (i.e. ERAs, such as resource extraction and concrete batching), the Coordinator-General is satisfied impacts to air quality will be minimal.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the construction EMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Based on advice from DERM, to ensure appropriate air quality controls are implemented during construction, the Coordinator-General has also set a condition (Appendix 1, Schedule A, Condition 6), which requires Sunwater to include additional requirements in the air quality and greenhouse gas sub-plan of the construction EMP, including construction air quality criteria for TSPs (in addition to PM_{10} and dust deposition) and an appropriate monitoring program.

DERM has also provided the Coordinator-General with a range of suggested conditions relating to ERAs of relevance to the project, which are designed to minimise the potential for unacceptable impacts. Therefore, in addition to the condition referred to above, the Coordinator-General has set conditions (Appendix 1, Schedule B), which must be attached to any development approval for an MCU for an ERA granted for the

project, to minimise environmental nuisance at any sensitive receiver resulting from activities during the construction phase of the project.

5.9.4. Greenhouse gas emissions

Context

There are several pieces of Commonwealth legislation and policies aimed at identifying and reducing Australia's greenhouse gas (GHG) emissions.

Sunwater is required to estimate and report annual GHG emissions under the National Greenhouse and Energy Reporting (NGER) system established by the *National Greenhouse and Energy Reporting Act 2007* (Cwlth). The NGER system establishes a single, national system for reporting GHG emissions, abatement actions, and energy consumption and production by corporations.

It is noted that Sunwater is committed to efficiently using all energy sources to minimise total energy consumption and to reduce the volume of GHG 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 GHG 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
- communicate Sunwater performance on energy management.

The development of consistent data capture and reporting processes as part of Sunwater's energy management policy[54] assists with the ongoing management of Sunwater's greenhouse and energy management programs.

Potential impacts and mitigation measures

The EIS presented an assessment of the likely GHG emissions and their significance, reporting the result as tonnes of carbon dioxide equivalent (t CO2-e).

The potential greenhouse gas impacts of the project have been assessed by estimating the direct and indirect GHG emissions resulting from the project and identifying mitigation measures to reduce emissions.

The National Greenhouse Accounts (NGA) Factors[55] and the Intergovernmental Panel on Climate Change 2006 Guidelines for National Greenhouse Gas Emissions[56] were used in preparing the greenhouse gas inventory, which for this project is based on:

- diesel fuel used for transportation
- consumption of purchased electricity
- upsteam emissions for construction inputs for diesel fuel, cement, concrete and steel
- clearing of vegetation and subsequent burning or decay

- decay of biomass and decomposition of soil organic matter following inundation.

The project's estimated construction- and operation-related GHG emissions as presented in the EIS are summarised in tables 5.11 and 5.12 below.

Table 5.11 Estimated GHG emissions during construction

Construction-related source	Estimated GHG emissions (t CO2-e)
GHG emissions from the estimated diesel fuel usage for transportation	289 379
Upstream emissions associated with construction	155 434
Total	**444 813**

Table 5.12 Estimated GHG emissions during operation

Operations-related source	Estimated annual GHG emissions (t CO2-e)
Energy consumption to pump water along the pipeline to Moranbah	34 443*
Estimated emissions of carbon dioxide from the inundation of 5,621 ha of vegetation and soil organic matter	107
Estimated emissions of methane from the inundation of 5,621 ha of vegetation and soil organic matter	1896
Total	**36 446**

* Note: GHG emissions were reduced from 80 100 to 34 443 following pump station and pipeline redesign post-EIS—refer to section 2 of this report for more information.

Section 18.3.1 of the EIS noted that the GHG emissions from estimated diesel fuel usage for transportation during construction represents approximately 0.05 per cent of Australia's total GHG emissions in 2006. The upstream emissions associated with construction include the manufacture of diesel, cement, steel and concrete for both the dam and pipeline construction.

During operation, the most significant GHG emissions will be generated from energy consumption to pump water along the pipeline to Moranbah. It was noted in section 2.1 of the SEIS and additional correspondence received from Sunwater dated 12 August 2011 (refer Appendix 8) that Sunwater has modified the design of the pipeline route and pumping system since the EIS to improve pumping efficiency. Sunwater advised that adopting the new design should reduce GHG emissions associated with power consumption to run the pumps by approximately 43 per cent, reducing the emissions from 80 100 t CO2-e to 34 443 t CO2-e.

Other operations emissions include diesel fuel usage for transportation during operation; and emission of carbon dioxide and methane from the inundation of 5621 ha of vegetation and soil organic matter are estimated, with indicative carbon dioxide emissions considered for a maximum ten-year period after inundation.

The EIS concluded that the GHG emissions from construction and operation of the project represent approximately 0.09 per cent of Australia's GHG emissions. Management measures to minimise GHG emissions from construction of the project are contained in the air quality and greenhouse gas sub-plan of the construction EMP (refer to Appendix 4 of this report).

During operation, the implementation of Sunwater's energy management standard will minimise emissions during operations by identifying opportunities to improve energy efficiency and providing education and training to increase the level of energy management skills and competencies of Sunwater's staff.

In its submission on the EIS, the Queensland Conservation Council (QCC) was concerned the EIS has substantially underestimated emissions resulting from decaying vegetation following initial inundation and the ongoing release of GHG-equivalent emissions from decaying vegetation carried into the storage by inflows over the life of the proposed dam.

In response (section 18.1 of the SEIS), Sunwater identified the assessment of emissions from rotting submerged vegetation (and submerged soil) provided in the EIS was determined in accordance with the 2006 IPPC Guidelines for National Greenhouse Gas Emissions, and that the QCC did not suggest an alternative methodology.

Coordinator-General's conclusions—GHG emissions

The Coordinator-General is satisfied that Sunwater has appropriately considered ways to reduce GHG emissions in the design of the project—in particular, pump design improvements since the release of the EIS will result in a 55 per cent reduction of estimated GHG emissions during the operation of the project.

Further, the Coordinator-General is confident that mitigation measures contained in the air quality and greenhouse gas sub-plan of the construction EMP will maximise energy efficiency and minimise GHG emissions during construction of the project.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the construction EMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

5.9.5. Noise and vibration

Context

The EIS reported that background noise levels at sensitive receivers near the proposed dam wall and surrounds are representative of a typical, quiet rural environment with grazing and forestry as the main land use, with noise sources such as traffic on the Marlborough Sarina Road. Existing noise levels vary widely along the proposed pipeline route due to proximity of grazing; coal mining operations; and rail, road and power infrastructure contributing to background noise levels in the area.

There are no current significant vibration sources in the project area that are likely to influence ambient vibration levels at sensitive receiver locations.

The EIS assessed the potential noise and vibration impacts from construction (and where appropriate operation) of the dam, pipeline and associated infrastructure, blasting, quarry operations, haulage of materials and goods to construction sites, water storage area preparations works and changed traffic type and volume on impacted roads.

The assessment was based on acoustic quality objectives set out in Environmental Protection (Noise) Policy 2008 (EPP(Noise)), low frequency noise goals from the draft *Assessment of Low Frequency Noise Guideline*[57] and vibration criteria for blasting from the Environmental Protection Agency (EPA) (now DERM) *Ecoaccess guideline: Noise and vibration from blasting.*[58]

Potential impacts and mitigation measures

The main potential impact on noise and vibration amenity will be caused by project construction activities, particularly site establishment, dam foundation excavations and construction of the diversion channel (earth work activities, drilling and blasting 10 hours/day on a roster of 10 days on and 4 days off) and dam construction including the roller compacted concrete dam wall (24 hours, 7 days per week over a five-month period). Pipeline construction hours will be limited to Monday to Saturday from 7 am to 5 pm. Noise and vibration during these times is considered more likely to be tolerated by residents than after-hours work as they are likely to be engaged in daily activities.

Dam construction and operational activity noise

The noise modelling results presented in section 19.2.2 of the EIS indicated noise impacts at sensitive receivers are unlikely during construction activities at the dam wall site and truck movements on Connors River Collaroy Road, including during the 24-hour per day work program. Noise levels are predicted to be in compliance with the day, evening and night time noise criteria on the basis of the EPP (Noise) acoustic quality objective.

Given the rural nature (with relatively low existing background levels) and the subjective nature of noise nuisance, some receivers may experience nuisance even if compliance with the EPP (Noise) objectives are achieved, therefore it is important to implement noise mitigation measures as presented in the noise and vibration sub-plan of the draft construction EMP (refer to Appendix 4 of this report). This includes measures relating to:

- general noise management practices and scheduling of activities
- plant and equipment
- construction traffic noise
- noise monitoring.

Section 19.2.2.1 of the EIS confirmed that minimal noise sources are expected for the operation of the dam. Therefore, it is considered that there will be no impacts on sensitive receivers during operation.

Pipeline and pump station noise

Noise impacts from pipeline and pump construction activities include:

- excavation backfilling and compacting of material for trenches
- pipe, conduit and/or fibre optic cable unloading, stockpiling and laying
- concrete and steel works for pump stations
- vegetation clearing and access road construction along the pipeline route.

As indicated above, the construction hours of the pipeline will be Monday to Saturday 7 am to 5 pm, with pipe laying activities in one location expected to last up to five days.

The key potential pipeline operational noise impact identified in the EIS is continuous noise, associated with operating pump station number 2. Sunwater advised the Coordinator-General on 28 June 2011 that this pump station had been removed from the project scope resulting in avoidance of any noise impact on the sensitive receivers. No low frequency noise impacts, based on goals set in the draft *Assessment of Low Frequency Noise guideline,*[57] are expected from the operation of the pumps near the dam due to the distance between the pump stations and sensitive receiver locations. Should the pumps exceed noise levels, acoustic housing may be required to ensure operational noise level goals are met (EPP (Noise)).

Associated infrastructure noise

Modelling indicates that there will be no noise impacts at sensitive receivers generated by the construction of associated infrastructure including:

- upgrading 20 km of the Connors River-Collaroy Road from Marlborough Sarina Road to the dam site (one kilometre from Doreen homestead)
- establishment and operations at the rock quarry, sand extraction, washing and screening areas (one kilometre from sensitive receivers) and road base extraction areas
- construction of the 66 kV electricity supply lines to the dam and to the pipeline pump station
- construction and operation of the construction camps near the dam site and along the pipeline route.

The results of modelling low frequency noise from construction activities indicate low frequency noise at all sensitive receiver locations are not expected to cause annoyance. Further, cumulative low frequency noise impacts of the pump stations and quarries are unlikely due to their isolation.

Section 4 of the SEIS confirmed that noise impacts (modelled in the EIS) do not alter significantly from those modelled for the original quarry location. Section 14.2.4.1 of the EIS confirmed that no noise impacts are expected from the operation of associated infrastructure.

As indicated above, the noise and vibration sub-plan of the draft construction EMP (refer to Appendix 4 of this report) identifies mitigation measures and site noise management practices to achieve performance criteria for noise levels and minimise the potential for impacts at sensitive receivers.

Vibration

Estimates of vibration and overpressure levels shown in section 19.2.2.2 of the EIS indicated there will be no vibration impact on sensitive receivers from using explosives to excavate the diversion channel (the main source of vibration from dam construction activities), or from ripping, drilling and blasting activities at locations along the pipeline route.

There is potential for the associated infrastructure of road upgrades, the rock quarry and the sand extraction areas to generate vibration impacts at sensitive receivers. Estimates of vibration and overpressure levels indicate that the nearest sensitive receiver to the quarry site at Marylands is 4500 metres away; and no impact is expected as the vibration and airblast overpressure goals will not be exceeded. Sunwater confirms the preferred alternative quarry sites discussed in the SEIS do not alter this outcome.

The EIS finds that given the distances between the location of all sensitive receivers and the dam and pipeline construction activities, there are not expected to be any human comfort impacts or damage to property from blasting vibration and airblast overpressure during construction of the dam (including quarry), the dam access road, Marylands homestead new access road, Connors River-Collaroy Road upgrade.

Further, the EIS found there will be no vibration sources associated with the dam, pipeline, pumps stations and associated infrastructure operational activities.

Blasting

The EIS found that, during blasting, the air blast overpressure will be the determining factor in achieving the project's air blast overpressure and vibration criteria outlined in the *Ecoaccess guideline: Noise and vibration from blasting*[58]. Modelling shows no receivers would experience exceedences of the air blast overpressure criteria as a result of blasting required for construction.

It is noted that a mitigation measure in the noise and vibration sub-plan of the draft CEMP requires a detailed management plan to be developed by the blasting contractor to ensure compliance with the project's blast overpressure and vibration limits and performance criteria and to address *Australian Standard AS 2187.2.2006 Explosives – Storage and Use – Use of explosives*.[59] It is further noted Sunwater will inform the community of upcoming activities and duration prior to commencing site works and will investigate community complaints relating to noise.

Further, it is noted Sunwater recommends blast overpressure and vibration monitoring for trial blasts at key residential locations to identify site-specific details and make adjustments, then follow up with monthly monitoring under changing temperature and meteorological conditions.

Coordinator-General's conclusions—noise and vibration

Noise and vibration resulting from construction and operation of the project are predicted to be within relevant noise and vibration goals at sensitive receiver locations. The noise and vibration sub-plan of the draft construction EMP sets out a range of mitigation measures and monitoring requirements to minimise noise and vibration

impacts from construction activities at sensitive receiver locations near project construction areas. The noise and vibration sub-plan also establishes target goals and requirements for noise and vibration levels to guide construction planning and management.

It is noted that project activities that create noise and vibration, such as extraction, abrasive blasting and concrete batching, are ERAs and to operate, Sunwater will be required to comply with noise and vibration conditions and produce a site-based management plan identifying sources of environmental harm, impacts and actions taken to prevent environmental harm. Sunwater will need to apply for development approval from DERM for each ERA if the activity does not meet a code of environmental compliance.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the CEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Based on advice from DERM, to ensure the implementation of appropriate noise and vibration controls during construction, the Coordinator-General has also set a condition that requires Sunwater to include more detailed requirements in the noise and vibration sub-plan of the construction EMP (Appendix 1, Schedule A, Condition 5).

DERM has also suggested conditions relating to ERAs of relevance to the project, which are designed to minimise environmental nuisance at any sensitive receiver resulting from activities during the construction phase of the project. Therefore, in addition to the conditions referred to above, the Coordinator-General has set conditions that must be attached to any development approval for an MCU for an ERA granted for the project (Appendix 1, Schedule B).

Based on the modelling presented in the EIS, distance between construction activities and sensitive receivers, removing pump station number 2 from the project design, the temporary nature of impacts, the mitigation measures contained within the draft EMP, and approvals required for project activities that create noise and vibration emissions (i.e. ERAs, such as resource extraction and abrasive blasting), the Coordinator-General is satisfied impacts to noise and vibration amenity will be minimal.

5.9.6. Waste

Context

The regulatory requirements governing waste management are contained within the EP Act, the Environmental Protection Regulation 1998 and associated Environmental Protection (Waste Management) Policy 2000 (EPP (Waste)), and the Environmental Protection (Waste Management) Regulation 2000.

The movement of regulated waste in Queensland is subject to a waste tracking system. The draft CEMP for the project presents a waste tracking system for wastes that require tracking, including procedures for identifying regulated waste. In addition, the treatment, storage and transport of regulated waste requires a registration certificate under the EP Act. Where a contractor carries out these activities, the contractor will be required to hold the appropriate approvals.

Potential impacts

The following waste streams will be generated during construction of the project:

- construction waste (timber framing, concrete, scrap metal, cable wire, plastics and materials packaging waste)
- regulated wastes (waste oil/oil-water mixtures, tyres, hydraulic fluid, packing materials, cement additives and solvents, paints and resins, oil filters and batteries)
- general waste from office areas and construction camp areas
- wastewater from kitchen, laundry and toilet facilities, dewatering of foundations, run-off from roads and construction areas, vehicle wash down activities and workshop bund sumps
- excess spoil (excavated rock and soil) from the diversion channel alignment, dam footprint and the pipeline trench
- vegetative waste associated with land clearing.

Existing buildings that will be removed from the site are included as waste and will be relocated in tact or dismantled, with materials being recycled where possible.

Decommissioning of all construction sites includes removing temporary buildings and structures, material stockpiles, water treatment plant, concrete batching plant, water and fuel tanks and rehabilitating works areas. The construction camps will be dismantled at the completion of construction and the sites rehabilitated.

The operational phase of the dam is expected to create minor waste streams such as household waste and waste from maintenance activities and the proposed recreation area. Volumes will be minimal and all wastes are to be disposed of at licensed facilities. Waste at the proposed recreation area will be the responsibility of IRC. Ablutions facilities at the recreation area will use septic trenches designed in accordance with IRC guidelines.

Sunwater proposes to mulch as much of the vegetative waste as practicable for use in construction site stabilisation or rehabilitation, landscaping of recreational facilities or make it available for potential use in regional rehabilitation schemes. The Coordinator-General agrees with Sunwater's intention to only pit-burn cleared vegetation as a last resort, given risks associated with burning and environmental nuisance from burning activities. Based on DERM's advice, a condition has been set to manage potential impacts (Appendix 1, Schedule A, Condition 9).

Mitigation measures

Environmental harm associated with project-generated wastes (construction and operation) will only occur if wastes are not managed appropriately. Accordingly, the waste sub-plan of the draft construction EMP (Appendix 4 of this report) aims to prevent or minimise waste generation, where practicable, and to appropriately contain, control and re-use or dispose of all waste generated. This includes implementing the waste minimisation hierarchy for the project with mitigation measures dealing with waste minimisation, waste disposal, wastewater and liquid waste, waste transport, regulated waste, environmental incidents and contaminated land, for example:

- implementing a waste management plan before commencing construction, to address issues of storage, transport and disposal
- avoid and minimise waste and re-use or recycle where possible
- colour coded and signed bins for waste separation and recycling
- training employees to understand the waste management plan and to recycle
- using licensed liquid waste contractors to dispose of liquid waste from workshops
- waste management procedures to deal with incidents of waste material released to the environment.

The Coordinator-General has set a condition (Appendix 1, Schedule A, Condition 1) to ensure the effective implementation of the construction EMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

Further, it is noted that project activities that create waste, such as extraction, and concrete batching, are ERAs and to operate, Sunwater will be required to comply with waste management conditions and produce a site-based management plan identifying sources of environmental harm, impacts and actions taken to prevent environmental harm. Sunwater will need to apply for development approval from DERM for each ERA if the activity does not meet a code of environmental compliance.

DERM has suggested conditions relating to ERAs of relevance to the project, which are designed to minimise environmental nuisance at any sensitive receiver resulting from activities during the construction phase of the project. Therefore, in addition to the conditions referred to above, the Coordinator-General has set conditions that must be attached to any development approval for an MCU for an ERA granted for the project (Appendix 1, Schedule B).

Coordinator-General's conclusions—waste

Based on the mitigation measures in the draft EMP, approvals and licences required for project activities that generate waste (e.g. ERAs, such as resource extraction and abrasive blasting), and conditions set by the Coordinator-General to ensure appropriate waste management, the Coordinator-General is satisfied waste arising from the project will be effectively managed.

5.9.7. Land contamination

Context

The EIS documents the results of contaminated land investigations, which included searches of the Contaminated Land Register (CLR) and Environment Management Register (EMR), aerial photograph interpretation, a roadside inspection of potential contaminated land sites within and surrounding the water storage area and pipeline route.

These investigations identified five livestock dip or spray race operations within or near the water storage area. The livestock dip and spray race sites may contain a variety of contaminants including arsenic, organochlorins, organophosphates and synthetic pyrethroids. Any contamination present could pose a threat to water quality and aquatic

organisms in the reservoir if remediation is not undertaken. Other potentially contaminated sites are the farm buildings on four properties within the water storage area and surrounds. The buildings may contain asbestos and may contain chemicals and petroleum products. No land parcels were listed on the CLR or EMR within or near the water storage area.

Investigations along the proposed pipeline route revealed eight land parcels listed on the EMR. In addition, aerial photography revealed cattle yards, farm buildings and disturbed land areas at multiple locations along the proposed route.

Potential impacts and mitigation measures

Potential land contamination impacts arising from the project include:

- Construction:
  - human contact/exposure to potentially contaminated material
  - soil, groundwater and surface water contamination from spillage of contaminates during transportation, storage, use and disposal.
- Operation:
  - contamination of dam water supply following inundation
  - limitation to land use surrounding the dam.

In the contaminated land sub-plan of the draft construction EMP, Sunwater has committed to a schedule of further investigations and remediation/management activities to meet the requirements of the *Draft guidelines for the assessment and management of contaminated land in Queensland*[60] in relation to the five identified sites within the dam and surrounds. The options to manage contaminated sites include on-site treatment to reduce contamination, capping of contaminated sites, excavation and off-site disposal to an off-site landfill and excavation and on-site disposal to a suitable location in the project area with appropriate engineered controls (e.g. liner, cap).

Section 424 of the EP Act requires that a person removing and disposing of contaminated soil from land which is recorded on the EMR or CLR to an off-site location must obtain a disposal permit from DERM as outlined in section 1, Table 4.2 of this report (page 32). Disposal permits enable appropriate and legal disposal and tracking of contaminated soil or materials. Sunwater has indicated that disposal permits will be obtained from DERM and that remediation of a site may not include removal from the EMR. Any necessary remediation and validation will be completed before dam construction has proceeded to a stage where the site is likely to be inundated or pipeline trenching works has commenced.

Investigations and remediation activities will be undertaken to meet the requirements of EP Act with regard to contaminated land, and to protect the quality of the water in the reservoir. Investigation, remediation where necessary and validation of all potentially contaminated sites located below the 1 in 100 year AEP flood level will be undertaken to ensure that the risk of contamination entering the water supply during the nominal 100-year life of the dam remains low.

Any necessary remediation and validation will be completed before dam construction has proceeded to a stage where the site is likely to be inundated. All contaminated sites must be remediated as appropriate to ensure there are no risks to human health or the environment during construction or to human health, water quality or aquatic organisms during operation. Remediation is to be either by burial and capping with an impermeable clay, removal and disposal at an approved waste disposal facility or in-situ treatment. Once treatment is completed, a final site assessment must be undertaken to validate the treatment effectiveness.

The processes required by the EP Act will be followed to remove all land in the project area from the EMR.

Searches of the Department of Defence website reveal that there is no potential for residual unexploded ordnance (UXO) to be present within the dam and surrounds or along or within 1.5 km of the pipeline route.

In its submission on the EIS, Queensland Health raised concerns regarding the lack of information on remediation activities to be undertaken on identified contaminated sites before inundation, to determine the potential risk to human health following inundation, particularly for recreational users of the dam.

The issue was responded to by Sunwater in section 8.1 of the SEIS with a commitment to undertake further investigations and remediation/management activities as specified in the land contamination sub-plan of the draft construction EMP.

Coordinator-General's conclusions—land contamination

There are a range of contamination risks that may impact land during construction, operation and decommissioning of the project. The Coordinator-General supports the advice provided by Queensland Health, that more detailed information is required to assess the impacts of contaminated land on human health.

Sunwater has made a number of commitments in the contaminated land sub-plan of the draft construction EMP, to appropriately manage existing potentially contaminated materials, prevent spills from occurring at the project site, and contain, clean up and if necessary, remediate any spills that do occur.

The Coordinator-General has set conditions to ensure the effective implementation of the contaminated land sub-plan of the construction EMP for the project, and to establish a monitoring, auditing and reporting regime to ensure compliance (Appendix 1, Schedule A, conditions 1 and 7).

Based on the mitigation measures contained within the draft EMP, the legislative requirements of the EP Act regarding contaminated land, and conditions set by the Coordinator-General to ensure the appropriate management of land contaminates, the Coordinator-General is satisfied potential impacts arising from land contamination will be minimal.

5.10. Hazard and risk

5.10.1. Introduction

The following section provides an analysis of hazard and risk impacts that may arise from construction or operation of the project.

Some submissions on the EIS raised issues in relation to hazard and risk. The Coordinator-General has considered each of the submissions and how the SEIS responded to the issues raised. The key issues that the Coordinator-General considered warranted particular elaboration and/or explanation in his evaluation included:

- emergency management
- flood risks at construction sites or worker camps during construction.

These matters are discussed further below in this section of the report.

Submitter issues regarding road safety and transport efficiency, increased demand for emergency services and their ability to respond in a timely manner as a result of the increase traffic generated by the project, are addressed in section 5.8 of this report.

5.10.2. Context

Statutory legislation (and related subordinate legislation such as Regulations, Codes of Practice, Australian Standards and other guidance materials) establishes the minimum standard by which activities for this project must be undertaken. In particular the:

- *Water Supply (Safety and Reliability) Act 2008* (Qld) sets the legislative framework for dam safety in Queensland
- *Explosives Act 1999* (Qld) sets out the requirements for handling, storing, transporting and manufacturing explosives.
- *Workplace Health and Safety Act 1995* (Qld) sets out requirements to prevent a person's death, injury or illness being caused by a workplace, by a relevant workplace area, by work activities, or by plant or substances for use at a workplace
- *Building Act 1975* (Qld) sets out permit requirements for the storing flammable and combustible liquids from the relevant local Council
- *Dangerous Goods Safety Management Act 2001* (Qld) sets standards for the transport and storage of substances and the systems to be adopted based on these substances.

The *Water Supply (Safety and Reliability) Act 2008* mandates that a failure impact assessment (FIA) must be undertaken for the Connors River Dam given its proposed height (greater than 8 metres) and storage capacity (greater than 500 megalitres). However, the FIA is not required during the EIS phase of the project, as detailed design information is required to undertake a full FIA. Accordingly, a FIA will be undertaken during the detailed design phase for the dam and results provided to the reviewer and regulator for approval.

5.10.3. Potential impacts and mitigation measures

Chapter 26 of the EIS provided the results of the preliminary hazard identification and a preliminary risk assessment and analysis undertaken by Sunwater in accordance with *Australian/New Zealand Standard AS/NZS 430:2004 Risk Management*[61] and Australian National Committee on Large Dams Incorporated (ANCOLD) guidelines[62]. This framework has allowed Sunwater to identify, prioritise, manage and compare environmental, social and economic risks and hazards of concern in regard to each aspect of the design, construction, operation and decommissioning of the project components.

The main hazard events identified are sudden dam failure and public safety. All other off-site hazards identified due to dam construction are either of low or medium residual risk. The on-site risks to workers during construction are generally low to moderate with the exception of safety risks from blasting and contact with electricity while relocating high voltage power lines. As part of the hazard and risk sub-plan of the draft construction EMP (Appendix 4 of this report), Sunwater has committed to developing safety management systems, emergency management plans and mitigation measures to be implemented during the design, construction and operation of the project to manage the residual risk, particularly in relation to sudden and catastrophic failure of the dam.

Climate, climate change, natural hazards and extreme weather conditions have been examined and considered in the design, construction and operation of the project. Dam safety emergency plans and contingency plans will be developed for the construction, operation and maintenance phases of the project to account for natural disasters such as storms, floods and fires. While earthquakes have been recorded in the region (the Coordinator-General was advised that post-EIS and SEIS release, a seismic event occurred near Bowen in early 2011), the project is located in an area of low earthquake risk. As the dam will be constructed in accordance with ANCOLD, Sunwater advise that earthquake risk can be accommodated within the design. The hazard and risk sub-plan of the draft construction EMP requires appropriate design factors to account for earthquake and fault movement to be applied for the dam and pipeline construction.

It is acknowledged that the dam design is only preliminary, and only an initial assessment of the consequences of dam failure has been completed by Sunwater. As a result, the required dam break study (a requirement of the FIA) is yet to be completed. The legislatively required FIA (which must be independently certified) and quantitative level of risk assessment and associated risk contouring will need to be completed to the satisfaction of the dam safety regulator (DERM) before constructing the dam wall. It is common practice that these investigations be conducted by Sunwater as part of the detailed design of the structure. The investigations produce the information that the dam safety regulator requires in accordance with the detailed requirements set out in Appendix 1, Schedule C.

From preliminary investigations, Sunwater considers it likely the dam will be classified as having a ‘High C’ category for a sunny day failure hazard and the FIA will be ‘Category 1’ (as defined under the Water Supply (Safety and Reliability) Act). In the absence of a formal dam break assessment, Sunwater advise it is difficult to assign an

incremental flood hazard category; however, the incremental flood hazard category is not expected to exceed the sunny day failure hazard category.

The acceptable flood capacity for a dam is based on the assigned hazard category. In Queensland, this must be undertaken according to the *Guidelines on Acceptable Flood Capacity for Dams*[63] which deviates slightly from the comparable ANCOLD requirements. The fall back option for a 'High C' hazard category dam is that it is required to have adequate spillway capacity to safely pass a flood with an annual exceedence probability (AEP) between 1 in 10 000 for the probable maximum precipitation design flood (PMPDF, which equates to an AEP of 1 in 800,000 for the dam). However, due to the uncertainty of the hazard category at this time, Sunwater has designed the dam spillway to pass the probable maximum flood (PMF) which significantly exceeds this requirement. The dam is designed to have sufficient discharge to safely pass the PMF so that if such an event occurs, any downstream community will not be subject to additional risk due to it being in place.

In response to submissions on the EIS regarding emergency management, including at the proposed construction camps, Sunwater acknowledges the requirement to include all emergency services in the development of proposed emergency management plans. This specifically includes Queensland Police Service (QPS), Queensland Fire and Rescue Service (QFRS), State Emergency Services (SES), Queensland Ambulance Service (QAS) and hospital services. Emergency planning will be undertaken during detailed design, when a construction contractor has been appointed. This is because aspects of the project that are particularly relevant to such planning are strongly influenced by the contractors work practices, policies and procedures.

Evacuation and access maps of the construction camps, including the identification of a possible helicopter landing site, will be provided to emergency services during the emergency planning process. Sunwater acknowledge in section 26.1 of the SEIS that due to the project's relative isolation from immediate emergency service response, it is essential that staff working and/or living at the construction site are fully conversant with the emergency management, action plan and response procedures, including the use of installed firefighting equipment along with any other on-site equipment that is primarily for their use.

The construction camps will be designed and built in accordance with State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide. It is noted that QFRS has a legislative jurisdiction to provide input into the design of a building or structure's fire safety systems as an advice agency.

The Coordinator-General has set a condition which will require the inclusion of additional requirements in the hazard and risk sub-plans for both the CEMP and OEMP for the project (Appendix 1, Schedule A, Condition 8). In particular:

- a dedicated helicopter landing pad is to be designed, constructed and maintained by Sunwater at the dam site for the duration of both the construction and operational phases of the project to allow any required evacuation (e.g. accident victims) during project construction, and operation as a water storage and recreational site
- ongoing liaison with local health and emergency service providers to identify potential capacity constraints ahead of time

- development of response plans, roles and responsibilities in consultation with local emergency services, including fire, ambulance and police stations
- development and implementation of a health and safety plan in consultation with relevant emergency services organisations to limit the number of project-related emergencies.

It is noted in section 24.3.1.1 of the EIS that Sunwater will manage the land use in the acquired and partially acquired properties that abut the water storage in the flood margin to ensure public safety and prevent property damage in the event of a flood during construction and operation of the dam.

5.10.4. Coordinator-General's conclusions

Sunwater has made commitments in the hazard and risk sub-plan of the draft construction EMP to safely manage risks to the workforce, public and existing environmental values, including surrounding land uses associated with the project.

The Coordinator-General has set conditions to ensure the effective implementation of a comprehensive hazard and risk sub-plan for the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance (Appendix 1, Schedule A, conditions 1, 2 and 8).

Based on the mitigation measures contained within the draft EMP, legislative requirements that establish minimum health and safety standards, and the Coordinator-General's conditions, the Coordinator-General is satisfied that hazards and risks will be appropriately managed during construction and operation of the project.

6. Environmental management plan

6.1. Environmental management plans proposed by Sunwater

A draft EMP has been prepared by Sunwater and is contained within Chapter 29 of the EIS. The draft EMP sets out the project commitments to avoid or minimise potential environmental impacts as identified in the EIS and SEIS during both construction and operational phases of the project (hereafter referred to as the CEMP and OEMP, respectively), including identification of environmental aspects to be managed and how environmental values may be protected and enhanced.

The draft EMP has been developed on the understanding detailed EMPs for construction and operation are to be prepared by the contractor and reviewed by Sunwater and DERM. Both detailed EMPs must include, but not be limited to, mitigation measures that address the environmental objectives and performance criteria of the draft EMP and conditions imposed by the Coordinator-General or other government agencies on approvals required for the project.

The EMPs will be dynamic documents that incorporate continuous improvement. Each plan will be updated to incorporate further information, approval conditions, and changes in environmental management procedures in light of ongoing monitoring results, new techniques and relevant legislative requirements.

The draft EMPs are divided into sub-plans corresponding to different chapters of the EIS (where applicable). These are shown in Table 6.1 of this report. Each sub-plan contains the following information:

- proposed environmental management objectives, actions and performance criteria to be implemented to mitigate adverse impacts
- monitoring, reporting and auditing requirements
- the entity responsible for implementing the proposed action
- corrective actions if monitoring indicates that performance requirements have not been met.

Since the release of the EIS, Sunwater has updated its draft CEMP and OEMP to ensure all commitments and mitigation measures proposed in the EIS and SEIS have been included. The updated draft EMPs are contained within Appendix 4 of this report.

Table 6.1 Index of CEMP and OEMP sub-plans

EIS section number	Sub-plan	Strategies, control plans, programs and systems
Draft CEMP		
29.9.3	Geology and soils	Sediment and erosion control plan
29.9.4	Land contamination	Contaminated land management procedure

EIS section number	Sub-plan	Strategies, control plans, programs and systems
29.9.5	Surface water hydrology	Sediment and erosion control plan Water quality management plan Vegetation clearance strategy
29.9.6	Groundwater	Groundwater monitoring and management program
29.9.7	Surface water quality	Project water quality monitoring program Sediment and erosion control plan
29.9.8	Terrestrial flora	Vegetation clearance management plan Weed management plan rehabilitation plan Environmental offset strategy
29.9.9	Terrestrial fauna	Pest management plan Fauna Relocation Plan
29.9.10	Aquatic flora and fauna	Fauna relocation plan Pest management plan Weed management plan
29.9.11	Weeds	Weed management plan
29.9.12	Animal pests	Pest management plan
29.9.13	Air quality and greenhouse gas	Dust management plan Greenhouse gas reduction
29.9.14	Noise and vibration	Site noise management practices
29.9.15	Waste	Waste management procedures
29.9.16	Hazard and risk	Workplace health and safety plan Fire management plan Asbestos management plan
29.9.17	Transport and roads	Traffic management plan Construction traffic management plan Road-use management plan
29.9.18	Indigenous and non-Indigenous cultural heritage	Cultural heritage management plan
29.9.19	Social and economic	Communication program Complaint management system
Draft OEMP		
29.10.2	Management of water storage and pipeline	Operation and maintenance manual Geomorphic monitoring plan Critical water supply strategy
29.10.3	Dam safety	Emergency action plan
29.10.4	Geology and soils	Geomorphic monitoring plan
29.10.5	Surface water quality	Surface water quality risk management plan Water quality monitoring program
29.10.6	Hazardous substances	

EIS section number	Sub-plan	Strategies, control plans, programs and systems
29.10.7	Social and economic	
29.10.8	Pests and weeds	Weed management plan Pest management plan

6.2. Approval, implementation and review of EMPs

The Coordinator-General has required Sunwater to submit to DERM for approval (as per Appendix 1, Schedule A, conditions 1–2):

- a CEMP at least 30 business days before commencing construction works
- an OEMP at least 60 business days before the proposed operations commencement date.

The Coordinator-General has also required Sunwater to report to DERM on the implementation of the CEMP and OEMP, including construction and operations phase compliance reporting, and construction and operation incidents and exceedence reporting.

These conditions are directed at ensuring an integrated implementation of conditions of this report, and establishing a monitoring, auditing and reporting regime to ensure compliance.

In addition, the Coordinator-General has set additional requirements for inclusion in the draft CEMP and/or OEMP for the following sub-plans:

- Groundwater (Appendix 1, Schedule A, Condition 3)
- Geology and Soils (Appendix 1, Schedule A, Condition 4)
- Noise and vibration (Appendix 1, Schedule A, Condition 5)
- Air quality and greenhouse gas (Appendix 1, Schedule A, Condition 6)
- Land contamination (Appendix 1, Schedule A, Condition 7)
- Hazard and risk (Appendix 1, Schedule A, Condition 8)
- Waste (Appendix 1, Schedule A, Condition 9)
- Social and Economic (Appendix 1, Schedule A, Condition 10).

The effective implementation of the EMP will satisfy the commitments made by Sunwater in the SEIS and the requirements of conditions, and will effectively manage the environmental impacts of the project.

6.3. Proponent commitments

Appendix 5 of this report contains a list of commitments provided by Sunwater.

The commitments are derived from the mitigation measures referred to in the EIS and SEIS and also the EMP, which Sunwater will need to incorporate into the construction contracts.

7. Matters of national environmental significance

7.1. Introduction

This section of the report addresses the requirements of Part 13 of the *State Development and Public Works Organisation Regulation 2010* (SDPWO Regulation) and Schedule 1 of the bilateral agreement. It has been drafted to serve as a standalone document to assist the requirements of the Australian Government. Accordingly, some parts of this section are necessarily duplicated from other sections of this report.

7.2. The project

The project is the construction and operation of the Connors River Dam and Pipelines project. The project is described at section 2 of this report. The proponent of the project is Sunwater Limited (Sunwater).

7.3. Controlling provisions for the project

On 28 August 2008, Sunwater referred the project to the Australian Government Environment Minister (referral number EPBC 2008/4429) for determination as to whether the project would constitute a 'controlled action'[64] with respect to potential impacts on matters of national environmental significance (MNES) under sections 75 and 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act).

The EPBC Act establishes an Australian Government process for assessing environmental impacts and approving proposed actions that are likely to have a significant impact on MNES or on Commonwealth Government land.

On 25 September 2008, the minister determined the project to be a 'controlled action' under the EPBC Act, and therefore it must be assessed for approval under the EPBC Act. The relevant controlling provisions under the EPBC Act are:

- sections 12 and 15(A) world heritage properties
- sections 15B and 15(C) national heritage places
- sections 16 and 17(B) wetlands of international importance
- sections 18 and 18(A) listed threatened species and ecological communities
- sections 20 and 20(A) migratory species protected under international agreements.

The Australian Government has accredited the State of Queensland's EIS process, conducted under the *State Development and Public Works Organisation Regulation 2010* (SDPWO Regulation), pursuant to a bilateral agreement between the Australian and Queensland governments. Under the agreement (made under section 45 of the EPBC Act), if a controlled action is a significant project for which an EIS is required under the SDPWO Act, then the project does not require assessment under Part 8 of

the EPBC Act. The agreement enables the EIS to meet the impact assessment requirements of both Commonwealth and Queensland legislation.

The controlled action may be considered for approval under section 133 of the EPBC Act, once the minister has received the Coordinator-General's EIS evaluation report (prepared under section 35 of the SDPWO Act).

7.4. Description of the proposed action

Sunwater proposes to construct and operate the Connors River Dam (on the Connors River in Central Queensland) and associated water delivery infrastructure.

The proposed project consists of the construction and operation of the Connors River dam, pipeline and associated infrastructure (refer to Figure 7.1).

7.4.1. Location

The project is located in Central Queensland on the Connors River at adopted middle thread distance (AMTD) 95.7 km (measured from the junction with the Isaac River), some 5 km downstream of the junction of Murray and Collaroy Creeks, approximately 110 km due east of Moranbah and 70 km south of Sarina.

The project is contained wholly within the Isaac-Connors (River) sub-catchment area of the Fitzroy (River) Basin catchment.

The dam site (latitude 22:1:58X, longitude 147:7:57E) is approximately 247 km upstream of the junction of the Connors/Isaac/Mackenzie River system with the Fitzroy River and is 618.7 km from the mouth of the Fitzroy River. The Connors/Isaac/Mackenzie River system drains the western slopes of the Connors Range, which is part of the mountain range that separates the area from the coastal plains around Sarina.

The trunk water distribution pipeline from the dam to Moranbah initially follows the Connors River and the Connors River-Collaroy Road until it crosses the Connors River where it continues west to the Marlborough-Sarina Road. From there, it extends north-west and follows the BHP Billiton Mitsubishi Alliance (BMA) pipeline alignment until it reaches the Peak Downs Highway at the junction with the Fitzroy Development Road. The pipeline then largely follows the Peak Downs Highway to Moranbah.

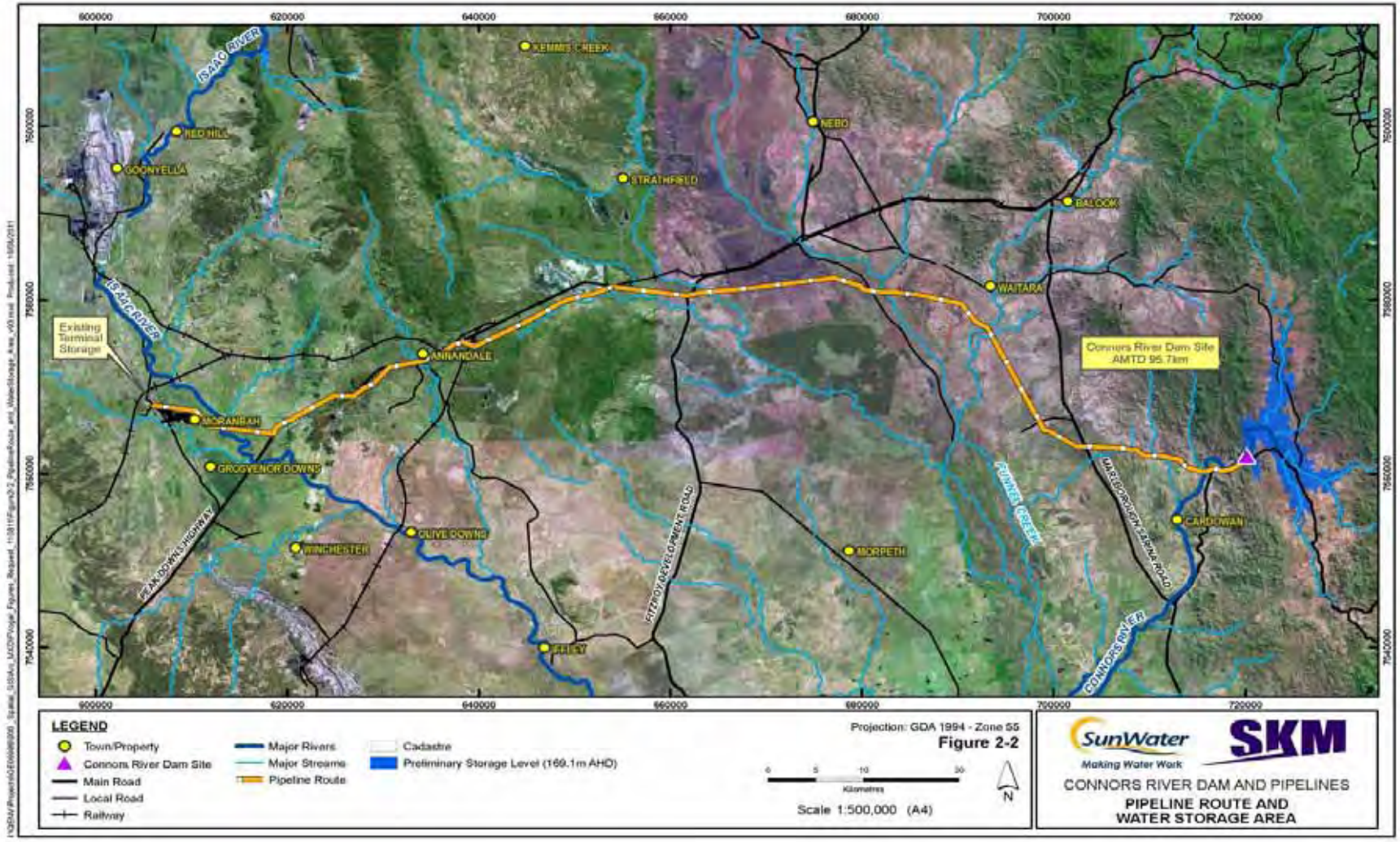


Figure 7.1 Pipeline route and water storage area

7.4.2. Connors River Dam

The dam will have a maximum water storage capacity of 373 662 megalitres at full supply level (FSL) 169.1 metres Australian Height Datum (AHD) and a minimum water storage capacity (dead storage) of 14 863 megalitres at elevation level 154 metres AHD. The dam will inundate an area of approximately 5850 ha including 2061 ha of native remnant vegetation and approximately 1353 ha of watercourse vegetation. The extent of inundation is shown in Figure 7.2.

In addition to the water storage area, 2122 ha of flood margin, based on the 1 in 100 annual exceedence probability (AEP) flood, will be provided and a further 56 ha will be required for the dam construction area. However, the dam is not intended to serve a flood mitigation role and as such does not include gates that would allow mitigation of flood flows.

The dam will yield 54 500 megalitres per annum of water, of which 49 500 megalitres per annum of high priority water will service water users in the Bowen Basin coal region[65] and surrounds (largely coal mines and associated urban communities) and 5000 megalitres per annum of medium priority water will be available for downstream irrigated agricultural use.

The 602-metre-long dam wall will be constructed using roller compacted concrete (RCC) and includes the following associated facilities:

- a 250-metre long, uncontrolled fixed crest, smooth, central spillway
- an aquatic fauna transfer device
- offtake and outlet works
- one pump station with three pumps.

At FSL, the spillway crest will be 32 metres above the river bed and the water level difference between the upstream reservoir and the downstream tail water will be 29 metres. The dam has an expected design life of 100 years.

The dam wall, water storage and flood margin areas, associated infrastructure (such as access roads), and related vegetation or biodiversity offsets requirements will impact 10 properties. Five grazing properties (Undercliff, Ridgeland, Collaroy, Marylands and Doreen) and three small lots (Telstra repeater tower, Council reserve and unallocated State land) are directly impacted by the construction and operation of the dam and/or associated infrastructure. The affected properties are shown in Figure 7.3.

Sunwater's mitigation of affected properties is to acquire land which is directly impacted by the proposed dam, including the water storage area, the flood margin, the construction footprint and for vegetation and biodiversity offset purposes.

Sunwater has acquired all grazing properties directly impacted by the dam. Grazing properties Deacey and Mountain View (refer to Figure 7.3) were also purchased on the basis that these properties were indirectly impacted through the loss of road access. However, since the release of the EIS, Sunwater has proposed a new access road through Marylands (refer to section 7.4.6 of this report for more information). This will

ensure the viability of farming operations and will allow the resale of these properties for grazing purposes.

With the exception of Ridgeland, which will be exclusively managed for environmental offset purposes (refer to section 7.11.4 of this report for more information) Sunwater's property acquisition strategy provides for the resale of parts of acquired properties not required for the project (for example, for the water storage area, flood margin and associated infrastructure) as grazing properties. Proposed vegetation offset areas on these properties (including Marylands, Undercliff and Collaroy) will be protected through an appropriate form of tenure or protected area status under the *Nature Conservation Act 1992* (Qld).

Operation of the dam involves routine inspection of the water storage to manage water quality, vegetation, landscape stability, weeds, land, property and asset management, and mechanical and electrical maintenance.

Figure 7.2 Extent of Inundation

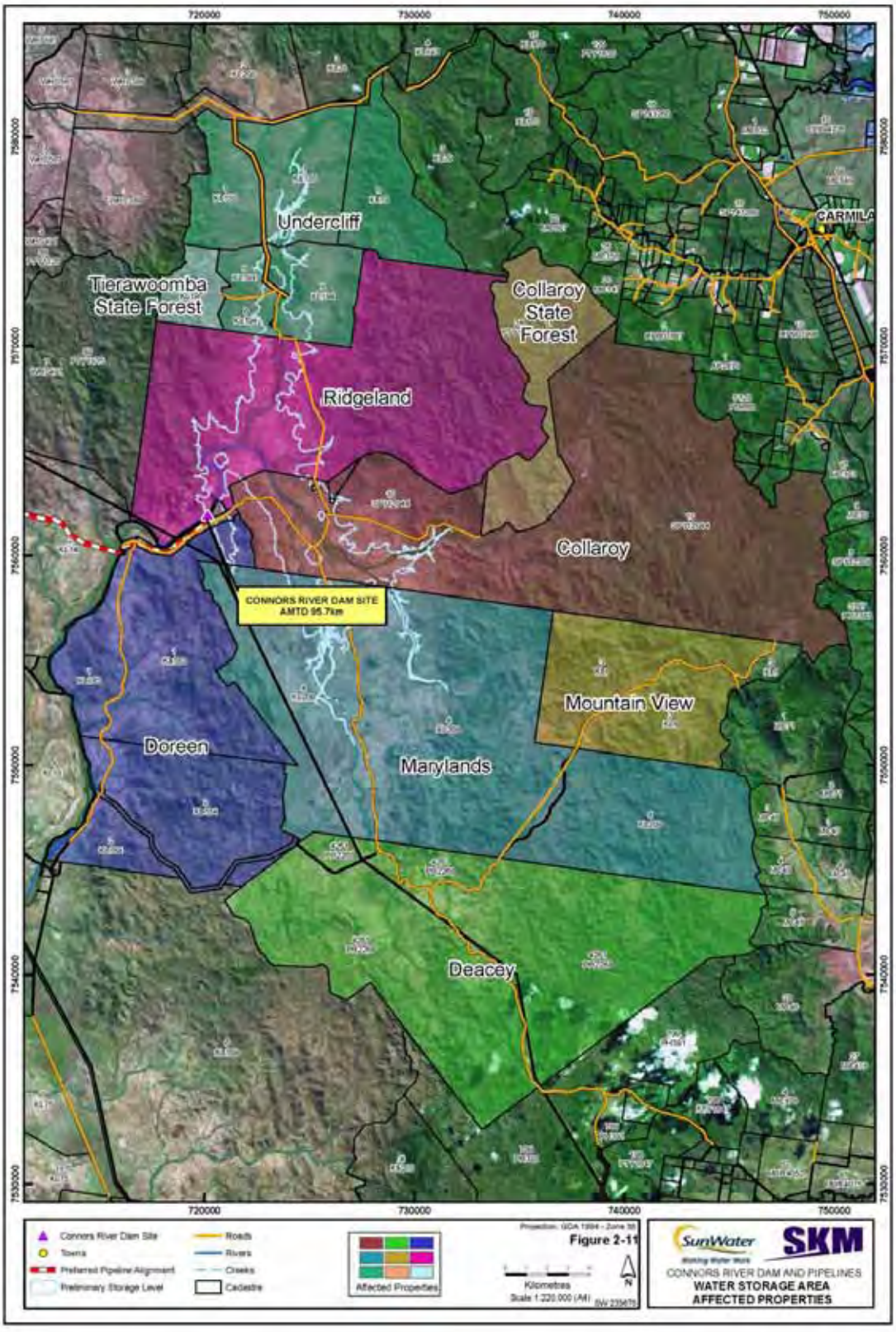


Figure 7.3 Properties affected by the water storage area

7.4.3. Pipeline

A 133-kilometre, 1200 to 1500 millimetre diameter mild steel cement lined pipe (MSCL) trunk water distribution pipeline will transport water from the dam west to Moranbah.

The pipeline diameter will be 1500 millimetres from the dam to the five-megalitre balancing storage and 1200 millimetres from the five-megalitre balancing storage to Moranbah.

The pipeline will be predominantly buried with a 900-millimetre cover in a 15-metre-wide easement and includes the following associated water distribution facilities:

- one pump station with three pumps
- one five-megalitre concrete ring tank balancing storage, 35 metres in diameter and 5.2 metres high
- 330 air release valves
- two control and reflux valves
- three surge tanks and 18 air cushion standpipes
- 100 scour outlets
- nine swab isolation valves and four pigging stations
- cathodic protection systems
- approximately 346 thrust blocks
- mechanical and electrical works
- fibre optic cable in or adjacent to the pipeline to provide telecommunications for operating the pipeline
- a three-metre-wide vehicle access track for inspections and maintenance.

The pipe, concrete foundations and supports for the above-ground pipe have an expected design life of 80 years, while other associated infrastructure such as pumps, valves and motors, have an expected design life of 40 years.

The trunk water distribution pipeline component of the project includes a trunk pipeline only and does not include connecting lateral pipes to water customers.

The trunk water distribution pipeline and associated infrastructure will impact 75 properties and/or land tenures. These affected properties are primarily rural and agricultural and are shown in Figure 7.4. Sunwater's mitigation of affected properties is to acquire the tenure for the balancing storage and pump station, and put in place easements for the remaining impacted properties.

The pipeline will in general operate automatically; however, there will be a requirement for periodic monitoring for leaks and maintenance of mechanical equipment.

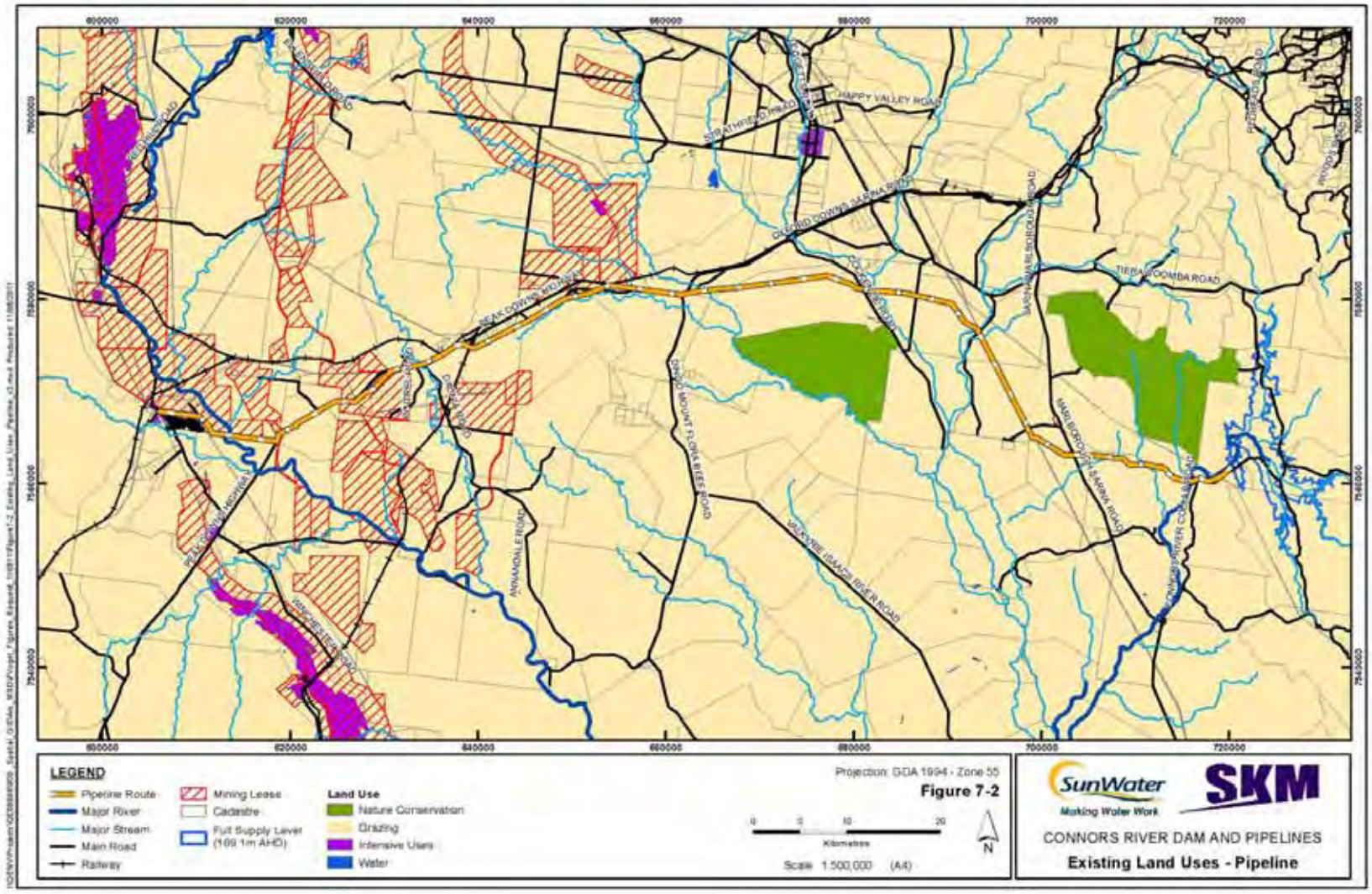


Figure 7.4 Existing land uses along the pipeline route

7.4.4. Associated infrastructure

Infrastructure requirements associated with the construction and operation of the dam component of the project include:

- construction of a new 14.2-kilometre, single-lane, unsealed rural access road, which connects the Connors River-Collaroy Road, just south of the dam wall, with the Killarney-Collaroy Road, near the Marylands homestead, providing construction access to the dam wall from the north
- a 4.5-metre-wide bridge over Collaroy Creek, five causeways, three major culvert crossings and 13 minor culvert crossings as part of the new 14.2-kilometre northern access road
- upgrade approximately 20 km of the Connors River-Collaroy Road from the Marlborough-Sarina Road to the proposed dam site and recreation area, to two-lane, unsealed, high quality pavement surface standard
- upgrade the Marlborough-Sarina Road/Connors River-Collaroy Road intersection to accommodate all construction and operational traffic generated by the project
- closure of sections of the Connors River-Collaroy Road, Collaroy-Tierawoomba Road and Killarney-Collaroy Road
- removal of existing Ergon low voltage electrical transmission infrastructure
- relocation to near the dam wall and upgrade to 3G coverage of a Telstra telecommunications tower and repeater station
- construction of new 66-kilovolt supply lines, likely from Nebo to the dam, the precise location of which will be determined by the electricity providers, to service the pump stations and dam
- a temporary dam construction site office at the dam site
- a 250-person temporary dam construction camp located approximately 10 km downstream of the dam site on the Connors River-Collaroy Road near the intersection with the Marlborough-Sarina Road
- potable water (30 000 litres per day) and wastewater treatment plants at the dam site and the construction camp
- installation of telephone and data services for construction camp accommodation, dam site office and permanent dam facilities
- installation of new gauging stations at headwater and tailwater of the new dam and at major tributaries upstream of the dam
- a three-hectare recreation area adjacent to the dam water storage, incorporating a boat ramp, car park, picnic facilities, septic toilet facilities, rainwater tanks and general landscaping
- resource extraction areas, including a hard rock quarry near the right abutment of the dam wall.

Project infrastructure requirements associated with the construction and operation of the pipeline component of the project, include:

- a permanent, very low level concrete causeway crossing of the Connors River, approximately 6 km downstream of the dam

- temporary pipeline construction crossings of Funnel Creek and Denison Creek
- new shallow water bores and associated turkeys nest storages at a number of pipeline watercourse crossings
- construction of 66-kilovolt power lines from Nebo to the pump stations
- a pipeline construction project office located with one of the temporary pipeline construction camps
- two 150-person temporary pipeline construction camps:
  - one located at the eastern end of the pipeline route at or about the Hamilton Park property and accessed from Waitara Road
  - one located at the western end of the pipeline route at or about the five-megalitre balancing storage, 20 km from Moranbah and adjacent to the Peak Downs Highway
- wastewater treatment plants at the construction camps
- six lay-down areas of varying footprints, ranging from four to nine ha, along the pipeline route
- resource extraction areas, including sand for pipe bedding located within the water storage area and from a number of watercourses along the pipeline route, road base or gravel for access tracks located near the dam wall, and clay for the five-megalitre balancing storage located approximately five km east of Moranbah.

7.4.5. Key environmental design features

The project includes the following key environmental design features:

- a multi-level offtake tower, screened to prevent aquatic fauna entrapment and designed to operate at minimum storage level to enable best quality water to be extracted
- outlet facilities that provide flexibility with respect to environmental flow releases and re-aeration of water released downstream
- an aquatic fauna transfer device that operates to very low water levels, and is designed to maintain passage and minimise injury, death and entrapment of aquatic fauna
- provision of structural habitat for aquatic fauna
- use of land, including land management practices, in the dam catchment for environmental offset purposes
- community recreational facilities at the dam
- a predominantly buried water distribution pipeline
- dam operating procedures, which addresses water quality, ecology and human use.

At the time of finalising this report, the capital cost of the project is estimated to be $1.17 billion, of which $587 million is associated with the dam and $584 million is for the pipeline. The project is expected to create a peak workforce of 620 during the 26-month construction period and up to eight jobs over the 80–100 year operational life of the project.

7.4.6. Project changes

Since the release of the EIS, Sunwater has further developed the design of the project as a result of further investigations, issues raised in submissions on the EIS and ongoing consultation with landowners. Changes to the project scope as described in Part C of the SEIS, include:

- constructing a new 14.2-kilometre, single-lane, unsealed rural access road, which connects the Connors River-Collaroy Road, just south of the dam wall, with the Killarney-Collaroy Road, near the Marylands homestead, providing construction access to the dam wall from the north
- refining the pipeline route resulting in the deletion of alignment options 'Eastern B', 'BMA A', 'BMA B' and 'Moranbah', splitting of pump station one into two separate stations, relocating pump station two and the 600-megalitre balancing storage. The pipeline refinement has reduced impacts on 11 small lots and resulted in one additional large lot impact
- replacing the originally proposed stepped spillway with a smooth spillway
- revising the proposed vegetation and biodiversity offsets strategy
- identifying additional suitable hard rock quarry sites on the west of Marylands property and on the east of Doreen property, confirmation that the original Marylands property and right abutment of the dam wall sites were suitable and that the Mount Bridget site was not suitable, with the preferred site being the right abutment of the dam wall
- refining the land acquisition strategy to take account of the revised vegetation and biodiversity offsets strategy.

Since the release of the SEIS, Sunwater has further progressed the design of the project resulting in the following changes to the scope of the project:

- removing pump station two and the five-megalitre balancing storage
- increasing the size of the pumps at the dam pump station and reducing the number of pumps from seven to three
- replacing the 600-megalitre balancing storage with a five-megalitre balancing storage, 35 metres in diameter and 5.2 metres high
- increasing the pipeline diameter from 1200 millimetres to 1500 millimetres and from 1125 millimetres to 1200 millimetres from the dam to the balancing storage and from the balancing storage to Moranbah, respectively
- eliminating the need for clay extraction for the five-megalitre concrete ring tank.

Further details of these project changes can be found in Appendix 8.

The project changes noted above are included in the description of the project as set out above and in section 2.2.4 of this report. Impacts of the changes have been assessed by the Coordinator-General in preparing this report.

7.4.7. Dependencies and relationships with other projects

The project is dependent upon proposed mines proceeding in the northern Bowen Basin, around Moranbah. As noted in subsection 1.6 of the EIS (alternatives to the project) and subsection 1.3 of the SEIS (alternatives to the project), without water from the Connors River Dam and Pipelines project, there is insufficient water available from other sources to service the proposed mine developments in the northern Bowen Basin within the necessary timeframes and at an acceptable price.

Other water infrastructure proposed in the Fitzroy (River) Basin catchment to meet the shortfall in water demand, include:

- Glebe Weir raising on the Dawson River
- Nathan Dam and Pipeline project on the Dawson River
- Lower Fitzroy River infrastructure project, on the Fitzroy River (includes the raising of Eden Bann Weir and construction of a new weir at Rookwood)
- Gladstone to Fitzroy Pipeline project.

However, these proposed water infrastructure projects are significantly remote from the demand centres in the northern Bowen Basin. Accordingly, they are unlikely to be a viable source of supply to meet demand in the northern Bowen Basin and consequently have no effect on the delivery of the Connors River Dam and Pipelines project.

In addition to existing and planned water infrastructure in the Fitzroy (River) Basin, there are numerous (existing) distribution infrastructure facilities supplying water to the northern Bowen Basin from the Burdekin (River) Basin catchment, including the Eungella Water Pipeline and the Burdekin to Moranbah Pipeline. These pipelines do not have spare capacity to provide additional water to the northern Bowen Basin.

However, there are a number of proposed water distribution projects in the northern Bowen Basin at various stages of planning and development (refer to Figure 7.5). These proposed projects, if they proceed, would result in a water pipeline grid, which would enable the supply of additional water to the northern Bowen and Galilee Basins from multiple sources, including the Burdekin Falls Dam and proposed Connors River Dam, to meet the anticipated increase in demand. These proposed water pipelines, include:

- duplication of the Southern Eungella pipeline
- Burdekin to Moranbah pipeline augmentation (currently under construction)
- Gorge Weir to Byerwen Coal Mine pipeline
- Bingegang Weir to Middlemount pipeline
- Moranbah to Alpha pipeline.

These pipelines would access existing water storages and/or the proposed Connors River Dam to redistribute existing water allocations – that is, they do not involve the diversion of additional water from their supply sources or the construction of any in-stream infrastructure.

The Connors River Dam and Pipelines project would be an integral part of such a water pipeline grid and would play a key role in supplying water to proposed mining development in the northern Bowen and Galilee Basins, given the project's advanced planning status.

Figure 7.5 Sunwater's proposed water pipeline grid

7.5. Public consultation

7.5.1. Terms of reference

A final initial advice statement (IAS) was lodged with the Coordinator-General on 20 February 2008 and on 7 March 2008, the Connors River Dam and Pipelines project was declared a 'significant project for which an EIS is required' pursuant to section 26(1)(a) of the SDPWO Act.

Draft terms of reference (TOR) were prepared by the former Department of Infrastructure and Planning (DIP) on behalf of the Coordinator-General, with relevant input from SEWPaC.[66]

The IAS and draft TOR were advertised for public comment on 31 January 2009. Comments on the draft TOR were accepted until close of business on 9 March 2009. The final TOR was issued to Sunwater on 16 July 2009.

A total of 22 submissions were received on the draft TOR. Eighteen submissions came from advisory agencies, two from non-government organisations and two from private submitters.

7.5.2. Environmental impact statement

An EIS, addressing the TOR, was prepared by Sunwater and presented to the Coordinator-General on 16 October 2009. Following an iterative review process, whereby the Coordinator-General and SEWPaC determined the EIS substantially addressed the TOR, the EIS was publicly advertised on 6 February 2010 inviting submissions from the public for a six-week period until close of business on 22 March 2010.

Table 7.1 outlines the public and agency submissions on the EIS.

Table 7.1 Public and agency comments received on the EIS

Agency	No. submissions	Issue summary
Queensland Government		
Department of Transport and Main Roads	1	Transport, Road and Rail Corridor, Land Use and Infrastructure
Department of Infrastructure and Planning	1	Urban Water Supply
Department of Community Safety	1	Climate and Natural Disasters, Hazard and Risk
Qld Health	1	Land Contamination, Surface Water Quality, Social Values and Management of Impacts
Department of Environment and Resource Management	1	Surface Water

Agency	No. submissions	Issue summary
Department of Communities	1	Social values and Management of Impacts, Land Use and Infrastructure
Qld Police	1	Traffic & Transport, Hazard & Risk, Social Values and Management of Impacts
Department of Employment, Economic Development and Innovation	1	Surface Water, Aquatic Fauna
Local Government		
Isaac Regional Council	1	Surface Water, Transport, Economic Environment and Management of Impacts
Stakeholder and community groups		
Construction, Forestry, Mining and Energy Union	1	Surface Water, Social values and management of impacts
Qld Conservation Council	1	Surface Water, Surface Water quality, Climate and Natural Disasters
Powerlink	1	Land Use and Infrastructure
QR Network	1	Rail Infrastructure
Private individuals	2	Surface Water, Surface Water Quality
Total	**15**	

7.5.3. Supplementary EIS

The Coordinator-General requested Sunwater submit a supplementary EIS (SEIS) to address public and agency comments received on the EIS, and some of the key elements of the project which have changed since the release of the EIS. Key changes, as described in the SEIS, include:

- a new 14.2-kilometre section of construction access road
- refinement to the pipeline route
- refinement to land acquisition requirements
- replacement of the originally proposed stepped spillway with a smooth spillway
- refinement to the proposed vegetation and biodiversity offset strategy
- inclusion of additional quarry investigation areas.

Table 7.2 outlines the submissions received on the SEIS.

Table 7.2 Public and agency comments received on supplementary project information

Agency	No. submissions	Issue Summary
Queensland Government		
Department of Community Safety	1	No further information required
Qld Police	1	Transport and Traffic, Hazard and Risk
Department of Employment, Economic Development and Innovation	1	Aquatic Fauna, Surface Water, Cumulative Impacts, Geology and Soil
Department of Communities	1	Satisfied with SEIS
Qld Health	1	Land Contamination, Surface Water Quality
Department of Transport and Main Roads	1	Traffic and Transport, Proposed Pipeline
Department of Employment and Training	1	Satisfied with Supplementary EIS
Department of Environment, Resource Management and Innovation	1	Water Resources, Environmental Management Plans, Flora and Fauna (including Fitzroy River turtle), Vegetation Offsets, Environmentally Relevant Activities
Stakeholder and community groups		
Macarthur Coal Limited	1	Pipeline Route
QR National Network Services	1	Land Use and Infrastructure
Total	**10**	

7.6. Project approvals

The SDPWO Act establishes the framework for environmental assessment of declared significant projects in Queensland and coordinates the relevant state development assessment jurisdictions for the project.

The planning and approvals framework applicable to the project's development is the *Sustainable Planning Act 2009* (Qld) (SPA). SPA is accompanied by the Sustainable Planning Regulation 2009 (Qld) (SPR). The SPA and SPR provide for the assessment of certain development against Local Government planning schemes and policies and State Government legislation.

Under SPA, any 'assessable development' requires a development permit. The following components of the project are assessable development under the Belyando, Nebo and/or Broadsound Planning Schemes.

The State and Local Government approvals or permits anticipated as being required for the project are identified in Tables 7.3 and 7.4 below.

Table 7.3 identifies approvals or permits which have been addressed as part of this report; while Table 7.4 identifies other approvals or permits that will be required following the release of this report, but which have not been addressed as part of this report.

Table 7.3 Approvals and permits anticipated as being required for the project and addressed as part of this Evaluation Report

Approval type and activity	Legislation	Agency	Report section
Local Government			
Material change of use (MCU) for: • Utility (Public) (being the dam) • Utility (Public) and Major Utility (being the pipeline)	*Sustainable Planning Act 2009*	Isaac Regional Council (IRC)	Stated conditions pursuant to section 39 of the SDPWO Act (refer to Appendix 1, Schedule A)
State Government			
MCU for an environmentally relevant activity (ERA): • ERA 8 (Chemical storage) • ERA 14 (Electricity Generation) • ERA 16 (Extractive and screening activities) • ERA 17 (abrasive blasting) • ERA 38 (Surface coating) • ERA 43 (Concrete batching) • ERA 47 (Timber milling and woodchipping) • ERA 63 (Sewerage treatment) • ERA 64 (Water treatment)	*Sustainable Planning Act 2009;* Sustainable Planning Regulation 2009; *Environmental Protection Act 1994;* Environmental Protection Regulation 2008	Department of Environment and Resource Management (DERM)	Stated conditions pursuant to section 39 of the SDPWO Act (refer to Appendix 1, Schedule B)
Development permit: for a referable dam	*Sustainable Planning Act 2009;* Sustainable Planning Regulation 2009*; Water Supply (Safety and Reliability) Act 2008*	DERM	Stated condition pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule C)
Development Permit: operational works for clearing native vegetation	*Sustainable Planning Act 2009;*Sustainable Planning Regulation 2009*; Vegetation Management Act 1999*	DERM	Stated condition pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule E)
Water Permit: to authorise taking water for a temporary purpose, such as construction	*Water Act 2000*	DERM	Coordinator-General Recommendation 4 (Appendix 2, Part 2)

Approval type and activity	Legislation	Agency	Report section
Development Permit: for the removal of quarry material from a watercourse.	*Sustainable Planning Act 2009,* Sustainable Planning Regulation 2009*, Water Act 2000*	DERM	Coordinator-General Recommendation 6 (Appendix 2, Part 2)
Development Permit: for waterway barrier works	*Sustainable Planning Act 2009;* Sustainable Planning Regulation 2009*; Fisheries Act 1994*	Department of Employment, Economic Development and Industry	Stated condition pursuant to section 39 of the SDPWO Act (Appendix 1, Schedule D)
Riverine Protection Permit: to excavate, place fill or destroy vegetation in a watercourse	*Water Act 2000*	DERM	Recommendation pursuant to section 52 of the SDPWO Act (Appendix 2, Part 1, Recommendation 1)
Interim Resource Operations Licence: to authorise the interference with water necessary to operate infrastructure on an interim basis	*Water Act 2000*	DERM	Recommendation pursuant to section 52 of the SDPWO Act (Appendix 2, Part 2, Recommendation 5)
Clearing Permit: to take protected plans, subject to certain exceptions	*Nature Conservation Act 1992*	DERM	Recommendation pursuant to section 52 of the SDPWO Act (Appendix 2, Part 1, Recommendation 2)

Table 7.4 Approvals and permits anticipated as being required for the project which have not been addressed as part of this Evaluation Report

Approval type and activity	Legislation	Agency
Local Government		
MCU for: • Extractive Industry (being quarry and sand extraction sites) • Industry (General) (being the concrete batching plant) • Works Camp (being the construction camps) • Local Utility otherwise Utility (Public) (being the water treatment plant) • Local Utility (where ancillary to a construction camp), otherwise Utility (Public) and Special Purpose (being the waste water treatment plants) • Utility (Public) and Major Utility (being the transmission lines) • Open Space (being the recreation area) • Storage Facility and Other (not defined use) (being the laydown areas) Telcommunications Facility where not Utility (Local) (being the telecommunications tower and repeater station)	*Sustainable Planning Act 2009*	IRC
Road licence: for alterations or improvements to local-government-controlled roads, required for pipeline crossings and road upgrades/closures	*Local Government Act 2009;* Broadsound Shire Council Local Law No. 21; Nebo Shire Council Local Law No. 4 and Belyando Shire Council Local Law No. 21	IRC
Flammable and combustible liquids licence: storage of flammable and combustible liquids on site during construction	Dangerous Goods Safety Management Regulation 2001	IRC
Notification of Large Dangerous Goods Location 2001: Storage of flammable and combustible liquids on site during construction	Dangerous Goods Safety Management Regulation 2001	IRC
Building works: may be assessable or self-assessable	*Sustainable Planning Act 2009,* Sustainable Planning Regulation 2009*, Building Act 1975*	IRC/private certifier
Reconfiguration of a lot: for excisions or long-term leases for ancillary infrastructure such as balance storages	*Sustainable Planning Act 2009,* Sustainable Planning Regulation 2009*; Land Titles Act 1994*	IRC

Approval type and activity	Legislation	Agency
Plumbing or drainage works compliance permit: required for new buildings/ onsite sewerage treatment systems	*Plumbing and Drainage Act 2002*, *Sustainable Planning Act 2009*	IRC/private certifier
Development permit: for carrying out operational work for not associated with: • an MCU – excavating, filling • reconfiguring a lot • other operational works	*Sustaonable Planning Act 2009, Sustainable Planning Regulation 2009*	IRC
Advertising device: signage may be assessable development; permit for placing an advertising device on premises	Local laws *Nebo Plan 2008*	IRC
State Government		
Registration Certificates	*Environmental Protection Act 1994*	DERM
Failure impact assessment: required for referable dams	*Water Supply (Safety and Reliability) Act 2008*	DERM
Disposal permit: to remove and treat or dispose of contaminated soil from land on the Environmental Management Register (EMR) or Contaminated Land Register (CLR)	*Environmental Protection Act 1994*	DERM
Allocation Notice: to authorise the taking of quarry material from a watercourse	*Water Act 2000*	DERM
Forestry Act Permit: to interfere with quarry material and forest products on Crown Holdings and Crown Land.	*Forestry Act 1959*	DERM
Road Corridor Permit: certain ancillary works and encroachments on state controlled roads must be authorised in writing by the CEO	*Transport Infrastructure Act 1994*	Department of Transport and Main Roads (TMR)
Approval to interfere with state-controlled roads	*Transport Infrastructure Act 1994*	TMR
Approval to interfere with a railway	*Transport Infrastructure Act 1994*	Queensland Rail
Public Utilities Plan: coordination of utility relocation	*Electricity Act 1994; Telecommunications Act 1997*	Public utility providers

7.7. Assessment of potential impacts and mitigation measures

7.7.1. World Heritage properties

Context

The Great Barrier Reef (GBR) is the largest World Heritage Area (WHA) on earth, extending over 2000 km and covering 348 000 square km. The GBR was declared a WHA in 1981 by the World Heritage Committee for its outstanding universal value. It remains one of only a small number of world heritage properties worldwide that have been adopted for all four natural criteria (the World Heritage Values (WHV). These criteria are noted in Appendix 8 of this report and comprise the following:

- outstanding example representing a major stage of the earth's revolutionary history
- outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment
- contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty
- provide habitats where populations of rare and endangered species of plants and animals still survive.

The project is located outside of the GBRWHA, approximately 35 km to the west in a straight line direction over the Connors Range, and approximately 619 km upstream of the GBRWHA (mouth of the Fitzroy River).

The Connors River is located within the Fitzroy (River) Basin catchment and flows into the Isaac River, the Mackenzie River and the Fitzroy River, before discharging into the Fitzroy River estuary. The Fitzroy (River) Basin catchment is the second largest in Australia, covering 142 537 square km. Issues in the catchment include clearing for rural development, erosion and runoff of sediment, nutrients and pesticides.

In general, water quality deteriorates with distance downstream from the Connors River towards the Fitzroy River estuary, with high levels of suspended sediment and nutrient loads entering downstream reaches from diffuse catchment runoff. The Fitzroy River is a major source of sediment and nutrients (particulate and dissolved) to the southern lagoon of the GBR, and significant changes to the flow regime and the fresh flows that deliver vital sediment and nutrients to the reef have the potential to impact on the GBR ecosystems and surrounds.

The *Fitzroy Basin Water Resource Plan Environmental Assessment—Stage 2 Assessment Report (December 2010)*[67] noted that major land-use practices in the GBR-draining catchment have led to increased delivery of sediments and nutrients over pre-1850 levels. Reefs at a number of inshore locations along the coast have been disturbed and remain in a disturbed state, exhibiting characteristics consistent with altered ecological function due to enhanced nutrient availability or sedimentation.

Potential impacts and mitigation measures

In Australia, an action that has, will have, or is likely to have, significant impact on the WHV of a World Heritage property requires approval under the EPBC Act. The *Matters of National Environmental Significance: Significant Impact Guidelines*[68] consider an action is likely to have a significant impact on the WHV of a declared World Heritage property if there is a real chance or possibility that it will cause one or more of the values to be:

- lost
- degraded or damaged, or
- notably altered, modified, obscured or diminished.

Direct impacts

The project is located approximately 619 km upstream of the GBRWHA. Accordingly, construction and operation of the project will result in no direct disturbance to WHV for any of the four identified criteria (i.e. those associated with geology or landscape, biology or ecology, and wilderness, natural beauty or rare or unique environments).

Indirect impacts

Potential indirect impacts to WHV via this approximate 619 km pathway include:

- sediment and nutrient change related to land use changes
- hydrological change
- impacts to water quality.

Sediment and nutrient change related to land use changes

Over 22 300 ha of predominantly grazing land will be taken out of agricultural production by the footprint of the project. Some areas of additional surrounding land will be managed for environmental purposes, which will also reduce sediment and nutrient runoff from the Connors River catchment. Of the reduced sediment that does run off, the impoundment will trap approximately 247 000 tonnes per year (representing approximately 0.05 per cent sediment inflow per year).

The project allows for 5000 megalitres per annum of medium priority water to be purchased for irrigated agriculture downstream of the proposed dam. Section 14.5.1.2 of the EIS noted that a maximum of 833 ha of land could be developed for new cropping land, most likely to irrigate cereal and fodder crops (this figure is based on an assumed usage rate of six megalitres per annum, the irrigation rate used in the Fitzroy WRP 1999). However, the EIS noted a significant proportion of the additional water is more likely to be used for improving the security of existing users rather than establishing new cropping land.

Even if new land is converted to irrigation, the large amount of upstream land removed from grazing (over 22 300 ha) would far outweigh any possible increase in the erosion and nutrient runoff rates from the change in downstream land use. Accordingly, in the context of the proposed dam reducing current rates of sediment delivery and transport in the catchment, which are much higher than pre-European conditions, there will be no net increases in sediment or pollutants entering the GBRWHA.

Hydrological change and water quality

Several methodologies were used in assessing the existing surface water environment and the potential impacts of the proposed dam. Water resource modelling, using the Integrated Quantity Quality Model (IQQM) was undertaken to assess streamflow and water usage (and compliance with the Fitzroy WRP 1999 specified water allocation security objectives (WASOs) and environmental flow objectives (EFOs)). IQQM is the standard tool used in Queensland to simulate the impacts of water resource management on flows and has been subject to rigorous and widespread scientific reviews.

The assessment of the existing surface water environment has been based on a full entitlement scenario, which incorporates all surface water resource development within the catchment existing at the time the model was developed, and assumes full utilisation of all existing water entitlements, regardless of the actual degree of utilisation. This provides information on the committed entitlements and represents the approved level of surface water resource use in the catchment.

Modelling of the dam operations and hydrologic impacts incorporates a preliminary operational strategy for the dam, comprising the following:

- high priority and medium priority water products supplied by the dam
- low flow release and fishway operation
- first post winter flow event (FPWFE) release
- revision of the modelling of unsupplemented irrigation licenses downstream of the dam
- compensation strategy for impacted irrigators.

Tables 14-23 and 14-24 of the EIS presented the predicted mean and median annual flow with the dam in operation, including the implementation of the preliminary operational strategy. Results show localised impacts immediately downstream of the proposed dam (Mount Bridget gauge, 700 metres downstream of the proposed dam wall) due to the operation of the storage. These impacts are reduced through downstream tributary inflows, with the majority of impacts limited to the reach between the dam and Funnel Creek (46.1 km downstream of the proposed dam).

Impact on flows in the Isaac and Connors Rivers downstream of the dam is also predicted. These impacts are shown to decrease with distance downstream from the dam as flow from additional tributaries enter the river. Impacts downstream of Coolmaringa (Mackenzie River—212 km downstream of the dam) are practically indistinguishable from the current flow regime. Consequently, changes at the Fitzroy River estuary (619 km downstream of the dam) are indistinguishable from the existing flow regime.

Modelled flow duration curves (Figures 14-14 to 14-17 of the EIS) show the Connors River at Mount Bridget gauge site (700 metres downstream of the dam wall) to be the most highly impacted by dam operations. However, by Pink Lagoon (47.5 km downstream of the dam), the flow regime returns to close to the full entitlement flow regime, reflecting existing levels of development. A minor level of impact is evident at

Yatton on Isaac River and Coolmaringa on Mackenzie River, but beyond this point the flow duration curves are indistinguishable from the full entitlement scenario.

Modelling shows changes in water quality in the freshwaters downstream of the confluence with the Isaac River (including the Mackenzie and Fitzroy Rivers) are also unlikely, due to catchment influences having a greater impact on water quality than releases from the dam (refer to section 16 of the EIS and section 5.2 of this report).

In addition, while flow is not the sole factor which determines sediment load, the above-mentioned sediment trapping effect of the proposed dam (247 000 tonnes per year, representing 0.05 per cent sediment inflow per year) is not expected to result in significant changes to sediment delivery to the Fitzroy Estuary (and coast) due to the significant additional river flows that occur between the proposed dam and the Fitzroy Estuary and the predicted negligible impacts of the project on flows in the Fitzroy Estuary.

Given there will be no discernable impacts to flow in the Fitzroy River or downstream, and the proposed dam is not expected to impact on the water quality or sediment input of the Fitzroy Estuary, no significant impacts on estuarine and marine flora and fauna, including in the GBRWHA, are predicted from the dam's operation.

Furthermore, Sunwater has committed to implement mitigation measures to address potential impacts associated with hydrological, water quality and sediment and nutrient changes which, in accordance with modelled flow statistics, are likely to be limited to the reach between the dam and Funnel Creek (46.1 km downstream of the proposed dam). Sections 5.1 and 5.2 of this report provide the Coordinator-General's assessment of surface water (hydrology, flood risk and fluvial geomorphology) and surface water quality. Key measures to mitigate potential impacts, as described in the draft CEMP and OEMP for the project (refer to Appendix 4 of this report), include:

- avoiding wet season construction as far as possible
- routing analysis and boring (rather than trenching) of sensitive creek crossings
- implementing a SECP and managing riverine quarry material extraction in accordance with best practice
- removing organic matter prior to filling
- monitoring water quality during filling, developing a first release strategy to minimise impacts and withholding releases if water quality is poor
- using a multi-level offtake during operation to source the most appropriate water for release
- developing an operational strategy to maintain key environmental flows, including low flows, fishway releases and a first post winter flow event release
- monitoring downstream geomorphic assessment sites to maintain hydraulic habitat in other parts of the river system and to assess bank stability and apply appropriate stabilisation techniques should significant undermining occur.

The Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance. As identified in Table 7.4, Sunwater must also obtain approvals for the project pertaining to

the management of surface water resources as required under the *Water Act 2000* (for example, a water permit to authorise taking water for a temporary purpose, and a resource operations licence to authorise the interference with water necessary to operate water infrastructure) and *Water Supply (Safety and Reliability) Act 2008* (for example, development permit for a referable dam).

Cumulative impacts

Section 14.2.4 of the EIS describes the modelling results of a cumulative impacts scenario that represents operation of existing water infrastructure and water infrastructure currently proposed for the Fitzroy Basin, including:

- Connors River Dam
- Nathan Dam on the Dawson River
- Lower Fitzroy River Infrastructure on the Fitzroy River (Eden Bann Weir Stage 3 and Rookwood Weir Stage 2 in a staged development, hereafter referred to as the 'Lower Fitzroy weirs').

Nathan Dam and the Lower Fitzroy weirs are in the early approvals phase and require a business case to be developed and approved before they can proceed. It is therefore not assured that the proposed water infrastructure will progress.

The cumulative impact scenario presented in the EIS is only intended to give a preliminary assessment of the likelihood that the proposed infrastructure projects can be developed in a sustainable manner. Modelling for the Nathan Dam and Lower Fitzroy weirs does not include compensation strategies for unsupplemented irrigators, low flow environmental release strategies or any other strategies to address flow issue specifically related to those projects. These strategies are expected to be developed as the projects progress. As such, there is substantial future scope to address compliance with the Fitzroy WRP 1999, amongst other issues.

Cumulative impacts are predicted to occur in the Lower Fitzroy sub-catchment (the Connors River Dam and Nathan Dam projects are located upstream in separate sub-catchments) and as such, the Lower Fitzroy sub-catchment has been the focus of the cumulative impact assessment (i.e. downstream of the confluence of the Dawson River and in the reaches affected by the proposed Lower Fitzroy weirs). The following section presents potential cumulative impacts on EFOs. Refer to section 5.1.3 of this report for an assessment of cumulative impacts to existing water users.

Cumulative impacts to key environmental flow objectives

Results show that the seasonal baseflow objective was not met under the cumulative impacts scenario in September to December at the Eden Bann Weir or Fitzroy Barrage (Table 14-45 of the EIS). However, Sunwater noted that specific baseflow strategies have yet to be developed for each infrastructure project and it is expected that these effects can be adequately addressed.

The FPWFE performance indicators were achieved at both Eden Bann Weir and Fitzroy Barrage, with one exception: the number of flows within four weeks of a pre-development event does not pass the objective at the Fitzroy Barrage. However, Sunwater expects that these effects can be adequately addressed by developing

appropriate strategies in the future, based on the substantial buffer between the target and the achieved flow for most statistics, which suggests there is scope to optimise operational strategies.

Although the majority of FPWFE performance indicators were achieved, there was still some change from the performance under the 'full entitlement' (existing condition) scenario, particularly at the Fitzroy Barrage. The overall number and volume of the FPWFEs has decreased, reducing the average peak flow and duration.

The medium to high flow event objectives at the Fitzroy Barrage were met, with the exception of the upper riparian zone statistic, which fails the non mandatory objective, but still passes the mandatory objective.

Approval of operational strategies (including environmental flow releases and management rules) for each of these projects will be required under the *Water Act 2000* (including a Resource Operations License (ROL) or Interim ROL – refer to section 7.6 of this report for more information) to authorise interference with the flow of water and allow for construction.

7.7.2. Coordinator-General's conclusions—World Heritage properties

The project is located approximately 619 km upstream of the GBRWHA. Accordingly, construction and operation of the project will result in no direct disturbance to WHV for any of the four identified criteria (i.e. those associated with geology or landscape, biology or ecology, and wilderness, natural beauty or rare or unique environments).

Potential indirect impacts to WHV via an approximate 619-kilometre river pathway (Connors River, Isaac River, Mackenzie River, Fitzroy River discharging at the Fitzroy Estuary—part of the GBRWHA) include hydrological change, impacts to water quality and sediment and nutrient change related to land use changes.

However, the Coordinator-General notes IQQM water resource modelling results demonstrate no discernable impacts to flow in the Fitzroy River or downstream, and that the dam is not expected to impact on the water quality or sediment input of the Fitzroy Estuary due to the significant additional river flows that occur between the proposed dam and the Fitzroy Estuary.

Furthermore, even under a worst case scenario of sediment and nutrient change related to downstream land use change (that is, the conversion of 833 ha of downstream land to new (irrigated) cropping land), in the context of the proposed dam reducing current rates of sediment delivery and transport in the catchment (which are much higher than pre-European conditions), the Coordinator-General is satisfied there will be no net increases in sediment or pollutants entering the GBRWHA.

Overall, the cumulative impacts of the Connors River Dam, Nathan Dam and Lower Fitzroy Weirs projects on environmental flows in the Lower Fitzroy sub-catchment are not excessive, and Sunwater notes they will be managed through the operational strategies for each project (subject to approval under the *Water Act 2000*).

The Coordinator-General is therefore satisfied the project is sufficiently remote from the GBRWHA that there is no possibility the project will cause one or more of the WHV to

be lost, degraded or damaged, notably altered, modified, obscured or diminished. Accordingly, no significant impacts (direct or indirect) are expected on the WHV of the GBRWHA.

7.8. National heritage places

The GBR was one of 15 World Heritage places included in the National Heritage List on 21 May 2007. The national heritage contained in the property is expressed by WHV.

Section 7.7 of this report provides the Coordinator-General's assessment of potential impacts on WHV of the GBRWHA, which concludes that no significant impacts (direct or indirect) are expected. Accordingly, no significant impacts are predicted on the national heritage place that is the GBR.

7.9. Wetlands of international importance

7.9.1. Context

The Shoalwater and Corio Bays area have been identified as wetlands of international importance that may be affected by the project. The Shoalwater and Corio Bays area is situated approximately 50 km to the north of the Fitzroy Estuary (as described in section 7.4) the proposed dam will be situated on the Connors River, approximately 619 km upstream of the mouth of the Fitzroy River.

The Shoalwater and Corio Bays Area Ramsar site is bounded by approximately 330 km of coastline, including all islands, and meets six of the nine criteria[69] for identifying wetlands of international importance. The site supports populations of threatened marine turtles (including the loggerhead turtle, green turtle, flatback turtle, and hawksbill turtle), dugong, and local and migratory shorebirds.

The Shoalwater and Corio Bays Ramsar wetlands have values based on supporting vulnerable, endangered and critically endangered species that are important for regional biodiversity and support species at a critical stage of their life cycles.

7.9.2. Potential impacts

Direct impacts

The project is located approximately 619 km upstream of the Fitzroy Estuary. Accordingly, there will be no direct disturbance to habitat within or proximate to the Shoalwater and Corio Bays RAMSAR wetlands.

Indirect impacts

Potential indirect impacts downstream from the project are addressed in section 7.7 of this report. The EIS showed there will be no discernable impacts to flow in the Fitzroy River or downstream, and the dam is not expected to impact on the water quality or sediment input of the Fitzroy Estuary. Accordingly, there will be no significant impacts from the project on the processes and values of the Ramsar site, including estuarine marine flora and fauna.

7.10. Listed migratory species

7.10.1. Environmental values

Four listed migratory species have been recorded in the project area:

(a) the cotton pygmy-goose

(b) rufous fantail

(c) white-bellied sea eagle

(d) rainbow bee-eater.

In addition, 16 migratory species are considered likely occurrences based on the presence of suitable habitats within the project area (refer to Table 7.5 below).

Table 7.5 Listed migratory species 'known'[70] or 'likely'[71] to occur within the project area

Species name	Likelihood of occurrence
Cotton Pygmy-goose (*Nettapus coromandelianus*)	**Known**. This species was recorded on the Connors River below the dam wall site. It is an almost exclusively aquatic species, preferring freshwater with abundant floating and submerged aquatic vegetation, interspersed with patches of open water.
Rainbow Bee-eater (*Merops ornatus*)	**Known**. Species regularly recorded within project area. A common, widespread species that occurs in a wide variety of habitats, including highly modified land such as pasture.
Rufous Fantail (*Rhipidura rufifrons*)	**Known**. Rufous Fantails occur in riparian and closed forest habitats and the project area provides suitable habitat for this species.
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	**Known**. Species largely restricted to significant waterbodies, lakes and the ocean shoreline. One individual was recorded flying over the Connors River and is a likely occurrence along other major rivers along the pipeline route.
Great Egret (*Ardea alba*)	**Likely**. Great Egrets forage in a wide range of habitats including artificial waterbodies and other modified habitats such as pasture. This species is common and widespread throughout its range.
Cattle Egret (*Bubulcus ibis*)	**Likely**. Cattle Egrets inhabit grasslands, wetlands and wooded lands, often foraging way from water in grassland, pasture and crops. The species is strongly associated with grazing livestock, and is common and widespread throughout its range. This species was observed in the vicinity of rivers and creeks along the pipeline route.
Osprey (*Pandion haliaeetus*)	**Likely**. Ospreys feed on fish, foraging in rivers, lakes, estuaries and inshore coastal waters. The species typically requires large areas of open water. Breeding pairs require nesting sites near suitable foraging areas, and nesting sites include tall trees and artificial structures such as power poles and towers. Currently the project area provides little suitable habitat.

Species name	Likelihood of occurrence
Latham's Snipe (*Gallinago hardwickii*)	**Likely**. Latham's Snipe occurs in swamp and marsh margins and in wet pasture. The species is likely to occur seasonally within inundated grasslands and wetlands within the project area.
White-throated Needletail (*Hirundapus caudacutus*)	**Likely**. An aerial species that may at times fly over the project area. The species forages over a wide variety of habitats, including highly modified areas such as pasture and those dominated by human infrastructure.
Little Curlew (*Numenius minutus*)	**Likely**. Little Curlew occurs on short, dry grasslands and sedgelands, including artificial areas such as airfields, sporting fields, roadsides and lawns, and on the grassy edges of freshwater wetlands.
Barn Swallow (*Hirundo rustica*)	**Likely**. Barn Swallow occurs on a regular basis in Australia only in the north. In Queensland it is a vagrant south of Townsville. It is an aerial species of open habitats, including highly modified areas.
Australian Painted Snipe (*Rostratula australis*)	**Likely**. This species is a vagrant across most of Qld and particularly in the south-east and tropical north. It prefers freshwater or saline wetlands with dense fringing vegetation. Suitable habitat occurs within the project area.
Spectacled Monarch (*Monarcha trivirgatus*)	**Likely**. These species occur in more moist habitats such as wet sclerophyll forest and riparian vegetation. The monarchs also frequent closed forests, including vine-thickets. The pipeline route traverses such habitats.
Black-faced Monarch (*Monarcha melanopsis*)	
Satin Flycatcher (*Myiagra cyanoleuca*)	
Marsh Sandpiper (*Tringa stagnatilis*)	**Likely**. These species occur on freshwater wetlands, typically those with shallow edges and suitably soft substrates. This includes many artificial waterbodies and wetlands in non-remnant vegetation. The project area supports such habitats for these species.
Common Greenshank (*Tringa nebularia*)	
Sharp-tailed Sandpiper (*Calidris acuminata*)	
Australian Reed-Warbler (*Acrocepalus astralis*)	**Likely**. Occurs in dense vegetation near water. Likely to occur along rivers, creeks and drainages.
Fork-tailed Swift (*Apus pacificus*)	**Likely**. This is an aerial species that may at times fly over the project area.

7.10.2. Potential impacts and mitigation measures

The *MNES Significant Impact Guidelines 1.1*[72] state that an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species[73]
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or

- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Tables 28-24 and 28-25 of the EIS presented an assessment of the level of impact of the project on the migratory species known and considered likely to occur within the project area in accordance with the significant impact criteria.

The assessment found that the project area does not support 'important habitat' for any migratory species, nor does it support an ecologically significant population of these species. Given their migratory habitats, the ephemeral nature of important food and habitat resources, and the extent of similar and comparable habitat throughout the range of these species, it is likely that the habitats contained within the project area would be utilised infrequently and on a transitory basis only.

The project is likely to result in positive and negative impacts on migratory species:

- the creation of the water storage area is likely to provide additional habitat for the migratory wetland and shorebird species (including the cotton pygmy goose), which are reliant on, or never far from, a permanent water source
- the loss of watercourse habitat including riparian vegetation within the water storage area and along the pipeline route may result in adverse impacts for some terrestrial migratory species, including the rufous fantail.

Adjacent areas are considered to provide suitable habitats in the short-term and the rehabilitation of the pipeline easement (except for the 15-metre wide operational maintenance corridor) at priority locations and establishing vegetation offsets will provide compensatory habitat for these species (refer to section 7.11.4). This includes the protection of watercourse habitat (1411.35 ha of vegetation in total), which will help to maintain:

- bank stability by protecting against bank erosion
- water quality by filtering sediments, nutrients and other pollutants
- aquatic habitat
- terrestrial habitat.

7.10.3. Coordinator-General's conclusions—listed migratory species

In accordance with the EPBC Act MNES Significant Impact Guidelines, the Coordinator-General finds that the project will result in negligible impacts on migratory species listed under the EPBC Act, on the basis that the project does not support 'important habitat' for any migratory species, or an 'ecologically significant population' of these species.

Creating a large permanent water source is likely to result in positive impacts for migratory wetland and shorebird species. Vegetation offsets required to be provided as part of the project, including like-for-like protection of watercourse habitat (1411 ha in total), will provide compensatory habitat for terrestrial migratory species.

7.11. Threatened species and communities

7.11.1. Context

Aquatic ecology

Two aquatic flora and fauna surveys were undertaken of the proposed dam and surrounds study area to describe the aquatic flora and fauna present in the freshwater habitats that may be affected by the project, including sites upstream of, within and downstream of the proposed water storage area. These surveys included a pre-wet season survey (5–12 December 2007) and a post-wet season survey (27 May – 3 June 2008). One aquatic flora and fauna survey was undertaken of the pipeline study area in the post-wet season (27–31 October 2008).

The Fitzroy (River) Basin has high conservation value with respect to freshwater turtles, due to the high degree of biodiversity endemism.[74] Accordingly, freshwater turtles were the subject of a targeted survey effort to inform the EIS, comprising three surveys to identify freshwater turtles upstream, within and downstream of the water storage area (the first survey during the 2007 dry season, the second during a post-wet event in November 2007 and the third in August 2008 during the pre-wet season). The 'vulnerable' Fitzroy River turtle (*Rheodytes leukops*) was not identified during these surveys, despite the presence of suitable habitat.

In response to DERM and SEWPaC comments on the EIS and SEIS, additional freshwater turtle surveys were undertaken in August 2010 and in October 2011. The August 2010 survey was undertaken during a period of better water clarity, which allowed snorkelling, spotlighting and the use of underwater video. This survey confirmed the presence of the Fitzroy River turtle within and downstream of the proposed water storage area. While no species were recorded upstream of the water storage area, suitable habitat (including nesting banks) was identified within many of the more substantial reaches surveyed (stream order 4 or greater).

The October 2011 survey was undertaken from the base of the proposed dam wall on the Connors River, to the Funnel Creek confluence approximately 44 km downstream of the proposed dam wall. This survey found significant numbers of Fitzroy River turtle (92 captured and a further 90 sighted), comprising a large number of females in breeding condition. The increased survey effort has resulted in the expanded known distribution of the Fitzroy River turtle.

The assessment of impacts to threatened species and communities has taken into account the results of all aquatic ecology surveys undertaken to date for the project.

Terrestrial ecology

Two terrestrial flora surveys were undertaken of the proposed dam and surrounds study area. An initial phase of post-summer field survey was completed in April 2008 during which the bulk of the floristic data from within the proposed dam water storage area was collected. This allowed a preliminary assessment of the extent, condition and significance of vegetation within the area. A secondary winter survey was undertaken

in July 2008, which targeted specific information gaps and any seasonally specific flora which had potential to occur within the area.

One terrestrial flora survey was undertaken of the pipeline study area over an eight-day period in July 2008. Chapter 28 of the EIS stated that lack of full seasonal sampling is not believed to have detracted from the utility of the survey for impact assessment purposes.

Two terrestrial fauna surveys were conducted within the proposed dam and surrounds study area during the summer/autumn (11–18 March 2008) and winter (12–16 June 2008) periods. Portions of the pipeline route were surveyed in June and October 2008, with non-accessible areas being assessed remotely using satellite imagery and/or vegetation mapping data.

As noted in section 2.2.4 of this report, Sunwater has further developed the design of the project since the release of the EIS, including (but not limited to) refining the pipeline route and proposing to construct a new access road to the Marylands property. Further terrestrial flora and fauna assessment was therefore undertaken as part of the SEIS. This included a field survey in January 2011 of the new access road route.

Sunwater commissioned 3D Environmental to undertake a further summer season targeted survey on the pipeline route in May 2011. The scope of this survey was to determine the condition and floristic composition of grassland and grassy woodland ecosystems potentially impacted by the proposed pipeline, including a targeted survey for listed threatened species or communities (state and federal) within grassland and grassy woodland habitats.

The assessment of impacts to threatened species and communities has taken into account the results of all terrestrial ecology surveys undertaken to date for the project.

7.11.2. Threatened flora species and ecological communities

Environmental values

Table 7.6 identifies EPBC Act-listed flora species and ecological communities known or likely to occur in the project area.

Table 7.6 EPBC-listed flora species and ecological communities 'known'[75] or 'likely'[76] to occur in the project area

Species name	EPBC Act status	Likelihood of occurrence
Brigalow (*Acacia harpophylla* dominant and co-dominant)—hereafter referred to as 'brigalow EEC'	Endangered	**Known**. Five Regional Ecosystems (REs) containing brigalow are present along the pipeline route (REs: 11.3.1, 11.4.8, 11.4.9, 11.9.5 and 11.12.21). Many of these communities have been disturbed, with patches within the pipeline route being small and often isolated within cleared land, and have a total area of approximately 2.21ha. No communities classifiable as this EEC were identified from within the water storage area. Over 60% of original vegetation of the southern Brigalow Belt has been cleared over the last 200 years, primarily as a result of land clearing for agricultural development. As a result, vegetation communities, flora and fauna, including several species of reptiles, have become threatened.
Semi-evergreen vine thickets (SEVT) of the Brigalow Belt (North and South) and Nandewar Bioregions—hereafter referred to as 'SEVT EEC'	Endangered	**Known**. Two 1 hectare patches of semi-evergreen vine thicket (RE 11.8.3) were identified during the May 2011 supplementary field survey of the pipeline route. No communities classifiable as this Endangered Ecological Community were identified from within the water storage area.
Black Ironbox *(Eucalyptus raveretiana)*	Vulnerable	**Likely**. Potential habitat (RE 11.3.25) exists along Denison, Funnel, Boothill, Nebo and Bee Creeks. Not observed within water storage area despite potentially suitable habitat in riparian open forests and woodlands of RE 11.3.25.

The 'Natural Grasslands of the Queensland Central Highlands and northern Fitzroy Basin' Endangered Ecological Communities (EEC) was considered a potential occurrence along the pipeline route (this community includes the former 'Bluegrass (*Dichanthium spp*.) dominant grasslands of the Brigalow Belt bioregions (North and South)' EEC, which was listed in 2001). Although none of the regional ecosystems (REs) that constitute the community (11.3.21, 11.4.4, 11.8.1 or 11.9.12) were identified on the pipeline route, the SEIS noted there was a possibility the community could still occur (survey of these areas was undertaken in July 2008 which is not considered to be a suitable seasonal window to assess natural grassland condition) and recommended a supplementary seasonal survey be undertaken of the pipeline route. The May 2011 field survey failed to identify this EEC and consequently the Natural Grasslands EEC is considered to be an unlikely occurrence along the pipeline route.

Similarly, the SEIS considered the grass species *Digitaria porrecta* (endangered), *Dicanthium queenslandicum* (vulnerable) and *D setosum* (vulnerable) as potential occurrences within a single 4.1-hectare patch of RE 11.4.13 which occurs along the pipeline route between Funnel and Denison Creeks, and recommended a

supplementary seasonal survey to confirm the presence of these species. The May 2011 field survey failed to identify these grass species, which were subsequently considered to be unlikely occurrences along the pipeline route.

Potential impacts

Construction of the project may result in the following potential impacts:

- water storage area:
  - loss of 719 ha of potential habitat (RE11.3.25) for the Black Ironbox (*Eucalyptus raveretiana)*
- pipeline easement:
  - loss of 2.21ha of brigalow EEC
  - Loss of 4.5 ha potential habitat (RE 11.3.25) for the Black Ironbox (*Eucalyptus raveretiana).*

Constructing the pipeline will require the clearing of up to a 30 metre wide easement along the pipeline route (15 metres from the centreline of the alignment).

The May 2011 supplementary seasonal survey identified the margins of the eastern most and western most occurrences of semi-evergreen vine thickets (SEVT) EEC to be approximately 30 metres and 60 metres from the centreline of the pipeline alignment, respectively, adjacent to extensive cleared grazing paddocks. Accordingly, construction of the pipeline will be sufficiently removed so as not to impact upon these patches of SEVT EECs.

However, clearing of vegetation for both the water storage area and pipeline may result in indirect impacts to brigalow EEC, SEVT EEC and potential habitat for the Black Ironbox through the proliferation of weeds into cleared and disturbed areas, including newly created edges of the FSL and pipeline easement.

Mitigation measures

The terrestrial flora sub-plan of the revised draft construction EMP (CEMP) (Appendix 4, section 29.9.8) identifies a range of mitigation measures to minimise the impacts on, and provide protection to, identified protected flora species. Key mitigation measures relate to preparing and implementing a vegetation clearance management plan, rehabilitation plan and a weed management plan (WMP).

The Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2), to ensure the effective implementation of the CEMP and OEMP for the project, and the establishment of a monitoring, auditing and reporting regime to ensure compliance.

As identified in Table 7.4, Sunwater must also obtain a number of approvals for the project pertaining to the management of vegetation and habitat as required under the *Vegetation Management Act 1999* (development permit for operational works that is clearing of native vegetation)*, Water Act 2000* (a permit to excavate, place fill or destroy vegetation in a watercourse) and *Nature Conservation Act 1992* (clearing permits).

Vegetation clearance management plan

Key measures of the proposed vegetation clearance management plan include (but are not limited to):

- species-specific pre-construction surveys for *Eucalyptus raveretiana*
- identify areas of vegetation to be retained, which are to be clearly marked by tape and/or pegs
- avoid impact on vegetation outside the inundation area by clearly identifying the FSL, and directing staff, contractors and others constructing the project to avoid these areas
- implement mitigation recommendations in the design of the final pipeline route to minimise impacts on significant vegetation communities, including ensuring the maximum possible width of existing cleared easements is utilised for construction, avoiding large habitat trees and locating the pipeline route within cleared/disturbed areas wherever possible
- limit vegetation clearing within the riparian zones to within 1.5 metres of FSL
- require the clearing contractor to monitor vegetation clearing to ensure only approved areas are cleared
- restrict clearing for the pipeline easement to a width of 30 metres and further reduced in riparian zones
- a qualified botanist will be on site prior to any vegetation clearing works within remnant vegetation communities to inspect the area for significant flora. If any species of conservation significance are confirmed as present, suitable management measures will be implemented, such as development of translocation programs and associated management plans.

Rehabilitation plan

A rehabilitation plan will be prepared to progressively rehabilitate the construction site in areas that will not be inundated or used for permanent infrastructure (this includes the majority of the construction easement for the pipeline, apart from the maintenance track and area directly over the buried pipeline).

The plan will support the replacement of topsoil, contouring of the landform and revegetation as soon as possible after disturbance and will contain, at a minimum, the following information:

- method and species to be utilised in revegetation (including seeds of local provenance). This will include topsoil stabilisation
- spatial configuration of plantings (if tubestock are used), seed mixes for direct seeding and hydromulching and watering requirements
- benchmark criteria for rehabilitation, including requirements for final landform (slope, aspect), vegetation cover, vegetation species composition and depth of topsoil (amongst other parameters).

WMP

A WMP will be prepared and implemented for both construction and operational phases of the project.

Specific mitigation measures relate to weed management (for example, minimising soil disturbance within retained vegetation to avoid weed recruitment), weed removal and the use of 'washdown' facilities and clean plant.

The distribution of known declared weeds will be monitored and, where feasible, a plan made to eradicate or contain these infestations in accordance with *the Land Protection (Pest and Stock Route Management) Act 2002* (Qld).

Employees and contractors working on site will also be required to receive appropriate weed identification training and report the presence of declared weeds by the end of the working day.

7.11.3. Threatened fauna

Environmental values

A total of 124 fauna species have been previously recorded from or are considered likely occurrences within the water storage area and pipeline route based on database searches. Table 7.7 identifies eight threatened fauna species (all with a vulnerable listing under the EPBC Act), which are known or likely to occur in the project area,

Table 7.7 Threatened fauna 'known'[77] or 'likely'[78] to occur within the project area

Species name	EPBC Act Status	Likelihood of occurrence
Reptiles		
Fitzroy River turtle (*Rheodytes leukops*)	Vulnerable	**Known**. Recorded from within and downstream of the proposed water storage area. Suitable habitat also exists upstream of the proposed water storage area.
Brigalow Scalyfoot (*paradelma orientalis*)	Vulnerable	**Likely**. Likely to occur within linear roadside brigalow remnants. Pressures include habitat reduction and degradation, and predation.
Yakka Skink (*Egernia rugosa*)	Vulnerable	
Ornamental Snake (*Denisonia maculate*)	Vulnerable	
Dunmall's Snake (*Furina dunmalli*)	Vulnerable	
Birds		
Squatter Pigeon (*Geophaps scripta scripta*) southern	Vulnerable	**Known**. Recorded on several occasions throughout the project area predominantly at the edge of tracks and in a variety of open forest, woodland and grassland habitats close to water Known pressures include habitat loss, habitat degradation and grazing. Suspected pressures include predation by feral animals, fire and weeds.

Species name	EPBC Act Status	Likelihood of occurrence
Australian Painted Snipe (*Rostratula australis*)	Vulnerable	**Likely**. This species is a vagrant across most of Qld and particularly in south-east and tropical north. It prefers freshwater or saline wetlands with dense fringing vegetation. Suitable habitat occurs within the project area. Pressures include drainage of wetlands, diversion of water from rivers, clearance of wetland vegetation and overgrazing.
Red Goshawk (*Erythrotriorchis radiatus*)	Vulnerable	**Likely**. This species occurs in large, contiguous woodlands and open forests in coastal and tropical regions, often along major river systems. This species is a likely occurrence within the ranges adjacent to the project area and may occasionally occur within the Connors River and tributaries. Pressures include loss and fragmentation of habitat, fire, egg-collecting, shooting, loss of prey species and possibly secondary poisoning.

Potential impacts and mitigation measures

Fitzroy River turtle

Potential construction impacts

This section provides an evaluation of the following potential impacts to the Fitzroy River turtle that may result from the construction of the proposed dam and pipeline:

- direct physical impacts to the species and/or habitat
- degraded downstream water quality.

Direct physical impacts to species and/or habitat

Potential Fitzroy River turtle habitat between and under the coffer dams and the dam construction area will be lost when construction commences. The diversion channel will connect to the river both upstream and downstream of the coffer dams and construction of the links will disturb the banks of the watercourse. While the diversion channel will not be designed specifically to allow for fauna movement, the draft CEMP (Appendix 4, section 29.9.10) specifies that physical structures such as boulders or logs must be included within the channel to provide rest areas for fauna which may use the channel as a movement conduit.

During dam wall construction, Fitzroy River turtle populations may also be impacted by falling water levels (and therefore available habitat) through the extraction of water from the Connors River upstream of the construction site. Fitzroy River turtles may also become trapped in the inlet pipe if approach velocities exceed the swimming capability of the turtles present. The impact of water extraction from the Connors River will be minimised by implementing the following mitigation measures as identified in the draft CEMP (Appendix 4, section 29.9.10):

- storing water during the wet season to reduce the effects of drawdown in Connors River during the dry season (the spoil from the diversion channel could potentially construct an off-stream storage in the proposed water storage area)
- extracting water from the largest pool possible
- extracting water at a slow and steady rate
- fitting floating booms to the water supply inlet pipe with a protective cage to prevent turtle entrapment.

Physical disturbance will also occur within the water storage area, with the felling of all trees and shrubs in riparian zones with the exception of those vertically within 1.5 metres of FSL.

The overall impact of pipeline placement on Fitzroy River turtle populations is considered to be low, as pipeline crossings constitute a relatively small total area of the creek and much of the habitat consists of intermittent dry areas with occasional intermittent or perennial pools. Pipeline crossings and rehabilitation will occur in the dry season before significant flows occur.

Sand extraction for the pipeline will directly remove sand from the stream bed, thereby removing habitat and impacting potential nesting sites. Under the provisions of the *Water Act 2000*, Sunwater must obtain a Quarry Material Allocation Notice (QMAN) and a development permit (operational works) for the removal of quarry material from a watercourse. The Coordinator-General has recommended conditions of approval for inclusion in future development permit (Appendix 2, Part 2, Recommendation 6). In particular, no quarry material shall be removed from nesting areas used by the Fitzroy River turtle.

Each site will also require disturbance of the riparian zone for the access track or tracks plus clearing of stockpile and works areas on nearby land. By implementing appropriate sediment and erosion controls, including dry bed extraction and managing sand extraction to prevent impacts to all turtle nesting sites, impacts are expected to be localised and relatively minor.

Direct impacts to the Fitzroy River turtle will also be minimised through the capture and translocation of the species within the construction footprint prior to works commencing (refer to Appendix 4, section 29.9.10: aquatic flora and fauna sub-plan).

Degraded downstream water quality

Vegetation clearing, earthworks, pipeline waterway crossings and the construction of other associated infrastructure proximal to waterways may cause a temporary increase in suspended sediment loads entering adjacent and downstream waterways. Unmanaged, this could result in increased turbidity and smothering of benthic habitat.

As outlined in section 5.1 of this report, Sunwater will implement a SECP, which will be detailed in the CEMP for the project (refer to Appendix 4, section 29.9.3). The SECP will be designed in accordance with guidelines such as the International Erosion Control Association's (IECA's) *Australasia Best Practice Erosion and Sediment Control*[79] to significantly reduce the potential for additional sediment to enter watercourses.

Potential operation impacts

This section provides an evaluation of the following potential impacts to the Fitzroy River turtle which may result from the operation of the proposed dam and pipeline:

- change in habitat in the water storage area
- impacts to movement/migration due to the proposed dam wall
- change in habitat downstream of the proposed dam wall
- indirect impacts due to changes in water quality
- cumulative impacts.

Change in habitat in the water storage area

Operation of the dam will result in the inundation of approximately 9.7 km of the Connors River (to the junction of Collaroy and Whelan creeks) and the inundation of 41.6 km of major streams. Inundation will reduce habitat diversity, including the loss of run and pool habitat, with occasional glide, backwater, and riffle habitat.

Inundation of riffle-pool habitat may reduce the area of foraging and nesting habitat available for the listed Fitzroy River turtle. Limpus et al.[80] identify less diverse impounded habitat to have a lower carrying capacity for the species than unflooded riffle-pool habitat. Notwithstanding this, both species are known to occur in existing impoundments in the Fitzroy River where only flooded pool habitats are available and nesting occurs on the banks of the water storage areas. Accordingly, the proposed dam area may be used by these species along with others which have been recorded in the study area.

While a reduction in aquatic fauna habitat diversity within the proposed water storage area is unavoidable, the draft EMPs will require the following measures to be implemented to minimise impacts:

- limiting vegetation clearing within riparian zones to within 1.5 metres (vertical) of the new FSL (refer to Appendix 4, section 29.9.8) (tree and shrub vegetation provides shading to channels and aquatic habitat such as snags and overhanging vegetation)
- minimising impacts on upstream riparian habitat to allow for recolonisation (refer to Appendix 4, section 29.9.10)
- salvaging appropriate material (e.g. trees) during vegetation clearing for use as ‘large woody debris’ (LWD) habitat within the proposed dam (refer to Appendix 4, section 29.9.10). LWD provide important habitat for freshwater turtles.[80]

Sunwater will also manage the terrestrial zone around the impoundment to enhance nesting opportunities for the Fitzroy River turtle. Measures include:

- effective management of animal pests during construction and operation of the project to reduce the loss of turtle eggs from predation via a pest management plan (refer Appendix 4, draft EMPs)
- reduced grazing by stock to avoid damage to nesting habitat from trampling
- managing weeds to prevent them from blocking access to suitable nesting habitat for turtles (weed management is discussed in section 5.4.4).

Impacts to movement/migration due to the dam wall

Without mitigation, the dam wall presents a complete barrier to upstream Fitzroy River turtle movement and an almost complete barrier to downstream movement. This may result in a reduction of genetic variability and associated in-breeding issues.

As indicated in section 7.4.2, an aquatic fauna transfer device (or 'fishway') designed to maintain passage and minimise injury, death and entrapment of aquatic fauna has been included in the design of the dam wall. In accordance with a condition imposed by the Coordinator-General regarding a development permit required for waterway barrier works (Appendix 1, Schedule A, Condition 1), the detailed design of the fishway will be finalised following further consultation with relevant agencies and in general accordance with the DEEDI (Fisheries Queensland) Fish Passage Design and Implementation Process set out in of this report.

Fishways have traditionally been less successful in providing adequate passage for turtles, which prefer to walk upstream rather than use fishways and as such, are unlikely to use the fishway in significant numbers. Notwithstanding this, recent monitoring data from Paradise Dam on the Burnett River (QPIF, 2009[81]) shows that the upstream fishway is catering for significant numbers of some turtle species. This potential impact is of importance given the habitat requirements of cloacal ventilating turtles such as the Fitzroy River turtle, which move between riffle and pool habitats during the dry and wet seasons.

The current downstream preliminary design of the fishway has been taken into account comments made during consultation with DERM experts. Sunwater commits to continued consultation with DERM experts as part of developing the detailed fishway design, to maximise turtle passage opportunities and minimise the potential for physical damage (refer to Appendix 4, section 29.10.2). The fishway will include pit tag readers to easily monitor turtle movement.

Sunwater notes in section 13.1.2 of the SEIS that while it is likely effective transfer will result from the detailed fishway design process outlined above, if monitoring shows this is not the case, effective short term transfer and genetic mixing could be achieved by simple catch and carry techniques.

If monitoring indicates the species are aggregating near the dam wall but are not using the fish transfer device in significanct numbers,or in the event the fishway is non-operational for a period of greater than two weeks during the nesting or egg hatching season of the Fitzroy River turtle, the Coordinator-General has imposed a condition (Appendix 3, Condition 2 and the Fitzroy River turtle Species Management Program requirements set out in Appendix 6) requiring the capture and transfer of Fitzroy River turtles to release points to be determined in consultation with DERM. The number of individuals to be transferred, their sex and condition must also be determined in consultation with DERM. Transfer must continue on one day per fortnight during these periods.

In addition to the operation of the fishway, water will also exit the dam via the multi-level offtake structure or over the spillway when the volume in storage exceeds FSL.

Operation of offtake structures may result in the entrapment of Fitzroy River turtles in the offtake and outlet works. Screens covering the multi-level offtake will direct turtles towards the fishway entrance. High volume water releases may also result in injury or death to turtles passing through, or aggregated at or within the downstream side, of outlet structures. To mitigate potential impacts, Sunwater commits to excluding turtles from outlet structures which produce high velocities, reducing the velocity of high volume water release events and gradually increasing the rate of water release from outlet structures.

In its submission on the EIS, DEEDI (Fisheries Queensland) advised against using stepped spillways due to the risk of injury and mortality to fish (and other aquatic fauna such as Fitzroy River turtle), and requested Sunwater identify measures to mitigate stepped spillway impacts and prevent contact with dissipaters and the stilling basin.

In response, Sunwater replaced the originally proposed stepped spillway with a smooth spillway and, as part of detailed design, committed to reduce potential impacts to aquatic fauna by developing the design of the stilling basin and energy dissipation device, cognisant of advice provided by DEEDI and DERM.

With mitigation measures in place, the residual risk of impacts to aquatic fauna movement/migration due to the dam wall is expected to be low. The exception lies with freshwater turtle species. Sunwater has offered a direct offset to compensate for residual impacts to the Fitzroy River turtle (refer section 7.11.4 below).

Change in habitat downstream of the water storage area

The most significant changes in Fitzroy River turtle habitat are expected immediately downstream of the dam. IQQM modelling results show a slight overcompensation in low flows is expected immediately downstream of the dam, extending the period of time riffle zones downstream of the dam will be available for foraging purposes. The low flows will also help contribute to maintaining water quality within the deeper pools which, during zero flows, will become a refuge for both fish and turtles (in particular, the Fitzroy River turtle).

The predicted reduction in the number and frequency of floods during spring and early summer has the potential to influence migratory or breeding cues for some aquatic fauna (particularly fish). The EIS notes this is a typical impact of water storages and the first post winter flow event (FPWFE) release was included in WRP's to mitigate this impact.

The FPWFE for this project will occur between 1 October and 30 April and will be triggered by flows into the dam equivalent to one metre above 'cease to flow' at Mount Bridget. Inflows to the proposed dam will then be released for 14 days (capped at the maximum outlet capacity of 1300 megalitres per day). The flow level of the FPWFE is such that it will only affect the lower levels of sand banks. Accordingly, the FPWFE is unlikely to impact on nesting habitat for Fitzroy River turtles, which lay eggs predominantly in September/October. Along with the block release strategy for irrigation allocations, the two strategies are expected to substantially mitigate potential impacts to Fitzroy River turtles and other aquatic fauna.

The downstream extent of this impact is likely to be limited to the confluence of the Connors River with Funnel Creek (approximately 46.1 km downstream of the proposed dam wall), with impacts to existing flow regimes beyond this point predicted to be minimal. Further, all mandatory and most non-mandatory environmental flow objectives (EFOs) specified within the Fitzroy WRP 1999 can be met with the proposed dam in place. In particular, mandatory FPWFE performance indicators will be achieved for all locations (Yatton on Isaac River, Tartrus on Mackenzie River, and Eden Bann Weir and Fitzroy Barrage on Fitzroy River).

EFOs play an important role in ensuring the survival of aquatic fauna, including Fitzroy River turtles, in the Fitzroy (River) Basin, including movement and migration cues. DERM's evaluation of the performance of the Fitzroy WRP 1999 EFOs over a ten-year period[82] shows the EFOs are effective in achieving their ecological intent in the Fitzroy (River) Basin, including:

- top-up flows for downstream pools and waterholes
- connectivity for many fish and other aquatic species
- provision of flows for riffle-dependent taxa
- maintenance of good water quality during periods of low flow
- delivery of food and nutrients
- fish spawning and recruitment
- dispersal of fish and other organisms
- mixing and flushing of waterholes
- temporal diversity in aquatic habitats.

With respect to Fitzroy River turtle nesting, while a reduction in the number and frequency of floods during spring/early summer will reduce the natural loss of nests, it may also potentially prevent the natural rejuvenation of nesting banks by allowing the establishment of vegetation. However, the SEIS also noted that as large flows will still pass the dam on a generally annual basis, the rejuvenation of sand bars will still occur.

In the event nesting banks have not rejuvenated due to the expected reduction in the number and frequency of floods during spring and summer, as a precautionary measure, Sunwater commits to monitoring changes in nesting banks downstream from infrastructure, and where necessary, rehabilitating nesting banks which have not rejuvenated at significant nesting banks between the proposed dam and Cardowan (a known Fitzroy River turtle nesting site located approximately 16.8 km downstream of the dam).

The Coordinator-General has imposed a condition (Appendix 3, Condition 2 and the Fitzroy River turtle Species Management Program requirements set out in Appendix 6) which formalises and expands upon Sunwater's commitment. In particular, weeds or seedlings (including aquatic weeds which may prevent bank access) must be physically removed (without the use of herbicides) from significant nesting banks prior to the Fitzroy River turtle nesting season each year in tributaries upstream, within and downstream of the water storage area to the Funnel Creek confluence (46.1 km downstream of the proposed wall). Significant nesting banks is defined as banks at which multiple nest sites are confirmed during the requisite baseline and annual

population surveys conditioned by the Coordinator-General in Appendix 3.Condition 2. The nesting areas at which this occurs may not be the same each year, depending on the results of the annual population surveys.

With mitigation measures in place, the residual risk of adverse impacts to Fitzroy River turtle habitat downstream of the water storage is expected to be minimal.

Indirect impacts due to changes in water quality

Construction, filling and operation of the proposed dam may result in changes to water quality, which could indirectly result in the loss and/or injury of aquatic fauna. The quality of water received downstream from a dam is dependent on whether the impoundment is stratified, whether there are blue-green algal blooms in the impoundment, and existing management measures to manage water releases.

The surface water quality sub-plan contained in the draft operational EMP (OEMP) (section 29.10.5 of the EIS and updated in Appendix 4 of this report) outlines a number of measures to mitigate potential impacts to surface water quality both within the dam and downstream during operation. Of particular note is vegetation clearing prior to filling, managing stratification in the water storage area and the use of a multi-level offtake tower to allow water of appropriate quality to be drawn from a suitable level within the dam to maintain existing conditions downstream.

With mitigation measures in place, the residual risk of indirect impacts to the Fitzroy River turtle due to changes in water quality is expected to be minimal.

Cumulative impacts

Construction of the proposed water infrastructure will result in a greater proportion of lacustrine (pool) habitat in the Fitzroy (River) Basin, at the expense of habitat such as runs, glides, riffles and backwater. As described above, a reduction in habitat diversity may reduce the area of foraging and nesting habitat available for the Fitzroy River turtle, although the species is known to forage and nest in existing impoundments in the Fitzroy River.

Construction of the proposed water infrastructure will also result in a greater number of physical barriers to aquatic fauna movement and migration in the Fitzroy (River) Basin. Where each barrier is fitted with an effective fishway, the cumulative impacts to most aquatic fauna are expected to be minimal and acceptable. This will need to be confirmed by the impact assessment process for each project (e.g. Nathan Dam and Lower Fitzroy Weirs) as details of design and operation become available.

However, as identified above, Fitzroy River turtles are unlikely to use fishways in significant numbers.

In recognition of the cumulative impacts of the project on the Fitzroy River turtle, Sunwater has proposed an indirect offset (refer to section 7.11.4). The Coordinator-General has also imposed conditions to formalise and expand upon measures to mitigate and offset cumulative impacts to the Fitzroy River turtle (refer to section 7.11.4 and Appendix 3, Condition 2).

Monitoring program—Fitzroy River turtle

Sunwater commits to monitor the above-mentioned potential impacts to the Fitzroy River turtle (i.e. changes in habitat structure, flow regime, population fragmentation) and the effectiveness of corresponding mitigation strategies. Final design of the monitoring program will be developed in consultation with DERM and SEWPaC, and as a minimum monitoring will include:

- recording the sex and number of individuals moved, and where they were moved to, during the translocation from the construction area. Individuals will be pit tagged using DERM approved techniques
- undertaking annual population surveys during the nesting season in each tributary that supports suitable habitat upstream of the water storage area, within the water storage area, and downstream as far as Cardowan (approximately 20 km downstream of the dam wall) to assess the population and likelihood of nesting. All individuals captured will be pit-tagged. Results will be assessed with respect to the monitored flow regime, dam water levels, fishway evaluations and changes over time
- if nesting is observed within the dam catchment, the nests will be protected from predators using mesh cages (as used in the Fitzroy Barrage and Mary River) and the site will be inspected for evidence of hatching at the appropriate time
- monitoring and reporting turtle use of the fishway and any other turtle movement process
- inspecting offtakes, outlet structures and the spillway for evidence of injury or death to turtles. If evidence suggests the design of screens, stilling basin or outlet structures can be improved to avoid or minimise such instances, feasible and practical modifications will be undertaken as corrective action.

The Coordinator-General has also imposed a condition to formalise and expand upon the monitoring program requirements for the Fitzroy River turtle (refer to section 7.11.5 and Appendix 3, Condition 2).

Reptiles of the Brigalow Belt

As indicated in Table 7.6, four reptile species listed as ‘vulnerable’ under the EPBC Act (brigalow scalyfoot, Dunmall’s snake, yakka skink and ornamental snake) are likely to occur on the pipeline route and more specifically, in associated with the brigalow EEC. The impacts of vegetation clearing on the brigalow EEC have been discussed within this section and are not reiterated in detail here.

Approximately 80 ha of brigalow EEC occurs within 250 metres of the pipeline route. Of this, up to 2.21 ha (2.75 per cent) may be impacted by the clearing width for the construction of the pipeline. The loss of 2.75 per cent of brigalow EEC within proximity to the pipeline route is unlikely to result in a long-term decrease in the size of populations of these species.

Pipeline construction has the potential to create a barrier to reptile movement by restricting access for some species across an unfavourable habitat (i.e. cleared land), which has the potential to fragment a population. Avoiding intact patches of brigalow EEC through pipeline realignments and rehabilitation of the pipeline easement post

construction will reduce the impacted areas to minimal levels. In addition, progressive rehabilitation will ensure the pipeline easement remains permeable for dispersing fauna thereby maintaining movement corridors.

The breeding cycles of these species are not well understood. Accordingly, a spotter-catcher will be employed during pipeline construction to work ahead of vegetation clearing to 'flag' significant microhabitat (e.g. woody debris, burrows) and will be present to ensure clearing of such features is conducted in a way which minimises impacts to breeding fauna.

The feral cat is a potential threat to these species and is known from the proposed water storage area and is a likely occurrence along the pipeline route. Implementing a pest management plan (refer to Appendix 4, draft EMP) during construction and operation will ensure pests are controlled as part of the project.

Squatter pigeon

The project will result in the permanent loss of 1830 ha of woodland and open forest habitat for this species within the water storage area and an additional 166 ha of habitat along the pipeline route.

An assessment provided in section 28 of the EIS found the population of squatter pigeon within the project area is not an 'important' population (i.e. a population that is necessary for a species' long-term survival and recovery), given:

- there are no important population listings of squatter pigeon in SEWPaC's Species Profile and Threats (SPRAT) database
- the squatter pigeon (southern) exists as a single, continuous inter-breeding population
- the population at the project area is not near the limit of the species' range.

The squatter pigeon is a highly mobile species and movements are responsive to seasonal conditions and access to water. Accordingly, the project will not fragment an existing population of this species.

Feral cats were observed within the proposed dam area and along the pipeline route. Implementing a pest management plan (refer to Appendix 4, draft EMP) during construction and operation will ensure pests are controlled as part of the project.

A formal recovery plan has not been prepared for the squatter pigeon. However, managing feral cats and rehabilitating and protecting habitat around the periphery of the water storage area may assist with the recovery of this species at the local scale.

Australian painted snipe

The project will result in the loss of 61 ha of riparian vegetation habitat for this species.

Given the species is an opportunistic breeder that breeds in response to seasonal conditions and water availability, the creation of the water storage area is unlikely to disrupt the species' breeding cycle and may provide habitat at the periphery of the water storage and contribute to favourable breeding sites throughout the year.

The project is also unlikely to fragment the existing population given the distribution of the species (Northern Territory, Queensland, New South Wales, Victoria and parts of South Australia) and the species is nomadic and mobile across the landscape.

The feral cat is a potential threat to the Australian painted snipe. Implementing a pest management plan (refer to Appendix 4, draft EMP) during construction and operation will ensure pests are controlled as part of the project.

A formal recovery plan has not been prepared for the Australian painted snipe; however, the project will not interfere with the recovery of this species and may provide year-round habitat areas.

Red goshawk

The project will not impact on the ranges adjacent to the proposed dam water storage area, which is the species' preferred habitat. Approximately 65 ha of riparian vegetation, which may be used occasionally, will be lost as a result of inundation and along the pipeline route where it traverses major rivers. The loss of riparian vegetation may impact on red goshawks, which are associated with riverine forests along major waterway systems. However, the EIS noted over 750 000 ha of suitable habitat within the Brigalow Belt bioregion for this species.

The project area contains ephemeral waterways and therefore is unlikely to support a breeding pair of birds; however, the project will provide direct habitat offsets for vegetation lost through inundation or mechanical clearing. Offset areas will be protected in perpetuity and managed to reduce threatening processes. As such, the project will contribute to protecting and managing potential habitat for the red goshawk within the same catchment as the impact.

7.11.4. Environmental offsets

The following section presents a summary of environmental offsets committed to by Sunwater to offset adverse residual impacts to MNES, including brigalow EEC, squatter pigeon and the Fitzroy River turtle. Appendix 10 contains Sunwater's current offset proposal which is intended to address both Queensland and Australian Government offset requirements.

The offset proposal to satisfy EPBC-Act offset requirements involves securing approximately 13 500 ha of vegetation, including riverine and riparian areas for the Fitzroy River turtle, across four properties. This involves securing approximately:

- 13,000 ha of remnant, high-value regrowth (HVR) and non-remnant vegetation on Ridgeland, including 54 ha of riverine and riparian habitat
- 115 ha of riverine and riparian habitat on Undercliff
- 60 ha of riverine and riparian habitat on Collaroy.

Offsets for brigalow EEC

Sunwater will offset impacts of the brigalow EEC (2.21 ha) using a multiplier of 1:5. Accordingly, Sunwater commits to legally securing a property containing at least 11.05 ha of brigalow EEC. Sunwater is investigating properties downstream of the

proposed dam which contains over 10 000 ha of brigalow regrowth vegetation based on an assessment of pre-clear REs.

The provision of 11.05 ha of brigalow EEC will also offset potential impacts to the four reptiles associated with the brigalow EEC, which will be impacted by the pipeline route (brigalow scalyfoot, Dunmall's snake, yakka skink and ornamental snake).

Offsets for squatter pigeon

Sunwater will offset impacts to the squatter pigeon (1996 ha) by securing the entire Ridgeland property above the water storage area as an offset, which equates to approximately 13 000 ha and an offset multiplier of approximately 1:6.5.

Ridgeland is a 15 600-hectare grazing property located to the north of the Collaroy property, extending east from the water storage area (refer to Figure 7.3). Ridgeland is located between Collaroy and Tierawoomba State Forests. The majority of the vegetation on the property is eucalypt woodlands with a grassy understorey. This is considered highly suitable habitat for the squatter pigeon and the EIS noted a number of observations of the species nearby during field surveys. Therefore it is likely that the remnant and non-remnant areas on the property will provide habitat for the squatter pigeon.

The 13 000-hectare offset is aimed at directly satisfying the requirement related to squatter pigeon but also providing catchment related benefits for the Fitzroy River turtle. Given the location of the property between two state forests, the property will create a large contiguous area that will be of substantial environmental benefit to a broad suite of species and communities. Parts of the property will also be used to satisfy Queensland Government offset requirements.

Offsets for Fitzroy River turtle

Direct offsets

In recognition of potential residual impacts to the Fitzroy River turtle, Sunwater is offering a direct offset in two geographically distinct areas—upstream and downstream of the proposed dam. The offset involves protecting and managing 70 km (500 ha) of riverine and riparian habitat (within 50 metres of the high water mark), which is known or likely to support the species. The offset areas are restricted to substantial reaches (watercourses classified as order 4 or higher) as the species has not been found in smaller watercourses in this area and is generally acknowledged as a species that requires permanent watercourses.

Upstream of the dam, suitable habitat for the species was found on the Ridgeland, Undercliff and Collaroy cattle grazing properties (Appendix D6 of the SEIS). Offsets proposed on these properties are shown in Table 7.7 and figures 7.1–7.3. The length of river upstream of the dam at FSL included in this offset is approximately 24 km. As identified in section 2 of this report, Sunwater has already acquired these properties.

Sunwater is also proposing to provide an additional 45 km of offsets at a privately owned property (referred to as 'Property A') located on the Connors River downstream of the dam—preferably located within reasonable proximity to the Funnel Creek confluence with the Connors River. Offsets in this location would be contiguous to the

70 km of offsets immediately downstream of the dam wall and extend the length of river within which habitat protection and/or management actions will be undertaken. Fitzroy River turtles have been found at most sites sampled as far downstream as Funnel Creek (refer to Appendix 6) and also at Tartrus Weir on the Mackenzie River (pers. com. Limpus, November 2011).

Management measures would include reduction of grazing pressure (primarily through seasonal exclusion of cattle from nesting areas), weed and feral animal control.

Table 7.8 Stream order lengths associated with direct offsets for Fitzroy River turtle

Stream Order	Undercliff (km)	Ridgeland (km)	Collaroy (km)	'Property A'* located on the Connors River downstream of the proposed dam (km)
4	6.96	5.48	2.20	To be determined
5	5.43	-	3.71	To be determined
6	-	-	-	To be determined
7	-	-	-	To be determined
Total	12.39	5.48	5.91	Approximately 45

* yet to be identified, negotiated and agreed with landowner

Figure 7.6 Proposed Fitzroy River turtle offsets on Undercliff

Figure 7.7 Proposed Fitzroy River turtle offsets on Ridgeland

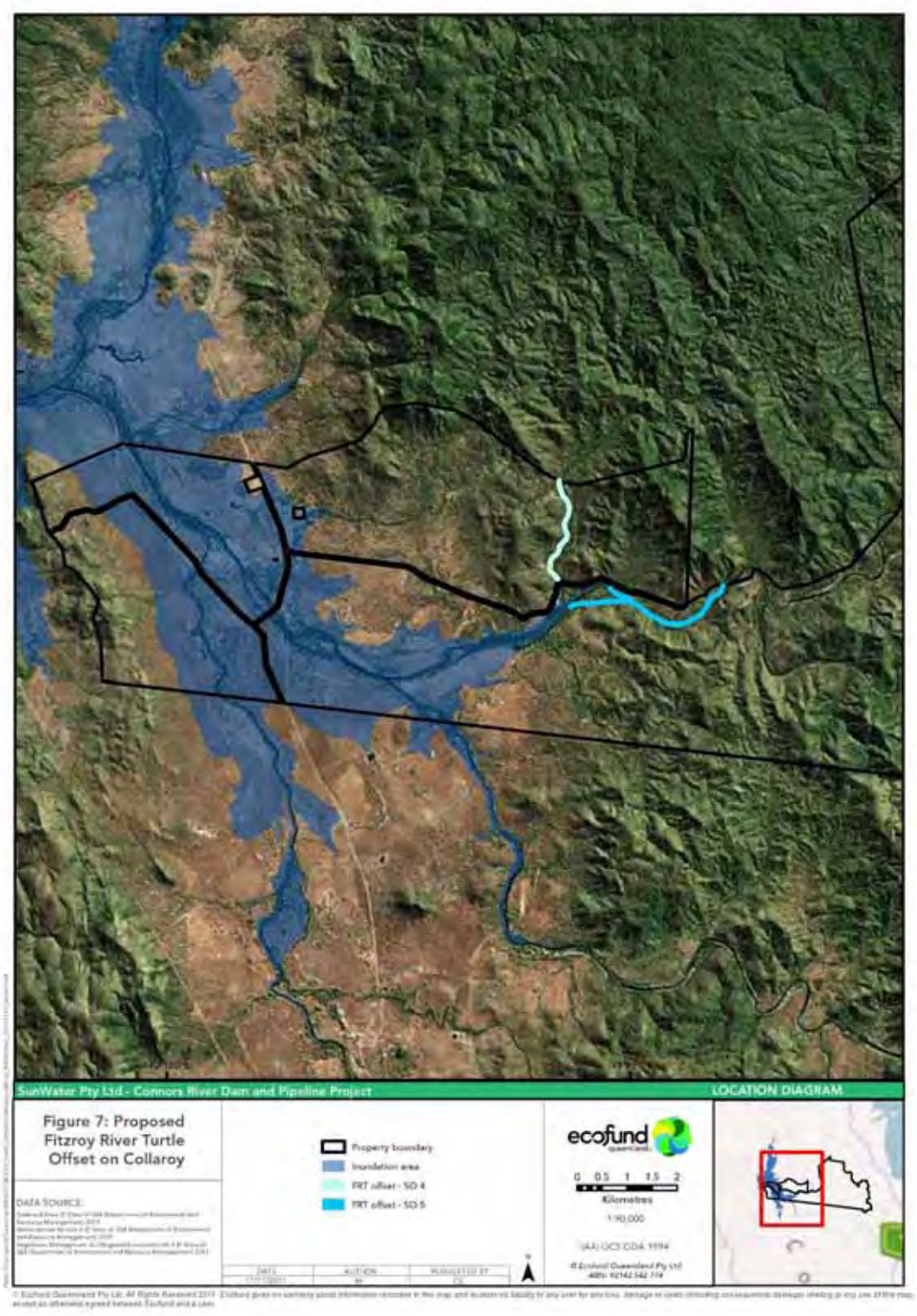


Figure 7.8 Proposed Fitzroy River turtle offsets on Collaroy

Indirect offsets

In recognition of the potential for residual cumulative impacts to the Fitzroy River turtle, and as Sunwater or joint proponent for three possible projects in the Fitzroy (River) Basin catchment (Connors River Dam, Nathan Dam and Lower Fitzroy Weirs), Sunwater has committed $100 000 per year per project for five years ($500 000 per project) towards a catchment-wide research and monitoring program, with research directed at both ecological parameters (e.g. distribution, abundance, location of nesting areas) and at practical means to reduce the impact of existing structures. The design of the program would be formulated via discussion with SEWPaC, DERM and relevant researchers, and would be linked with the funding to the existing Fitzroy Basin Association Regional Natural Resource Management plan and Central Queensland University research programs.

Sunwater has also approved $4 million from the Queensland Government's dividend reinvestment scheme towards the design, construction and monitoring of a turtleway prototype to facilitate turtle movement through man-made barriers. Tartrus Weir will be used to develop a turtleway prototype, which will be followed by a two-year period of monitoring. The approved project is not specific to Fitzroy River turtles but will be undertaken in the Fitzroy (River) Basin catchment.

While not directly relevant to this project, the results will be used to inform the design of turtle transfer facilities on any further dams or weirs within the Fitzroy (River) Basin and enable informed retrofitting to existing structures.

Offsetting unavoidable impacts to watercourse habitat

As identified in Table 7.9, Sunwater will secure offsets on the Ridgeland and Marylands properties to satisfy State offset requirements for unavoidable impacts to watercourse vegetation.

The *Vegetation Management Act 1999* (Qld) and the relevant Policy for Vegetation Management Offsets (Performance Requirement 3) requires the current extent of vegetation associated with any watercourse to be maintained in order to provide:

- bank stability by protecting against bank erosion
- water quality by filtering sediments, nutrients and other pollutants
- aquatic habitat
- terrestrial habitat.

Marylands is a 21 500-hectare cattle grazing property located at the southern end of the water storage area. The property borders the Collaroy and Mountain View properties to the north and contains areas of remnant, HVR and non-remnant vegetation and stream orders ranging from 1 to 5.

The location and characteristics of the Ridgeland property is discussed above as part of offsets for impacts to the squatter pigeon.

Table 7.9 Proposed offsets for watercourse vegetation

Stream Order	Offset requirement (ha)	Ridgeland (ha)	Marylands (ha)
1	124.74	124.74	-
2	83.23	83.23	-
3	145.19	-	145.19
4	166.888	-	166.88
5 +	891.31	742.79	148.52
Total	1411.35	950.76	460.59

The protection of 1411 ha of watercourse habitat will benefit other MNES as it will provide suitable habitat for the black ironbox, Australian painted snipe, red goshawk and terrestrial migratory bird species.

Refer to section 5.4 of this report for more detailed information on offsets provided to meet Queensland offset requirements.

Legally securing offset areas

With the exception of 'Property A', all offset areas (including Ridgeland, Undercliff and Collaroy) have been purchased by Sunwater as part of Sunwater's flood mitigation strategy (refer to section 7.4.2 of this report).

Sunwater is currently offering to gift the 13 000 ha Ridgeland property to DERM for the purpose of declaring the land as National Park, thereby preserving the conservation values in perpetuity.

Other properties nominated in Sunwater's offset strategy (including Undercliff, Collaroy and 'Property A') will be protected under a legally binding conservation mechanism under either the *Nature Conservation Act 1992* or another mechanism administered approved by the State of Queensland.

Sunwater advise there is also a possibility that DERM may be willing to accept a covenant issued by Sunwater in favour of DERM under the *Land Title Act 1994* for the preservation of offset areas. These forms of conservation tenure could be extended to the entirety of Ridgeland if National Park status for this property does not eventuate.

To ensure the proposed offset areas are protected in perpetuity, the Coordinator-General has set conditions (Appendix 1.Schedule E) requiring details of the legally binding mechanism/s used to secure offset areas to be provided as part of Sunwater's application for a development permit to clear native vegetation pursuant to the *Vegetation Management Act 1999*.

7.11.5. Coordinator-General's conclusions—threatened species and communities

Threatened flora and ecological communities

Brigalow EEC

Based on the extent of potential impact (clearing of 2.75 per cent of brigalow EEC within proximity to the pipeline route), measures proposed to mitigate impacts, including a vegetation clearance management plan and WMP; and the provision of an offset for unavoidable impacts to brigalow EEC (11.05 ha using a offset multiplier of 1:5), the Coordinator-General is satisfied that residual impacts to brigalow EEC will be minimal.

SEVT EEC

There will be no direct impacts to SEVT EEC through the construction of the project. Implementing the proposed vegetation clearance management plan and WMP will mitigate any potential indirect impacts to this EEC. Accordingly, the Coordinator-General is satisfied impacts to the SEVT EEC will be negligible.

Black ironbox

Based on the extent of potential impact (clearing of 723.5 ha of potential habitat), measures proposed to mitigate impacts, including a vegetation clearance management plan and WMP; and protecting 1411 ha of watercourse habitat, most of which is suitable for black ironbox, the Coordinator-General is satisfied that residual impacts to black ironbox will be minimal.

Threatened fauna

Fitzroy River turtle

The Coordinator-General notes the high conservation value of the study area with respect to freshwater turtles—in particular the cloacal ventilating Fitzroy River turtle ('vulnerable' listing, *Nature Conservation Act 1992* (Qld) (NC Act) and EPBC Act).

The Coordinator-General recognises water infrastructure such as dams and weirs, and non-water infrastructure, such as road crossings, can impede the upstream and downstream movement of freshwater turtles, particularly as these species move between habitats during the dry and wet seasons. Further, Limpus et al.[83] found cloacal ventilating turtles are the most negatively impacted by impoundments as they have life histories linked with well-oxygenated riffle zones, which become inundated by impoundments. The Coordinator-General notes this to be of particular importance for this project given aquatic fauna within the study area are not currently impacted by impoundments or flow regulation, with the nearest man-made barrier being Tartrus Weir on Mackenzie River approximately 175 km downstream of the proposed dam.

The Coordinator-General acknowledges the range of measures identified in the EIS and the SEIS to mitigate potential impacts to the Fitzroy River turtle and recognises Sunwater's commitment to implement an ongoing monitoring program to evaluate the

effectiveness of mitigation as well as the provision of direct (land-based) and indirect (research-based) offsets.

The Coordinator-General has imposed a condition (Appendix 3, Condition 2 and the Fitzroy River turtle Species Management Program requirements set out in Appendix 6) to formalise, and in some cases expand upon, measures to mitigate direct and cumulative impacts to the Fitzroy River turtle.

In its submission on the SEIS, DERM advised that more baseline information on the presence and abundance of Fitzroy River turtles and white-throated snapping turtle populations (and associated nesting sites) is required to inform the proposed monitoring program and allow for the adequate protection and enhancement of both species and their habitat during operation of the project.

Accordingly, the Coordinator-General requires a comprehensive baseline study of Fitzroy River turtle and white-throated snapping turtle populations in each tributary upstream of the inundation area, within and downstream of the water storage area (refer to Appendix 6(d)). The baseline study must:

- be conducted prior to operations commencing (for a period of at least one year prior to the closure of the dam wall)
- establish a tagged population of both species
- document:
  - estimates of annual nesting and recruitment
  - evidence of injury and disease
  - known or likely nesting areas, including nesting microhabitat, distance from and height above the water to nest
  - estimates of predation and other losses of eggs at nesting areas.

The Coordinator-General notes changes to the downstream flow regime resulting from operation of the proposed dam will be limited to the confluence of the Connors River and Funnel Creek, approximately 46.1 km downstream of the proposed dam wall. However, the geographical extent of Sunwater's proposed annual population surveys is limited downstream as far as Cardowan, approximately 16.8 km downstream of the proposed dam wall.

Given monitoring results will need to be assessed with respect to (but not limited to) potential impacts associated with flow regime change, the Coordinator-General's condition requires that population surveys extend further downstream, beyond Cardowan, to the Funnel Creek confluence. In addition, the Coordinator-General requires that monitoring form part of a species management program for the Fitzroy River turtle and white-throated snapping turtle (refer to Appendix 6 of this report), and shall include a reporting and corrective action regime to address impacts to these species' populations, habitat and passage upstream and downstream of the proposed dam.

Limpus et al.[83] suggest that, with a catchment-wide approach, '*it will be possible to reverse the negative impact of not only the new infrastructure developments but to also compensate for cumulative impacts*'.

Accordingly, to address predicted cumulative impacts in the Fitzroy (River) Basin catchment, the Coordinator-General requires Sunwater to prepare, in collaboration with DERM, SEWPaC and the Fitzroy Basin Association, a catchment-wide conservation plan for the Fitzroy River turtle and white-throated snapping turtle pursuant to section 112(2) of the NC Act (Appendix 3, Condition 2(b)). The plan must specify the research and management measures necessary to ensure the survival and natural development of species' populations in the Fitzroy (River) Basin catchment, and provide a planned and logical framework for key interest groups and responsible government agencies to coordinate their work to improve the plight of both species in the catchment.

A coordinated approach to the research and management of the Fitzroy River turtle and white-throated snapping turtle is considered to be of particular importance, given the other water infrastructure projects proposed in the Fitzroy catchment currently undergoing assessment (Nathan Dam and Pipelines and Lower Fitzroy Weirs projects).

In response to DERM and SEWPaC comments regarding the adequacy of Sunwater's proposed financial commitment to address cumulative impacts, and based on advice from DERM regarding the level of funding required to allow for continuity of staffing for this conservation work, the Coordinator-General requires Sunwater to increase the financial contribution for this project from $100 000 to $250 000 per year for five years into a fund administered by DERM. The funding must commence on the date of adoption of the conservation plan and shall be used to implement the research and management measures identified in the adopted Conservation Plan (Appendix 3, Condition 2(b)(iii)).

The Coordinator-General acknowledges Sunwater's financial commitment of $100 000 per year for five years is also applicable to other water infrastructure projects proposed in the Fitzroy (Basin) catchment including Nathan Dam and Lower Fitzroy Weirs. However, given both projects are undergoing assessment and are therefore yet to receive the necessary approvals, there is no certainty that either of these projects will proceed. In addition, in the event of all projects proceeding, the Connors River Dam, Nathan Dam and Lower Fitzroy Weirs projects will not be constructed simultaneously. Accordingly, Sunwater's identified financial commitment for a single project does not ensure adequacy or continuity of staffing.

Under the provisions of the *Water Act 2000*, Sunwater must obtain a development permit (operational works) for the removal of quarry material from a watercourse (refer to section 7.6 of this report for more information). The Coordinator-General has also recommended a condition (Appendix 2, Part 2, Recommendation 6), to ensure no quarry material is removed from Fitzroy River turtle nesting areas, and that adequate information is provided with an application for a development permit to demonstrate no impact of turtle nesting areas.

Based on measures to mitigate impacts to the Fitzroy River turtle identified in the draft CEMP and OEMP for the project (Appendix 4), the proposed monitoring program and offsets (direct and indirect) to address Fitzroy River turtle impacts, and the additional requirements set by the Coordinator-General to address direct and cumulative impacts to the species, the Coordinator-General is satisfied that impacts to the Fitzroy River turtle can be effectively managed and that the residual impacts are minimal.

Reptiles of the Brigalow Belt

Given the extent of potential impact to these species' habitat (clearing of 2.75 per cent of brigalow EEC within proximity to the pipeline route), measures proposed to mitigate impacts indentified in the draft CEMP and OEMP for the project (Appendix 4, in particular the vegetation clearance management plan and pest management plan), and the provision of an offset to offset unavoidable impacts to brigalow EEC (11.05 ha using a offset multiplier of 1:5—suitable habitat for these species), the Coordinator-General is satisfied that impacts to the brigalow scalyfoot, yakka skink, Dunmall's Snake and Ornamental Snake and their habitat will be minimal.

Squatter pigeon

Given the extent of potential impact to squatter pigeon habitat (when compared with the availability of suitable habitat (almost three million ha) for this species within the Brigalow Belt bioregion), the squatter pigeon population within the project area is not considered to be an 'important population', measures proposed to mitigate impacts identified in the draft CEMP and OEMP for the project (Appendix 4, in particular the pest management plan), and that 13 000 ha of compensatory habitat will be provided and protected (using an offset multiplier of 1:6.5), the Coordinator-General is satisfied that residual impacts to the squatter pigeon and its habitat will be minimal.

Australian painted snipe

Based on the extent of potential impact to this species' habitat (61 ha when compared with more than 20 000 ha of suitable habitat within the Brigalow Belt bioregion), measures to mitigate potential impacts and that habitat lost within the water storage area will be offset by the long-term protection of 1411 ha of compensatory watercourse habitat, the Coordinator-General is satisfied that impacts to the Australian painted snipe and its habitat will be minimal.

Red goshawk

Given the extent of the potential impact to this species habitat (65 ha when compared with over 750 000 ha of suitable habitat within the Brigalow Belt bioregion), measures to mitigate potential impacts, and that lost habitat will be offset by the long-term protection of 1411 ha of compensatory watercourse habitat, the Coordinator-General is satisfied that impacts to the red goshawk and its habitat will be minimal.

Summary—threatened species and communities

The Coordinator-General is confident that, with measures proposed to mitigate impacts, and the provision of identified offsets, in conjunction with additional requirements set regarding the Fitzroy River turtle, impacts to threatened species and communities will be minimal.

The Coordinator-General has set conditions (Appendix 1, Schedule A, conditions 1–2) to ensure the effective implementation of measures to mitigate potential impacts to threatened species and communities as described in the draft CEMP and OEMP for the project, including the establishment of a monitoring, auditing and reporting regime to ensure compliance.

As identified in Table 7.4, Sunwater must also obtain a number of approvals for the project pertaining to the management of vegetation and habitat as required under the *Vegetation Management Act 1999* (development permit for operational works that is clearing of native vegetation)*, Water Act 2000* (removal of quarry material from a watercourse; interim resource operations license to maintain downstream environmental flows) and NC Act (clearing permits).

To ensure proposed offset areas are protected in perpetuity, the Coordinator-General has set conditions (Appendix 1.Schedule E) requiring details of the legally binding mechanisms used to secure offset areas to be provided as part of Sunwater's application for a development permit to clear native vegetation pursuant to the *Vegetation Management Act 1999*.

The Coordinator-General notes the strategic conservation benefits that the offset proposal (in particular, the 13 000-hectare Ridgeland property offset to compensate for the loss of squatter pigeon habitat) will provide for the region.

The Ridgeland property comprises high quality habitat for a variety of threatened flora and fauna species, as well as the potential for natural regeneration in a number of areas. Ridgeland is connected directly to large tracts of remnant vegetation of a viable size in the landscape and will sustain populations of flora and fauna species. The Ridgeland offset will also improve habitat connectivity along watercourses to existing tracts of remnant riparian vegetation and large tracts of remnant vegetation to the east and west (Tierawoomba and Collaroy State Forests).

The property encompasses a range of land zones, and consequently the vegetation varies from woodlands on alluvial plains to eucalypt forests on ridge lines. The property will also provide connectivity from one ridge to another. The diversity of vegetation and characteristics therefore make Ridgeland well suited for use as a conservation reserve.

In accordance with VM Act requirements, the offset properties, including Ridgeland, will require management of remnant and non-remnant vegetation to ensure conservation benefits are achieved and natural regeneration occurs. The management measures required include strategic in-filling of habitat gaps through active management of natural regeneration, fire management, pest animal management, weeding and the exclusion of livestock. DERM advises cleared areas on Ridgeland have the potential to rehabilitate with recruitment of the dominant eucalypt species emerging from the grass understorey, and regrowth is expected to flourish with the exclusion of livestock.

Given the location of Ridgeland between two existing protected areas (Tierawoomba State Forest on the northwest (15 500 ha) and Collaroy State Forest on the north-east (3860 ha)), the protection, restoration and enhancement of vegetation and habitat on Ridgeland will therefore improve connectivity in the landscape and provide real conservation outcomes for a variety of species by enhancing the health, diversity and productivity of the environment.

Furthermore, given the strategic conservation value of the property, the QPWS advise Ridgeland is suitable for possible declaration as a national park, subject to interim tenure arrangements for that part of the property to be managed by Sunwater for offset purposes. In addition, Tierawoomba State Forest, which DERM considers to be an 'important strategic link for future national park acquisitions', has been transferred to

‘forest reserve’ which is a transitional tenure normally preceding transfer to national park.

Accordingly, the Coordinator-General finds the Ridgeland offset has the potential to deliver priority additions to Queensland’s protected area estate. This would assist in addressing higher level policy objectives such as the Australian Government’s goal of increasing the size of the National Reserve System to 125 million ha (a 25 per cent increase) by 2013[84] and the Queensland Government’s target of expanding the protected area estate to 20 million ha by 2020.[85]

8. Conclusion

In undertaking his evaluation of the EIS, the Coordinator-General has considered the EIS, issues raised in submissions, the SEIS, Sunwater's response to information requests, and the advice received on key issues from state agencies and SEWPaC.

The Coordinator-General is satisfied the requirements of the SDPWO Act have been satisfactorily fulfilled, and that sufficient information has been provided to enable the required evaluation of potential impacts attributable to the project.

The project is a key component of the Queensland Government's strategy to increasing the availability and security of water supply in Central Queensland, in particular the Bowen Basin. The project will support planned mining activity in the Bowen Basin and the associated social and economic benefits likely to be associated with that activity.

The various potential impacts, identified in both the EIS and SEIS, are recognised. The Coordinator-General considers those impacts to be acceptable having regard to the significance of the project in terms of ensuring security of water supply for recent and planned mining development in the Bowen Basin and the mitigation and offset measures that will be provided by the project.

In particular, the strategic protection, restoration and enhancement of significant areas of vegetation on grazing properties located between two state forests (Tierawoomba and Collaroy state forests) will secure long-term habitat connectivity in the landscape and provide real conservation outcomes for a variety of species, with the potential to deliver priority additions to Queensland's protected area estate.

Further, the Coordinator-General's conditions regarding the preparation and funding of a catchment-wide conservation plan for the Fitzroy River turtle and white-throated snapping turtle will provide a framework for key interest groups and responsible government agencies to coordinate research and management measures necessary to ensure the recovery of these species.

Accordingly, the Coordinator-General recommends the project, as described in this evaluation report, proceed, subject to the conditions and recommendations in Appendixes 1–3, Sunwater's revised EMP and offset strategy, and the commitments made by Sunwater.

The conditions that are set out in Appendixes 1–3 of this report include:

- stated conditions that must be imposed on development approvals for the project (Appendix 1). While these conditions must attached to a development approval under SPA, the statement of these conditions does not limit the assessment manager's power to assess the development application and impose additional conditions not inconsistent with the Coordinator-General's conditions
- recommendations for other state approvals that will be required for the project (Appendix 2, Part 1), where the decision maker must take this Coordinator-General's evaluation report into account
- imposed conditions under the SDPWO Act, which are enforceable through the SDPWO Act (Appendix 3).

To ensure conditions and recommendations of this report are applied in a systematic and auditable manner, the Coordinator-General has required at Appendix 1, Schedule A, conditions 1 and 2, that Sunwater submit to DERM for approval:

- a CEMP at least 30 business days prior to the commencement of construction works on the project
- an OEMP at least 60 business days prior to the proposed operations commencement date.

The Coordinator-General has also required Sunwater to report to DERM on the implementation of the CEMP and OEMP, including construction and operations phase compliance reporting, and construction and operation incidents and exceedence reporting.

This report will now be provided to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities, pursuant to section 17(2) of the SDPWO Regulation and the bilateral agreement between the State of Queensland and the Australian Government, as the assessment report to enable a decision on approval of the controlled action for this project pursuant to section 133 of the EPBC Act.

Sunwater will also be required to obtain a number of state approvals, including for ERAs, and interim resource operations licence and operational works approvals for clearing native vegetation, waterway barrier works, removing quarry material from a watercourse and th\e construction of a referable dam.

A copy of this report will be provided to Sunwater and advisory agencies and will be made publicly available on the Department of Employment, Economic Development and Innovation website, at **http://projects.industry.qld.gov.au**

Appendix 1. Stated conditions

This appendix includes the Coordinator-General's stated conditions[86], stated under section 39 of the SDPWO Act.

These conditions must attach to a development approval issued under the *Sustainable Planning Act 2009* (Qld) (SPA) for the project. The conditions are taken to be concurrence agency conditions under SPA.

The conditions imposed do not limit the assessment manager's power to assess the development application and impose conditions not inconsistent with the conditions in this appendix.

The development approvals under the SPA for which the Coordinator-General has set conditions are:

Schedule A	Making a material change of use of premises
Schedule B	Making a material change of use of premises for an environmentally relevant activity—Environmental *Protection Act 1994*
Schedule C	Operational work that is the construction of a referable dam as defined under the *Water Supply (Safety and Reliability) Act 2008*
Schedule D	Operational works that is constructing or raising waterway barrier works—*Fisheries Act 1994 (preliminary approval only)*
Schedule E	Operational work that is the clearing of native vegetation (Schedule 3, Part 1, Table 4, *Sustainable Planning Regulation 2009*) *(preliminary approval only)*

SCHEDULE A. MAKING A MATERIAL CHANGE OF USE OF PREMISES

Condition 1. Construction environmental management plan

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) A construction environmental management plan (CEMP) must be prepared and implemented for all construction aspects of the Connors River Dam and Pipelines project. The project must be constructed in accordance with the CEMP, which must:

  (i) be developed generally in accordance with the draft CEMP in section 29.9 of the Connors River Dam and Pipeline EIS and SEIS;

  (ii) incorporate Conditions 1–10 of Appendix 1, Schedule A;

  (iii) identify elements of the CEMP requiring ongoing action in the operational phase of the project

(b) At least 30 business days prior to the commencement of construction works[87] on the project, Sunwater and/or its contractor(s) shall submit the Connors River Dam and Pipeline project CEMP to the Chief Executive of DERM for approval.

(c) The CEMP shall incorporate sub-plans to address the environmental objective/s, performance criteria, mitigation measures, monitoring, reporting, responsibility and corrective action for at least the following:

  (i) Geology and soils (refer to Condition 4)

  (ii) Land contamination (refer to Condition 7)

  (iii) Surface water hydrology

  (iv) Groundwater (refer Condition 3)

  (v) Surface water quality

  (vi) Terrestrial flora

  (vii) Terrestrial fauna

  (viii) Aquatic flora and fauna

  (ix) Weeds

  (x) Animal pests

  (xi) Air quality and greenhouse gas (refer to Condition 6)

  (xii) Noise and vibration (refer to Condition 5)

  (xiii) Hazard and risk (refer to Condition 8)

  (xiv) Waste (refer to Condition 9)

  (xv) Transport and roads

  (xvi) Indigenous and non-Indigenous cultural heritage

(xvii) Social and economic environment (refer to Condition 10)

(d) In finalising the CEMP, Sunwater must ensure that:

(i) all recommendations, mitigation measures and proponent commitments identified in the EIS and SEIS and proponent correspondence dated 28 June 2011 and 12 August 2011 are included in the CEMP, except where the matter is addressed by these conditions, and then to the extent required by these conditions.

(ii) audits are undertaken on a three monthly basis during construction by an independent and appropriately qualified person(s) to determine whether the project's activities are in compliance with the CEMP.

(iii) a mechanism for reporting on compliance is established in the CEMP, generally consistent with the hierarchy of reporting presented in Table A1.

Table A1: CEMP—Reporting on compliance and performance

Report	Frequency and scope
Construction Compliance Report	Trimonthly: • undertaken by an independent and appropriately qualified person; • compliance with conditions and details of any non-compliances; • compliance with the CEMP; • compliance with Sunwater's commitments and details of any non-compliances; • response to incidents of non-compliance, including corrective actions, revised construction practices, responsibility and timing; and • all other matters pertaining to environmental performance during construction.
Construction Incidents and Exceedence Report	Interim Report: • within 2 business days of an incident or an exceedence or non-compliance with a condition, goal or requirement being identified; and • details of incident and initial response. Full Report: • within 15 business days of incident or an exceedence or non-compliance with a condition, goal or requirement being identified; and • details of incident, response, corrective action, responsibility and timing.
All reporting must be to DERM and be available to relevant agencies on request.	

(iv) Construction compliance reports must be prepared by an independent and appropriately qualified person and provided to the Chief Executive of DERM within 30 business days of the end of the monitoring period to which the audit relates. The report must include details of any non-compliance, corrective actions, revised practices and evidence to support the findings of the audit.

(v) The first audit period will begin on commencement of construction works and end once all audit report corrective actions have been completed.

Condition 2. Operational environmental management plan

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) An operational environmental management plan (OEMP) must be prepared for the Connors River Dam and Pipelines project and implemented post construction. The project must be operated in accordance with the OEMP. The OEMP must be developed in accordance with the draft OEMP in section 29.10 including OEMP sub-lans outlined in sections 29.10, of the Connors River Dam and Pipeline EIS, and SEIS.

(b) Sunwater and/or its contractor(s) shall finalise the Connors River Dam Pipeline Project OEMP and submit it to the Chief Executive of DERM for approval at least 60 business days prior to the proposed operations commencement date.

(c) The OEMP shall contain sub-plans for at least the following:

(i) Management of water storage and pipeline

(ii) Dam safety

(iii) Geology and soils

(iv) Surface water quality

(v) Groundwater

(vi) Pests and weeds

(vii) Hazardous substances

(viii) Social and economic.

(d) In finalising the OEMP, Sunwater must ensure that all relevant recommendations, mitigation measures and proponent commitments identified in the EIS and SEIS and proponent correspondence dated 28 June 2011 and 12 August 2011 except where the matter is addressed by these conditions, and then to the extent required by these conditions.

(e) Monitoring—Ongoing monitoring for operational impacts must be undertaken for operational aspects as necessary to assess performance relative to the environmental objectives set out in the EIS Chapter 29 Draft OEMP outline or these conditions. The form of monitoring must be appropriate to the issue and should adopt the parameters established in the OEMP. Where compliance and monitoring requirements for a particular matter are incorporated in another project approval or statutory instrument (e.g. ROP in relation to aquatic fauna), those requirements may replace the relevant requirements contained in these conditions;

(f) Review, response and modifications—There must be a regular review of the OEMP. A process for review of mitigation measures must be outlined in the OEMP. The process should provide for further mitigation measures or review of mitigation measures to be implemented as soon as practical in response to monitoring results (where shortfalls are identified) and the outcomes of any community consultation

(g) Complaints—There must be a formal process for receiving and dealing with complaints about the operation of the project in relation to the environmental objectives. This process should be the same as that established during the construction phase (refer to Appendix 1, Schedule A, Condition 10)

(h) Non-Conformance—A process for dealing with circumstances where thresholds are exceeded during operation must be established prior to the commencement of operations. This process must establish a mechanism for reporting, taking corrective action where required and indicating responsibilities and timing for such action; and

(i) Reporting—Reporting on the compliance with the conditions must be prepared and provided to the Chief Executive of DERM in accordance with the hierarchy of reporting in Table A2. The report must identify aspects of non-compliance against the conditions together with any complaints and the responses to such complaints.

Table A2: Operations—Reporting on compliance and performance

Report	Frequency and scope
Operations Phase Compliance Report	Six-monthly: • Undertaken by a suitably qualified person; • compliance with Conditions; • compliance with Sunwater's commitments and details of any non-compliances; • satisfaction of environmental objectives and EMP requirements; • response to incidents of non-conformance, including where necessary corrective actions, revised operations practices, responsibility and timing; and • all other matters pertaining to environmental performance during operations.
Operations Incidents and Exceedence Report	Interim Report; • within 2 business days of incident or an exceedence of a condition, goal or requirement, being identified; and • details of incident and initial response. Full Report • within 15 business days of incident or an exceedence of a condition, goal or requirement, being identified; and • details of incident, response, corrective action, responsibility and timing.
All reporting must be to the Chief Executive of DERM, and must be available to a relevant agency on request. Reporting is required only for a total period of five years from completion of construction works, or as otherwise confirmed in writing by the Chief Executive of DERM.	

Condition 3. Groundwater monitoring

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) Prior to the commencement of Construction Works, Sunwater must prepare a groundwater monitoring plan to the satisfaction of the Chief Executive of the DERM.

(b) The groundwater monitoring plan must form part of the CEMP and OEMP Groundwater sub-plans (Condition 1(c)(iv) and Condition 2(c)(v) respectively) and must include at least the following:

  (i) details of the design and location of a groundwater monitoring network in the alluvium including the alluvium downstream of the dam in the Isaac-Connors catchment to the junction of the Mackenzie and Isaac rivers

  (ii) a commitment to water level and water quality data being monitored quarterly and supplied to the Chief Executive within 30 business days of being collected

  (iii) a description of how the groundwater monitoring system will be used to assess potential impacts on existing groundwater users including monitoring programs, predictive modelling if required and the development of mitigation measures if required

  (iv) a requirement for collection and assessment of the monitoring data obtained from the Groundwater Monitoring Network, and if impacts are identified, preparation of a mitigation plan for the Chief Executive's approval and implementation by Sunwater

  (v) collection of point source water level and water quality data from existing bores, including established DERM piezometers. Water quality samples will include analysis of electrical conductivity (EC), pH, dissolved oxygen (DO), and major cations and anions

  (vi) surface water measurement points to correlate flows in the Isaac and Connors rivers downstream of the dam with groundwater levels.

  (vii) correlation of groundwater levels with hydrographic data from the Isaac and Connors rivers downstream of the dam

  (viii) correlation of groundwater quality results with surface water quality data to define potential interactions

  (ix) Identification of any water quality variations along length of alluvium downstream of the proposed dam.

(c) If it is demonstrated that adjacent landholders are experiencing adverse groundwater impacts (falling or rising water table, or adverse changes to water quality) due to the Project, Sunwater must investigate, and if the observations are reasonably attributable to the project, implement mitigations to make good those impacts

(d) An annual report that assesses the impacts of the dam on groundwater shall be forwarded to Chief Executive, DERM, by 30 September each year. The annual report should include a summary of the monitoring data collected, an assessment of impacts, and any recommended mitigation methods and any make good measures that have been undertaken in that year.

Condition 4. Sediment and erosion

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) A Sediment and Erosion Control Plan (SECP) must form part of the CEMP and OEMP Geology and Soils sub-plans (Condition 1(c)(i) and Condition 2(c)(iii) respectively) and must include at least the following:

  (i) be based on predictive modelling for areas where construction works or the impounded waters are likely to intercept groundwater, cause erosion, or cause sediment runoff, or where there is a specific relevant risk identified in the EIS/ SEIS

  (ii) collection and assessment of the monitoring data obtained from the above network and, if salinisation is predicted to occur, prepare a mitigation plan for implementation by Sunwater

  (iii) contain measures to avoid, or mitigate and manage impacts on surface water quality by construction works

  (iv) contain measures for the interception, treatment if required, and disposal of contaminated surface water from construction or spoil-dump sites

  (v) on the basis of the above assessments, a draft OEMP sub-plan setting out measures to manage identified potential impacts that may extend into the operational phase of the Project.

(b) The SECP must detail measures relating to the following management approaches in the Project area (dam and pipeline) and/or the upstream area of the dam impoundment:

  (i) surveys and documentation of the condition and extent of existing riparian vegetation upstream and around the area of inundation from 1.5 metres below FSL to the 1 in 100 year flood level within the impoundment area

  (ii) surveys and documentation of existing instream sediments between the FSL and 1 kilometre downstream of the dam wall

  (iii) monitoring, maintaining and enhancing catchment and riparian vegetation, particularly in the vicinity of the reservoir and the pipeline, including any stream/waterway crossings

  (iv) retaining trees tolerant of wet conditions in the first 1.5 m below FSL

  (v) encouraging the recruitment of endemic tree and shrub vegetation that is tolerant of wet conditions as far as is practical into the reservoir—depending on release strategies

  (vi) placing/retaining partly buried logs and tree stumps just below FSL to break up wave action and to provide habitat for aquatic species.

(c) The SECP must incorporate detailed measures relating to the following management approaches in the area downstream from the dam wall for a distance of 1km:

  (i) surveying and documenting the condition and extent of existing riparian vegetation

(ii) surveying and documenting existing in-stream sediments and bank condition.

(d) The following management approaches must be addressed in the SECP in relation to the construction sediment and erosion control and soil management:

(i) diverting overland, or channelled flows away from disturbed areas

(ii) installing flow and sediment-control structures on and below disturbed areas

(iii) constructing and maintaining sediment barriers and sedimentation ponds as close as practical to disturbed areas

(iv) progressive clearing of sites, undertaking of works and rehabilitation to ensure that areas are exposed for the minimum possible time

(v) minimizing exposure of dispersible soils

(vi) scheduling of works requiring high levels of soil disturbance and high traffic on surface soils to occur between April and September, inclusive, to minimise compaction of wet soils and erosion risk. If not practical, then ripping must be implemented

(vii) scheduling of rehabilitation works to ensure plantings are in place, with adequate temporary erosion protection, by 30 September so that spring/summer rains will aid establishment

(viii) to avoid dispersion under rainfall, clay subsoil materials should not be left exposed and, if stockpiles or excavated surfaces must be left exposed, installing and maintaining temporary erosion protection, sediment traps and sedimentation ponds for the duration of the works

(ix) shaping disturbed surfaces to spread, rather than concentrate flows

(x) constructing stockpiles to ensure surfaces are reasonably level, but with sufficient roughness to trap water and aid infiltration—rather than large conical, or elongated and crested stockpiles where run-off will be rapid

(xi) stockpiling topsoil for the minimum practical time before using for rehabilitation work (to minimise loss of biota). Where topsoil has been stockpiled for more than eight weeks, apply a ~50 millimetre surface layer of material from a more recent stockpile

(xii) avoiding compaction of stockpiles

(xiii) testing topsoils before reusing to determine whether the addition of fertilisers, which are compatible with native species, are required to aid the re-establishment of vegetation

(xiv) using only topsoil for rehabilitation works. Topsoil should extend only to the top of any clay subsoil, or to an appreciable colour change including any bleached layer (pale grey or white when dry), whichever is the higher. (Lower layers are generally infertile and may be sodic and/or saline and should not be used for rehabilitation purposes)

(xv) returning topsoil to the area from which it was stripped (if above FSL)—to maximise the return of plant propagules to their area of origin

(xvi) using quick-growing groundcover plant species to protect stockpiles and similar sites, but unless endemic to the locality, preventing seeding

(xvii) using run-off water and water from foundation dewatering as part of the water supply for construction and site rehabilitation.

(e) The following management approaches must be included in the SECP in relation to long-term erosion protection:

(i) using exposed rock that is a natural feature of the local landscape or other engineered, acceptable and site appropriate long term controls to provide protection where very steep slopes cannot be avoided

(ii) monitoring vegetation establishment and persistence and providing replacements, possibly with hardier species wherever required

(iii) using locally endemic plant species that are known to be well adapted to the area and soils, including threatened species, or species indicative of impacted regional ecosystems

(iv) managing potential run-off so that flows are dispersed and concentration of potential run-off is avoided, unless drainage structures have been provided

(v) spreading flows at culvert or drain outlets and provide structures to retard discharge velocity (s);

(vi) for grassed surfaces, shaping landforms to provide slopes similar to, or lower than those of the surrounding landscape, and establish grass as quickly as possible where it will be the primary vegetation cover for erosion protection. The slope goals presented in Table A3 must not be exceeded, unless additional appropriate erosion protection measures—such as graded contour banks or terraces using rock walls—are provided and approved by DERM

Table A3: Slope goals

Soil type	Natural soils	Reconstructed soils
Deep well structured uniform- textured soils	slopes up to 20%	slopes up to 15%
Coarse and medium uniform textured soils, gradational textured soils and non-sodic texture contrast soils	slopes up to 15%	slopes up to 12%
Sodic texture contrast soils	slopes up to 8%	slopes up to 5%

(vii) for surfaces to be covered by trees and shrubs in impacted areas above FSL, shaping landforms to provide slopes similar to and/or graded into the surrounding landscape; securely anchoring biodegradable erosion protection; and establishing trees and shrubs as soon as possible to provide erosion protection

(viii) designing fencing of rehabilitation areas to ensure that livestock is excluded

(ix) ensuring that rehabilitation areas have sufficient depth of soil material of appreciable water holding capacity to support plant growth.

(f) The SECP should monitor the effectiveness of erosion controls during construction by addressing each of the following:

(i) effectiveness of sediment traps in preventing sediments leaving worksites

(ii) ensuring suspended sediments in released waters are no higher than 40 NTU

(iii) surveying replanted vegetation survival, growth, density or other indicators to ensure adequate surface protection is applied, and has become established.

(g) The design and construction of the Project must provide suitable measures to intercept, treat if required, and dispose liquid wastes, such as fire retardants, wash-down water, and contaminated stormwater, to avoid contamination of waters.

Condition 5. Noise and vibration

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) Construct the Project in accordance with the CEMP Noise and Vibration sub-plan, incorporating measures that will avoid, or mitigate and manage the potential adverse environmental impacts of noise and vibration arising from construction activities. These measures must include at least the following:

(i) a background noise survey to define background noise levels at all potentially affected sensitive receptors, and the establishment of specific noise criteria at these receptors in accordance with Table A4: Noise and vibration

(ii) identification of all sensitive receptors where elevated offsite impacts may potentially occur (and the conditions under which these impacts may take place), based on predictive modelling having regard to the proposed construction methods and the proximity of residences and other relevant receptors

(iii) an implementation plan detailing all approaches adopted and all reasonable and feasible mitigation measures to address environmental noise and vibration issues. The implementation plan must include specific measures for mitigation of predicted impacts on sensitive receptors where predictive modelling indicates exceedence of Project Noise and Vibration criteria as per Table A5, Table A6 and Table A7 below. Mitigation measures should include but not be limited to:

(A) programming of activities (e.g. hours of work) for particular circumstances

(B) installation of acoustic screens

(C) enclosure of worksites possibly with purpose-built sheds

(D) operational techniques (e.g. use of particular construction techniques to suit circumstances)

(E) other mitigation measures as outlined in section 19.2 and Table 19.20 of the EIS and draft EMP section 29.9.14 of EIS

(iv) regular monitoring of noise and vibration to determine whether environmental requirements of the CEMP Noise and Vibration sub-plan are being met. The monitoring program, including the frequency of monitoring and the locations of monitoring stations, are to be established in the CEMP Noise and Vibration sub-plan, including a monitoring station immediately adjacent to any sensitive receptors along the pipeline route

(v) prior to commencement of construction, building condition surveys must be conducted of properties not being removed or demolished which are identified in the predictive modelling above as likely to be adversely affected by vibration and/or blasting

(vi) where the predictive modelling predicts that noise criteria for the project are likely to be exceeded by construction works, initiate/apply practicable mitigation and management measures, and monitoring and consultation programs that will ensure and demonstrate a commitment to achieving compliance. Such measures must be developed in consultation with owners and occupants of any potentially-affected premises.

Table A4: Noise and vibration

Noise level dB(A) measured as	**Monday to Saturday**			**Sundays and public holidays**		
	7am - 6pm	**6pm - 10pm**	**10pm - 7am**	**9am - 6pm**	**6pm - 10pm**	**10pm - 9am**
	Noise measured at a 'Noise sensitive place'					
$L_{Aeq,\ 1hr}$	Bg* + 10	Bg + 5	Bg + 3	Bg + 5	Bg + 3	Bg + 0
$L_{A1,\ adj,\ 10\ mins}$	Bg + 15	Bg + 10	Bg + 6	Bg + 10	Bg + 6	Bg + 0
	Noise measured at a 'Commercial place'					
$L_{Aeq,\ 1hr}$	Bg + 15	Bg + 10	Bg + 6	Bg + 10	Bg + 6	Bg + 0
$L_{A1,\ adj,\ 10\ mins}$	Bg + 20	Bg + 15	Bg + 9	Bg + 15	Bg + 9	Bg + 0
	Sleep Disturbance Criteria					
The construction noise activities for the Project must not cause the indoor sound pressure level to exceed La max 45 dB(A) at a noise sensitive place from 10pm – 7am more than 10-15 times per night						
* Bg is the background sound pressure level, $L_{A90,15\ min}$						

(vii) where predictive modelling indicates that vibration criteria for the project are likely to be exceeded by construction works, adopt reasonable and practicable mitigation and management measures and initiate a monitoring program developed in consultation with owners and occupants of potentially affected premises. The vibration criteria are contained in Table A5 and Table A6 below.

Table A5: Vibration criteria—levels for minimal risk of cosmetic damage

		Peak particle velocity (mm/s)	
Vibration type	**Heritage listed**	**Residential**	**Commercial and industrial**
Transient vibration	2	10	25

Note: Measured in the ground directly adjacent the building of concern

Table A6: Vibration criteria—levels for human comfort within buildings

Receiver	Time	Continuous or intermittent vibration 8–80 Hz (peak)	Transient vibration excitation with several occurrences per day 8–80 Hz (peak)
Residential	Day	2.9 to 5.8 mm/s	43 to 129 mm/s
	Night	1.6 mm/s	1.6 to 29 mm/s

Note: Measured in the ground directly adjacent the building of concern

(viii) Where predictive modelling indicates that the blasting criteria for the Project are likely to be exceeded by construction works, adopt reasonable and practicable mitigation and management measures and a monitoring program developed in consultation with owners and occupants of potentially-affected premises. The measures must have regard for residents' attitudes towards continuous noise over an extended period from mechanical excavation options are preferable to a short-term exceedence(s) from blasting. The blasting criteria (measured at a sensitive receptor), are:

(A) airblast overpressure must not exceed 120 dB (linear) peak for any blast

(B) airblast overpressure must not be more than 115 dB (linear) peak for 9 out of any 10 consecutive blasts initiated regardless of the interval between blasts

(C) ground-borne vibration must not exceed a peak particle velocity of 5 mm/s for 9 out of any 10 consecutive blasts initiated regardless of the interval between blasts

(D) ground-borne vibration must not exceed a peak particle velocity of 10 mm/s for any blast.

(ix) Where exceedence of either the noise or vibration criteria are predicted at noise-sensitive premises, continuously monitor such premises prior to the commencement of construction works.

(x) Monitor construction noise and vibration in accordance with accredited procedures. In circumstances where the criteria are not met, reports must describe the corrective actions taken to avoid or mitigate and manage the impacts. Monitoring results must be reported in accordance with the requirements of Table A1 (Appendix 1, Schedule A, Condition 1).

Monitoring results and management actions regarding construction noise and vibration must be included in the required reporting.

Condition 6. Air quality

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) Construct the Project in accordance with the CEMP Air Quality and Greenhouse Gas sub-plan, incorporating measures that will avoid, or mitigate and manage the potential adverse environmental impacts of diminished air quality arising from construction activities and these measures must:

  (i) Identify all areas where elevated off-site impacts may potentially occur (and the conditions under which such impacts may take place), including road works, worksite activities, vegetation disposal, movement or queuing of construction vehicles with diesel-powered motors adjacent to sensitive receptors, and long-term operation of diesel-powered plant and equipment at worksites

  (ii) include an implementation plan detailing all reasonable and feasible mitigation measures to address environmental dust issues in the surrounding areas, including but not limited to:

    (A) wet suppression—regular watering of construction areas

    (B) consideration of chemical stabilisation

    (C) vehicles restrictions such as to dedicated haul roads, and speed-limitations

    (D) protection of established vegetation

    (E) rehabilitation of disturbed surfaces as soon as practicable

    (F) other mitigation measures as outlined in Table 29.9.13 of the EIS.

  (iii) contain a communication strategy advising potentially affected receptors of planned mitigation measures

  (iv) incorporate regular monitoring of air quality (in suitable proximity of the dam site works and where pipeline works are within 500m of sensitive receptors) for deposited dust, total suspended particulates (TSP) and particulate matter (PM 10) to determine whether environmental requirements of the CEMP are being met. The monitoring program must include monitoring frequency and locations of monitoring stations

  (v) include where all available practical mitigation measures are applied, but monitoring demonstrates that air quality criteria will be, or has been exceeded, reduce operations for short durations to ensure air quality goals are met and maintained.

(b) Dust releases from the construction works must not exceed the dust-fall criteria specified as described in Table A7.

Table A7: Construction air quality criteria

Pollutant	Construction air quality criteria

Pollutant	Construction air quality criteria
Particles as PM_{10}	50 µg/m^3 (24 hour average)
	(5 exceedences allowed per year)
Total Suspended Particles	90 µg/m^3 (Annual average)
Particle deposition	120 micrograms per square metre per day (mg/m^2/day)

(c) Monitoring for construction impacts on ambient air quality must include representative sampling of baseline air quality.

(d) Monitoring for construction air quality impacts must be reported in the construction compliance report in accordance with Table A7: Construction air quality criteria. Records of monitoring results are to be maintained by Sunwater at all times during the construction program and must be available for inspection by the relevant agency at any time.

Condition 7. Contaminated land

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) Construct the project in accordance with the CEMP Land Contamination sub-plan, which must include at least the following actions to prevent land contamination:

(i) pumping out of all dips and fixed spray reservoirs below the 1 in 100 AEP flood level and appropriate disposal of contents

(ii) removing of any portable spray reservoirs below the 1 in 100 AEP flood level and appropriate disposal of contents and reservoirs

(iii) checking all sheds and yards below the 1 in 100 AEP flood level for chemical containers and appropriate disposal of contents and containers

(iv) removing and appropriate disposing, through immediate remediation or disposal to landfill) of other potential sources of contamination below the 1 in 100 AEP flood level.

(b) The CEMP Land Contamination sub-plan must include the requirement that Material Safety Data Sheets be obtained and communicated to all site personnel involved in the storage, handling, use and disposal of dangerous and hazardous substances and materials. The storage, handling and use of these materials/substances must be in accordance with current Australian Standards, industry codes of practice and best environmental management practices. Appropriate controls for these materials must be implemented avoid risks to employees, adjacent land users, general public and the environment.

Condition 8. Hazard and Risk

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

Part 1: Construction

(a) Construct the Project in accordance with the CEMP Hazard and Risk sub-plan and AS4360:2004 Risk Management, incorporating the objectives, performance

criteria, mitigation measures and other matters contained within Table 29.9.16 and 29.10.6 of the EIS.

(b) Prepare and implement the CEMP Hazard and Risk sub-plan having regard to the potential risks associated with dam construction including, among other things, flood during construction, fire hazard, chemical hazard, traffic hazards associated with construction traffic, accessibility for emergency services vehicles to the road network and construction sites, maintenance of essential services (e.g. water, power), transport and the use and storage of dangerous goods in construction sites, and communications during incidents.

(c) The CEMP Hazard and Risk sub-plan must incorporate specific emergency response actions to project related medical emergencies, and the design and construction of a helicopter pad, a communications tower and an emergency water-based vessel mooring and access prior to inundation.

(d) The CEMP Hazard and Risk sub-plan must be prepared and implemented in consultation with the relevant emergency services organisations, including the Department of Emergency Services (DES), Queensland Police Service (QPS), Queensland Fires and Rescue Service (QFRS), Queensland Ambulance Service (QAS), Queensland Health (QH) and local hospitals, for risk minimisation and incident management during construction.

Part 2: Operation

(a) Conduct the operation of the Project in accordance with the OEMP Dam Safety sub-plan incorporating the performance criteria, mitigation measures and other matters set out in Table 29.10.2, 29.10.3 and 29.10.6 of the EIS and proponent commitments and mitigation measures contained in section 24.5, 24.6 and 26.1 of the SEIS.

(b) The OEMP Dam Safety sub-plan must:

  (i) meet the requirements of the QPS, DES, QFRS and QAS;

  (ii) incorporate specific emergency response actions and the maintenance of a helicopter pad, a communications tower and an emergency water-based vessel mooring and access

  (iii) include simulation exercises prior to commencement of operation of the Project

  (iv) provide for routine testing of emergency response systems

  (v) designate responsibilities in the event of an incident.

Condition 9. Waste

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

Part 1: Construction

(a) Construct the Project in accordance with the CEMP Waste Sub-Plan, incorporating the performance criteria, mitigation measures and other matters contained in Table 29.9.15 of the EIS.

(b) The CEMP Waste Sub-Plan:

(i) must adopt and reflect the principles of ‘reduce, re-use, recycle, energy recovery from waste, and waste disposal’ (i.e. the Waste Management Hierarchy)

(ii) must identify the type, source and estimated quantities of waste

(iii) must identify the procedures and responsibilities for dealing with an incident in which waste material with the potential for causing environmental harm, is released to the environment

(iv) must include either the waste management measures contained in the Draft CEMP in Table 29.9.15 of the EIS or other measures designed to meet the environmental objectives and performance criteria in table 29.9.15 of the EIS Draft CEMP.

(c) Burning of vegetative waste may only be implemented where other re-use options are not practical, having regard to factors such as cost, potential beneficial reuses and vegetation types. Burning of vegetative waste may only occur in favourable weather conditions, with proper permits obtained and the agreement of the relevant authority. The CEMP Waste Sub-Plan must include a transparent decision making procedure for disposal of vegetative waste. This must:

(i) be developed in consultation with the DERM and Isaac Regional Council

(ii) address specific types and/or locations of vegetative waste

(iii) be consistent with the Waste Management Hierarchy

(iv) involve third party review/audit of implementation (along with other people/organisations, DERM and Isaac Regional Council may be the third party).

(d) Offsite burning may only occur for purposes of energy recovery and where energy recovered is greater than energy expended in transporting the waste.

(e) In circumstances where waste material is released to the environment, the incident must be reported within 24 hours to the relevant authorities and such corrective or remedial action as required to render the area safe and to avoid environmental harm must be taken forthwith.

(f) All regulated waste must be transported by a licensed operator and disposed of at a facility licensed to accept such waste.

Part 2: Operation

(a) Conduct the operation of the Project in accordance with the OEMP and an Operation Waste EMP Sub-Plan that incorporates the performance criteria, mitigation measures and other matters set out in Table 20-3 and section 20.4 of the EIS.

(b) Prior to the commencement of operations, prepare and implement an Operation Waste EMP Sub-Plan. This Sub-Plan:

(i) must adopt and reflect the principles of ‘reduce, re-use, recycle’

(ii) must identify the type, source and estimated quantities of waste

(iii) must identify the procedures and responsibilities for dealing with an incident in which waste material with the potential for causing environmental harm, is released to the environment.

(c) In circumstances that such waste material is released to the environment, the incident must be reported within 24 hours to the relevant authorities and such corrective or remedial action as required to render the area safe and to avoid environmental harm must be taken forthwith.

(d) All regulated waste must be transported by a licensed operator and disposed of at a facility licensed to accept such waste.

Condition 10. Community and Stakeholder Management Plan

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) A Community and Stakeholder Management Plan must form part of the CEMP Social and Economic sub-plans.

(b) The Community and Stakeholder Management Plan shall be prepared by Sunwater, at its cost, in consultation with community members (for example, landowners, tenants, business owners, community groups, relevant state agencies and councils), directly affected by the construction of the project, and shall include:

(i) a detailed communication strategy to ensure that community members are informed of the project status in a timely manner and on a regular basis

(ii) written notification to community members, a minimum of 5 business days prior to any construction or investigative activities or changed traffic conditions

(iii) consultation with and written notification to relelvant community members a minimum of 5 business days prior to any landowner access issues

(iv) the availability of project contact details (free call and website) where more information can be sought and feedback provided

(v) a complaints management system which responds to, records, compiles and keeps, for 5 years, the following information for all complaints received:

(A) time, date, name and contact details of the complainant

(B) the allegation made by the complainant

(C) details of communications with the complainant

(D) any investigations undertaken

(E) conclusions formed

(F) any actions taken.

(c) All complaints are to be responded to within 2 business days of a complaint being received by a staff member of the relevant Connors River Dam and Pipeline construction and/or operating entity and initiate complaint resolution measures which includes the implementation of preventative or corrective actions and the mechanisms to inform the person who made the complaint of actions being undertaken in response to the complaint.

(d) No later than three months prior to the commencement of project construction works, Sunwater shall submit the Community and Stakeholder Management Plan to DERM for approval.

(e) Sunwater shall implement, comply with and regularly review the Community and Stakeholder Management Plan for the duration of the project construction phase.

SCHEDULE B. MAKING A MATERIAL CHANGE OF USE OF PREMISES FOR AN ENVIRONMENTALLY RELEVANT ACTIVITY—ENVIRONMENTAL PROTECTION ACT

The Coordinator-General nominates DERM as having jurisdiction for these conditions. DERM is the responsible agency for monitoring compliance with these conditions.

Sunwater has indicated that Environmentally Relevant Activities (ERAs) 8, 14, 16, 17, 38, 43, 47, 63 and 64 will be triggered during the construction or operational phase of this project.

ERA 8 Chemical storage, consists of storing—

(a) 50t or more of chemicals of dangerous goods class 1 or class 2, division 2.3 in containers of at least 10m3; or

(a) 50t or more of chemicals of dangerous goods class 6, division 6.1 in containers capable of holding at least 900kg of the chemicals; or

(b) 10m3 or more of chemicals of class C1 or C2 combustible liquids under AS 1940 or dangerous goods class 3; or

(c) the following quantities of other chemicals in containers of at least 10m3—

  (i) 200t or more, if they are solids or gases;

  (ii) 200m3 or more, if they are liquids.

ERA 14 Electricity generation, consists of generating electricity by using fuel at a rated capacity of 10MW electrical or more.

ERA16 Extractive and screening activities, consists of any of the following—

(a) dredging a total of 1000t or more of material from the bed of naturally occurring surface waters, in a year;

(b) extracting, other than by dredging, material from a wild river area;

(c) extracting, other than by dredging, a total of 5000t or more of material, in a year, from an area other than a wild river area;

(d) screening 50t or more of material, in a year, in a wild river area;

(e) screening 5000t or more of material, in a year, other than in a wild river area.

ERA 17 Abrasive blasting, consists of cleaning equipment or structures on a commercial basis using a stream of abrasives in either a wet or dry pressure stream

ERA 38 Surface coating, consists of using, in a year, 1t or more of surface coating materials for—

(a) anodising, electroplating, enamelling or galvanizing; or

(b) coating or painting or powder coating.

ERA 43 Concrete batching, consists of producing 200t or more of concrete or concrete products in a year, by mixing cement with sand, rock, aggregate or other similar materials.

ERA 47 Timber milling and wood chipping, consists of milling a total of 5000t or more of timber in a year.

ERA 63 Sewage treatment consists of—

(a) operating 1 or more sewage treatment works at a site that have a total daily peak design capacity of at least 21EP; or

(b) operating a sewage pumping station with a total design capacity of more than 40KL in an hour, if the operation of the pumping station is not an essential part of the operation of sewage treatment works to which paragraph (a) applies.

Note: It is assumed that the ERA will only apply to construction camps and not a permanent facility.

ERA 64 Water treatment consists of carrying out any of the following activities in a way that allows waste, whether treated or untreated, to be released into the environment—

(a) desalinating 0.5ML or more of water in a day

(b) treating 10ML or more of raw water in a day

(c) carrying out advanced treatment of 5ML or more of water in a day.

Code of Environmental Compliance

A code of environmental compliance is a document that contains the standard environmental conditions for an activity and criteria that will determine when (and to what extent) a Code applies to an activity. Codes may apply to an aspect of an ERA 16 and ERA 17 for this project.

If a Code applies to an activity, the carrying out of the activity becomes self-assessable development under Schedule 3, Part 2, Table 5, Item 1 of the Sustainable Planning Regulation 2009. This means that a development approval for the activity is not required for the ERA component of the activity. The following conditions apply to ERA 16 and ERA17.

ERA16 Extractive and screening activities

Extractive and screening activites which meet the scope of the ‘Code of environmental compliance for certain aspects of extractive and screening activities (ERA16)’ must be carried out in accordance with this code of compliance.

ERA 17 Abrasive blasting

Abrasive blasting activities which meeting the scope of the ‘Code of environmental compliance for certain aspects of mobile and temporary abrasive blasting (ERA 17)’ must be carried out in accordance with this code of compliance.

The conditions under section 39 of the SDPWO Act for the Project consist of the following parts:

- Part 1—General
- Part 2—ERA 8 Chemical storage
- Part 3—ERA 14 Electricity generation

- Part 4—ERA 16 Extraction and screening
- Part 5—ERA 17 Abrasive blasting
- Part 6—ERA 38 Surface coating
- Part 7—ERA 43 Concrete batching
- Part 8—ERA 47 Timber milling & wood chipping
- Part 9—ERA 63 Sewage treatment
- Part 10—ERA 64 Water treatment
- Part 11—Definitions

Part 1 conditions apply to ALL environmentally relevant activities.

Part 1: General

Schedule G—General

Scope

(1) This approval authorises the environmentally relevant activities to be carried out for and during the construction phase of the project.

Prevent and/or Minimise Likelihood of Environmental Harm

(2) A person carrying out an environmentally relevant activity to which this permit relates must take all reasonable and practicable measures to prevent and/or to minimise the likelihood of environmental harm being caused.

Display of Development Permit

(3) A copy of the development permit must be kept in a location readily accessible to personnel carrying out the activity.

Site Based Management Plan

(4) The site based management plan (SBMP) must be implemented prior to commencement of an environmentally relevant activity and identify all potential sources of environmental harm, including but not limited to the actual and potential release of all contaminants, the potential impact of these sources and what actions will be taken to prevent the likelihood of environmental harm being caused. The SBMP must also provide for the review and 'continual improvement' in the overall environmental performance of all environmentally relevant activities that are carried out. A copy of the SBMP must be provided to the administering authority within one month of commencing an environmentally relevant activity.

The SBMP must address the following matters:

(a) environmental commitments—a commitment by senior management to achieve specified and relevant environmental goals;

(b) dentification of environmental issues and potential impacts;

(c) control measures for routine operations to minimise likelihood of environmental harm;

(d) contingency plans and emergency procedures for non-routine situations;

(e) organisational structure and responsibility;

(f) effective communication;

(g) monitoring of contaminant releases;

(h) conducting environmental impact assessments;

(i) staff training;

(j) record keeping; and

(k) periodic review of environmental performance and continual improvement.

(5) The activity must be operated in accordance with the Site Based Management Plan.

(6) The SBMP must not be implemented or amended in a way that contravenes any condition of this permit. If there is a potential conflict between the SBMP and the conditions of this permit, the conditions of this permit take precedent.

(7) The SBMP must be reviewed, and if necessary amended, every three years from the issue date of this development permit. A copy of the most recent SBMP must be provided to the administering authority within 1 month of any alterations made.

Maintenance of measures, plant and equipment

(8) The registered operator of an environmentally relevant activity to which this Permit relates must:

(a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this permit; and

(b) maintain such measures, plant and equipment in a proper and efficient condition; and

(c) operate such measures, plant and equipment in a proper and efficient manner.

Equipment calibration

(9) All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this approval must be calibrated, and appropriately and competently operated and maintained.

Spill Kit(s)

(10) Appropriate spill kit(s) and relevant operator instructions/emergency procedure guides for the management of wastes and chemicals associated with the environmentally relevant activity must be kept at the site.

Spill Kit Training

(11) Anyone operating under this permit must be trained in the use of the spill kit(s).

Record Keeping

(12) The operator of an environmentally relevant activity authorised by this development permit must record, compile and keep all data required by this permit. This data must be made available to the administering authority if requested.

(13) All records required by this permit must be kept for 5 years.

Notification

(14) Any emergency, incident or event, which results in the release of contaminants not in accordance with, or reasonably expected to be in accordance with the conditions of this permit, must be reported by telephone to the administering authorities' pollution hotline on 1300 130 372. Any such release must be reported as soon as practicable, but no later than 24 hours after the holder of the development permit becomes aware of the release.

Information to follow notification

(15) Within 14 days of any notification advice and in accordance with **Condition 14**, a written notice detailing the following information must be provided to the administering authority:

(a) the name of the operator, including their permit/registration number;

(b) the name and telephone number of a designated contact person;

(c) quantity and substance released;

(d) vehicle and registration details;

(e) person/s involved (driver and any others);

(f) the location and time of the release;

(g) the suspected cause of the release;

(h) a description of the effects of the release;

(i) the results of any sampling performed in relation to the release,

(j) actions taken to mitigate any environmental harm caused by the release; and

(k) proposed actions to prevent a recurrence of the release.

Annual monitoring report

(16) An annual monitoring report must be provided to the administering authority with the annual return. This annual report must include:

(a) a summary of the previous twelve (12) months' monitoring results obtained under any monitoring programs required under this approval and, in graphical form showing relevant limits, a comparison of the previous twelve (12) month's monitoring results to both this authority limits and to relevant prior results;

(b) an evaluation/explanation of the data from any monitoring programs;

(c) a summary of any record of quantities of releases required to be kept under this approval;

(d) any tank integrity testing undertaken;

(e) a summary of the record of equipment failures or events recorded for any site under this approval; and

(f) an outline of actions taken or proposed to minimise the environmental risk from any deficiency identified by the monitoring or recording programs.

Third party auditing

(17) Compliance with the conditions of this permit must be audited by an appropriately qualified third party auditor, nominated by the holder of this permit and accepted by the administering authority, within one year of the commencement of the first ERA associated with the Project, and every three years thereafter until the currency of all ERA's ceases.

(18) Within 28 business days of receiving the third party audit report(s), the holder of this permit must submit a copy to the administering authority.

(19) The third party auditor must certify the findings of the audit in the report.

(20) The financial cost of the third party audit is borne by the holder of this permit.

(21) The holder of this permit must act upon any recommendations arising from the audit report and:

(a) investigate any non-compliance issues identified; and

(b) as soon as practicable, implement measures or take necessary action to ensure compliance with this permit.

(22) Subject to **Condition 21**, and not more than three (3) months following the submission of the audit report, the holder of this permit must provide written advice to the administering authority addressing the:

(a) actions taken by the holder to ensure compliance with this permit; and

(b) actions taken to prevent a recurrence of any non-compliance issues identified.

Definitions

(23) Words and phrases used throughout this development permit are defined in the Definitions section of this permit. Where a definition for a term used in this development permit is sought and the term is not defined within this development permit, the definitions in the *Environmental Protection Act 1994*, its regulations and policies must be used.

Schedule A—Air

Odour Nuisance

(24) The release of noxious or offensive odours or any other noxious or offensive airborne contaminants resulting from the activities must not cause a nuisance at any nuisance sensitive place.

Dust Nuisance

(25) The release of dust and/or particulate matter resulting from the activities must not cause an environmental nuisance at any nuisance sensitive place.

(26) Release of dust or particulate, exceeding the following levels, when measured at any nuisance sensitive place, is considered as an environmental nuisance:

(a) dust deposition of 120 milligrams per square metre per day over a 30-days averaging period, when monitored in accordance with *Australian Standard AS 3580.10.1:2003 Methods of sampling and analysis of ambient air—Determination of particulate matter—Deposited matter—Gravimetric method* (or more recent editions); or

(b) concentration of particulate matter with an aerodynamic diameter of less than 10 micrometres (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging period, at a nuisance sensitive place downwind of the site, when monitored in accordance with:

(i) *Australian Standard AS 3580.9.6 of 2003* (or more recent editions) *'Ambient air—Particulate matter—Determination of suspended particulate PM10 high-volume sampler with size-selective inlet—Gravimetric method';* or

(ii) any alternative method of monitoring PM10 which may be permitted by the *'Air Quality Sampling Ma*nual' as published from time to time by the administering authority.

(27) When requested by the administering authority, dust and particulate monitoring must be undertaken within a reasonable timeframe nominated by the administering authority, to investigate any complaint of environmental nuisance caused by dust and/or particulate matter which has not been resolved by other means. The results of the monitoring must be notified to the administering authority within 7 days following completion of the monitoring. Monitoring must be carried out at a place(s) relevant to the potentially affected nuisance sensitive place and at upwind control sites and must include:

(a) for a complaint alleging dust nuisance, dust deposition; and

(b) for a complaint alleging adverse health effects caused by dust, the concentration per cubic metre of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere over a 24hr averaging time.

(28) If monitoring indicates particulate exceedence of the limits in **Condition 26** then the development permit holder must:

(a) address the complaint including the use of appropriate dispute resolution if required; and

(b) immediately implement dust abatement measures so that emissions of dust from the activity do not result in further environmental nuisance.

Schedule N–Noise

Noise nuisance

(29) Noise resulting from the activities must not cause an environmental nuisance at any nuisance sensitive place.

(30) When requested by the administering authority, noise monitoring must be undertaken within a reasonable and practicable timeframe nominated by the administering authority to investigate any complaint of environmental nuisance at any sensitive or commercial place which has not been resolved by other means The monitoring investigation report must be notified within 14 days to the administering authority following completion of monitoring.

(31) If the development permit holder can provide evidence through monitoring that the limits defined in Schedule N, Table 1—Noise Limits, are not being exceeded then the holder is not in breach of **Condition 29**. Monitoring must include:

(a) LA, max adj, T;

(b) relevant background sound level;

(c) the level and frequency of occurrence of impulsive or tonal noise; and

(d) atmospheric conditions including wind speed and direction location, date and time of recording.

(32) If monitoring indicates exceedence of the limits in Schedule N, Table 1—Noise Limits, then the development permit holder must:

(a) address the complaint including the use of appropriate dispute resolution if required

(b) immediately implement noise abatement measures so that emissions of noise from the activity do not result in further environmental nuisance.

(33) The method of measurement and reporting of noise levels in response to any noise monitoring conducted under this permit must be in accordance with the most recently published edition of the administering authority's *Noise Measurement Manual* or an equivalent authoritative document approved by the administering authority *(e.g. AS 1055 Acoustics—Description and measurement of environmental noise).*

Schedule N, Table 1: Noise Limits

Noise level dB(A)	**Monday to Saturday**		
	7am - 6pm	**6pm - 10pm**	**10pm - 7am**
	Noise measured at a 'sensitive or commercial place'		
$L_{A10, adj, 10 mins}$	B/g + 5	B/g + 5	B/g + 3
$L_{A1, adj, 10 mins}$	B/g + 10	B/g + 10	B/g + 5
Noise level dB(A)	**Sundays and Public Holidays**		
	7am - 6pm	**6pm - 10pm**	**10pm - 7am**
	Noise measured at a 'sensitive or commercial place'		
$L_{A10, adj, 10 mins}$	B/g + 0	B/g + 0	B/g + 0
$L_{A1, adj, 10 mins}$	B/g + 0	B/g + 0	B/g + 0

Note: "Background" means background sound pressure level measured in accordance with the latest edition of the administering authority's Noise Measurement Manual.

Note: Table 1 does not purport to set operating hours for the environmentally relevant activity.

Quality assurance and records

(34) The measurement of reporting of noise levels must be undertaken by a person or body possessing both the qualifications and the experience appropriate to perform the required measurements and reporting.

Schedule W—Waste

(35) Waste must not be released to the environment, stored, transferred or disposed of contrary to any condition of this permit.

(36) From commencement of an environmentally relevant activity to which this permit relates, a waste management plan must be implemented. The Waste Management Plan must address at least the following matters:

(a) the types and amounts of waste generated by the environmentally relevant activity;

(b) how the waste will be dealt with, including a description of the types and amounts of waste that will be dealt with under each of the waste management practices mentioned in the waste management hierarchy (section 10 of the Environmental Protection (Waste Management) Policy 2000);

(c) procedures for identifying and implementing opportunities to improve the waste management practices;

(d) procedures for dealing with accidents, spills and other incidents that may impact on the waste management;

(e) details of any accredited management system employed, or planned to be employed, to deal with the waste;

(f) how often the performance of the waste management practices will be assessed (at least annually); and

(g) the indicators or other criteria on which the performance of the waste management practices will be assessed.

(37) A record of all regulated waste must be kept detailing the following information:

(a) date of pickup of waste;

(b) description of waste;

(c) quantity of waste;

(d) origin of the waste; and

(e) destination of the waste.

(38) All regulated waste removed from the site must be removed by a person who holds a current Permit to transport such waste under the provisions of the *Environmental Protection Act 1994*.

(39) Regulated waste must be handled and transferred in a proper and efficient manner to prevent any leakage or spillage of waste.

(40) All waste generated in carrying out the activity must be disposed of at a facility that can lawfully accept that waste.

(41) Waste, excluding vegetation, must not be burnt or allowed to burn on the licensed site unless permitted by the administering authority.

Schedule WA—Water

(42) Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to any waters except as permitted under the conditions of this development permit.

(43) Sunwater will discuss the proposed management of each type of water stream produced on site with the regulator to determine the most appropriate form of management and treatment where necessary**.**

Stormwater management

(44) Sunwater must provide the administering authority detailed information about the location of any proposed discharge points for treated stormwater, including site plan/s of discharge locations of where the release of contaminants to waters will occur prior to carrying out any environmentally relevant activity to complete Table 1 below.

Table 1: Discharge Locations and depicted in Attachment 1 – Water Discharge Locations to be attached to this development permit.

Table 1- Discharge Locations

Release Point	Easting (GDA94)	Northing (GDA94)	Receiving waters description

(45) The release of contaminants to waters must not exceed the release limits in Schedule WA, Table 2: Contaminant Release Limits when measured at the release point identified in Schedule WA, Table 1-Discharge Limits.

Table 2: Contaminant Release Limits

Quality characteristic	Measurement Unit	Minimum Limit	Maximum Limit	Monitoring frequency
pH	(pH Units)	6.5	8.5	Once on first discharge (taken within 24 hours of release commencement) and weekly thereafter during discharge event.
Total Suspended Solids	mg/L	-	30	Once on first discharge (taken within 24 hours of release commencement) and weekly thereafter during discharge event.
5-day Biological Oxygen Demand	mg/L	-	20	Once on first discharge (taken within 24 hours of release commencement) and weekly thereafter during discharge event.
Dissolved Oxygen	mg/L	4	-	Once on first discharge (taken within 24 hours of release commencement) and weekly thereafter during discharge event.
Petroleum hydrocarbons (C6-C9)	mg/L	-	1	Once on first discharge (taken within 24 hours of release commencement) and weekly thereafter during discharge event.

Quality characteristic	Measurement Unit	Minimum Limit	Maximum Limit	Monitoring frequency
Petroleum hydrocarbons (C10-C36)	mg/L	-	1	Once on first discharge (taken within 24 hours of release commencement) and weekly thereafter during discharge event.

(46) In addition to the quality characteristic limits specified in Table 2-Contaminant Release Limits, stormwater contaminated by site activities and released in accordance with condition 45, must not have any properties nor contain any organisms in concentrations that are capable of causing serious or material environmental harm.

(47) The release of treated stormwater directly or indirectly to waters:

(a) must not produce any visible discolouration of receiving waters; and

(b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.

(48) Suitable banks and/or diversion drains must be installed and maintained so that all stormwater originating from land up-gradient of disturbed areas is diverted away from entering these areas and any ponds or other structures used for the storage or treatment of contaminants or waste.

(49) All stormwaters flowing over disturbed areas must be diverted to an onsite sediment basin.

(50) Minimum design specifications for on site sediment control measures are as follows:

(a) the minimum size of any sediment basin must be sufficient to contain the contaminated runoff expected from a 24 hour storm with an average recurrence interval of 1 in 5 years; and

(b) water retaining structures must be designed to prevent the influx of surface water from adjacent water courses from a 24 hour storm with an average recurrence interval of 1 in 10 years; and

(c) drainage structures must be sufficient to convey the runoff from a 24 hour storm with an average recurrence interval of 1 in 10 years; and

(d) in the event of site flooding, flow paths must be designed to minimise re-suspension of fines or slimes; and

(e) site discharge spillways must be constructed of, and built in, competent materials.

(51) All structures used for the storage or treatment of contaminants or wastes at or on the authorised place must be constructed, installed and maintained:

(a) so as to minimise the likelihood of any release of contaminants or wastes through the bed or banks of the structure to any waters (including groundwater)

(b) so that a freeboard of not less than 0.5 metres is maintained at all times, except in emergencies; and

(c) so as to ensure the stability of the structures' construction.

(52) Stormwater treatment infrastructure must be maintained to ensure water quality meets release limits specified in Table 2- Contaminant Release Limits.

Land rehabilitation

(53) All infrastructures, including stormwater management structures, constructed by or for the development permit holder during the licensed activities must be removed from the site prior to surrender, except where agreed in writing by the landowner/holder.

NOTE: This is not applicable where the landowner/holder is also the Development Permit holder.

Erosion protection measures and sediment controls

(54) Appropriate erosion protection and sediment control measures must be implemented and maintained as necessary and activities must be carried out in manner to minimise erosion and sediment loss.

Plant and equipment maintenance

(55) The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas where contaminants cannot be released to any waters.

Spill clean up

(56) Any spillage of wastes, contaminants or other materials must be cleaned up as quickly as practicable. Such spillages must not be cleaned up by hosing, sweeping or otherwise releasing such wastes, contaminants or material to any waters.

Water monitoring

(57) All determinations of water quality must be:

(a) performed by a person or body possessing appropriate experience and qualifications to perform the required measurements;

(b) made in accordance with methods prescribed in the latest edition of the administering authority's Water Quality Sampling Manual;

(c) carried out on representative samples; and

(d) laboratory testing must be undertaken using a laboratory accredited (e.g. National Association of Testing Authorities) for the method of analysis being used.

Storage dams

NOTE Any storage dams that trigger regulation of a regulated dam for either quality of waste water contained and/or size of the dam must be applied for in the development permit application. The application must provide engineering construction designs, maximum surface area of the dam (ha), maximum volume

of dam (ML), maximum depth of dam (m), design storage allowance, spillway design, and mandatory reporting level.

Schedule L—Land

Preventing contaminant release to land

(58) Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly to land except as permitted under the conditions of this development permit.

(59) Any waters to be released to land will be treated to Class A standard prior to use.

Chemical and fuel storage

(60) All flammable and combustible liquids must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current edition of *AS 1940—Storage and Handling of Flammable and Combustible Liquids*.

(61) Spillage of all flammable and combustible liquids must be controlled in a manner that minimises environmental harm.

(62) All chemicals must be contained within an on-site containment system and controlled in a manner that prevents environmental harm and maintained in accordance with the current version of the relevant Australian Standard.

(63) Spillage of all chemicals must be controlled in a manner that prevents environmental harm.

(64) All chemicals and flammable or combustible liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land. Where no relevant Australian Standard is available, the following must be applied:

(a) storage tanks must be bunded so that the capacity and construction of the bund is sufficient to contain at least 110 per cent of a single storage tank or 100 per cent of the largest storage tank plus 10 per cent of the second largest storage tank in multiple storage areas; and

(b) drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25 per cent of the maximum design storage volume within the bund.

Schedule S—Social

Complaint response

(65) The operator of the activity must record the following details for all complaints received and provide this information to the administering authority on request:

(a) time, date, name and contact details of the complainant;

(b) the allegation made by the complainant;

(c) details of communications with the complainant;

(d) any investigations undertaken;

(e) conclusions formed; and

(f) any actions taken.

(66) The operator of the activity must attempt to make contact with any complainant within 24 hours of a complaint being received and initiate complaint resolution measures

End of conditions for Part 1.

Part 2: ERA 8 Chemical storage

Scope

(67) Prior to undertaking any environmentally relevant activity, Sunwater must provide the administering authority information regarding the storage quantity and the type of chemicals at the site.

Tank Dewatering/Maintenance

(68) Contaminants arising from tank dewatering or tank maintenance operations must not be released into the on-site stormwater treatment system.

Groundwater

(69) The proponent must undertake a groundwater monitoring program if requested by the administering authority.

(70) The groundwater monitoring program must be developed and submitted to the administering authority and include the following:

(a) to include bore(s) that are potentially impacted by the activities associated with this development permit;

(b) representative groundwater samples from the aquifers potentially affected by bulk handling activities;

(c) background groundwater quality in hydraulically isolated background bore(s) that have not been affected by any bulk handling activities;

(d) the monitoring point names and locations provided in easting and northings (GDA94); and

(e) a location map showing the monitoring points.

(71) Groundwater must be monitored for the water quality parameters and frequencies defined in Table 3- Groundwater Monitoring Quality Parameters and Frequency.

Table 3: Groundwater Monitoring Quality Parameters and Frequency

Parameter	Measurement Unit	Maximum Limits	Monitoring frequency
Total Suspended Solids	mg/L	No greater than 10% above the background quality.	Six monthly
Total Petroleum Hydrocarbons, C6–C9	mg/L		
Total Petroleum Hydrocarbons, C10–C36	mg/L		
benzene	mg/L		
toluene	mg/L		
ethyl benzene	mg/L		
xylene	mg/L		
polynuclear aromatic hydrocarbons	mg/L		
lead	mg/L		
phenols	mg/L		

(72) The development permit holder must ensure that the groundwater monitoring data gathered in accordance with the conditions of this permit is analysed and interpreted to assess the nature and extent of any environmental harm.

The assessment must also include, but not be limited to:

(a) the location of the groundwater bores;

(b) nature (confined, unconfined etc.) of the aquifer;

(c) water quality of each aquifer;

(d) define groundwater contours; and

(e) indicate direction of flow.

(73) The data collection, analysis and assessment must be conducted by a suitably qualified and experienced person and must be submitted to the administering authority with the annual return.

Tank Integrity

(74) The holder of this approval must conduct a tank integrity test on all petroleum storage tanks and related pipes, at intervals at not more than five (5) years.

(75) The tank integrity test must be capable of detecting a leak of 0.38 litres per hour, with a probability of detection of at least 0.95 and a probability of 0.05 or less.

(76) Records of tank integrity tests must be kept on site and must contain the following information:

(a) tank and equipment identification numbers;

(b) location of test;

(c) date of test;

(d) result of test;

(e) test method;

(f) report by testing company or individual; and

(g) name and address of approved testing company or individual.

(77) A copy of the records of any tank integrity testing undertaken must be submitted to the administering authority with the Annual Return.

End of conditions for Part 2.

Part 3: ERA 14 Electricity Generation

Scope

(78) The proponent must provide the administering authority details on the type of fuel used, the sulphur content of the fuel burned in the power generators, and the electricity generation capacity (MW) of the plant intended to be operated prior to undertaking this activity.

Trained / Experienced Operator(s)

(79) The daily operation of the electricity generation station and pollution control equipment must be carried out by a person(s) with appropriate experience and/or qualifications to ensure the effective operation of the station and control equipment.

Release of Contaminants to the Atmosphere

(80) Prior to the proponent undertaking this activity, the proponent must submit to the administering authority the following information to amend Table 4 Contaminant release limits to air;

(a) release points

(b) release velocities

(c) release heights

(d) release emission rate/concentration.

Table 4 Contaminant release limits to air

Release point number	Minimum release height (metres)	Minimum velocity (m/sec)	Contaminant release	Maximum release limit

(81) Monitoring of any releases to the atmosphere required by a condition of this approval must be carried out in accordance with the following requirements:

(a) monitoring provisions for the release points listed in Table 5—Contaminant Release Points must comply with the Australian Standard AS 4323.1—

1995 'Stationary source emissions, Method 1: Selection of sampling positions' (or more recent editions).

(b) the following tests must be performed for each determination specified in Table 4—Contaminant Release Limits to Air:

(i) gas velocity and volume flow rate;

(ii) temperature; and

(iii) water vapour concentration (moisture content).

(c) samples must be taken when emissions are expected to be at maximum rates.

(d) during the sampling period the following additional information must be gathered:

(i) production rate at the time of sampling;

(ii) raw materials and fuel used;

(iii) number of plant or equipment and operating units operating;

(iv) reference to the actual test methods and accuracy of the methods.

(82) All release points referred to in Table 5—Contaminant Release Points must be conspicuously marked with the corresponding release point number.

Table 5: Contaminant release points

Determination required	Release point numbers	Frequency
Mass emission rate and concentration of oxides of nitrogen (NOx) in the flue gas at 15 percent oxygen reference level.	**To be provided to the administering authority**	All stacks must be monitored during commissioning (See Note 1) of the facility and one stack per year thereafter on rotational basis.
Mass emission rate and concentration of oxides of nitrogen (NOx) in the flue gas at 15 percent oxygen reference level.	**To be provided to the administering authority**	All stacks must be monitored during commissioning (See Note 1) of the facility and one stack per year thereafter on rotational basis.
Mass emission rate and concentration of oxides of nitrogen (NOx) in the flue gas at 3 percent oxygen reference level.	**To be provided to the administering authority**	All stacks must be monitored during commissioning (See Note 1) of the facility and one stack per year thereafter on rotational basis.
CO_2 Vents	**To be provided to the administering authority**	
Nitrogen Rejection Units	**To be provided to the administering authority**	
Flare	**To be provided to the administering authority**	

Note 1: The above NOx release limits are applicable during all timings except start-up, shut-down and calibration of emission monitoring devices. The start-up duration is allowed up to 30 minutes.

(83) The proponent must provide the administering authority stack emission details to complete Tables 4 and 5. Plant design criteria must meet minimum environmental standards that are specified within *NSW Protection of the Environment Operations (Clean Air) Regulation 2010 Schedule 3 Standards of concentration for scheduled premises: activities and plant used for specific purposes*.

(84) Within 3 months of commissioning the facility, the holder of this permit must conduct air emission monitoring to demonstrate compliance with air emission limits listed in Table 4—Contaminant Release Limits to Air and submit report to the administering authority.

Flare conditions

(85) The flare must be equipped with a flare tip design to provide good mixing with air, flame stability and achieve a minimum Volatile Organic Compound (VOC) removal efficiency of 98 per cent under varied gas flow rate and meteorological conditions and meet the best practice design standards.

(86) The flare must be equipped with a continuously burning pilot or other automatic ignition system that assures gas ignition and provides immediate notification to appropriate personnel when the ignition system ceases to function.

(87) The flare must be designed to handle large fluctuations in both the volume and the chemical content of gases.

(88) The flare must be equipped with a continuously burning pilot or other automatic ignition system that assures gas ignition and provides immediate notification to appropriate personnel when the ignition system ceases to function.

(89) The flare must be designed to handle large fluctuations in both the volume and the chemical content of gases.

(90) Visible smoke and particulate emissions must not be permitted for more than five minutes in any two hour period during normal operating conditions.

(91) Contingency plans and emergency procedures must be developed and implemented for non-routine situations to deal with foreseeable risks and hazards including corrective responses to prevent and mitigate environmental harm (including a contingency plan when plant shuts down for maintenance or other reasons).

Fugitive emissions

(92) The holder of this permit must ensure that all reasonable and practicable measures are taken in the design and operation of the plant to minimise fugitive VOC emissions. Reasonable and practicable measures include but are not limited to:

(a) implementation of a monitoring program to regularly leak test all units/components including pumps, piping and controls, vessels and tanks; and

(b) operating, maintenance and management practices to be implemented to mitigate fugitive VOC sources.

(93) The ducting and extraction systems that transfer effluent gases from one location to another must be constructed, operated and maintained so as to minimise any leakage of VOCs and vapours to the atmosphere occurring from these sources.

(94) Contaminated water produced by the electrical generation activity must be contained on site in a fully enclosed tank and be removed by an authorised regulated waste transporter for treatment and disposal.

End of conditions for Part 3.

Part 4: ERA 16 Extraction and screening

(95) If the activity does not meet the code of compliance then the proponent is not authorised to undertake this ERA.

End of conditions for Part 4.

Part 5: ERA 17 Abrasive blasting

(96) If the activity does not meet the code of compliance then the proponent is not authorised to undertake this ERA.

End of conditions for Part 5.

Part 6: ERA 38 Surface coating

Scope

(97) The proponent must provide the administering authority information regarding the quantity of surface coating to be applied during a one year period prior to undertaking this activity.

End of conditions for Part 6.

Part 7: ERA 43 Concrete batching

Scope

(98) The proponent must provide the administering authority information regarding the quantity of concrete or concrete products produced in a year by mixing cement with sand, aggregate or other similar materials prior to undertaking this activity.

Maximum area of disturbance

(99) The proponent must provide the administering authority details of the area (ha) of disturbance to land at the site prior to undertaking this activity.

Land

(100) The development permit holder must take all reasonable and practicable actions necessary to secure loads prior to transporting materials off site to minimise emissions or spillage of any material from vehicles or other transport infrastructure.

End of conditions for Part 7.

Part 8: ERA 47 Timber milling and woodchipping

Scope

(101) Sunwater must provide the administering authority information regarding the storage quantity, the type of chemicals at the site and the quantity of timber to be milled in a year prior to undertaking this activity. Note that this condition does not apply to timber milling and woodchipping activities undertaken by DERM.

End of conditions for Part 8.

Part 9: ERA 63 Sewage treatment (for short-term construction camp use)

Scope of activity

(102) Sunwater must provide the administering authority information regarding the peak design capacity of the sewage treatment plant at the site, for the equivalent persons and kilolitres of sewage generated per day to be treated under peak dry weather flow conditions prior to undertaking this activity.

(103) The contingency and emergency plan/procedures in the SBMP must include provisions for the following:

(a) standard connections for emergency by-pass pumping;

(b) standard connections for mobile generators, or a back-up power source that automatically starts in the event of power failure and stops when power is restored (with manual override facility);

(c) stand-by pumping equipment and associated controls;

(d) identify critical components and a system to ensure adequate and timely access to spare parts;

(e) containment and clean up equipment;

(f) a monitoring program and monitoring equipment should a spill occur; and

(g) all weather access for maintenance and emergency activities to sewage treatment infrastructure.

Minimise infiltration/exfiltration

(104) All reasonable and practicable measures must be taken to minimise the infiltration of stormwater and/or groundwater to sewer.

(105) All reasonable and practicable measures must be taken to minimise the exfiltration of sewage to groundwater, surface waters and/or land.

Transfer of treated effluent

(106) If treated effluent is given or transferred off-site:

(a) the responsibility for the treated effluent must only be given or transferred in accordance with a written agreement; and

(b) include in the written agreement a commitment from the person utilising the treated effluent to use treated effluent in such a way as to prevent environmental harm or public health incidences and specifically make the persons aware of the General Environmental Duty (GED) under section 319 of the *Environmental Protection Act 1994*, environmental sustainability of the treated effluent disposal and protection of environmental values of waters.

(107) The volume of treated effluent transferred off-site must be recorded on a daily basis by an appropriate method with an accuracy of +/- 5 per cent and records kept of such determinations.

(108) The permit holder must cease the supply of treated effluent off-site if the permit holder becomes aware that environmental harm is, or has the potential, to occur.

Biosolids

(109) Biosolids being dried for disposal must be stored in an area surrounded by an impervious bund.

(110) Sewage biosolids and sludges must be transported by authorised regulated waste transporters and disposed at a lawful facility.

Water Release

(111) Treated or untreated effluent must not be released to waters.

Monitoring of Volume of Sewage

(112) The daily volume and flow rate of sewage entering the Sewage Treatment Plant must be determined or estimated by an appropriate method with an accuracy of +/- 5 per cent, for example a calibrated flow meter and records kept of such determinations.

(113) All treated effluent released from the sewage treatment facilities must be monitored from the treated effluent storage tank and at the frequency for the parameters stated in Table 5—Treated Sewage Waste Quality Characteristics.

Table 5—Treated effluent quality characteristics

Water Quality Parameters	Units	Minimum	Maximum	Monitoring Frequency
pH	pH Scale	6.0	8.5	continuous
Residual Total Chlorine	mg/L	1	-	continuous
E. coli	colony forming units / 100 mL	-	100	weekly
Total Nitrogen	Nitrogen as mg/L	-	15	monthly
Total Phosphorous	mg/L as Phosphorus	-	10	monthly
Total Suspended Solids	mg/L	-	30	monthly
Biochemical Oxygen Demand	5 day inhibited, mg/L	-	20	monthly

(114) Treated effluent must not exceed water quality limits defined in Table 5: Treated Effluent Quality Characteristics.

Schedule L—Land

Protecting land from contaminants

(115) Treated or untreated effluent must not be released to land.

Sewage treatment plant and pump station

(116) There must be sufficient backup power available to operate the sewage treatment plant, associated infrastructure, alarms and any instrumentation.

(117) Sewage pump stations must be fitted with stand-by pumps and pump-failure alarms and/or telemetry, as well as high-level alarms to warn of imminent pump station overflow.

(118) All alarms and telemetry systems must be able to raise an alarm should mains power failure occur at the pump station and sewage treatment plant. When triggered the alarm must be reported to the appropriate person to respond to the failure.

(119) The operator must test and validate the alarm system at least once per month and maintain a log of all alarm testing, faults identified and remedial action taken.

(120) Sewage pump overflows must be contained for return back into the sewage treatment system.

Treated effluent storage

(121) A fully enclosed storage facility must be installed to store treated effluent for pump out collection. A freeboard of 250kl must be maintained to prevent an unauthorised discharge.

End of conditions for Part 9.

Part 10: ERA 64 Water treatment

Scope of activity

(122) Sunwater must provide the administering authority information regarding the peak design capacity of the water treatment plant at the site prior to undertaking this activity.

(123) The contingency and emergency plan/procedures in the SBMP must include provisions for the following:

(a) standard connections for emergency by-pass pumping;

(b) standard connections for mobile generators, or a back-up power source that automatically starts in the event of power failure and stops when power is restored (with manual override facility);

(c) stand-by pumping equipment and associated controls;

(d) identify critical components and a system to ensure adequate and timely access to spare parts;

(e) containment and clean up equipment;

(f) a monitoring program and monitoring equipment should a spill occur; and

(g) all weather access for maintenance and emergency activities to water treatment infrastructure.

Trained/experienced operator(s)

(124) The operation of the water treatment plant and pollution control equipment must be carried out by a person(s) with appropriate experience and/or qualifications to ensure the effective operation of that treatment plant and control equipment.

Water

(125) Treated or untreated water must not be released to waters.

Land

(126) Treated or untreated water must not be released to land.

End of conditions for Part 10.

Part 11: Definitions

Words and phrases used throughout this permit are defined below. Where a definition for a term used in this permit is sought and the term is not defined within this permit the definitions provided in the relevant legislation shall be used.

- **"administering authority"** means the Department of Environment and Resource Management or its successor.
- **"annual return"** means the return required by the annual notice (under section 316 of the Environment Protection Act 1994) for the section 73F registration certificate that applies to the development approval.
- **"approval"** means 'notice of development application decision' or 'notice of concurrence agency response' under the *Sustainable Planning Act 2009*.
- **"approved plans"** means the plans and documents listed in the approved plans section in the notice attached to this development approval.
- **"authorised place"** means the place authorised under this development approval for the carrying out of the specified environmentally relevant activities.
- **“bed and banks”** Bed and banks, of a watercourse or lake, means land over which the water of the watercourse or lake normally flows or that is normally covered by the water, whether permanently or intermittently. Bed and banks does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.
- **“bund”** means-
  - an earth mound or similar structure (e.g. a concrete block wall) whether impervious or not, constructed to contain spilled material (e.g. petrol, diesel, oil, contaminated stormwater or other contaminated material); or
  - a structure to prevent or reduce soil erosion
- **"commercial place"** means a place used as an office or for business or commercial purposes.
- **"dwelling"** means any of the following structures or vehicles that is principally used as a residence –
  - a house, unit, motel, nursing home or other building or part of a building;
  - a caravan, mobile home or other vehicle or structure on land;

– a water craft in a marina.

- **"Department of Environmental and Resource Management"** means the department or agency (whatever called) administering the *Coastal Protection and Management Act 1995* or the *Environmental Protection Act 1994*.
- **"intrusive noise"** means noise that, because of its frequency, duration, level, tonal characteristics, impulsiveness or vibration –
  – is clearly audible to, or can be felt by, an individual; and
  – annoys the individual.

  In determining whether a noise annoys an individual and is unreasonably intrusive, regard must be given to *Australian Standard 1055.2—1997 Acoustics—Description and Measurement of Environmental Noise Part 2—Application to Specific Situations.*
- **"LA 10, adj, 10 mins"** means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 10 per cent of any 10 minute measurement period, using Fast response.
- **“LA 1, adj, 10 mins"** means the A-weighted sound pressure level, (adjusted for tonal character and impulsiveness of the sound) exceeded for 1 per cent of any 10 minute measurement period, using Fast response.
- **“LA, max adj, T"** means the average maximum A-weighted sound pressure level, adjusted for noise character and measured over any 10 minute period, using Fast response.
- **"land**" in the "land schedule" of this document means land excluding waters and the atmosphere.
- **"mg/L"** means milligrams per litre.
- **"noxious"** means harmful or injurious to health or physical well being.
- **"NTU"** means nephelometric turbidity units.
- **"nuisance sensitive place"** includes –
  – a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
  – a motel, hotel or hostel; or
  – a kindergarten, school, university or other educational institution; or
  – a medical centre or hospital; or
  – a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 1992* or a World Heritage Area; or
  – a public thoroughfare, park or gardens; or
  – a place used as a workplace, an office or for business or commercial purposes and includes a place within the curtilage of such a place reasonably used by persons at that place.

- **"offensive"** means causing offence or displeasure; is disagreeable to the sense; disgusting, nauseous or repulsive.
- **"protected area"** means –
  - a protected area under the *Nature Conservation Act 1992*; or
  - a marine park under the *Marine Parks Act 1992*; or
  - a World Heritage Area.
- **"regulated waste"** means non-domestic waste mentioned in Schedule 7 of the *Environmental Protection Regulation 1998* (whether or not it has been treated or immobilised), and includes -
  - for an element—any chemical compound containing the element; and
  - anything that has contained the waste.
- **"site"** means the area or areas in which the approved environmentally relevant activities are carried out.
- **“stormwater”** includes a run-off of rainwater from an urban or rural source.
- **"watercourse"** means a river, creek or stream in which water flows permanently or intermittently-
  - in a natural channel, whether artificially improved or not; or
  - in an artificial channel that has changed the course of the watercourse.
- **"waters"** includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part-thereof.
- **"works" or "operation"** means the development approved under this development approval.
- **"you"** means the holder of this development approval or owner / occupier of the land which is the subject of this development approval.

End of conditions for Part 11

END OF CONDITIONS FOR ALL PARTS

SCHEDULE C. OPERATIONAL WORK THAT IS THE CONSTRUCTION OF A REFERABLE DAM AS DEFINED UNDER THE *WATER SUPPLY (SAFETY AND RELIABILITY) ACT 2008*

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

Condition 1. Operational works that is the construction of a referable dam

Operational Works that is the construction of a dam requiring failure impact assessment under the *Water Supply (Safety and Reliability) Act 2008*

Referable Dam Category Assessment:

(1) Failure Impact Assessment Category: 1

Basic Description of the Dam:

Purpose:	Water Supply for Industry
Location:	Connors River at AMTD 95.7km
	Latitude 21° 1’ 58” S, Longitude 147° 7’ 57” E
Maximum Dam Height:	42 metres
Full Supply Level:	EL 169.1
Storage Capacity:	373 662 ML
Catchment Area	129 140 ha
Construction Type:	Roller Compacted Concrete
Total Dam Length:	602 metres
Dam Abutment Level:	EL 180.0
Spillway:	
Location	Central
Profile	Ogee
Length	250 metres
Depth	10.9 metres

General

The dam is to be kept safe, and be maintained and operated in accordance with the current versions of the following guidelines issued in Queensland under the Water Supply (Safety and Reliability) Act 2008 (where specifically referred to in this dam safety condition schedule):

- Queensland Dam Safety Management Guidelines.
- Guidelines for Failure Impact Assessment of Water Dams.

Documentation

Any documentation prepared in order to comply with these conditions must be stored securely until such time as the dam is decommissioned.

The documentation must be made available for inspection by the Dam Safety Regulator, within seven (7) days of a written request for access being received by the dam owner.

On change of ownership of the dam, all documentation prepared in compliance with these conditions must be transferred to the new owner.

Incidents and Failures

In addition to the requirements detailed within the Emergency Action Plan (EAP), the dam owner must report in writing all incidents and failures (as defined in the Queensland Dam Safety Management Guidelines) to the Dam Safety Regulator, within two (2) days of becoming aware of the incident or failure.

The dam owner must advise the Dam Safety Regulator, of any proposed remedial actions in writing within thirty (30) days of the incident or failure or such longer time as may be approved in writing by the Dam Safety Regulator.

Design Report

The dam owner must update the Preliminary Design Report in accordance with this condition and the Queensland Dam Safety Management Guidelines, and provide a copy of the updated design report to the Dam Safety Regulator:

(a) at least one (1) month prior to the commencement of construction of the dam, or such later time as may be agreed in writing by the Dam Safety Regulator; and

(b) within three (3) months of practical completion of construction, or such later time as may be agreed in writing by the Dam Safety Regulator;.

The update of the Design Report must detail changes since the previous version and show how the works will satisfy the design criteria given in Preliminary Design Report. It should include:

(a) Results of any additional hydraulic model studies since the preliminary design phase;

(b) results of foundation and other investigations carried out since the investigation and preliminary design phase;

(c) complete set of construction drawings and specifications;

(d) final instrumentation arrangement for the dam;

(e) design modifications necessary as a result of information obtained during the construction phase; and

(f) managing risk during construction.

Design and Construction

The dam is to be designed and constructed to comply with the relevant DERM and the Australian National Committee on Large Dams (ANCOLD) guidelines..

The Connors River Dam must be constructed in accordance with the final design drawings approved by the Dam Safety Regulator.

The dam owner must advise the Dam Safety Regulator, of the ‘practical completion of construction’ of the works within seven (7) days of that point of construction being reached.

Construction of any temporary works must be carried out in accordance with current engineering practice and standards.

Any remedial works or reconstruction of the dam must be carried out in accordance with current engineering practice to ensure that the dam remains in accordance with the documentation listed within this condition.

Where remedial, reconstruction or upgrade works are proposed, a copy of the final design and construction methodology must be forwarded to the Dam Safety Regulator, no later than thirty (30) days prior to commencement of any construction works.

Data Book

The dam owner must prepare a Data Book in accordance with this condition and the Queensland Dam Safety Management Guidelines.

The Data Book must be prepared by no later than 90 days after 'practical completion of construction' of the dam.

The Data Book must include all information as is required by the Queensland Dam Safety Management Guidelines including:

(a) all pertinent records and history relating to the dam;

(b) documentation of investigation, design, construction, operation, maintenance, surveillance, monitoring measurements and any remedial action taken during construction and subsequent operation of the dam; and

(c) records of known deficiencies such as seepage, cracking.

The dam owner must ensure the Data Book is reviewed (and if necessary updated) in accordance with the Queensland Dam Safety Management Guidelines by the 1st day of October of each calendar year.

A written notification confirming that the Data Book has been reviewed (and if necessary updated) must be signed by the dam owner and submitted to the Dam Safety Regulator, by the 31st day of October of that same calendar year.

‘As Constructed’ Documentation

The dam owner must develop ‘as constructed’ documentation for Connors River Dam in accordance with this condition and the Queensland Dam Safety Management Guidelines.

The owner must provide one (1) copy of the ‘as constructed’ documentation to the Dam Safety Regulator, within three (3) calendar months of “practical completion of construction”.

The 'as constructed' documentation must include:

(a) a record of any decisions to adapt the nominated design to suit actual field conditions;

(b) 'as constructed' drawings indicating the actual lines, levels and dimensions to which the structure is built;

(c) a description of the construction process;

(d) systematically compiled and comprehensive photographs of the construction;

(e) summary of material test results;

(f) summary of construction inspection reports;

(g) initial instrumentation data; and

(h) certification by a Registered Professional Engineer of Queensland (RPEQ) that the works have been constructed in compliance with all relevant engineering standards.

Standing Operating Procedures

The dam owner must develop Standing Operating Procedures (SOP) in accordance with the Queensland Dam Safety Management Guidelines. The SOP must include the following activities:

(a) Personnel training and procedural issues:
  (i) operator Training;
  (ii) documentation Control and Review; and
  (iii) setting of Normal Operation Criteria.

(b) Emergency Action and Incident Reporting;
  (i) accident and Incident Report;
  (ii) review of EAP including verification of emergency contact numbers;
  (iii) communication procedures and procedures covering loss of communication; and
  (iv) maintenance of Dam Log Book for recording of surveillance inspections, equipment testing, planned and unplanned maintenance and incident details.

(c) Critical Operating Procedures
  (i) inspection, testing and maintenance of critical mechanical and electrical equipment;
  (ii) water level monitoring procedures; and
  (iii) communication security and failsafe procedures

(d) Monitoring and Surveillance
  (i) owner's routine dam safety inspection including check lists and reporting requirements;
  (ii) dam Safety five yearly Comprehensive Inspection (DS 11);
  (iii) inspection during and after flood or seismic events; and
  (iv) water level and piezometer monitoring procedures.

The dam owner must submit a copy of the SOP to the Dam Safety Regulator, within 30 days of the 'practical completion of construction'.

The dam must be operated in accordance with the SOP.

The dam owner must then ensure the SOP are reviewed by the 1st day of October of each calendar year, and updated and/or added to if necessary.

Where amendments are made to any SOP, the updated documents are to be forwarded to the Dam Safety Regulator, by the 31st day of October of that same calendar year.

Where no amendments are necessary, a written notification confirming that the SOP have been reviewed shall be signed by the dam owner and forwarded to the Dam Safety Regulator, by the 31st day of October of that same calendar year.

Detailed Operation and Maintenance Manuals

The dam owner must prepare detailed Operation and Maintenance Manuals in accordance with the Queensland Dam Safety Management Guidelines.

The Operation and Maintenance Manuals must be prepared and finalised by three (3) months following the date of practical completion of construction.

The dam owner must ensure that the Operation and Maintenance Manuals provide a comprehensive set of instructions on all equipment operated at the dam.

The dam must be operated and maintained in accordance with the Operation and Maintenance Manuals.

The dam owner must then ensure the detailed Operating and Maintenance Manuals are reviewed, and if necessary updated, by the 1st day of October of each calendar year.

A written notification confirming that the Operating and Maintenance Manuals have been reviewed, and if necessary updated, shall be signed by the dam owner and forwarded to the Dam Safety Regulator by the 31st day of October of that same calendar year.

Special Inspections

When directed by the Dam Safety Regulator, a Special Inspection must be carried out at the cost of the dam owner and a report must be prepared in accordance with the Queensland Dam Safety Management Guidelines.

The Dam Safety Regulator shall be advised in writing of the date of the inspection and may elect to observe any or all procedures involved in the inspection process.

The dam owner must provide one copy of the Special Inspection Report to the Dam Safety Regulator, within thirty (30) days of completion of inspection.

Comprehensive Inspections

The dam owner must carry out a Comprehensive Inspection of the dam in accordance with the Queensland Dam Safety Management Guidelines, within one (1) month of “practical completion of construction” of the Connors River Dam.

Further Comprehensive Inspections are to be carried out on or before the 1st day of October 2014 and on or before every fifth anniversary thereafter.

The Dam Safety Regulator, shall be advised in writing of the date of the Comprehensive Inspection and may elect to observe any or all procedures involved in the inspection process.

A Comprehensive Inspection Report detailing the findings of the Comprehensive Inspection in accordance with the Queensland Dam Safety Management Guidelines must be submitted to Dam Safety Regulator, within three (3) months after completion of the Comprehensive Inspection.

Safety Review

The dam owner must carry out a Safety Review in accordance with the Queensland Dam Safety Management Guidelines by the 1st day of October 2034.

The dam owner must prepare a Safety Review Report and provide one (1) copy of the Safety Review Report to the Dam Safety Regulator, within three (3) months of completing the review.

Further Safety Reviews are to be carried out at twenty (20) year intervals, but may be required at more regular intervals by the Dam Safety Regulator, in such cases as:

(a) an absence of adequate documentation;

(b) detection of abnormal behaviours of the structure;

(c) changes to design standards, construction standards; and

(d) a regulatory requirement.

Emergency Action Plans and Event Reports

The dam owner must prepare and maintain an Emergency Action Plan (EAP) in accordance with this condition and the requirements of the Queensland Dam Safety Management Guidelines.

The EAP must be disseminated by Sunwater to those staff and operators who have responsibilities under the EAP prior to commencing construction of the dam and shall:

(a) determine and identify those conditions that could forewarn of an emergency and specify the actions to be taken and by whom;

(b) identify all jurisdictions, agencies and individuals who could be involved in the EAP (for example, local governments, the Queensland Police, State Emergency Services and downstream residents);

(c) identify primary and secondary communication systems, both internal (between persons at the dam) and external (between dam personnel and outside entities);

(d) identify all resources, special tools, equipment, keys and where they can be located if required in an emergency; and

(e) list and prioritise all persons and entities involved (including contact details) in the notification process and the roles and responsibilities assigned to them (e.g. A flow chart may be useful).

The EAP must be in place prior to construction of Connors River Dam commencing and be progressively updated to meet the requirements of the Queensland Dam Safety Management Guidelines as the construction of the Dam proceeds.

The dam owner must provide a copy of the EAP to the Dam Safety Regulator prior to commencing construction of the dam wall.

The emergency events described in the EAP shall cover those events as outlined in the Queensland Dam Safety Management Guidelines, and include such failure modes as:

(a) sunny day dam failure, and

(b) flood induced failure.

Inundation mapping shall be developed as outlined in the Queensland Dam Safety Management Guidelines, and shall be at a sufficiently large scale to easily identify those areas subject to possible danger. Mapping shall be developed for all failure modes described in the EAP prior to commencing construction of the dam wall and submitted to the Dam Safety Regulator.

The dam owner must ensure the EAP is reviewed by the 1st day of October of each calendar year.

(a) where amendments are made to any EAP, a copy of the updated document is to be forwarded to the Dam Safety Regulator, by the 31st day of October of that same calendar year;

(b) where no amendments are necessary, a written notification confirming that the EAP has been reviewed shall be signed by the dam owner and forwarded to the Dam Safety Regulator, by the 31st day of October of that same calendar year;

If the EAP is changed between the normal review periods, the dam owner must provide one (1) copy of the changed EAP to the Dam Safety Regulator, within thirty (30) days of the changes being made;

The dam owner must ensure that in addition to any copy or amended copy of the EAP provided to the Dam Safety Regulator, in compliance with this condition, current versions of the EAP are also provided to the following parties:

(a) Isaac Regional Council;

(b) local Counter Disaster Coordination Committees; and

(c) any additional group with responsibilities under the EAP.

The Dam Owner must ensure the readiness of dam operators with desktop or field emergency training exercises.

In all emergencies, the Dam Owner must respond in accordance with the EAP, and must notify the Dam Safety Regulator within forty-eight (48) hours of the commencement of the event. The notification shall include a brief description of the event and the time of activation of the EAP.

Within thirty (30) days of the event or such later time as may be agreed in writing by the Dam Safety Regulator, the dam owner must prepare an Emergency Event Report and provide a copy of the report to the Dam Safety Regulator. The Emergency Event Report must include:

(a) a description of the event

(b) instrumentation readings (where appropriate)

(c) description of any observed damage

(d) photographs

(e) details of communication and actions which took place during the emergency

(f) how the EAP was implemented during the event and comment on the adequacy of the EAP and any changes proposed.

Decommissioning

The dam must not be taken out of service (decommissioned) except in accordance with a Decommissioning Plan submitted to and accepted by the Dam Safety Regulator.

The Decommissioning Plan must indicate how the dam is to be rendered safe in the long term and how the contents are to be drained in a controlled and safe manner.

Definitions

'Comprehensive Inspection' for a dam means an assessment of the appropriateness, effectiveness and application of dam safety management practices at the dam and includes an evaluation of the structural and operational safety of the dam through review of surveillance data and visual examination to identify physical deficiencies.

'Dam safety regulator' means the chief executive, or their delegate, of the Department or Agency administering the Water Supply (Safety and Reliability) Act 2008 or, if that Act is repealed, such later legislation as addresses dam safety. The current Dam Safety Regulator is the chief executive of the Department of Environment and Resource Management or their delegate.

'Practical completion of construction'. For the purpose of these conditions, the dam construction shall reach the stage of "practical completion of construction" when:

(a) the dam is capable of storage to full capacity; and

(b) the inlet/outlet works are operational (minor components may not necessarily be installed).

'Preliminary Design Report' means the 'Final Report, Connors River Dam, Preliminary Design, April 2010' prepared by Sunwater.

'Safety Review' means an assessment of dam safety by methodical examination of all design and surveillance records and reports, and by the investigation and analysis of matters not addressed previously or subject to new design criteria.

'Special Inspection' means an examination of a particular physical feature or operational aspect of a dam for a particular reason. For example, a special inspection may be carried out on a particular feature of a dam that has been identified as having a possible deficiency or has been subject to abnormal loading conditions.

SCHEDULE D. OPERATIONAL WORKS THAT IS CONSTRUCTING OR RAISING WATERWAY BARRIER WORKS—*FISHERIES ACT 1994*

In accordance with section 39(1)(c) of the SDPWO Act, this approval must be a preliminary approval only.

The Coordinator-General nominates DEEDI (Fisheries Queensland) as having jurisdiction for this condition. DEEDI (Fisheries Queensland) is the responsible agency for monitoring compliance with this condition.

(a) The design, construction and operation of the project shall adequately provide for the passage of fish across all waterway barrier works, as defined in the *Fisheries Act 1994*, to the satisfaction of DEEDI (Fisheries Queensland).

(b) A fishway, as defined in the *Fisheries Act 1994*, must be incorporated into the Connors River Dam wall and shall:

  (i) be constructed in accordance with Final Fishway Design Documentation

  (ii) be maintained in good working order and repair throughout the life of the Connors River Dam

  (iii) be subject to Independent Certification at Sunwater's cost, by a Certifier identified by DEEDI (Fisheries Queensland) in consultation with Sunwater.

(c) The Final Fishway Design Documentation must:

  (i) be developed at Sunwater's cost in consultation with DEEDI (Fisheries Queensland) generally in accordance with the Fish Passage Design and Implementation Process set out in of this report

  (ii) be submitted to, and approved by, DEEDI (Fisheries Queensland) prior to the commencement of any works within the spillway area beyond excavation of the foundation and placement of the grout curtain (on the basis foundation excavation and grout curtain placement is the first component of instream construction works for the dam).

SCHEDULE E. OPERATIONAL WORK THAT IS THE CLEARING OF NATIVE VEGETATION (SCHEDULE 3, PART 1, TABLE 4, *SUSTAINABLE PLANNING REGULATION 2009*)

In accordance with section 39(1)(c) of the SDPWO Act, this approval must be a preliminary approval only.

The Coordinator-General nominates DERM as having jurisdiction for this condition. DERM is the responsible agency for monitoring compliance with this condition.

(1) A development approval for operational work that is clearing of native vegetation must be obtained prior to clearing assessable vegetation.

(2) A property vegetation management plan (PVMP), consistent with the *Vegetation Management Regulation 2000*, must be provided with the development application for operational work that is clearing of native vegetation. The PVMP must include:

  (a) Details on how the clearing of vegetation has been avoided or minimised;

  (b) The location and extent of the areas proposed to be cleared (including Regional ecosystems, essential species habitat, wetland type, stream order of the areas proposed for clearing);

  (c) The purpose for clearing;

  (d) Details of how the proposed clearing meets the performance requirements of the Regional Vegetation Management Code for Brigalow Belt and New England Tablelands bioregions; and

  (e) A vegetation offset proposal consistent with the Policy for Vegetation Management Offsets, Version 3, 30 September 2011 (PVMO), including an ecological equivalence assessment of the areas to be cleared and the offset areas, and information to demonstrate that the offset areas are functioning ecosystems.

(3) If the offset proposal is for all or part of the required offsets to be a direct offset, as defined by the PVMO then, prior to the development application for operational work that is clearing of native vegetation being approved, the applicant shall provide to the administering authority for approval:

  (a) Details of the offset areas consistent with the PVMO, including an ecological equivalence assessment of the areas to be cleared and the offset areas, and information to demonstrate that the offset areas are functioning ecosystems;

  (b) Details of the legally binding mechanism to be used to secure and protect the offset areas; and

  (c) An Offset Area Management Plan consistent with the requirements of the PVMO and providing for legal access to offset areas for relevant management activities stated in the plan.

(4) The approved direct offset areas must be legally secured within four months (4 months) of the date upon which the development approval for operational work that is clearing of native vegetation is issued.

(5) If the offset proposal is for all or part of the required offsets to be provided by an offset transfer then, prior to the development application for operational work that is clearing of native vegetation being approved, and before the offset transfer is approved by the administering authority, the applicant shall:

  (a) Provide DERM with a copy of a legally executed contractual agreement with an offset broker (broker agreement); and

  (b) Enter into an agreement with DERM whereby DERM approves the offset broker agreement (broker agreement).

(6) In accordance with section 8.4.2 of the PVMO, the offset transfer with the broker agreement must identify at least the following:

  (a) Requirement to locate and legally secure an offset area consistent with the requirements set out in the PVMO;

  (b) Requirement to provide a written quarterly report to DERM on the progress of legally securing an offset area;

  (c) Ecological equivalence scores for ecological condition and species features on the clearing area; and

  (d) Financial amount which is the subject of the broker agreement.

(7) The Applicant must legally secure the offset areas to be provided by offset transfer within twelve months (12 months) of the date upon which the development approval for operational work that is clearing of native vegetation.

(8) Should the Applicant be unable to legally secure all or part of the offset areas required by condition 6 within 12 months of the date of approval, through no default on the applicant's part, the applicant may apply to the Chief Executive administering the *Vegetation Management Act 1999* for an extension of the period to legally secure all or part of the offset areas subject to offset transfer.

(9) The granting of an extension of the period to legally secure all or part of the offset areas subject to offset transfer shall be at the discretion of the Chief Executive administering the *Vegetation Management Act 1999* having regard to evidence of progress in locating and securing an offset by the applicant and the time required by the administering authority to assess the offset proposals.

(10) In the event that all offset requirements of the PVMO can not be met through direct offsets and offset transfer, the Applicant may provide an offset payment for the outstanding requirements, subject to approval by the Chief Executive administering the *Vegetation Management Act 1999*.

Appendix 2. Coordinator-General's recommendations

Part 1: Recommendations for other approvals

Appendix 2, Part 1 includes recommendations made under section 52 of the SDPWO Act. The recommendations relate to acts other than the Sustainable Planning Act 2009 or the Environmental Protection Act 1999, chapter 4A or 5, which require the preparation of an EIS, or a similar statement to address environmental effects, for the project.

While the recommendations guide the assessment managers[88] in assessing the development applications, they do not limit their ability to seek additional information nor power to impose conditions on any development approval required for the project.

Recommendation 1. Riverine protection permit—*Water Act 2000*

The entity responsible implementing this recommendation is DERM.

Note: A permit is required under the *Water Act 2000* for construction activity in watercourses.

The following conditions apply to the construction of the Connors River Dam and associated pipelines to the extent that activities involve works in a watercourse, lake or spring (as defined under the *Water Act 2000*), involving the destruction of vegetation, excavation, or placing of fill.

(a) Activities involving the destruction of vegetation, excavation or placing of fill within a watercourse, lake or spring must be undertaken in accordance with a SECP containing site-specific erosion, sediment and drainage controls consistent with the International Erosion Control Association Australasia guideline *Best Practice Erosion and Sediment Control*.

(b) The SECP must include, but is not limited to:

  (i) measures to maintain defined low flows in a watercourse past the location of the activities;

  (ii) design criteria for vehicle access tracks within a watercourse that restrict width to the minimum needed for the safe passage of vehicles and equipment;

  (iii) measures to limit excavation and fill in the watercourse to the extent that is reasonable and necessary for access and construction purposes; and

  (iv) measures to align watercourse bank cuttings in the downstream stream direction to minimise erosion.

(c) For all works, other than works for the dam wall and works in areas to be inundated, the SECP must specify that:

  (i) lowering or destabilisation of natural controls creating waterholes in the bed of the watercourse will not occur;

(ii) native vegetation in the watercourse may only be destroyed to the extent that is reasonable and necessary for access and construction purposes;

(iii) where native vegetation is to be destroyed, it must be cut off at the ground level and the ground and root mass are not to be disturbed, except as required by excavation; and

(iv) there is to be no permanent alteration of the existing course of the low flow channel of the watercourse.

(d) The Chief Executive of the administering authority shall be notified in writing within five days after the completion of activities at each watercourse crossing site.

Recommendation 2. Conditional permits—*Nature Conservation Act 1992*

The entity responsible implementing this recommendation is DERM.

(a) The proponent shall comply with the provisions of the *Nature Conservation Act 1992* particularly in regard to the following:

(i) Where there is a requirement for clearing of plants protected under the *Nature Conservation Act 1992*:

(A) clearing of protected plants must occur only in accordance with a clearing permit under the *Nature Conservation Act 1992*

(B) offsets must be provided for the permanent loss (take) of near threatened, vulnerable and endangered plants to achieve an equivalent, or better overall outcome at a regional scale in accordance with the Queensland Government Environmental Offsets Policy 2008 and in accordance with the Queensland Government Biodiversity Offsets Policy.

(ii) Where there is a need to take, keep or use fauna, the prior approval of DERM shall be obtained.

(iii) Where activities of the proponent are likely to cause disturbance to animal breeding places (as defined in the *Nature Conservation (Wildlife Management) Regulation 2006*), the approval of DERM must be obtained prior to the commencement of the activity. A Species Management Program must be submitted to DERM as part of the approval, detailing how the population and habitat of a protected animal listed under the *Nature Conservation Act 1992* will be managed during construction and operation of the project (including but not limited to listed threatened species either already identified through the EIS process or found prior to or during construction within the project area).

Part 2: General recommendations

Recommendation 3. Water for towns

(a) In order to increase the security of urban water supplies in the region, the Coordinator-General recommends the proponent make available water from the Connors River Dam to supply townships in the region – in particular the townships of Nebo and Moranbah.

(b) The proponent should negotiate in good faith with the relevant Council with a view of reaching agreement with the Council on matters related to the supply of untreated water, including:

  (i) The volume of untreated water likely to be required by the towns of from year to year

  (ii) The price to be paid by Council for the untreated water

(c) This recommendation does entitle the proponent to any exemptions from approvals that may be required in order to supply water to townships in the region.

Recommendation 4. Construction Water Supply Requirements

(a) Requirements under the *Water Act 2000* for construction water supply are:

  (i) Water supplies may be secured from existing authorised overland flow dams, with consent of the landholder, without the need for a permit under the *Water Act 2000*.

  (ii) Water supplies may be secured from existing groundwater bores or pumps, with consent of the landholder and will require Water Permits under the *Water Act 2000*.

  (iii) A Water Permit under the *Water Act 2000* will be required for the take of water from a watercourse. A water permit may contain flow conditions and/or minimum take levels to ensure water users are not adversely affected.

  (iv) Construction of new storage dams that capture overland flow will need to be built in accordance with the Water Resource (Fitzroy Basin) Plan 2011

Recommendation 5. Interim Resource Operations Licence requirements

(a) The Connors River Dam must be constructed and operated in accordance with an Interim Resource Operations Licence or Resource Operations Licence granted by the Chief Executive administering the *Water Act 2000*.

(b) Prior to amendment of the *Fitzroy Basin Resource Operations Plan 2004* (FBROP) for the operational arrangements for the Connors River Dam and the grant of an Interim Resource Operations License or Resource Operations Licence to the owner of the dam, the owner of the dam must:

  (i) complete assessments of the impacts of the dam on water supplies available to existing water entitlement holders on the Connors River Dam Storage ponded area and on the Connors and Isaac Rivers downstream of the dam;

(ii) complete any necessary negotiations with holders of impacted water entitlements for proposed arrangements to ensure the provision of water supplies equivalent to those provided under the current water entitlements, or suitable negotiated outcome; and

(iii) provide to the Chief Executive administering the *Water Act 2000* the proposed arrangements for addressing impacts of the dam on existing holders of water entitlements for review and approval.

(c) All volumes of water for any proposed additional take that are currently not covered by an existing authorisation under the *Water Act 2000* require assessment and approval in accordance with the *Water Act 2000*, the *Water Resource (Fitzroy Basin) Plan 2011* and the FBROP. Copies of the *Water Resource (Fitzroy Basin) Plan 2011* and the FBROP can be viewed at the following website:
www.legislation.qld.gov.au/LEGISLTN/SLS/2011/11SL283.pdfhttp://www.derm.qld.gov.au/wrp/pdf/fitz/fitzroy-basin-rop.pdf

(d) The rules and procedures governing actual dam operations for a Resource Operations Plan must consider the environmental flow objectives (EFO) and water allocation security objectives (WASO) in the *Water Resource (Fitzroy Basin) Plan 2011*. Any differences or variances must be supported and demonstrated, to the satisfaction of the Chief Executive administering the Water Act 2000, as providing equivalent or better performance, against each mandatory EFO and WASO within the *Water Resource (Fitzroy Basin) Plan 2011*.

(e) The owner of the Connors River Dam must install and maintain infrastructure to determine inflows to the dam and releases from the dam for the operation and management of environmental flows.

Recommendation 6. Removal of quarry material from a watercourse

Quarry Material Allocation

(a) Under provisions of the *Water Act 2000,* Sunwater is required to obtain a Quarry Material Allocation Notice (QMAN) for removal of quarry material from a watercourse, prior to application for a development permit (operational works) for removal of the quarry material.

(b) The following conditions of approval are recommended for inclusion in a development permit for operational works for removal of quarry material from a watercourse

(i) No quarry material shall be removed from nesting areas used by the Fitzroy River turtle or white-throated snapping turtle

(ii) Sunwater shall lodge, with an application for a development permit, details of proposed extraction sites to the administering authority for the Quarry Material Allocation Notice (QMAN), including:

(A) the name and section of watercourse where the material is to be removed;

(B) a map and GPS points showing the location of the area where the quarry material will be removed; and

(C) the quantity of quarry material to be removed.

Removal of quarry material

(c) All works shall be carried out in accordance with an Operations Plan approved by the administering authority for the QMAN prior to commencement of development

(d) Access to the removal sites over banks to the bed of the rivers or creeks shall be via existing tracks unless there are no existing tracks.

(e) Where an existing access track is not available, any new track shall be subject to written approval by the administering authority for the QMAN, or in accordance with site specific conditions of a QMAN or development permit.

(f) Access tracks shall be maintained to a standard fit for purpose and rehabilitated prior to abandonment of the site in accordance with the Operations Plan or written instruction by the administering authority for the QMAN.

(g) All machinery used shall be stored, refuelled and maintained outside the high banks of the watercourse, except for pumping equipment that may be required during the works.

(h) Prior to commencement of extraction at each site, the site specific limits to removal of material shall be agreed in writing with the administering authority for the QMAN, including:

(i) Downstream AMTD: Lat: [Bearing] Long: [Bearing];

(ii) Upstream AMTD: Lat: [Bearing] Long: [Bearing];

(iii) Minimum distance from defined native vegetation;

(iv) Minimum distance from the toe of the banks; and

(v) Maximum depth below natural surface

unless defined in the QMAN or conditions of development permit.

(i) Existing sand, gravel, clay or rock bars that create a significant natural storage in the bed of the watercourse shall not be lowered or disturbed without the written approval of the administering authority for the QMAN, unless provided for by site specific conditions of a QMAN or development permit.

(j) Removal of material must not be carried out within 200 metres of any public road, bridge culvert or railway crossing, unless subject to written approval of the administering authority for the QMAN, or provided for by site specific conditions of a QMAN or development permit.

(k) Removal of quarry material and associated operations shall not:

(i) cause erosion or damage to the bed or banks of the watercourse;

(ii) cause damage to the vegetation growing on the bed or banks of the watercourse, other than in accordance with relevant exemptions or necessary approvals;

(iii) cause damage to pumps, fences or structures within the watercourse; or

(iv) cause interference to the flow of water;

unless provided for by site specific conditions of a QMAN or development permit, or subject to written approval of the administering authority for the QMAN.

(l) The final surface area within the bed of the watercourse subjected to extraction activity shall be restored to an even longitudinal grade, smooth and free from holes and ridges, or as required by the Operations Plan or a rehabilitation plan approved by the administering authority.

(m) Batters shall not be steeper than one (1) vertical on three (3) horizontal.

(n) Material removed from the watercourse shall be stored above the high banks of the river or creek channel and shall only be returned to the watercourse in accordance with the Operations Plan.

(o) Screening and stockpiling of quarry materials shall not occur within the high banks of the channel.

(p) Removal of quarry material shall only be carried out for the period specified in the Quarry Material Allocation Notice relevant to each site.

Recommendation 7. Dam community recreational facilities

(a) Prior to making a development application for material change of use for the project, the proponent must execute a Dam Community Recreational Facilities Agreement with IRC for the delivery of the Dam Community Recreational Facilities. The nature and extent of the Dam Community Recreational Facilities must be informed by a Facilities Options Study to be carried out by the proponent at its cost in consultation with IRC and will include the following facilities as a minimum:

  (i) an area of at least 3 ha adjacent the dam water storage dedicated to community recreation facilities located generally in accordance with Figure 5.14 of this report

  (ii) a boat ramp (two lanes)

  (iii) picnic facilities

  (iv) toilet facilities

  (v) car park

  (vi) landscaping

  (vii) an all weather, two-lane, high quality gravel pavement surface (minimum class 4B(AARB 2009)) access road from the Connors River-Collaroy Road to the dam community recreation area.

(b) The Dam Community Recreational Facilities shall be constructed at the proponent's cost and shall be completed and commissioned on or before construction of the Connors River Dam is completed.

(c) The Dam Community Recreational Facilities shall be maintained and managed by the Isaac Regional Council.

Appendix 3. Imposed conditions

This appendix includes conditions imposed[89] by the Coordinator-General under section 54B of the SDPWO Act. The conditions are relevant to applications for development approvals for those parts of the project where there is no relevant approval applicable under other legislation.

All of the conditions imposed in this appendix take effect from the date of this Coordinator-General's report.

These conditions do not relieve Sunwater of the obligation to obtain all approvals and licenses from all relevant authorities required under any other Act.

In accordance with section 54B(3) of the SDPWO Act, the Coordinator-General has nominated entities as having jurisdiction for the conditions in this schedule. These entities are shown in Appendix 4.

Pursuant to section 54D of the SDPWO Act, these conditions apply to anyone who undertakes the project, such as Sunwater and an agent, contractor, subcontractor or licensee of Sunwater, and any public utility providers undertaking public utility works as a result of the project.

Condition 1. General (project description, third party auditing, non-compliance) *State Development And Public Works Organisation Act 1971*

The project must be carried out in accordance with the Connors River Dam and Pipelines project, as described in this *Coordinator-General's report (January 2012)*, proponent correspondence dated 28 June 2011 and 12 August 2011 (Appendix 8 of this report), the *Supplementary Report to the EIS (February 2011)*, the *Environmental Impact Statement (January 2010)* and the *Initial Advice Statement (February 2008)* for the project.

Condition 2. Fitzroy river turtle and white-throated snapping turtle

The Coordinator-General nominates DERM as having jurisdiction for this imposed condition. DERM is the responsible agency for monitoring compliance with this condition.

(a) For impacts to Fitzroy River turtle and white-throated snapping turtle and their habitat, Sunwater must:

  (i) Submit to DERM for approval a Species Management Program detailing how the population and habitat of the Fitzroy River turtle and white-throated snapping turtle will be managed during construction and operation of the project.

  (ii) The Species Management Program must be prepared in accordance with the requirements set out in Appendix 6 of this Coordinator-General's Report

  (iii) The Species Management Program shall be subject to independent third party review by a suitably qualified expert with expertise in similar biota.

(iv) Provide an offset developed in consultation with and to the satisfaction of DERM that will ensure the survival and natural development of the Fitzroy River turtle in the wild pursuant to section 73 of the *Nature Conservation Act 1992*.

(b) To ensure the survival and natural development of the Fitzroy River turtle and white-throated snapping turtle in the Fitzroy Basin, Sunwater must:

(i) prepare, at its cost, a Conservation Plan for the Fitzroy River turtle and white-throated snapping turtle pursuant to section 112(2) of the *Nature Conservation Act 1992* which specifies research and management measures necessary to ensure the survival and natural development of populations of Fitzroy River turtle and white-throated snapping turtle

(ii) within 12 months following commencement of construction of the project, submit the draft Conservation Plan for the Fitzroy River turtle and white-throated snapping turtle for adoption by the Minister for Environment in accordance with section 120(2) of the *Nature Conservation Act 1992*

(iii) contribute $250,000 per year for at least 5 years, commencing on the date of adoption of the Conservation Plan, into a fund administered by the DERM for implementing the research and management measures identified in the adopted Conservation Plan

(iv) facilitate access to Connors River Dam for monitoring of the populations and habitats of turtles. Monitoring shall include both seasonal and event-based actions such as “overtopping” and water releases

(v) facilitate access to the findings of Sunwater’s current Turtleways Investigation and Design Project (a Sunwater funded investigation project assessing improved design of water infrastructure to improve the movement of freshwater turtles through, and lessen injury caused by, these structures)

(c) The draft Conservation Plan shall be prepared in collaboration with the DERM, the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) and the Fitzroy Basin Association.

(d) DERM shall be the entity responsible for implementing the adopted Conservation Plan for freshwater turtles in the Fitzroy Basin.

Condition 3. Third party auditing

The Coordinator-General nominates DEEDI (Office of the Coordinator-General) as having jurisdiction for this imposed condition. DEEDI (Office of the Coordinator-General) is the responsible agency for monitoring compliance with this condition.

(a) The following third party auditing requirements shall be applied for the whole project :

(i) compliance with the Coordinator-General’s imposed conditions of this report must be audited by an appropriately qualified and experienced third party auditor or auditors appropriate to the matters being audited, nominated by Sunwater, and approved by the Coordinator-General within 1 year of the commencement of construction of the project and annually thereafter.

(ii) Sunwater shall submit the third party audit report(s) to the Coordinator-General within 20 business days of the end of the relevant period.

(iii) the audit report must identify the component of the project being audited, the conditions that were activated during the period, and a compliance/non-compliance table. A description of the evidence to support the compliance table shall be provided. The audit report shall also contain recommendations on any non-compliance or other matter to improve compliance. The third party auditor shall certify the findings of the audit report.

(iv) the financial cost of the third party audit is borne by Sunwater.

(v) subject to Appendix 3, Condition 3(a)(i), and not more than 20 business days following the submission of the audit report, Sunwater shall provide written advice to the Coordinator-General addressing the actions taken by Sunwater promptly and routinely to ensure compliance with the Coordinator-General's imposed conditions and the actions taken to routinely prevent a recurrence of any non-compliance issues.

Condition 4. Non-compliance

The Coordinator-General nominates DEEDI (Office of the Coordinator-General) as having jurisdiction for this imposed condition. DEEDI (Office of the Coordinator-General) is the responsible agency for monitoring compliance with this condition.

(a) Sunwater shall when first becoming aware of a non-compliance of any Coordinator-General imposed condition:

(i) authorise and undertake action to bring the matter into compliance within an effective timeframe

(ii) report the non-compliance and remedial action to the Coordinator-General within 2 business days.

Appendix 4. Revised draft environmental management plan

CONTENTS

TABLES

29. ENVIRONMENTAL MANAGEMENT PLANS

29.1. Environmental management

A number of recommendations have been made in this Environmental Impact Statement (EIS) in relation to the management of environmental impacts during the construction and operation of the Project. These recommendations will require actions to be taken during the design, construction and operational life of the Project.

In order to ensure that these recommendations are implemented, a Draft Environmental Management Plan (EMP) has been developed for the Project.

An outline of the Draft EMP is provided in this EIS to demonstrate the commitment of SunWater to ensure that the recommendations of this EIS are implemented. Environmental management practices and strategies for individual project elements are described in Sections 29.9 and 29.10.

29.2. Purpose

An EMP is a management tool used to assist in minimising impact to the environment. The EMP is a dynamic document. It will be regularly updated to incorporate changes in environmental management procedures and practices in light of ongoing monitoring results, new techniques, legislation and environmental policies of the Proponent in consultation with the relevant authorities.

The implementation of the EMP will ensure that concepts and commitments given in the EIS are applied so that the potential impacts of the construction and operation of the proposed infrastructure on the environment are minimised.

The EMP provides for ongoing environmental performance review and compliance monitoring.

29.2.1. Environmental requirements and obligations

The EMP is devised to ensure that identified environmental impacts relating to the Project construction and operation are avoided or minimised. In this regard, the EMP may refer to environmental legislation, controls, standards and guidelines relevant to impact mitigation and avoidance. The EMPs also requires that, wherever possible, works related to site development meet environmental expectations of the local and broader community.

A list of applicable legislation is identified in this section. The Project environmental management representative will hold copies of relevant legislation, guidelines and standards on site during construction.

29.2.1.1. Commonwealth legislation

Commonwealth legislation relevant to the Project and the Draft EMP includes:

- *Environment Protection and Biodiversity Conservation Act 1999; and*
- *Native Title Act 1993.*

29.2.1.2. Queensland legislation

Queensland legislation relevant to the Project and the Draft EMP includes:

- *Environmental Protection Act 1994 (EP Act)*

The EP Act is the umbrella legislation for the regulatory management of the environment in Queensland. The EP Act is based on self-regulation and duty of care that places the responsibility for protection of the environment on all persons conducting any activities associated with the Project.

The EP Act provides for the licensing of Environmentally Relevant Activities (ERAs) and the granting of development approvals and registration certificates for conducting regulated activities. The EP Act also provides the power to administering authorities to order actions be taken to improve environmental management performance, conduct audits and environmental evaluations of activities, approval of environmental management programs and impose penalties or prosecute persons for non-compliance within the requirements of the EP Act.

The EP Act also allows for the preparation of Environmental Protection Policies (EPPs). The following EPPs have been proclaimed:

- *Environmental Protection (Water) Policy 1997;*
- *Environmental Protection (Noise) Policy 2008;*
- *Environmental Protection (Air) Policy 2008; and*
- *Environmental Protection (Waste Management) Policy 2000.*

29.2.1.3. Other State legislation

The EIS has been prepared under the provisions of the State Development and Public Works Organisation Act 1971 (SDPWO Act). Relevant information in the EIS is then used to support applications for permits, licenses and approvals as outlined in Appendix D of the EIS. In addition to the EP Act other major legislation relevant to the Project includes:

- *Aboriginal Cultural Heritage Act 2003;*
- *Dangerous Goods Safety Management Act 2001;*
- *Fisheries Act 1994;*
- *Health Regulations under the Health Act;*
- *Integrated Planning Act 1997;*
- *Land Act 1994;*
- *Nature Conservation Act 1994;*
- *Nature Conservation (Wildlife) Regulation 1994;*
- *Queensland Heritage Act 1992*
- *Soil Conservation Act 1986;*
- *Transport Infrastructure Act 1994;*
- *Vegetation Management Act 1999;*
- *Water Act 2000; and*
- Workplace Health and Safety Act 1995.

29.2.1.4. Planning for Ecologically Sustainable Development (ESD)

The Project will pursue the following overall objectives for ESD during the design, construction and operational stages of the Project including to:

- adopt and integrate good management practices for design, construction and operation of all aspects of the Project including:
- energy efficient measures (e.g. power demand management during construction, natural lighting and ventilation in appropriate locations);

- waste minimisation, management and recycling;
- wise use and re-use of natural resources (e.g. building materials, rock and other spoil);
- avoidance or minimisation and mitigation of impacts on ecological processes and habitat values adjacent to construction works (e.g. waterways and forests); and
- seek to achieve community benefits (e.g. re-establishment of recreational areas).
- comply with all applicable laws, regulations, standards and guidelines for protection of the environment;
- adopt best management means available to prevent or minimise adverse environmental impact;
- describe incident response protocols and procedures; and
- provide project employees and contractors with adequate and contemporary training in safety, hazard and risk management and environmental procedures.

29.2.2. Objectives and principles

The objectives of the EMP are those embodied in the Intergovernmental Agreement on the Environment (IGAE) and the Principals of ESD.

The core objectives are:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life support systems.

The guiding principles are:

- where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- the global dimensions of environmental impacts should be recognised and considered; and
- decisions and actions should provide for community involvement regarding issues that affect them.

No objective or principle should dominate others. A balanced approach which takes into account all of these objectives and principles is required to pursue the goal of ESD.

29.3. Responsibilities and implementation

29.3.1. Management structure

To achieve the over-arching objective of sound environmental management and deliver the Project with the least possible impact on the local community, a clear implementation and management structure is required.

The proposed structure, regardless of the contractual delivery mechanism adopted for the Project, includes the following roles.

- The Proponent (SunWater):
  - administrator of the head agreement or contract to ensure that the contract conditions are met;
  - liaise with and coordinate relevant agencies within the Queensland Government to provide timely advice to the Contractor for the smooth and efficient delivery of the project;
  - prepares detailed engineering designs and Construction Environmental Management Plan (CEMP);
  - obtains all necessary approvals, including development approvals, environmental licenses, WH&S and all other construction-related approvals;
  - ensure that prior to commencement of any work the Contractor/s have properly briefed community consultative committees and agreed to a schedule of regular meetings with each committee; and
  - ensure that the Contractor is operating in accordance with the CEMPs and in compliance with all applicable approvals and requirements for licensing.
- Contractor:
  - ensures all designs and construction works are prepared and conducted in accordance with approvals, with the contract, with relevant legislation and regulations, and with local laws; and
  - maintains for the duration of the construction phase, open and effective communications with the communities in the vicinity of the works areas about the construction program, scale, duration and nature of the proposed work, and details of proposed impact mitigation measures.

29.3.2. Overall responsibilities

The following tables provide a summary of the likely responsibilities and accountabilities of various parties who have active roles in the environmental management of the project. The responsibilities have been divided into the construction (Table 29-1) and operation (Table 29-2) stages.

Table 29-1 Project responsibilities - construction

Role	Responsibilities	Activities
Project Manager (PM)	SunWater	■ Responsible for the design phase, appointment of contractor and contract supervision. ■ Responsible for overall planning of the project to ensure operations are conducted safely and in accordance with statutory requirements. ■ Reports on performance of the system and certifies that the work is continuing in accordance with the EMP.
Construction Manager (CM)	Contractor	■ Responsible for overall construction work to ensure construction is conducted safely and in accordance with statutory requirements. ■ Directs construction activities according to the EMP. ■ Reports to Project Manager. ■ Instructs subcontractors to comply with specified control measures. ■ Directs site activities according to the EMP. ■ Ensures all site personnel are aware of any changes to the EMP and any revised procedures.
Site Supervisor	Contractor	■ Responsible to Contractor for project construction and ancillary works.

Role	Responsibilities	Activities
(SS)		▪ Attends site induction and ensures that adequate environmental procedures are followed. ▪ Reports to the EC or PM on any breaches of plans or statements, sightings of rare plants or animals, fauna, archaeological or heritage items, or environmental incidents (e.g. spills).
Environmental Coordinator (EC-C)	Contractor	▪ Monitors operations of the EMP and recommends any necessary changes to the SS and EC-S. ▪ Provides advice, assistance and direction to the SS and EC-S to ensure operations are conducted in a safe and environmentally sound manner. ▪ Maintains regular contact with personnel to ensure a safe working environment. ▪ Notifies the SS and EC-S of environmental incidents or contravention of environmental requirements (e.g. development conditions), once identified, records, investigates the cause and ensures measures are adopted to promptly secure compliance. ▪ Ensures that the work crew is inducted with regard to environmental procedures.
Environmental Coordinator (EC-S)	SunWater	▪ Ensures that the system for the environmental management is planned, documented, implemented and maintained in accordance with contract/tender documents ▪ Monitors operations of the EMP and recommends any necessary changes to the EC-C and PM. ▪ Audits the works for compliance and reports to PM

Table 29-2 Project responsibilities - operation

Project Responsibilities – Operation	
The Proponent (SunWater)	Develop the OEMP in accordance with SunWater's EMS Undertake periodic reviews and audits of the operator's performance where required.
Operator (SunWater)	Prepare an OEMP for the project consistent with the conditions of any applicable approvals and requirements. Continuously monitor the environmental performance of the Project during operation and provide regular reports on performance to the Proponent. Report to the Proponent on incidents of non-compliance. Ensure the Project is operated safely and with good environmental management practices at all times.

29.3.3. Environmental responsibilities

There are a number of general project responsibilities for all entities involved in the Project with respect to the EP Act. All project staff have a general environmental duty under section 319 of the EP Act, and must not carry out any activities that cause, or are likely to cause, environmental harm, unless all reasonable and practical measures are taken to prevent or minimise harm. If project staff while performing their work notice that serious or material environmental harm is being caused or threatened by their actions, or the actions of someone else, they should then report the matter, under Section 320 of the EP Act.

Additionally, project staff are required to comply with the following items at all times:

- Proponent's and Contractor's environmental policy and Environmental Management System (EMS);
- relevant legislation, with particular attention to environmental legislation under this Draft EMP;
- environmental management requirements for construction and operation;
- project training requirements; and
- all approvals, including the Coordinator-General's conditions.

29.4. Documentation, communication and complaints

29.4.1. Documentation and environmental records

Adequate records must be maintained to demonstrate compliance with the both the CEMP and Operation Environmental Management Plan (OEMP). These records will be available at all times and readily accessible for independent inspection and audit. This includes:

- contract documents;
- statutory permits and licences;
- reports;
- monitoring data results;
- environmental audits and reviews;
- environmental training records;
- details of non-conformance reports;
- complaints register;
- inspection, calibration and maintenance activity; and
- corrective action reports.

The following documents must be readily accessible for personnel to carry out the activities associated with the project:

- a copy of the CEMP;
- copies of environmental checklists and forms required by the CEMP;
- copies of relevant work instructions and procedures;
- Material Safety Data Sheets (MSDS) for any chemicals stored or used on the site; and
- copies of permits, approvals and attached conditions.

As required, modifications to the records keeping system shall be done to ensure it is effective and efficient for all levels of employees involved to ensure compliance with the requirements of the CEMP.

29.4.2. Internal communication

Environmental protection will be achieved through clear and concise internal communications, which will be subject to periodic audits to ensure that the communication structure is performing adequately and all actions are performed and recorded. The audits will also provide for follow-up on specific or corrective actions raised during previous audits to ensure responses are complete.

The CEMP will be held in a prominent location and will include at the start of the document a list of the names, affiliations, phone numbers and fax numbers (including after hours numbers where necessary) of the people within the designated environmental management reporting structure.

The Contractor will submit the following summary information as part of their monthly report to SunWater:

- works undertaken;
- monitoring results;
- compliance with approvals, licences and the CEMP;
- complaints; and
- corrective actions and contingency, and success of implemented measures.

Significant communications, including all reports, incident forms and complaints will be documented and kept up to date.

29.4.3. External communication

To ensure external communication is timely and transparent, only nominated personnel will be involved in consultation with external bodies on environmental issues. The Construction Manager is responsible for nominating all staff members responsible for external communication. The Construction Manager may also invite personnel to attend meetings with agencies and the community consultative committees.

Any incidents and environmental harm during construction works or operation of the Project will be reported to the Department of Environment and Resource Management (DERM) as soon as possible (as per Section 320 of the EP Act).

External communication responsibilities and training should be detailed in the CEMP.

29.4.4. Complaints and responses

The environmental management process managed by the Contractor is to include a procedure for receiving and acting upon complaints. Complaints will be carefully managed, prompt and effective, and will form a key part of the environmental reporting mechanism. Responsibility for maintaining the complaints procedure will rest with the Contractor.

While the CEMP and OEMP will establish the procedure for complaints, basic requirements will include:

- a procedure for receiving and responding to complaints which is acceptable to SunWater and DERM;
- the Contractor maintaining, during the construction phase, a complaints telephone service

- a process for registering and handling all complaints received in terms of:
  - time and date of complaint;
  - the identity of the complainant and the recorder of the complaint;
  - the specific action or activity causing the complaint;
  - whether environmental compliance requirements are being met;
  - the action taken to address the complaint if necessary;
  - a database for tracking of complaints and actions taken in response;
  - immediate communication of the complaint to the contractor;
  - details on how the action taken is to be communicated to the complainant and SunWater and the Contractor;
  - feedback to the complainant and SunWater, the Coordinator-General as required and DERM within a specified time period;
  - any subsequent remedial action required to avoid cause for future complaints if relevant;
  - regular reporting to the Coordinator-General, DERM and SSC on complaints and corrective actions; and
  - monitoring and auditing of the complaint handling system.

Other informative resources are also to be accessible by external stakeholders via the SSC website that will also offer feedback forms for complaints and grievances.

29.5. Monitoring, auditing and reporting strategies

29.5.1. Monitoring

Measuring, monitoring and evaluating will be key activities of each element within the EMP. Monitoring shall mean the setting in place and operation of various procedures to monitor, measure and record the level of impact on the environment during the execution of the Project.

The monitoring of environmental impacts shall be carried out in accordance with the monitoring requirements for each element throughout the EMP, relevant legislation and the conditions of any permit, where relevant.

Monitoring procedures will be developed in accordance with standard protocols and the requirements of DERM, Queensland Primary Industries and Fisheries (QPIF), and other relevant agencies as appropriate. All equipment used for environmental monitoring will be calibrated and maintained to the standards recommended by the supplier/manufacturer. Records of calibration and maintenance for each piece of monitoring equipment will be held on site.

Environmental monitoring samples, if taken, will be sent for analysis to a National Association of Testing Authorities (NATA) registered laboratory where applicable. All records of laboratory analysis results and quality assurance will auditable and available for inspection, on request, by regulatory agency officials or their representatives.

Environmental monitoring requirements for each phase of the development are detailed within Sections 29.9 and 29.10.

29.5.2. Auditing

Aspects of the Project with a potential for environmental impact will be subject to periodic environmental audits. The audit objectives will be to verify compliance with applicable Commonwealth, State and Local government environmental permits, approvals and regulations issued for the Project. The audit will also seek to verify the suitability of and compliance with the EMPs outlined in this CEMP (Section Section 29.9.).

Each audit will be internally reviewed by the Contractor and/or SunWater and all recommendations / actions raised will be addressed. Copies of audit reports and details of corrective actions will be made available for regulatory inspection, on request.

29.5.3. Reporting

Monthly environmental summary reports will be produced and included in the monthly project reports for the duration of the works. Copies of the reports shall be held on site and will be available for regulatory agency inspection, on request. The report shall include, but is not limited to, the following:

- record of inspections;
- a list of any performance criteria that have not been met, the corrective action taken and a description of the magnitude of any possible environmental impact;
- a register of complaints detailing:
  - origin of the complaint;
  - complaint investigation (personnel, date and summary of action/s taken); and
  - response to actions and suggested changes to practices or procedures.
- results of any surveys carried out;
- annual environmental reporting will be prepared in accordance with SunWater's EMS and legislative requirements containing, in part, the following information:
  - summary of the monthly environmental reports;
  - fluctuations in water storage levels;
  - releases;
  - water quality monitoring; and
  - operation of fish lift / lock.

29.5.4. Non-compliance and corrective actions

The monitoring and reporting will incorporate continual improvement in requirements identified through a non-compliance and corrective action procedure. These will be nominated in the Project's quality procedures and EMPs, and will specify

methods for recording and reporting non-conformances and ensuring that corrective actions are implemented to rectify the problem.

29.6. Competence, training and awareness

Environmental awareness training must be carried out to ensure that all personnel performing activities related to environmental management practices are training, qualified and competent.

Staff involved in environmental monitoring will be trained and competent in the operation, calibration and maintenance of the equipment. Sampling staff will also be trained and competent in sample collection, handling, storage and transport methodologies and techniques.

Records of staff training will be auditable and available for inspection, on request.

29.7. Decommissioning program

A decommissioning program will be developed prior to construction cessation for land disturbed by project activities that will not be continued in the operational phase. The program will be developed in conjunction with the relevant regulatory authority and will comply with contemporary legislative requirements and best practice.

As outlined in Section 2, following the completion of the site construction works the site will be rehabilitated, materials cleared, and all site construction infrastructure removed. The landform will be left in a stable and safe condition and in an appropriate standard as agreed. Ongoing rehabilitation will also be progressively undertaken during construction to re-establish vegetation and stabilise land as proposed in Section 10.

29.8. Overview of draft environmental management plan outline

The Draft EMP is presented within the EIS on the understanding that detailed EMPs for construction and operation, as well as relevant environmental plans are to be prepared by the Contractor and reviewed by SunWater and either DERM or State agency exercising its powers under legislation. The detailed EMPs for construction and operation will need to include, but not be limited to, mitigation measures that address the Environmental Objectives and Performance Criteria of this Draft EMP and any conditions imposed either by DERM or other agencies under other approvals. They will also need to refer to expressed community needs and issues as identified in the Draft EIS and any Supplementary Report.

The purpose of the Draft EMP is to set out the Project commitments to avoid or minimise potential environmental impacts as identified in the EIS, including identification of environmental aspects to be managed and how environmental values may be protected and enhanced. The EMP will be developed in conjunction with the other project plans such as Communications, Workplace Health and Safety (WH&S). During the development of the EMP there should be communication with the project team to ensure that the EMP does not conflict with any other 'project plans'.

The Draft CEMP and OEMP respectively, are dynamic documents as they incorporate continuous improvement. Each plan will be updated to incorporate further information, approval conditions, and changes in environmental management procedures in the light of ongoing monitoring results, new techniques, and relevant legislative requirements.

29.9. Draft construction environmental management plan outline

29.9.1. Overview

There are a number of activities taking place during the construction phase of the Project which have the potential to impact on environmental values in the area. These include:

- vegetation clearing;
- construction of earth embankments, dam wall and spillway;
- construction of a fishway;
- installation of intake towers;
- operation of workshop (mobile);
- construction of recreational areas;
- operation of site project / administration office;
- operation of construction camps;
- use of vehicles and equipment on site;
- operation of quarry, borrow pit and screening area;
- operation of concrete batching and RCC plant;
- construction and use of access and haulage road; and
- upgrade of roads, telecommunication, power transmission and associated infrastructure.

The environmental elements addressed in this CEMP are:

- Geology and soils
- Land contamination
- Surface water hydrology
- Groundwater
- Surface water quality
- Terrestrial flora
- Terrestrial fauna
- Aquatic flora & fauna
- Weeds
- Animal Pests
- Air quality and greenhouse gas
- Noise and vibration
- Waste
- Hazard and risk
- Transport and roads
- Indigenous and non-indigenous cultural heritage
- Social and economic environment

The CEMP is to incorporate sub-plans that comply with the relevant industry standards for environmental management and must include at least:

- a soil erosion and sedimentation management plan for each worksite and for spoil placement areas;
- a construction stormwater drainage and water quality management plan;
- a construction dust management plan;
- a construction noise and vibration management plan;
- a construction vehicle management plan;
- a construction traffic management plan;
- a construction emergency action plan;
- a construction fire management plan;
- a construction land contamination remediation plan;
- a vegetation clearance management plan; and
- other management plans necessary to achieve the environmental objectives and performance criteria.

29.9.2. Implementation

The Draft EMP demonstrates how potential impacts may be addressed during the construction and operational phases of the Project. The preparation of specified actions, strategies and recommendations implemented through each EMP includes:

- recommendations made in the EIS to minimise identified environmental impacts excluding those covered under specific legislation identified in section 29.2.1;
- good practice environmental management;
- general content requirements of international standard ISO 14001; and
- management and responsibility for performance.

An outline of how each EMP element is considered and presented is shown in Table 29-3.

Table 29-3 Outline of EMP Tables

EMP Component	Description	Example
Environmental Element	The aspect of the environment requiring targeted environmental management.	Terrestrial Flora
Environmental Objective	A short description of the high level aim of the project with respect to this environmental element.	Implementation of vegetation clearance, stockpiling, recycling or disposal practices that maximise the re-use of native vegetation and minimise environmental harm.
Performance Criteria	The performance criteria are results contributing to the overall objectives. This provides a benchmark against which management performance can be evaluated. Where possible these criteria should be measurable and monitored to assess level of achievement.	Retained vegetation is not compromised by site clearing works, gross mechanical disturbance or impacts associated with sedimentation and/or pollutant export from the dam construction area.
Implementation Strategy	The management actions to be undertaken to achieve the objectives of the plan. Implementation strategy may include a wide range of mitigation measures such as, but not limited to, changes in work procedures and practices, physical interventions to separate or buffer from predicted construction impacts, physical containment measures, and plans/procedures to minimise impacts. Such measures must be directed to achieving the Environmental Objectives and Performance Criteria, the statutory requirements, and must be consistent with the conditions of an approval from the Coordinator-General.	■ Identify clearing exclusion zones. ■ Minimise damage to retained vegetation. ■ Implement sediment and erosion control measures.
Monitoring	Establishes the parameter to be monitored, the type and frequency of monitoring.	Contractor to monitor vegetation clearance and earthworks and periodic monitoring of vegetation and sediment and erosion control devices.
Reporting	Purpose and frequency of reporting to demonstrate achievement of the environmental objectives and satisfaction of the performance criteria. The distribution of reports when generated.	Monthly Construction Report
Responsibility	The responsible entity for undertaking the activities and actions that has to be implemented.	Contractor
Corrective Action	This section establishes the corrective action that must be implemented if performance indicators are not achieved. It also provides guidance for contingency actions.	Rehabilitate areas if cleared within the exclusion zones

29.9.3. Geology and soils

Geology and soils - Sediment and Erosion Control Plan	
Environmental Objective	▪ Minimise environmental impact by preventing or minimising soil disturbance, loss and erosion. ▪ Seek to maximise the recovery of construction spoil for re-use in the project works.
Performance Criteria	▪ Manage and mitigate the impacts of spoil removal, haulage and placement in spoil retainment areas. ▪ Manage and mitigate the risks of soil erosion impacts from all work areas where vegetation is removed or the soil disturbed during construction works in accordance with IECA Australasia Best Practice Erosion and Sediment Control (2008) or updates thereof
Mitigation Measures	In preparing the Final Sediment and Erosion Control Plan the following elements of the Draft Sediment and Erosion Control Plan presented below should be considered:

Geology and soils - Sediment and Erosion Control Plan	
	▪ Undertake an erosion risk assessment to identify flow paths, suitable stockpile locations, soil cover type, and soil stability. ▪ Carry out high risk construction during periods of low average monthly rainfall (i.e. generally April to November) to minimise the potential for impacts from flooding or high intensity rainfall. ▪ Utilisation of erosion and sedimentation control techniques in accordance with guidelines such as IECA Australasia 2008 and to include as appropriate: – use of materials such as rip rap, geotextiles, mulch, silt sausages, silt fences, sand bag check dams and coir logs; – removal of loose, surplus excavated sand, gravel and clays; – rapid revegetation of disturbed areas; – minimising time areas left exposed; – diverting run on from the site; – controlling run-off through drains and disposing to stable drainage lines; – bunding stockpiled material; – confining traffic to defined roads; and – compacting high traffic areas. ▪ carrying out construction during periods of low average monthly rainfall to minimise the potential for flooding and high intensity rainfall. Rainfall and climatic records and historic flood frequency data suggest that construction works resulting in high levels of soil disturbance would be best carried out between April and November. ▪ implement erosion and sediment control strategies using materials that may include but are not limited to: rip rap, geotextiles, silt sausages, silt fences, sand bag check dams and coir logs. ▪ floating booms downstream of the diversion channel supporting silt curtains weighted to the river bed to be installed prior to any disturbances to the river banks and maintained on a daily basis. ▪ removal of loose, surplus excavated sand, gravel and clays to prevent excessive sediment transport during rainfall events. ▪ divert surface water runoff away from steep cuts and benches in quarries, dam excavations, road construction sites and cleared slopes using cut-off and interceptor drains. ▪ ensure road drainage design can accommodate the projected volume and load of traffic during and post construction without causing significant scour issues. ▪ ensure pipeline is constructed at appropriate depth to adequately allow for general scour at creek crossings. ▪ re-shape/contour the land surface and batters to minimise slope changes and angles. ▪ rehabilitate disturbed areas as soon as practicable after completion of works by backfilling, covering with topsoil and revegetating, hydroseeding or hydromulching. Rehabilitation work should be undertaken to coincide with vegetation growth periods and involve the use of appropriate native or sterile species including seeds of local provenance. ▪ undertake routing analysis and boring (rather than trenching) within sensitive creek crossings where possible. ▪ regular water quality monitoring programs to assess impacts of construction on sensitive receiving environments (i.e. water ways). ▪ as a means of reducing surface runoff in the event of a rain event, areas of disturbance should be isolated with silt fencing that is supported by a defined maintenance system throughout the duration of the Project. ▪ all stockpiles should be similarly protected and areas of disturbance stabilised by grassing where appropriate. ▪ runoff from water used in road maintenance and dust control is to be similarly guarded from leaving the site by purpose built silt traps and check dams. ▪ riparian vegetation should not be interfered with unless absolutely necessary; ▪ if stream banks are near vertical at crossing point they should be battered at the time of

Geology and soils - Sediment and Erosion Control Plan	
	trenching; ▪ earth banks should be constructed across slopes into streams to minimise sediment transport into the trench and into the stream channel; and ▪ if the watercourse has a bed of cobbles or coarse gravel this needs to be reinstated after construction to prevent establishing a new erosion head and downcutting of the channel. ▪ On sloping ground, earth banks should be established on contours at appropriate intervals for the soil type and gradient, usually between 10 m and 70 m. ▪ Topsoil should be stripped to about 20 cm over the trench and 5-10 cm in other areas of the easement where disturbance is to occur. ▪ The topsoil should be stockpiled separately from the subsoil and kept separate at all times. ▪ Provision should be made in planning the width of the easement to maintain separate stockpiles especially during rain events. ▪ Stockpiles should not be placed within 10 m of any drainage line and should not be placed against live trees. ▪ Stockpiles near drainage lines should be bounded on their downslope margin with silt fencing to prevent transport during rain events. ▪ Where the easement traverses sloping land, soil should only be stockpiled on the upslope side of the easement to a maximum height of two metres and in discontinuous lines (gaps at least every 50 m) to facilitate drainage and faunal movement. ▪ Topsoil will not to be backfilled around the pipe but will be spread over the surface after the trench has been filled. ▪ The topsoil should only be spread evenly over the easement after all the subsoil has been spread, a crown developed on the trench to accommodate future subsidence, deep ripping of compacted areas (such as access tracks) has been undertaken, and contour banks have been developed on steep slopes and above the banks at watercourse crossings. ▪ Topsoil should not be compacted and should be left rough as a seed bed
Monitoring	▪ Regular inspection of sediment and erosion control structures and measures. In wet weather or when using large quantities of water in construction works more frequent monitoring may be necessary. ▪ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	▪ Monthly report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ▪ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident, spill or release of materials to the environment. ▪ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	▪ Timely rehabilitation as outlined in Section 29.7. ▪ Appropriate control measures implemented where unacceptable sediment or erosion is occurring or may occur. ▪ The Contractor will ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding soil management and erosion control. ▪ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.4. Land contamination

Land contamination	
Environmental Objective	▪ Appropriately manage existing potentially contaminated materials. ▪ Prevent spills from occurring at project site. ▪ Contain, clean up and, if necessary, remediate any spills that do occur.
Performance Criteria	▪ Identified properties will be listed on the EMR in accordance with the EP Act. ▪ Undertake a Staged Contaminated Land assessment in accordance with the DERM Draft Guidelines. ▪ No unauthorised movement of contaminated materials. ▪ All fill used on site is 'inert' and must be free from contaminants. ▪ Containment of all spills involving materials that may cause environmental harm and effective remediation measures taken to prevent the incident from recurring.
Mitigation Measures	Contaminated Land A Contaminated Land Management Procedure will be developed prior to the commencement of construction which includes, but is not limited to: ▪ identification of the likely forms of contamination that could occur during the Project (fuels, oils, paints etc.) ▪ procedures for appropriate storage of hazardous materials in compliance with relevant standards; ▪ the prevention of land contamination during construction; ▪ the identification, investigation and management of unforeseen contamination; ▪ spill response and remediation; ▪ the management, remediation and disposal of contaminated soil and/or spoil generated from properties listed on the EMR/CLR; ▪ post construction management and/or monitoring requirements; and ▪ as required, approval and disposal permits will be obtained from DERM for the removal of contaminated soil in accordance with the EP Act. ▪ Sites identified as potentially contaminated, or encountered during Project construction, will be investigated, managed and remediated in accordance with the requirements of the contaminated land provisions of the EP Act and the DERM Draft Guidelines. Remediation may not include removal of the sites from the EMR. ▪ Prepare a Construction WH&S Plan which includes measures to manage exposure of construction workers to potential contaminants in soil and/or water. For example through the wearing of personal protective equipment and the control of dust during construction. ▪ Obtain an approval and a disposal permit from DERM (Contaminated Land Unit) for the removal of contaminated soil if required, in accordance with the Environmental Protection Act 1994. ▪ do nothing if the site investigation and assessment of risk determines that no action is necessary; ▪ on-site treatment/remediation to reduce contamination; ▪ capping of contaminated sites; ▪ excavation and off-site disposal to an off-site landfill; and ▪ excavation and on-site disposal to a suitable location within the Project area, with appropriate engineered controls (e.g. liner, cap). Spills ▪ Hazardous materials and chemical storage will comply with Australian Standards and Material Safety Data Sheets (MSDS) requirements. MSDS for products kept on site will be readily available to employees and contractors. ▪ Smaller quantities of chemicals, fuels and oils will be stored in self bunded pallets, within a bunded area in the workshop, or in a bunded container on the site. Bulk quantities of fuel should be stored in double skinned tanks (self bunding). ▪ Waste products (e.g. oil/water separator waste, sludges and residues), should be contained

Land contamination	
	within weatherproofed, sealed and bunded areas to ensure stability of the waste containment receptacles and prevent any leakages or spills causing environmental harm to soils, surface water or groundwater. Regular inspections will be carried out of the tanks, bunds and storage areas to ensure integrity. ▪ Standard procedures for the storage, handling, disposal and spill response for potentially hazardous waste materials should be described in an Emergency Management Plan. ▪ In the event of a large spill, sites will be investigated, managed and remediated in accordance with the requirements of the contaminated land provisions of the EP Act and the DERM Draft Guidelines. ▪ Obtain an approval and a disposal permit by DERM (Contaminated Land Unit) for the removal of contaminated soil, in accordance with the Environmental Protection Act 1994. ▪ Remove contaminated soils in accordance with a DERM approved Remediation Action Plan (RAP). ▪ Prepare and implement procedures for the remediation of contaminated soil spills that may occur during transport.
Monitoring	▪ Locate and quantify the extent and amount of contamination for all sites to be impacted by the Project identified before any construction activity. ▪ Recording of any spills that occur as an incident, as well as the follow up actions, any results and reporting to authorities. ▪ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	▪ Contaminated Site Assessment Reports for sites to be impacted by the Project are to be completed and approved by the DERM prior to the commencement of any construction activity or inundation of the dam. ▪ Any environmental incidents involving spills are recorded including time of incident, persons involved, details of incident, mitigation measures and actions taken to minimise the probability of recurrence. Immediate reporting to the Environmental Coordinator of any significant spills or potential risk of spills. ▪ The Environmental Coordinator is to report to DERM the extent and nature of any spills or leaks and the proposed clean-up operations. ▪ DERM is to be immediately alerted in the event of any significant environmental harm.
Responsibility	Contractor
Corrective Action	▪ Ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding waste management, spill procedures and the storage and handling of hazardous substances and materials with the potential to cause environmental harm. ▪ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.5. Surface water hydrology

Surface water hydrology	
Environmental Objective	Maintain flows in waterways during construction.
Performance Criteria	▪ No existing water users are to be affected by construction.
Mitigation Measures	Dam and Surrounds ▪ Downstream flows in the Connors River will be maintained throughout the construction process. A diversion channel will be constructed to divert water around the works as far as practical ▪ Work below the river bed level should be planned to take place in the drier months of the year. ▪ Prepare flood management plans for both construction and operation. ▪ All construction activities will be scheduled in such a way that the impacts of flooding on the

Surface water hydrology	
	construction of the dam will be minimised. ■ Develop and implement a construction geomorphic monitoring plan for sites immediately downstream of the dam wall that includes both visual proforma-based assessment of geomorphic stability to assess impact on both channel integrity and sediment entrainment that, at a minimum, assesses: – bed and bank stability, including the presence of any active erosion / failure or deposition; – slope (longitudinal bed and bank); – vegetation presence and contribution to stability (riparian and aquatic); – LWD presence and potential for further jams; – channel capacity; – bed and bank sediment types; – bed consolidation; and – cross-sections should be established. Pipeline ■ Aggregate extraction from within the Connors River should be accompanied by the development of a riverine sediment extraction management plan that is based on good-industry practice guidelines, such as those outlined in BCC (2000), DERM (2009), Groundwork (2001) and Rutherfurd et al. (2000). The management plan should include restoration and stabilisation plans post extraction and must: – set sustainable limits for each extraction point that considers sediment supply, stream condition and downstream requirements; – monitor allocations to ensure they are not exceeded; – establish safe buffer distances between extraction and stream banks; – provide a surveyed site plan that identifies hydraulic habitats, riparian vegetation location, extent and species present and planned area of extraction; – detail extraction operation plans, including any vegetation removal, staging, mitigation measures and buffer zones between extraction area and stream banks; – develop a monitoring plan that establishes sites upstream, downstream and within the area to be extracted; and – develop a rehabilitation plan. ■ As far as practical, construction work in creeks will be undertaken during periods of dry weather and/or minimal rain and conditions of minimal or no flow. ■ In the event that construction becomes necessary though a water body other than when dry, the water body will be contained by levee banks, the trench dug, the pipe laid and the area rehabilitated in the shortest practical time to minimise disturbance. ■ The construction of temporary waterway barriers during pipeline installation will include the provision to transfer flows from upstream of the works to the downstream channel without passing though the disturbed construction site. ■ All construction works within the bed and banks should be undertaken in accordance with relevant management requirements as detailed in the following: – Erosion and Sediment Control Plan (Section 29.9.3); – Water Quality Management Plan (Section 29.9.7); – Vegetation Clearance Strategy (Section 29.9.8); ■ The pipeline trench will be open for a minimal period of time during construction. ■ Materials reinstated will be compacted and reinstated as far as practical to the original profile including vegetation, in accordance with pre-installation surveys.
Monitoring	■ Monitoring of flows in affected water course to ensure that flows are maintained as far as reasonable and practical. ■ Assessment of the integrity and effectiveness of erosion control measures will be undertaken at regular periods. ■ In the first year following construction bi-monthly inspections and inspections after heavy rainfall

Surface water hydrology	
	will be conducted. ■ Further rehabilitation will be taken as necessary if erosion of reinstated areas is found. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ In the event that flows are significantly impeded by construction works, the following organisations are to be notified immediately: – DERM; – Isaac Regional Council; and – SunWater
Responsibility	Contractor
Corrective Action	■ Adverse impacts to flows will be reported to DERM and any impacts to potable water supply off-takes, reported to Isaac Regional Council as required. ■ Rehabilitation will be conducted on areas where unacceptable flow conditions have occurred. ■ The Contractor will ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding environmental flow requirements ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.6. Groundwater

Groundwater	
Environmental Objective	■ Limit potential impacts to groundwater quality during the construction phases of the project.
Performance Criteria	■ Minimisation of impacts on groundwater quality by implementing practical measures to prevent contamination as a result of construction activities. ■ Adequate monitoring and management of groundwater levels.
Mitigation Measures	Dam and Surrounds ■ Ensure Groundwater Monitoring and Management Programme is developed prior to construction to monitor groundwater levels as part of geotechnical program. Monitoring will include: – groundwater level monitoring down stream from the dam will be undertaken: o monthly for six to twelve months prior to construction; o quarterly during construction; and o bi-annually post-construction. – levels referenced to m AHD and m BGL; and – monitoring for pH, salinity, major anions and major cations. ■ Extracted groundwater will not be disposed of off-site. However, if off-site disposal of construction phase dewatering is required, groundwater will be tested and necessary approvals from regulatory bodies be sought prior to off-site release. ■ In the event that significant yields of groundwater are intersected during construction activities, it is currently proposed to pump intersected groundwater into a sedimentation basin and then release back to the river to facilitate the return of water into the groundwater system. ■ Annual review of downstream groundwater data will be undertaken to identify any impacts and whether ongoing monitoring is required. ■ Periodic monitoring in the form of visual and field assessments will be undertaken to identify evidence of salinisation including salt scalding and dying vegetation. Pipeline ■ Water dewatered during trench excavation will be returned to the creek to facilitate return to the groundwater system. ■ Storage, handling, transport and spill clean up of any chemicals, hazardous substances or any materials capable of effecting groundwater quality is carried out in accordance with measures

Groundwater	
	outlined in the water quality (Section 29.9.7), and Hazard and Risk (Section 29.9.16). ■ Construction works at creek crossings will be undertaken during the dry season. Water dewatered during trench excavation will be returned to the creek to facilitate the return to the groundwater system. ■ Monitoring of pipeline integrity and regular maintenance of the pipeline will ensure rupture of the pipeline does not occur. In the event pipeline rupture occurs, sufficient shut down or cut-off mechanisms will be put in place to prevent continued spillage of water. ■ Vertical low permeability barriers (bulkheads or trenchstops; 0.3 m wide) sourced from clayey material derived from pipeline trench excavation (or as sand bags or concrete collars), should be placed at set intervals (e.g. 200 m) along the length of the trench where the trench is at a slope. ■ In the event that contamination on-site has occurred, a site specific environmental investigation will be undertaken. Site specific remediation options will be developed based on findings from the environmental investigation.
Monitoring	■ Groundwater level monitoring should be undertaken in groundwater bores within the vicinity of subsurface construction activities to monitor any impacts. ■ Monitoring of downstream groundwater levels will be undertaken to identify any impacts as a result of modified downstream surface water flows. ■ Groundwater monitoring programme carried out to assess any changes in groundwater levels and in accordance with approval conditions. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ In the event that contamination on-site has occurred, a site specific environmental investigation will be undertaken. Site specific remediation options will be developed based on findings from the environmental investigation. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ Within the dam construction footprint Groundwater Quality Monitoring Programme introduced in the event that any significant spill may affect the groundwater. ■ Implemented remediation actions in accordance with Australian Standards and Guidelines ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or at risk of occurring.

29.9.7. Surface water quality

Surface water quality	
Environmental Objective	To preserve water quality within the Fitzroy and Connors River Catchments and maintain the Environmental Values (EVs) outlined in Table 16-4 and described in QWQG (2006c), Minimise environmental impact by maintaining water quality discharging from Project sites during construction.
Performance Criteria	Compliance with water quality objectives for the Project as outline in Project Water Quality Monitoring Program (PWQMP). The water quality objectives in the PWQMP should be informed by background water quality conditions recorded upstream of Project activities.
Mitigation Measures	Suspended solids and turbidity Implement Sediment and Erosion Control Plan as outlined in Table 29.9.3. Chemicals ■ Fuel, oil and chemicals will be stored in accordance with Australian Standard 1940, *the Storage and Handling of Flammable and Combustible Liquids*, and the *Dangerous Goods Act 1975* and

Surface water quality	
	the *Pesticides Act 1999*. ■ Spill containment kits will be available on site and staff trained in their use. ■ Oil containment booms and oil spill recovery equipment available when working on water. ■ Any contaminated soil will be removed to a licensed facility prior to the filling phase. ■ Emergency response procedures will be developed.
Monitoring	■ In the event that an unplanned spill or incident occurs within the construction area or as part of associated activities of the Project, targeted water quality monitoring will be carried out up and down stream to determine potential impacts from the event, in accordance with PWQMP. ■ A PWQMP will be developed and implemented. Sites will be identified upstream and downstream of priority Project activities with the potential to impact upon water quality. Parameters to be tested should include but not be limited to: – temperature, conductivity, dissolved oxygen, pH, turbidity; – nuisance algae and chlorophyll-a; and – total phosphorus, total nitrogen. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Report any non-compliance with water quality objectives as defined by PWQMP. ■ During and after rainfall, a visual inspection of the construction site undertaken to ensure that mitigation measures are in place and no major erosion is occurring. ■ Immediate reporting to Site Supervisor of any incident, spill or elevated release of materials contaminated by the Project into the environment. ■ Results of any water testing are to be recorded and made available to relevant authorities if requested. ■ Incidents, complaints and any environmental harm reported to regulatory authority, as required under the EP Act.
Responsibility	Contractor
Corrective Action	■ When contaminated waters (elevated turbidity, suspended solids etc) are observed flowing from the construction site into Connors River catchment, the Environmental Coordinator will determine the cause of the contamination and where necessary issue a stop work order until such a time that the source of the contamination is secured. ■ Where an impact is attributable to the Project, rehabilitation will be conducted on areas where sediment levels exceed that guideline value established in the PWQMP. . ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.8. Terrestrial flora

Terrestrial flora	
Environmental Objective	To minimise the extent of vegetation clearing within the footprint of the dam and surrounds, pipeline and associated infrastructure areas. To minimise the impacts on and provide protection to identified threatened flora species. Successfully implement vegetation management initiatives and offsets to establish a no net loss outcome for vegetation.
Performance Criteria	■ Finalise and implement an agreed environmental offset strategy. ■ Retained vegetation is not compromised by site clearing works, gross mechanical disturbance or impacts associated with sedimentation and/or pollutant export from the development area. ■ Weed invasion is prevented both within the construction site and in surrounding areas.
Mitigation Measures	■ Vegetation clearing will be staged so that only the area required for dam construction works is initially cleared then the remainder will be cleared progressively so that it is only fully cleared immediately prior to the dam being ready to fill.

Terrestrial flora	
	■ Timber suited to use as aquatic or terrestrial fauna habitat will be salvaged and placed in strategic locations. ■ As much of the remaining suitable material as practicable will be mulched for use in construction site stabilisation, rehabilitation or landscaping. ■ On completion of construction, progressive rehabilitation of the construction site in areas that will not be used for permanent infrastructure (house, parking, tracks to recreation area etc) or that are not inundated will be undertaken, by replacement of topsoil, contouring of the landform and revegetation as soon as possible after disturbance. ■ A qualified botanist will be on-site prior to any vegetation clearing works within remnant vegetation communities to inspect the area for significant flora. If any species of conservation significance are confirmed as present, suitable management measures will be implemented, such as development of translocation programs, and associated management plans. Vegetation Management Offsets ■ Vegetation offsets will be provided for the loss of significant REs as part of the Vegetation Management Offsets (VMO) Strategy for the Project. The Strategy will be developed to comply with the legislative requirements of the Vegetation Management Act 1999 (VM Act) and the guidelines detailed in the DNRW's Policy for Vegetation Management Offsets in order to meet relevant performance requirements under the Regional Vegetation Management Code (RVMC) for the Brigalow Belt Bioregion. (Noting that SunWater prefers a more strategic approach to offsets, as provided in Appendix D4 of the Supplement to the EIS) ■ A management plan will be developed for each offset to ensure long term success of the offset which will include measures for planting maintenance, weed and pest management and a monitoring program (discussed below). A Vegetation Clearance Management Plan will be developed for the Project to manage clearing and the impact to vegetation. Strategies include: ■ limit the clearing of vegetation within the riparian zones to within 1.5 m of the new FSL; ■ identify areas within the inundation area that are to be cleared and / or retained on Construction Drawings; ■ identify boundaries of vegetation to be retained, which are to be clearly marked by tape and / or pegs and conform to limits shown on drawings; ■ avoid impact on vegetation outside the inundation area by clearly identifying the FSL, and directing staff contractors and others working on the construction of the Project to avoid these areas, including that which is habitat for *Cerbera dumicola*; ■ minimise the area of vegetation cleared within the road corridors to the minimum required for the safety and effective construction to be undertaken; and ■ require the clearing contractor to monitor vegetation clearing to ensure only approved areas are cleared; ■ Undertake species specific pre-construction surveys for *Digitaria porrecta, Dichanthium queenslandicum, Eucalyptus raveretiana, Persoonia amaliae* and *Bertya pedicellata* and *Cerbera dumicola*; ■ limit vegetation clearing of the pipeline easement to the minimum practicable in sensitive areas such as riparian zones or where significant vegetation is encountered; ■ selection of sand extraction access sites to avoid remnant riparian vegetation where possible; ■ implement mitigation recommendations in the design of final pipeline route to minimise impacts on significant vegetation communities, including ensuring the maximum possible width of existing cleared easements is utilised for construction, avoiding large habitat trees and locating pipeline route within cleared / disturbed areas wherever possible. ■ Clearing for the pipeline easement will be restricted to a width of 30 m and further reduced in riparian zones. ■ A qualified botanist will be on-site prior to any vegetation clearing works within remnant vegetation communities to inspect the area for significant flora. If any species of conservation significance are confirmed as present, suitable management measures will be implemented, such as development of translocation programs, and associated management plans.

Terrestrial flora	
	Develop and implement a Sediment and Erosion Control Plan as outlined in Table 29.9.3. To minimise the potential for the spread and introduction of weeds from the outset of construction, a weed management plan will be developed for construction and operation of the Project. Specific management measures for construction will include: ■ undertake a risk assessment on the likelihood that weed infestation will be an issue to be managed during the project and identify those species to be addressed in a weed management plan; ■ use of wash-down facilities for vehicles and equipment entering and leaving the construction site and those areas proposed for vegetation clearance; ■ all machinery, equipment and vehicles shall be certified as "clean" prior to entering the construction site; ■ avoid the removal of vegetation, which is not salvaged for timber resource, from the vegetation clearance areas; ■ declared weeds not to be used as mulch for landscape will be disposed of at a landfill that accepts green waste or pit burnt and buried to prevent reseeding; ■ soil and landscaping material brought onto the site must be from a source that is clean and weed free; ■ weed inspection of the dam construction footprint to identify existing weed infestations; ■ weed control of new and existing weed infestations identified; ■ weed monitoring of dam construction footprint to identify new infestations and control any weeds identified; and ■ management methods for declared weeds must be consistent with recommendations in Pest Fact sheets produced by Queensland Primary Industries and Fisheries. A specific revegetation/rehabilitation plan will be prepared to support the EMP which contains the following information: ■ Method and species to be utilised in revegetation (including seeds of local provenance). This will include topsoil stabilisation. ■ Spatial configuration of plantings (if tubestock are used), seed mixes for direct seeding and hydromulching and watering requirements. ■ Benchmark criteria for rehabilitation including requirements for final landform (slope, aspect), vegetation cover, vegetation species composition and depth of topsoil (amongst other parameters).
Monitoring	■ Monitoring by Contractor of vegetation clearance, earthworks components and the above performance criteria of the proposed works on a continual basis to confirm that specific controls have been implemented and appropriate work practices are being adopted to achieve the specified performance criteria. ■ Regular inspection of cleared areas and contractor's methods during clearing to ensure compliance with EMP. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident which contravenes the objectives of the EMP. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ The Contractor will ensure that fully qualified appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding vegetation clearing and weed management. ■ The Construction Manager can request the cessation of works at any time should a breach of

Terrestrial flora	
	performance criteria of the EMP be occurring or at risk of occurring.

29.9.9. Terrestrial fauna

Terrestrial fauna	
Environmental Objective	Ensure that construction activities are completed in a manner that provides significant protection of the health and livelihood of native fauna.
Performance Criteria	■ The risk (of injury and death) to fauna is managed and minimised during site clearing works. ■ Retained habitat is not compromised by site clearing works, gross mechanical disturbance or impacts associated with sedimentation and/or pollutant export from the construction area. ■ Fauna species continue to utilise the retained habitat area post-development.
Mitigation Measures	Compliance with the Code of Practice ■ The program undertaken in compliance with Queensland Parks and Wildlife Service (QPWS) guidelines and the Draft Queensland Code of practice for the welfare and management of wild animals affected by land-clearing and the modification or destruction of wildlife habitats and wildlife spotter/catchers (Hanger 2006). Identification of Habitat Trees ■ Habitat trees identified prior to the selective clearing operations. (Section 11) ■ Clearing conducted using a staged approach. Removal of Tree Hollows ■ If any denning, roosting or nesting animals are observed within hollow limbs, but cannot be readily removed by an ecologist, it is recommended that, where appropriate, the hollow end of the limb be blocked with porous material and a chainsaw be used to remove the limb. The limb should then be relocated to a suitable place, determined in consultation with QPWS and the hollow end unblocked at an appropriate time of day to minimise fauna predation. In the case that a colony of microchiropteran bats are located, then the roost will either be felled at night (once bats have vacated) or the entry points shall be blocked, and the roost will be moved to an appropriate area of vegetation to be retained on or adjacent to the site. Flushing of Denning Fauna ■ Prior to tree removal, an appropriately qualified ecologist attempt to "flush out" any denning or nesting animals not observed during the initial hollow inspection. This may involve hitting target trees with a sledgehammer or another similar technique. Following felling, a second inspection of the relevant trees carried out to relocate fauna disturbed by the clearing process or remaining within the felled timber to a suitable location determined in consultation with QPWS. ■ Where possible, the actual felling of the habitat trees conducted in a manner that will maximize the chances of survival for any fauna remaining within the tree hollows. This involves pushing rather than cutting, and cushioning the tree fall with other felled timber and foliage. Trenching ■ The pipeline will be constructed progressively and the open trench will the minimum practicable length at any time; ■ The open pipeline will be plugged at the completion of each work day and backfilled so that the maximum distance of open trench will be less than 50 m; and ■ A Spotter-catcher will be employed to clear the open trench every morning and will be on call to remove trapped fauna during work times. Care of Injured Fauna ■ Employment of a Spotter-catcher to be on-site during clearing to provide fauna rescue services. ■ Installation of speed limits along haul roads to minimise vehicle strikes with fauna. ■ All injured animals immediately removed and taken to an appropriately qualified veterinary surgeon. Any orphaned or injured native fauna discovered at a later stage during works immediately reported to the QPWS.

Terrestrial fauna	
	Habitat Fragmentation ■ Progressive rehabilitation of pipeline easement to reflect type of vegetation cleared (i.e. woodland for woodland, pasture for pasture) Rehabilitation of riparian areas should be the maximum practicable. Loss of Fauna Habitat ■ The habitat loss will be offset by implementation of the Environmental Offset Strategy, incorporating the Vegetation Management Offset Strategy. ■ Where possible, minimise clearing by trimming of overhanging branches rather than tree removal and reduce clearing width in identified areas. Vegetation Clearance Management Plan (Section 29.9.8). Revegetation/rehabilitation plan (Section 29.9.8) A Pest Management Plan will be prepared to manage the occurrence of declared pests within the Project area during construction activities. Measures to be implemented could include disposal of food scraps in designated areas (Section 20). Lighting ■ All external lighting of the site should conform to the following Australian standards: – AS 1158 – Road lighting; and – AS 4282 – Control of the obtrusive effects of outdoor lighting.
Monitoring	■ Monitoring of vegetation clearance, earthwork components and requirements of this EMP on a continual basis to confirm that specific controls have been implemented and appropriate work practices are being adopted to achieve the specified Environmental Objectives. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident, spill or release of materials to the environment. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ Ensure that the fully qualified appropriate personnel undertake environmental awareness and training covering the requirements of the EMP regarding fauna management. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or at risk of occurring.

29.9.10. Aquatic flora and fauna

Aquatic flora and fauna	
Environmental Objective	■ Minimise and mitigate, as far as is practicable, the adverse impacts on aquatic fauna and flora, during construction of the project. ■ Minimise the opportunity for aquatic weed introduction as a result of construction activities.
Performance Criteria	■ No discharge of contaminated materials through stormwater runoff from construction areas, with particular regard to, fuels, chemicals, and oils. Minimise discharge of suspended sediments ■ No waste materials (general and construction rubbish etc) entering waterways from construction and operational areas. ■ Programme implemented to monitor and treat aquatic weeds and other pest species that may enter the dam from a work site. ■ No uncontrolled or untreated release of water or sediment from a work site.
Mitigation Measures	Vegetation Clearance Management Plan (Section 29.9.8). Sediment and Erosion Control Management Plan (Section 29.9.3)

Aquatic flora and fauna	
	Chemicals, Fuels, and Oils ■ Implementation and maintenance of the Water Quality and Hazards/Risks EMPs with particular reference to the appropriate storage measures of hazardous materials. Waste Materials ■ Implementation and maintenance of the Waste Management EMP (Section 29.9.15). Aquatic Fauna Relocation ■ The relocation of larger aquatic fauna (fish, turtles, platypus) will be undertaken at all construction work sites, including the dam construction and water storage area, trunk pipeline route and associated infrastructure, as necessary for road works and at resource extraction sites. Translocation of fish will be in accordance with QPIF fish salvage guidelines (DPI&F, 2004) and traps used to capture turtles will be designed to allow the turtles access to the surface to breath. Aquatic Fauna Passage ■ culverts used for temporary crossings are designed in accordance with QPIF guidelines to allow fauna passage (Section 14.2.3.1) ■ Whilst the diversion channel for dam construction will not be designed specifically to allow for fauna movement, physical structures such as boulders or logs will be included within the channel to provide rest areas for any fauna which use the channel as a movement conduit. Aquatic Fauna Habitat ■ Salvage aquatic fauna habitat (e.g. trees) to be used as large woody debris in the dam. ■ Minimise impacts on upstream riparian habitat such that recolonisation from this area is possible when the storage fills. Water Extraction ■ storing water during the wet season to reduce the effects of draw down in Connors River during the dry season (the spoil from the diversion channel could potentially construct an off-stream storage in the proposed inundation area) ■ extracting water from the largest pool possible ■ extracting water at a slow and steady rate, and ■ fitting floating booms to the water supply inlet pipe with a protective cage to prevent turtle entrapment. During filling, water quality in the dam is likely to be poor due to rotting inundated vegetation and high turbidity. This will inhibit the colonisation and growth of macrophytes until conditions have stabilised. Detrimental impacts are likely to be lessened by: ■ physical removal of vegetation from within the footprint before filling. ■ preventing stock from accessing the inundation area and waterways in the upstream catchment. ■ identifying and prioritising areas of erosion in the dam's catchment, and rehabilitating these areas by replanting and restoring vegetation. The creation of mosquito breeding habitat will be minimised through: ■ minimising the area of standing water, and ensuring drainage within 4 days where practical ■ profiling to ensure sufficient drainage ■ routinely filling incidental depressions and holes that may hold standing water ■ regularly clearing drainage lines to ensure that water continues to flow, and ■ constructing dams and water storages intended to contain stormwater and wastewater with steep edges, to minimise the extent of shallow water, which can provide breeding habitat.
Monitoring	Auditing ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Monthly report prepared and submitted to SunWater to include details of monitoring results, audits, training and the occurrence of any incidents. ■ Incidents, complaints and any significant environmental harm to aquatic environment reported to regulatory body/ies where required. ■ Assessment of performance against the identified indicators will be determined by auditing and

Aquatic flora and fauna	
	reporting on a monthly (internally) and three monthly (externally) basis during construction.
Responsibility	Contractor
Corrective Action	■ Measures undertaken to protect the aquatic environment where unacceptable impacts or risk of environmental harm becomes apparent. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident which contravenes the objectives of the EMP. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.11. Weeds

Weeds	
Environmental Objective	■ Declared weeds and introduced flora not present in study area are not introduced. ■ Declared and other weeds already present in the study area are not spread as a result of project activities.
Performance Criteria	■ Obligations under the Land Protection (Pest and Stock Route Management) Act 2002 are met. ■ All vehicles working off road have "clean" certificates. ■ Documentation available showing quarry sites inspected for weeds prior to extraction. ■ Infestation of weed and pest species reduced within the Project footprint. ■ No additional weed and pest infestations or increase in distribution as a consequence of the construction activities. ■ All employees working on site attend induction training sessions to identify weeds.
Mitigation Measures	Prepare a weed management plan which includes the following measures: Weed Management ■ All mulch produced on site from cleared vegetation and trees specifically exclude material from weed species. Vegetation mulching suitably controlled to avoid contamination. Mulch containing weed species material shall be treated separately and not used on site. ■ Soil disturbance within retained vegetation must be kept to a minimum to avoid weed recruitment. Areas to be regenerated (weed control) or revegetated completed under strict supervision to avoid unnecessary soil disturbance. ■ Soil and landscaping material brought onto the site must be from a source that is clean and weed free. ■ Management methods for declared weeds must be consistent with recommendations in DPIF Pest Fact sheets. Weed Removal ■ Priorities given to species of greatest environmental threat. Generally these species are prioritised by the classification allocated by the *Rural Lands Protection Act 1985*; the higher the category the greater the concern, however, in some cases, locally threatening species must have higher priorities. Weeds identified within the dam and surrounds include: *Thunbergia fragrans, Cryptostegia grandiflora, Opuntia tomentosa, Parthenium hysterophorus, Senna obtusifolia, Sporobolus pyramidalis, Sporobolus fertilis, Sporobolus jacquemontii, Aristolochia elegans, Lantana camara* Washdown Facilities and "Clean" Plant ■ Use of washdown facilities for vehicles and equipment entering and leaving the construction site and those areas proposed for vegetation clearance. Wash down facilities to be located at strategic access points to suit all construction areas. ■ All machinery, equipment and vehicles shall be "clean" prior to entering the construction site ■ Movement protocol developed and implemented for vehicles and plant to ensure declared weeds are not spread. This protocol will trigger the need for a "washdown".

Weeds	
Monitoring	■ The distribution of known declared weeds monitored and, where feasible, a plan made to eradicate or contain these infestations in accordance with the *Land Protection (Pest and Stock Route Management) Act 2002*. ■ Employees/contractors working on site to report presence of declared weeds to the Site Supervisor by the end of the working day. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Notification to the Environmental Coordinator by personnel of weed outbreaks or potential contamination. ■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident which contravenes the objectives of the EMP. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ The Contractor will ensure that the appropriate personnel undertake adequate environmental awareness training covering the requirements of the EMP regarding vegetation clearing and weed management. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.12. Animal Pests

Pests	
Environmental Objective	Pest infestations do not increase as a consequence of the project.
Performance Criteria	No increase in distribution of pest infestations as a consequence of the construction activities.
Mitigation Measures	Site Management ■ Ensure construction personnel do not create environments favourable to pest species, including: – ensure waste is managed appropriately; – where practicable, ensure water is not left to lie on sites for longer than 4 days (i.e. avoid ponds of standing water; and – ensure stormwater treatment and sediment control devices are designed and managed as to not create breeding habitat for mosquitoes and cane toads (*Bufo marinus*). Active Pest Control ■ Pest control measures, where necessary, completed using suitable and appropriate strategies as employed elsewhere within catchment area. If required, in consultation with landholders measures to be implemented include: – liaising with landholders impacted by the Project construction to cooperatively manage vertebrate pests; – encouraging Project workers to report pest sightings; – deployment of traps for Pigs; – destruction of Rabbit warrens, where practicable; and – placement of poisoned bait, where practicable and agreed with relevant agencies. Waste Disposal ■ All food scraps and other waste materials covered and removed off site regularly to reduce attraction to feral animals.
Monitoring	■ Presence of pests monitored as part of weekly site inspections. ■ All monitoring of waste will be carried out in accordance with the waste EMP. ■ Employees / contractors working on site to report presence of feral animals to the Environmental

Pests	
	Coordinator. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident which contravenes the objectives of the EMP. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ Appropriate control measures implemented where infestations occurring. ■ The Contractor will ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding pest management. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.13. Air quality and greenhouse gas

Air quality	
Environmental Objective	To minimise the potential to generate air quality impacts at sensitive receivers near the Project construction areas.
Performance Criteria	Aim to achieve: ■ PM10 (24 hr average) - 50 µg/m^3 Not to be exceeded: ■ PM10 (24 hr average) - 150 µg/m^3 ■ PM10 (annual average) - 50 µg/m3 ■ Dust Deposition - 120 mg/m^2/day
Mitigation Measures	Crushing and Concrete Batching ■ Regular watering of aggregate stockpiles where necessary to control visible dust. ■ Minimise drop heights for material deliveries / conveyor transfers etc. ■ Enclosures and water sprays to be installed on conveying systems where necessary to control visible dust. ■ Regular cleanup of spills beneath conveyors, handling areas and on sealed areas. ■ Ensure appropriate dust controls and enclosures are incorporated, including semi enclosing the crushing plant and batching plants and including dry collection systems (fabric filters etc). ■ vine thicket habitat adjacent to the left abutment will be fenced off to minimise dust impacts on *Cerbera dumicola.* Transportation and Wheel Generated Dust ■ Regularly inform truck drivers (including contractors) and machinery operators of designated vehicle access routes and other relevant practices applied for the project such as: – minimise vehicle speeds on unsealed road areas (60 km/hr); – use posts / kerbs to discourage vehicle movement on unsealed areas (short-cuts); – watering of unpaved roads and trafficked areas as required to prevent visible dust emissions travelling offsite from these areas; – use dust suppressants such as compacted road base, aggregate or chemical binding agents (subject to acceptability in water quality management practices); – install truck cleaning stations at site egress points to ensure dust and mud is removed from vehicle chassis and wheels prior to travelling along the public road network; – ensuring truck loads transported around the site are covered as required to control visible dust

Air quality	
	– regularly clean (sweep) mud and soil material tracked onto public roads at the site egress; and – ensuring truck loads transported around the site are no taller than the vehicle side walls as required to control visible dust. Excavation and Stockpiling ■ Water sprays (hand held hoses or sprinklers) should be used during excavation activities where necessary to control visible dust. ■ Stockpiles or material stores should be kept damp by water sprays and/or covered and should be located as far from residences as possible where necessary to control visible dust. ■ Any stockpiles would be stored in sheltered locations where possible, with the slope of the upwind surface minimised. Drilling and Blasting ■ Dry and fine material within the blasted area from drilling should be wetted down to suppress dust evolution. ■ Blasting should be restricted when strong winds are blowing (particularly during dry weather) and when winds are blowing towards sensitive areas. ■ Blast design should consider restricting blast size to minimise dust emissions. General Work Practices ■ Worked areas would be stabilised as soon as possible after earthworks have been completed; for example, by re-vegetation, paving, gravel, mulch. ■ Restrict areas that mobile plant and haulage vehicles can operate. ■ Regular inspection of site dust controls and their effectiveness. Greenhouse Gas Emissions ■ design 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; ■ maximise beneficial use of cleared material; ■ maintain construction equipment and haul trucks in good working order so fuel efficiency of equipment is maximised; ■ use appropriately sized equipment for construction activities; ■ raise awareness of energy efficiency and greenhouse gas emissions through workshops or toolbox talks; ■ minimise waste from construction (Section 20); and ■ greenhouse reduction initiatives at construction camps.
Monitoring	■ Visual inspections throughout workday, incidents requiring corrective action to be noted in site diary. ■ Continuous PM10 concentrations at 2 locations. ■ Monitor Meteorological Data (wind, weather forecast). ■ Dust deposition gauges. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally). Complaint Handling ■ Incident records, and actions taken to address air quality issues, would be used to further modify work or environmental management practices on site. ■ Findings from review of the complaints register, monitoring and site inspections would be discussed in regular Construction Environmental Management Reporting (e.g., monthly), including actions taken control or ameliorate further such incidents.
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of air quality monitoring results, audits, training and the occurrence of any complaints. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of significant dust event

Air quality	
	that will require mitigation measures to be implemented. ▪ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	▪ Air quality mitigation measures implemented immediately or as soon as practicable where air quality objectives are not being met. ▪ Ensure that the appropriate personnel undertake adequate environmental awareness training regarding air quality management and the environmental management commitments relating to dust generation. ▪ The Contractor can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.14. Noise and vibration

Noise and Vibration	
Environmental Objective	To minimise noise and vibration impacts from construction activities at sensitive receiver locations near the Project construction areas.
Performance Criteria	Aim to achieve ▪ Noise from dam construction activities would aim to achieve a level of ≤35 PNL – $L_{r,1hour}$ dB(A) during the day, and ≤28 PNL – $L_{r,1hour}$ dB(A) during the evening and night. ▪ Noise from pipeline construction activities would aim to achieve a level of ≤33 PNL – $L_{r,1hour}$ dB(A) during the day, and ≤28 PNL – $L_{r,1hour}$ dB(A) during the evening and night. Must be achieved ▪ Ground vibration from blasting must not exceed: – peak particle velocity of 5 mm per second for nine out of any ten consecutive blasts initiated, regardless of the interval between blasts; and – peak particle velocity of 10 mm per second for any blast. ▪ Air blast overpressure levels from blasting must not exceed: – 115 dB(linear) peak for nine out of any ten consecutive blasts, regardless of the interval between blasts; and – 120 dB(linear) peak for any blast.
Mitigation Measures	Construction hours ▪ As far as practicable, general construction activities will be in accordance with the EPP (Noise) and *Environmental Protection Regulation 1998*. General Noise Management Practices and Scheduling of Activities ▪ In general, construction works and consideration of quiet work practices will be carried out in accordance with AS 2436:1981 'Guide to noise control on construction, maintenance and demolition sites'. ▪ Prior to the commencement of site works, the community will be informed of the upcoming activities and likely duration. ▪ The construction programme will continue to be developed in consultation with the local community to schedule noisier activities during least sensitive times of the day. ▪ Employ respite periods for particularly noisy activities where possible. ▪ Maintain a site activity log, recording the type of activities occurring during various times of the day to assist with the retrospective investigation of community complaints relating to noise complaints. Plant and Equipment ▪ Equipment having directional noise characteristics (emits noise strongly in a particular direction) would be oriented such that noise is directed away from sensitive areas. ▪ Avoid the coincidence of noisy plant working at the same time close together adjacent to

Noise and Vibration	
	sensitive receivers. ■ All mechanical plant should be silenced by best practical means using current control technology and in accordance with manufacturers' specifications, and maintained appropriately. ■ Plant with the lowest noise rating which meets the requirements of the task should be selected. ■ Where possible for works in close proximity to sensitive receivers, use electric motors in preference to diesel motors. ■ Where reversing alarms are to be used in the vicinity of sensitive receptors, their acoustic range should be limited to the immediate danger area. Traditional 'beeper' alarms for mobile equipment could be replaced with "Smart alarms" or "Broadband" or "quacker" alarms. ■ Ensure that tailgates on trucks are securely fitted to avoid unnecessary "clanging" noise, particularly during movement of empty trucks. ■ Where using pneumatic equipment, select silenced compressors or use quieter hydraulic equipment. ■ Conduct regular inspections and effective maintenance of both stationary and mobile plant and equipment (including mufflers, enclosures etc). ■ Equipment not being utilised as part of the work should not be left standing with engines running for extended periods. Blasting ■ Blasting will be designed and managed by a blasting contractor, who would control blast overpressure and vibration in accordance with the Project limits, through a detailed management plan. The plan must address AS 2187 (2006) 'Explosives-Storage and Use Part 2: Use of explosives', and would include the following types of measures to minimise impacts: Airblast overpressure and ground vibration can be reduced by: – reducing maximum instantaneous charge of each blast; – changing drilling patterns, burden, blast hole diameter, deck loading, location, spacing and orientation of blast holes or using a combination of appropriate delays; and – where possible, orienting faces so that they do not face directly towards residences and keeping face heights to a minimum. ■ Consider weather forecasts in the ongoing management of blast impacts (allowing for the effects of adverse wind on the propagation of air blast to surrounding areas). Construction Traffic Noise ■ Establish designated access route/s to the site and inform drivers of these routes, parking lots and acceptable delivery times. ■ Undertake regular site road maintenance (and inspections) to minimise impact noises from trucks travelling over irregularities in the road surface (such as pot-holes, washouts or ruts). ■ Limit vehicle speeds in critical areas both on and off site. ■ Allow for one-way traffic flow through the site to minimise the use of reversing alarms as much as possible and minimise traffic delays. ■ The use of 'smart', reversing alarms. ■ Limiting excessive acceleration from site exits. ■ Entry and departure of heavy vehicles to and from the site are restricted to the standard daytime construction times.
Monitoring	Noise Monitoring ■ Due to the varying nature of the construction activities to be undertaken throughout the Project the effectiveness of the construction noise mitigation measures and management procedures would be reviewed regularly. Ongoing monitoring and review of the site noise management practices would be undertaken: – at the commencement of construction activities; – in response to a valid community complaint regarding construction noise; or – where review of upcoming construction schedule indicates a high likelihood for impact at nearest sensitive receiver locations.

Noise and Vibration	
	- investigating the likely sources of construction noise impact; - quantifying the extent of likely impact (through comparison with the Project noise level goals); - identifying the need for further controls or modified site noise management practices; and ■ The purpose of monitoring is as a proactive management tool to assist with: – investigating the likely sources of construction noise impact; – quantifying the extent of likely impact (through comparison with the Project noise level goals); – identifying the need for further controls or modified site noise management practices; and – establishing the effectiveness of noise mitigation implemented. Blast Overpressure Monitoring ■ Blast overpressure and vibration monitoring is initially to be undertaken for trial blasts at several key residential locations to identify site specific details and make adjustments to the blasting parameters and programme. ■ This monitoring should also be undertaken on a monthly basis under changing temperature and meteorological conditions to ensure blasting levels remain within the criteria. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ In the event of a complaint associated with the generation of excessive noise, a report will be prepared detailing the results of noise level measurements and investigations undertaken. The report will detail: – the time of monitoring; – the type and location of activities occurring on site at the time of monitoring; – the location of monitoring positions with respect to site noise sources (also marked on a plan); – noise generating activities audible at the monitoring location; – other extraneous noise sources which could influence the noise level measurements; and – weather conditions prior to and during the monitoring (or complaint).
Responsibility	Contractor
Corrective Action	■ Where construction noise level investigations in response to community complaints show unacceptable project noise levels, revision to the noise mitigation measures and management commitments will be undertaken to further control noise impacts.

29.9.15. Waste

Waste	
Environmental Objective	To prevent or minimise the generation of wastes, where practicable and to appropriately contain, control and re-use or dispose of all waste generated.
Performance Criteria	■ Implementation of the waste minimisation hierarchy with these waste management options: – waste avoidance; – waste re-use; and – waste recycling. ■ Water conservation, treatment and re-use. ■ Efficient energy usage. ■ Compliance with national and state waste management policies, the EP Act and associated regulatory instruments as a minimum. ■ Effective and lawful waste disposal (as a last option). ■ Construction and storage areas clean and tidy.
Mitigation Measures	Waste Minimisation ■ Preparation and implementation of site-specific Waste Management Plan prior to

Waste	
	commencement of construction activities addressing issues such as location and methods of storage, transport and disposal. ■ All reasonable efforts made to avoid and minimise waste and to reuse or recycle where possible. ■ Purchase agreements to include the requirement for suppliers to take back packaging where practicable. ■ Implementation of training for employees in the waste management plan and recycling opportunities. ■ On-site waste management practices highlighted during employee inductions. ■ Producing / procuring only the amount of materials necessary. ■ Concrete waste will be crushed and re-used in the batching plant or used as fill. ■ Building materials, timber and metal off-cuts and plastics from construction and demolition will be collected and stored in segregated areas for re-use on site where practicable. Disposal ■ During construction, colour-coded, signed bins will be used to segregate and collect food wastes, paper and recyclables. The bins will be located throughout offices and workshop areas to maximise economic waste recovery. ■ These bins will be emptied into larger bins or skips regularly and disposed to local approved waste facilities or recycling centres. ■ General wastes will be collected regularly and transported by licensed contractors for disposal to approved landfill. ■ Disposal bin not overfilled and waste compacted as much as possible before disposal. ■ Waste bins on-site monitored and arrangement for their replacement to occur on a regular basis and/or when full. ■ Prevention of animals from accessing the bins using specially designed lids and strategic placement where necessary. ■ Housekeeping procedures, (including spillage control, litter pick up and tidying up of site areas) implemented to minimise the generation of waste. ■ All domestic and industrial waste generated at the construction site removed from the site and disposed of at the nearest licensed disposal facility, as required. ■ Empty drums stored as per Australian Standards and collected by licensed transporter and dispatched to a licensed facility for recycling. ■ All waste construction material removed from the work site upon completion. ■ Records maintained of any waste generated and removed from the premises. Wastewater and Liquid Waste ■ Wastewater from the dam work site and construction camps will be treated via a commercially available wastewater treatment plant. Grey water released from the plant will be treated to Class A standard and re-used for either trickle irrigation for rehabilitated areas or dust suppression. ■ Wastewater from areas potentially containing contaminants (e.g. washdown and workshop areas), will be contained and directed to detention ponds. ■ Sewage sludge from portable ablution facilities pumped out by licensed contractor and transported a licensed facility. ■ Water for dust suppression, haul roads and rehabilitation is to be sourced from the sedimentation ponds, the Connors River or from bores along the pipeline route. Accumulated silt will be removed and used as topsoil where possible, or incorporated into fill. ■ All liquid waste from workshops will be disposed of by a licensed liquid waste contractor. Waste Transport ■ Restriction of site works and surface truck movements for transport of waste material to designated hours. ■ Transport of regulated wastes and contaminated soils or other materials conducted by licensed contractors for disposal at licensed facilities, in accordance with legislative requirements. ■ Movement of hazardous materials and regulated wastes at non-peak times to minimise the possibility of traffic conflicts and associated risks. ■ Waste only removed from the premises and disposed of in a lawful manner in accordance with the requirements of the DERM and Isaac Regional Council.

Waste	
	Regulated Waste ■ The regulated wastes generated during the construction of the dam include waste oils, fuels, lubricants, tyres, batteries, oily air filters, paints, resins, solvents, sewage sludges and residues, spill cleanup materials and water, soiled rags, drums and soils containing regulated wastes. These wastes will be reduced and/or recycled where possible. ■ The management of regulated wastes (collection, transport, tracking, treatment and disposal) will be in accordance with the DERM Guidelines, including appropriate licensing of the contractor, transport vehicles and facilities. ■ Should a significant spill occur which potentially causes or threatens environmental harm, the DERM will be notified, and the site will be investigated, managed and remediated in accordance with the requirements of the contaminated land provisions of the EP Act. ■ Implement the Land contamination and Hazard and risk EMPs. Incidents ■ Preparation of waste management procedures to deal with any potential incident in which waste material with the potential to cause environmental harm is released to the environment. ■ Immediate reporting to Site Supervisor and Environmental Coordinator any incident where harmful waste material is accidentally released to the environment. ■ In the event of an environmental incident, corrective or remedial action as is required to render the area safe and avoid or minimise environmental harm. Contaminated Soil ■ Implement the Land contamination EMP (Section 29.9.4). ■ Obtain an approval and a disposal permit by the DERM Contaminated Land Unit for the removal of contaminated soil, in accordance with the Environmental Protection Act 1994. ■ Remove contaminated soils in accordance with a DERM approved Remediation Action Plan (RAP). ■ Prepare and implement procedures for the remediation of contaminated soil spills that may occur during transport. Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Monitoring	■ Regular inspection of on-site facilities to ensure waste is being generated, stored, handled, disposed and transported in accordance with the EMP. ■ Registers and manifests maintained to track waste material. This documentation subject to internal or external audit, especially for any regulated waste material. ■ Any discharges from site that could impact on the environment monitored in accordance with DERM's requirements. ■ Records kept of any regulated waste removed from the site, including name and licence number of waste transporter, volume and description of waste transported, destination of waste and licence number of the waste treatment operator. ■ Waste contractors to provide certification (licence) records verifying their registrations and points of discharge of waste. ■ Recording of any spills that occur as an incident, as well as the follow up actions, any results and reporting to authorities. ■ Inspections against the EMP conducted weekly (internally).
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ Any environmental incidents involving spills recorded including time of incident, persons involved, details of incident, mitigation measures and actions taken to minimise the probability of recurrence. Immediate reporting to Environmental Coordinator of any large spills or potential risk of spills. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ Ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding waste management, spill procedures and the storage and handling of hazardous substances and materials with the potential to cause

Waste	
	environmental harm. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.16. Hazard and risk

Hazard and risk	
Environmental Objective	Safely manage the risks to the workforce, public and existing environmental values, including surrounding land uses associated with the Project.
Performance Criteria	■ Compliance with relevant Standards, guidelines and legislation. ■ Number of Incidents.
Mitigation Measures	■ Comply with AS4801 and AS4804 in developing and operating the safety management system. Hazardous Materials or Dangerous Goods ■ Undertake storage and transport of materials according to relevant Australian standards, guidelines and legislation, including: – AS4452 The Storage and Handling of Toxic Substances; – AS1940 The Storage and Handling of Flammable and Combustible Liquids; – AS3780 The Storage and handling of Corrosive Substances; – AS2809.1-2008 Road Tank Vehicles for Dangerous Goods; – Australian Code for the Transport of Dangerous Goods by Road and Rail; – Dangerous Goods Safety Management Act 2001; and – Local council requirements. ■ Spill kits for contaminated material and protective clothing will be provided at each transfer and storage location for use in the event of any spillages or leaks. ■ Copy of up to date MSDS for each chemical / product used on site, will be available on site and readily available to all site personnel. ■ Appropriate signage provided using Dangerous Goods classes which are to be visible at all times. Signage also listing contact details for the Environmental Coordinator and Safety Officer in case of an emergency. ■ Fire fighting equipment must be checked and maintained at all times. ■ Records will be kept on the existing inventory, storage location, personnel training and disposal of waste for all chemicals, fuel and dangerous goods used on site. ■ All relevant staff must be trained in appropriate handling, storage and containment practices for chemicals, fuel and dangerous goods. ■ All relevant staff must be trained in fire safety during the induction. ■ Liquid chemicals and fuels storage in above ground tanks and chemicals and fuels stored in drums will be bunded in accordance with relevant Australian Standards. ■ In the event that Asbestos is located on site, develop an Asbestos management plan. Earthquake and fault movement ■ Apply appropriate design factors for dam and pipeline construction. Flooding ■ Construction activities phased to minimise potential 'wash out' impacts. ■ Cease in-stream works and remove all construction personnel and equipment to higher ground in the likelihood of a flood event. ■ Cease RCC works well before flood event. ■ Constructing coffer dams and diversion conduit of capacity sufficient to pass a flood event with an AEP that will adequately limit the commercial risk of damage to the partly completed dam. Emergency Response ■ Designated first aid and emergency rescue facilities and equipment will be available. ■ Stores, workshops and offices will be fitted with approved and certified fire detection (smoke

Hazard and risk	
	detectors) and sprinkler systems. ■ First aid and fire fighting equipment (hand held extinguishers and fire hoses) will be installed at strategic points within each building and on equipment as required. ■ Develop a fire management plan for the site for construction and operation phases. ■ Fire fighting equipment and exit locations will be suitably signed and all work areas will be within the required distance to reach emergency exits. ■ Appropriately trained personnel will be available throughout the life of the Project to provide first aid and emergency response to on site emergencies. Vehicle Collision and Driving Conditions ■ Construction workers operating vehicles on-site will be trained and licensed, so that these vehicles are driven in a safe and appropriate manner. ■ Speed control (signage), driving to conditions, and prescribed driving etiquette on the site will be used to control the risk. ■ All vehicles will be fitted with radios for two-way communication. ■ Watering of roads and access areas will be undertaken regularly to suppress dust and improve visibility. ■ Adequate night lighting through the provision of lighting towers and vehicle headlights will be provided to ensure night operating and driving conditions are safe. ■ For clearing operations equipment is fitted with FOPS and ROPS as deemed to be required Explosives and Blasting ■ A specialist explosives company will provide the ammonium nitrate, emulsion, detonators and boosters to be used during blasting operations. The Contractor's personnel will be licensed and trained in the transport, handling, mixing and use of explosive materials. ■ Blasting operations will comply with the *Explosive Act 1999*. Safety and Security ■ Safe Working Procedures for working at height and falling objects will be employed. ■ PPE to be worn including high visibility clothing, steel capped boots, hard hats and hearing protection where required. ■ All remote operating light vehicles to have first aid kits. ■ Persons working alone should carry radios and consider providing EPIRB to staff working in remote locations. ■ Fall of persons will be controlled through appropriate elevated work platforms and the proper use of harnesses. ■ Fencing will protect selected areas with high risk of a security breach or unauthorised public access. ■ Prior to being given access to the Project site, visitors will complete mandatory registration and an environmental, health and safety induction. The scope of induction will reflect those areas of the Project site that the visitor will be permitted access. ■ Manage rock faces to prevent rock falls causing injury to workers, measures may include: – Machinery to clean the fact of the bench to prevent subsequent rock falls – Adequate allowance for pre-shift inspections of rock faces and benches – Rock faces to be shotcreted, rock bolted or meshed in required locations
Monitoring	■ Any defects of storage areas observed during daily operations e.g. with bunding, floor, cover, structure, hoses, valves and pumps or associated infrastructure to be reported to the SS or EC-C. ■ Equipment operators to regularly check equipment for evidence of leak and fitness of hydraulic hoses and seals, and conduct maintenance or repairs as necessary to prevent drips, leaks or likely equipment failures. ■ Monitor rainfall and weather warnings (issued by the Bureau of Meteorology) to anticipate and reduce the potential risk of flood impacts. ■ Monitoring will be undertaken in accordance with WH&S Plan to assess whether Project health and safety measures are being implemented and effective. Monitoring will involve the compilation and assessment of data relating to health and safety issues, such as reported near misses, accident reports and any health surveillance data (sickness data). Outcomes from this

Hazard and risk	
	monitoring may trigger the need for additional safety and health risk control actions. ■ In accordance with the WH&S Plan, accident and near hit data will be monitored to identify where: – common themes occur – PPE is being incorrectly used/abused – corrective actions have not been strictly implemented – corrective actions are ineffective – procedures/practices need to be reviewed and retraining may be required – health surveillance data will be monitored to identify common themes ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Any environmental incidents involving spills recorded including time of incident, persons involved, details of incident, mitigation measures and actions taken to minimise the probability of recurrence. Immediate reporting to the Environmental Coordinator of any large spills or potential risk of spills. ■ Incidents, complaints and any significant environmental harm reported to regulatory authorities where required.
Responsibility	Contractor
Corrective Action	■ In the event of a spill of hazardous substances, necessary work procedures and operation controls will be reviewed to ensure they are fit for purpose and revised where necessary. ■ Schedule construction to avoid periods with highest risk from heavy rain events. ■ Ensure that the appropriate personnel undertake adequate environmental awareness training covering the requirements of the EMP regarding the management of hazardous substances. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.9.17. Transport and roads

Transport and roads	
Environmental Objective	Manage construction traffic and transport issues to minimise potential impact on the community and the operation of the road network.
Performance Criteria	■ Avoidance, mitigation and management of the potential construction traffic impacts on communities near worksites within the dam and surrounds, pipeline and associated infrastructure areas. ■ Minimisation, as much as possible, of potential traffic disruptions to the operation of the road network and the public transport (school buses) due to construction works. ■ Exclusion from project work areas for road users, including pedestrians, cyclists and tourists. ■ Implementation of traffic management measures near each worksite to avoid conflicts between construction traffic and local traffic. ■ Local and broader communities kept informed about the time and scale of changes in the traffic conditions on roads in the vicinity. ■ Traffic flows near construction works monitored, as required. ■ Corrective measures implemented in response to traffic impacts subsequent to construction works.
Mitigation Measures	■ Prepare a Traffic Management Plan in consultation with Department of Transport and Main roads and Isaac Regional Council for all elements of the works to include measures to minimise the adverse effects on the road network. The plan would address the safety and convenience for all road users and consider the following: – installation of proper signage to make drivers aware of road works – measures to help ensure safety and manage the changes in traffic conditions (e.g. traffic controllers/and/or variable message signage) – wet weather specific operational requirements including any management measures necessary to address any potential environmental impacts of wet weather operations.

Transport and roads	
	– truck routes and construction site access Truck Routes and Construction Site Access ■ Use of the established truck routes and arterial roads for the haulage of construction materials and spoil in order to minimise truck traffic on local roads. ■ Where required for bulk transport vehicles local roadways to the construction site will be adequate for this use. ■ Avoidance of haulage tasks during peak traffic periods and during the school drop-off and pick-up times. Where haulage in peak hours in unavoidable, such activities managed in accordance with specific traffic management plans provided to the relevant agencies and Council in advance. ■ Control of heavy vehicle movements to avoid interference with major events. Local Traffic ■ Notification to the local communities where practicable about proposed changes to local traffic access due to construction activities and provision of clear signage of changed traffic conditions. Emergency vehicles ■ Ensure access to construction sites by emergency vehicles is maintained at all times. Pipeline Construction mitigation measures ■ Implementation of a Road Use Management Plan (RUMP) to address the use of safety vehicle signs and qualified flagmen where works impinge on any road reserve, in particular access points to the pipeline easement and pipeline crossings at the seven identified locations for the preferred pipeline alignment; ■ using the construction easement for delivery of materials and transport of workers, and dedicated and trained personnel, where appropriate, to coordinate traffic on the roadway with the movement of construction personnel, vehicles and equipment during deliveries; ■ use of signage and construction tape prohibiting access to the easement outside working hours; ■ providing suitable, or upgrading existing, access and egress points between the public road network and the construction easement or the access track between the public roads and the easement; ■ placing the construction camp near the construction easement to minimise traffic on the public road network and facilitate use of the construction easement; ■ scheduling the delivery of bulk construction material for several months prior to construction commencing in order to spread the transport load; ■ establishing sand extraction areas and stockpile sites as near as possible to the easement to minimise transport distances and distances travelled on public roads; and ■ establishing access tracks to the edge of unformed road reserves to facilitate formalisation of these corridors as paved roadways (particularly in Area 6). ■ restricting access during the operation phase via a locked gate at the permanent concrete causeway to be constructed at the Connors River (Area 1) and at other fence lines along the easement when agreed with the landowner; ■ existing access tracks or roadways between Waitara Hamilton Park Road and the BMA borefield easement to be used as maintenance routes; ■ sharing maintenance tracks with adjoining easement owners will ensure these slow vehicles are not on the highway; ■ provision of six (currently envisaged) lay-down areas will be located at strategic points to minimise travel distances and interaction with general traffic; ■ implementation of dust management measures, such as the watering of pavement and speed controls, during high dust risk (windy) periods; ■ pipeline construction at road crossings will be scheduled outside peak periods to minimise disruption; and ■ reinstatement to the satisfaction of the local authorities of damage to roads that can be shown to be as a result of Project activities.
Monitoring	■ Monitoring of complaints regarding incidents, impacts on traffic flows and road network performance ■ Review of Construction Traffic Management Plan if necessary. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).

Transport and roads	
Reporting	■ Monthly report on local traffic conditions, including any accidents involving construction traffic. ■ Monthly report prepared and submitted to SunWater to include details of local traffic conditions, including any accidents involving construction traffic, any monitoring results, audits, training and incidents. ■ Immediate reporting to Site Supervisor and Environmental Coordinator of any incident which contravenes the objectives of the EMP. ■ Incidents, complaints and any significant environmental harm reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ Investigation and implementation of additional traffic management and transport options where required. ■ Ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding traffic management. ■ The Construction Manager can request the cessation of works at any time should they feel that the performance criteria of the EMP have been breached.

29.9.18. Indigenous and non-indigenous cultural heritage

Indigenous and non-indigenous cultural heritage	
Environmental Objective	Conduct all activities in a manner that will minimise the effect on heritage items including to protect indigenous and non-indigenous cultural heritage sites, artefacts and areas of high cultural and heritage value.
Performance Criteria	■ All known indigenous cultural heritage objects and areas, as identified by the Aboriginal Party for the Project area and documented in the cultural heritage management plan (CHMP) for the Project, are preserved and not impacted upon by the project or managed as specified in the agreed recommendations of the CHMP. (Note that no non-indigenous cultural heritage areas or artefacts have been identified within the project area.) ■ All unknown indigenous and non-indigenous cultural heritage items found during the course of the Project are managed in accordance with the relevant legislation as summarised in Sections 22 and 23 of the EIS.
Mitigation Measures	■ All site operations are to be carried out in accordance with the CHMP as agreed between SunWater and the Aboriginal Party for the area. Induction ■ Cultural heritage awareness training will be conducted for all relevant on-site personnel to enable them to identify areas and items of cultural heritage significance, and implement agreed management strategies as documented in the CHMP and the relevant legislation. Discovery of Artefacts ■ In the event that any indigenous or non-indigenous cultural heritage items are uncovered during the course of the construction of the Project, work in the immediate area should cease and the finds immediately be reported to DERM and SunWater.
Monitoring	■ Ongoing monitoring implemented as per the CHMP and following direction from DERM with respect to discovered non-indigenous items. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).

Reporting	■ Report any findings of indigenous and non-indigenous cultural heritage items to the Site Supervisor immediately, then follow the requirements of the CHMP.
	■ Report any findings of indigenous and non-indigenous cultural heritage items to DERM and SunWater. DERM contacts are as follows:
	  ■ Indigenous – Cultural Heritage Coordination Unit, Indigenous Services, Ph 131304
	  ■ Non-indigenous – Heritage Branch, EPA, Ph 131304

Indigenous and non-indigenous cultural heritage	
Responsibility	Environmental Coordinator (Contractor)
Corrective Action	Any non-compliances to be rectified in consultation with the appropriate parties (Aboriginal Party or DERM).

29.9.19. Social and economic

Social and economic	
Environmental Objective	Minimise impacts of the project's construction for affected communities and workers. Support development of local communities through sponsorship program. Maximise benefits of construction phase, including employment.
Performance Criteria	■ Local communities impacted by the proposed construction works, including through increased traffic, are informed in advance of construction activities and potential impacts. ■ Residents of properties adjacent to construction activities (i.e. pipeline) are informed of construction works. , ■ Community complaints are responded to in timely manner.
Mitigation Measures	■ Communication program implemented to local and regional communities about: – Construction activities, including timing, duration and likely impacts; – Management and mitigation measures; and – Details of complaint management system. ■ Ongoing training and communication to construction workers about land access protocols. ■ Complaint responses system followed including promotion and provision of phone contact with construction management staff during hours of construction, and a follow up procedure which notifies complainants within 24 hours of the intended response to the issue raised. ■ Site design and construction activities (including watercourse crossings) minimises the removal of vegetation, and plantings conducted at the earliest practicable opportunity to restore the existing visual qualities attributed to existing vegetation on the site. ■ In places where the pipeline is above ground in areas of currently utilised GQAL, appropriate arrangements will be negotiated with landholders to maintain access across the pipeline for stock and equipment ■ Establish and implement sponsorship program focussing on local communities most affected by the project. ■ Implement employment and training strategies to maximise employment opportunities for local communities. ■ Implementation of employment and training programs in partnership with education and training organisations (i.e. TAFE). ■ Compliance with Building and Construction Contracts Structure Training Policy (10% Training Policy). ■ Identification of Indigenous employment and training opportunities in consultation with local Aboriginal and Torres Strait Islander agencies. ■ Compliance with the Indigenous Employment Policy. ■ Development and implementation of protocols around worker behaviour within the camp and in local communities. ■ Implement local business procurement strategies to maximise opportunities for local businesses in the supply of goods and services to the construction phase through a Local Industry Participation Plan. ■ Compliance with the Local Industry Policy. ■ Ongoing consultation and communication with construction employees. ■ Provision of support for construction employees to assist them with their transition.

Social and economic	
	■ Implementation of transition programs, including provision of information for workers and their families on local services and facilities. ■ Avoid transporting workforce between regional towns during peak traffic periods. ■ Early and ongoing consultation and communication with local communities and emergency service providers about changes to local access and potential disruptions. ■ Ongoing consultation with community service providers regarding potential increased demand. ■ Encourage workers to use bus transport. ■ Implementation of road safety education and awareness programs for workers. ■ Regular monitoring of haulage routes for damage to roads. ■ Undertake consultation with the National Bicentennial Trail organisation to discuss the potential location of a new route. ■ Provision of a recreation area at the dam. The nature and extent of the recreational facilities will be informed by a Facilities Options Study to be carried out in consultation with IRC, but could include a boat ramp, picnic facilities, toilet facilities, general landscaping and viewing platforms. ■ Voluntary property purchase in part or whole where impact is significant. ■ Engagement with property owners and other stakeholders with accurate and timely Project information. ■ Work with landowners to minimise impact including:- – Agree location of easement to reduce impacts eg., outside property boundaries and/or along fence lines rather than through middle of property where practicable – Construction timing to minimise impact on farming operations – Provision of appropriate access and ability to cross easement – Avoid infrastructure and facilities as far as possible and replace like with like if not possible to avoid – Minimise time crossing farm access roads ■ Provide alternative access during unavoidable construction activities.
Monitoring	■ Follow up enquiries and complaints to assist in gauging community's perceived impacts from project on social and economic values and amenity. ■ Auditing of this EMP conducted bi-annually (internally) and annually (externally).
Reporting	■ Monthly Report prepared and submitted to SunWater to include details of monitoring results, audits, training and incidents. ■ Communications register to include communication activities, residents' complaints and resolution of complaints. Regular reviews required. ■ The results of annual monitoring of community satisfaction with environmental and complaints management collated into report for submission to SunWater. ■ Significant complaints and community issues reported to regulatory body/ies where required.
Responsibility	Contractor
Corrective Action	■ Appropriate actions implemented where complaints or comments reported during construction as per communications procedures. Ensure all complaints are followed up and logged. ■ Ensure that the appropriate personnel undertake adequate environmental awareness and training covering the requirements of the EMP regarding community liaison, incidents and complaints. ■ The Construction Manager can request the cessation of works at any time should a breach of performance criteria of the EMP be occurring or is at risk of occurring.

29.10. Draft operation environmental management plan outline

29.10.1. Overview

EMP Element Strategies describe proposed objectives, performance criteria and identified mitigation measures for the operational phase of the Project. It should be noted that most operational issues are addressed at the design and construction phase, so only brief details are provided here.

SunWater has considerable experience in the operation of dams, pipelines and water supply systems and has established Standard Operating Procedures for many aspects of operation.

Some of the environmental elements suggest specific monitoring requirements and / or statutory requirements and these are described in the following Sections.

The environmental element topics for this Draft OEMP are:

- management of water storage
- geology and soils
- water quality
- pests and weeds
- hazardous substances
- dam safety
- social and economic

29.10.2. Management of water storage and pipeline

Management of water storage	
Environmental Objective	Connors River Dam and water storage and water releases must be managed and scheduled to: ■ Optimise the distribution of water from Connors River Dam ■ Conform to flow requirements of the Water Resource Plan (WRP) ■ Comply with the Resource Operations Plan (ROP)
Performance Criteria	■ Compliance with the ROP ■ Staff trained in procedures associated with the monitoring required in the Operations and Maintenance Manual.
Mitigation Measures	Once an operator is appointed and the dam is commissioned the operator will be required to implement operating procedures as stated in a ROL. Develop an Operation and Maintenance Manual for Connors River Dam and pipeline ■ the risk of impacts to existing users and the environment through changed river flows is low and will be managed through the dam operational strategy and compensation strategy which will include confirming the flow threshold required to inundate Lake Plattaway; ■ the flood risk during construction and operation is low and will be managed through a combination of construction timing, flood management plan and land purchase strategy; ■ the possibility of changes to stream bed profiles, channel morphology and local drainage patterns is low and will be managed through appropriate construction management plans and procedures and operational monitoring of a downstream geomorphic assessment site; ■ the dam presents a potential barrier to fish and turtle movement in both the construction and operation phase. Consultation with DERM experts will be sought to assist with the design and development of a fishway which will provide fish and turtle passage at the dam wall. Appropriately designed drainage structures and waterway crossings will also be incorporated;

Management of water storage	
	■ develop a Critical Water Supply Strategy to manage and prioritise water supply during drought periods; ■ release water to meet the ROP and otherwise mimic natural patterns of flow. Avoid sudden changes in the volume discharged; and ■ regularly monitor and develop management measures (such as screening of offtakes) if exotic flora species colonise the dam. Weed control at discharge locations and in terminal storage. Develop and implement a operations geomorphic monitoring plan for sites immediately downstream of the dam wall that includes both visual proforma-based assessment of geomorphic stability to assess impact on both channel integrity and sediment entrainment that, at a minimum, assesses ■ bed and bank stability, including the presence of any active erosion / failure or deposition; ■ slope (longitudinal bed and bank); ■ vegetation presence and contribution to stability (riparian and aquatic); ■ LWD presence and potential for further jams; ■ channel Capacity; ■ bed and bank sediment types; ■ bed consolidation; ■ cross-sections should be established; and ■ bed and bank stabilisation as required in the area immediately below the dam should vertical scour be observed. ■
Monitoring	■ Connors River Dam and all associated structures and facilities within the included land area, are operated, monitored, and maintained in accordance with generally accepted engineering, dam safety, and water management practices; SunWater policies, and all applicable legislation. ■ The operator must monitor the dam for signs of stress and/or damage, keep records of all inspections, and promptly report all events or findings that concern dam safety. ■ Queensland Dam Safety Guidelines require that a Dam Log Book be kept to record major and exceptional events and to confirm compliance with dam safety requirements. ■ The operator must record and report all dam instrument readings, using the forms supplied by the Dam Safety Manager. ■ Carry out monitoring in accordance with SunWater's Standard Operating Procedures (SOPs), this will include monitoring of geomorphology associated with pipeline watercourse crossings; ■ Water quality monitoring within the impoundment in accordance with the Water Quality EMP. ■ Regular auditing undertaken to ensure compliance with objectives of the EMP.
Reporting	Operator to report on operations as per the ROL.
Responsibility	Operator
Corrective Action	Appropriate action will be taken if impacts are found to be unacceptable in terms of water supply, flows, adjoining land use, ecology or erosion. Depending on the circumstances, appropriate action could include: ■ review of operation and maintenance procedures; ■ removal of accumulated sediment; ■ measures to entrap sediment upstream at a site more accessible for sediment removal; ■ measures to improve stream bank stability upstream; or ■ catchment management measures to minimise erosion from sediment sources.

29.10.3. Dam safety

Dam safety is regulated for referable dams so that the community is protected from dam failure. As a referable dam, additional conditions for dam safety management will be required under Queensland Legislation. These requirements are likely to be those defined in the *Queensland Dam Safety Management Guidelines* (DNRW, 2002a) and consistent with the comparable ANCOLD guidelines. Measures have been proposed in Section 26 and below to manage dam safety.

Dam safety	
Environmental Objective	■ Safely manage the risks to the existing environmental values, including surrounding land uses associated with the Project
Performance Criteria	■ Compliance with relevant Standards, guidelines and legislation.
Mitigation Measures	Public Safety ■ Provide adequate signage to warn public of any dangers. ■ Restrict primary contact recreation if possible. ■ Enhancing physical protection to the public by the use of natural ground features. ■ A safety risk assessment will be undertaken of the Project to identify areas of high risk to public safety. Exclusion zones will be developed to prevent public access to high risk areas, with fences and signs erected to delineate such areas. Security ■ Fencing will protect selected areas with high risk of a security breach or unauthorised public access. ■ Prior to being given access to the restricted areas, visitors will complete mandatory registration and an environmental, health and safety induction. The scope of induction will reflect those areas of the Project site that the visitor will be permitted access. Sunny Day Failure ■ Regular maintenance. ■ Develop Emergency Action Plan (EAP). ■ Remote monitoring by maintenance crew. ■ An Operations and Maintenance manual will be prepared for the dam. The manual must be written such that persons unfamiliar with the dam can operate it properly. This should include procedures for the following: – operating the dam under normal conditions; – coordination with other flow regulating structures within the catchment; – maintaining environmental flows; – coordinating with emergency response and counter disaster agencies; – flood warning; – maintaining the dam, associated structures and associated equipment in accordance with the designer's operating criteria; – a program for surveillance and monitoring of the dam and all associated structures and equipment to allow for early detection of faults, deficiencies and potential environmental issues; – recording and reporting of routine and non-routine surveillance; – remedial action in the event of faults or deficiencies being identified by surveillance; and – periodic review, at regular intervals or when changes or other circumstances dictate.
Monitoring	■ Undertake monitoring in accordance with the Operations and Maintenance Manual. ■ Auditing of the EMP conducted bi-annually (internally) and annually (externally).

Dam safety	
Reporting	■ Record and report all routine and non-routine surveillance in accordance with the Operations and Maintenance Manual.
Responsibility	■ Operator
Corrective Actions	■ Ensure that the appropriate personnel undertake adequate training covering the requirements of the EMP regarding the operation of the dam.

29.10.4. Geology and soils

There will be limited disturbance in the site area during operation of the dam and pipeline after construction ceases. Maintenance of the stability of sediment and erosion control structures and monitoring around the site will be necessary to ensure minimisation of impacts.

Geology and soils	
Environmental Objective	■ Minimise environmental impact by preventing soil loss and erosion. ■ No impact to occur to any significant geological features in the Project area.
Performance Criteria	■ Maintain soil and water control devices for long-term surface stability and protection against erosion. ■ Compliance with the Environmental Protection (Water) Policy, 1997 – section 32 Prohibition on build up of sediment.
Mitigation Measures	■ Maintenance of permanent soil and water control devices. ■ Replanting of vegetation if rehabilitation fails in revegetated areas. Geomorphology ■ continued monitoring of geomorphic assessment sites for potential change that adheres to the construction geomorphic monitoring plan; and ■ bed and bank stabilisation as required in the area immediately below the dam should vertical scour be observed.
Monitoring	■ Regular monitoring of permanent soil and water control devices installed during operational phase for evidence of soil erosion and sedimentation; and ■ Regular inspections by qualified person of structures to ensure compliance with the design specifications. ■ Regular auditing undertaken to ensure compliance with objectives of the EMP.
Reporting	Operator to report on operations as per the Resource Operations Plan.
Responsibility	Operator
Corrective Action	■ Appropriate action will be taken if impacts are found to be unacceptable in terms of adjoining stability, sedimentation or erosion. Depending on the circumstances, appropriate action could include: – structural maintenance; – removal of accumulated sediment; – measures to entrap sediment upstream at a site more accessible for sediment removal; – measures to improve stream bank stability upstream; – replant vegetation in areas where revegetation has failed; or – catchment management measures to minimise erosion from sediment sources.

Operational phase regular maintenance and rectification of any issues identified during regular monitoring may require action with the potential for environmental impact

29.10.5. Surface water quality

Water quality is an important aspect of dam operation as discussed in Section 16. Water quality monitoring during the operation of Connors River Dam will be carried out in as per a Water Quality Monitoring Programme for operation. This programme will be drafted prior to the commissioning of the dam. The objectives for water quality are outlined below.

Surface water quality	
Environmental Objective	To preserve water quality within the Connors River Catchment and downstream and maintain the Environmental Values (EVs).
Performance Criteria	▪ Aquatic ecosystem environmental values as per the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Queensland Water Quality Guidelines. ▪ The overarching performance criterion is to maintain existing ecosystem attributes and water quality within Connors River Catchment throughout operation period. ▪ Surface water quality risk management plan as per the risk management framework contained within the Australian Drinking Water Guidelines.
Mitigation Measures	Undertake a water quality risk assessment (point and non-point sources) to identify and assess water quality risks arising from the catchment and storage, with results to inform the Water Quality Monitoring Programme. Turbidity ▪ Ensure buffer zone is well vegetated, particularly areas that contain dispersive soils; ▪ Where possible, revegetate agricultural land to minimise potential erosion and turbid runoff; ▪ Place signage regarding speed limits related to recreational boating; ▪ Within operational constraints, maintain shoreline water levels so that fringing wetlands and macrophyte beds can persist; and ▪ Manage upstream inputs where possible. For example, rehabilitation of riparian vegetation and restricted access by cattle and recreational users to the riparian zone may decrease bank erosion and turbid inputs into the river Nutrients ▪ Ensure buffer zone is well vegetated, to retard surface runoff and to act as a sink for nutrients; ▪ Maintain shoreline water levels in a manner that allows fringing macrophyte beds to persist as far as reasonably practicable; and ▪ Black water from ablutions in the future recreation area will be directed to septic disposal trenches designed in accordance with the requirements of Isaac Regional Council. Blue Green Algae Blooms ▪ Management of nutrient concentrations within the dam as outlined above; and ▪ Provide warning to recreational users. Water Use ▪ The dam will utilize a multilevel offtake tower to source the most appropriate water. The multilevel offtake will allow water, of appropriate quality, to be drawn from a suitable level within the dam to maintain existing conditions downstream. ▪ Withholding water release during the initial filling phase if water quality is determined to be poor.
Monitoring	Develop an appropriate monitoring program similar to other storages in Central Queensland which will include cyanobacteria sampling. Other suggested water quality monitoring includes: ▪ nutrients, physical-chemicals parameters; iron and manganese levels at a variety of depths; ▪ occurrence of stratification; ▪ metals, herbicides and pesticides that may be present within the impoundments waters at least for the first couple of years of operation; ▪ the recording of ambient temperatures, wind speed and direction, rainfall and inflow (via a weather station and gauging stations) would help place analytical results in context.

Surface water quality	
	Event base monitoring ■ Event-based monitoring may also be carried out in order to understand the inflow of contaminants into the proposed dam site and to monitor the success of catchment management practices. First release strategy ■ Develop a first release strategy to minimise the risk of poor quality water impacting on environmental values downstream of the dam. This is likely to include monitoring water quality in the water storage and in the receiving environment downstream.
Reporting	■ Monitoring results should be compared to the WQOs that support the EVs of the impoundment area and downstream of impoundment area, ■ During and after rainfall, a visual inspection of rehabilitated areas undertaken to ensure no major erosion is occurring. Additional monitoring may be required to determine the extent of stormwater runoff after pulse events. ■ Quarterly water quality reports prepared by operational personnel which report on water quality conditions within the Connors River Dam and Connors River catchment. ■ Reports issued as per the Resource Operations Plan to include any action to be implemented in the case of non-compliance and the person/ organisation responsible for action to be highlighted. ■ Operator to report on dam operations as per Resource Operations Plan.
Responsibility	■ Dam Operator ■ On-site operations personnel will be required to undertake the routine water quality monitoring and reporting. Separate personnel (suitably trained environmental scientists) shall independently audit the program as per the Resource Operations Plan, if required.
Corrective Actions	■ Where WQOs and EVs are not met management action should be taken to ensure objectives are met. ■ Any elevated physico-chemical parameters, or nutrient or metal concentrations, observed within the upper catchment, Connors River Dam or in the Connors River, will be identified and the appropriate action taken by the Dam Operator. ■ Any impacts to downstream water quality shall be reported to the DERM and any compromise to the quality of the raw water supplied to any drinking water service provider shall be reported to that provider

29.10.6. Hazardous substances

The operation of the dam and pipeline will have considerably less hazardous substances stored on site than during construction period. The chemicals used during the operation phase will be relatively benign. Substances are likely to consist of small packaged materials for servicing and maintenance of equipment. No bulk substances will be stored on site.

Hazardous substances	
Environmental Objective	■ Management of the purchase, quantities, storage, use and disposal of hazardous substances that may cause environmental harm. ■ Prevent spills from occurring, and contain, clean up and, if necessary, remediate any spills that do occur.
Performance Criteria	Requirements of the Flammable and Combustible Liquids Regulations and the relevant Australian Standards are met, such as: ■ AS4452 The Storage and Handling of Toxic Substances; ■ AS1940 The Storage and Handling of Flammable and Combustible Liquids; and ■ AS3780 The Storage and handling of Corrosive Substances.

Hazardous substances	
	All hydrocarbons will be stored and handled in accordance with: ■ AS 1940-2004; and ■ AS 4897-2008, The design, installation and operation of underground petroleum storage systems. ■ Storage areas clean and tidy. ■ Recording and reporting of incidents accurately and describing the extent of spill that occurred. ■ Correctly sized bunds that are structurally sound and free from materials. ■ Water quality in the dam not impacted as a result of spills within the catchment.
Mitigation Measures	■ In the event of leaks or spills, chemical storage areas will be suitably bunded and constructed to minimise the potential for leaks to cause environmental harm. All chemicals will be stored, handled and used according to provisions in their MSDS. The health risk presented by these chemicals is relatively low. ■ Storage, use and disposal of any chemicals, fuels, solvents or other hazardous materials or substances which may cause pollution, done so in such a way as to not cause environmental harm. ■ All spills involving materials that may cause environmental harm to be contained and effectively cleaned up and measures taken to prevent the incident from recurring.
Monitoring	■ Chemical and fuel storage areas and equipment inspected regularly to ensure the structures, containers and components are not faulty or pose any threat from loss or leakage, and to ensure cleanliness and security. ■ Recording of any spills that occur as an incident, as well as the follow up actions, any results and reporting to authorities. ■ Regular auditing undertaken to ensure compliance with objectives of the EMP.
Reporting	Operator to report on operations as required.
Responsibility	Operator
Corrective Actions	Ensure that all dam personnel are reminded of the requirements regarding hazardous substance transport, storage and management, and shall endeavour to ensure that the situation is improved by the allocation of staff and other resources to rectify any non-conformance.

29.10.7. Social and economic

The operation of the dam will allow the establishment of recreational activities and business possibilities within the region. Water from the dam will also be transported via the pipeline to Moranbah and will eventually service coal mines (and associated urban communities) in the Bowen Coal Basin. Sections 24 and 25 discuss the social and economic implications during operation phase. The management of those is outlined below.

Social and economic	
Environmental Objective	Maximise business activity and amenity values once dam and pipeline are commissioned and operational (revenues and recreational amenity may take a while to establish).
Performance Criteria	■ Visitor numbers and use of recreational areas
Mitigation Measures	■ Effective communication with local community towards the end of the construction period indicating when the recreation facilities will be opened to the public and what facilities will be available. ■ Consultation and communication with landholders about restrictions to land use and development within the pipeline easement
Monitoring	■ None required
Reporting	n/a

Social and economic	
Responsibility	Operator to communicate with local community Recreation area to be managed by Council similar to other local recreation areas.
Corrective Actions	■ None required

29.10.8. Pests and weeds

Monitoring of pests and weeds is an important factor to ensure the project is not adversely impacting on the aquatic environment. Measures have been proposed in Sections 10, 11, 12 and 13 and below to manage the health of the terrestrial and aquatic ecosystems.

Pests and weeds	
Environmental Objective	Minimise the opportunity for aquatic weed growth and increases in abundance or diversity of any other pest species.
Performance Criteria	■ Infestation of weed and pest species reduced within the Project footprint. ■ No additional weed and pest infestations or increase in distribution as a consequence of the operation. ■ All employees working on site attend induction training sessions to identify weeds and pests
Mitigation Measures	■ A weed management plan will be developed for operation of the dam and will accord with existing SunWater plans. Specific management measures for operation will include: – weed inspection across the Project area, targeting VMOs and water storage area edges, to identify the density and distribution of weed infestations; – weed control of new and existing weed infestations identified. Control methods may include physical (e.g. machinery or hand-pulling), chemical (e.g. herbicides) or cultural (e.g. replanting of native species). Specific control methods for all identified weeds in the Project area will be identified in the weed management plan; – weed monitoring (weed density and distribution) of weeded areas to determine effectiveness of treatments and identify areas requiring additional applications; – management methods for declared weeds must be consistent with recommendations in Pest Fact sheets; and – weed management will be undertaken by a suitably qualified officer and will focus on controlling and reducing weed species diversity and density. ■ Installation of educational signage to encourage thoughtful usage of the dam and avoid additional or increased weed and pest infestations
Monitoring	■ The distribution of known declared weeds monitored and, where feasible, a plan made to eradicate or contain these infestations in accordance with the *Land Protection (Pest and Stock Route Management) Act 2002*. ■ Employees/contractors working on site to report presence of pests and declared weeds to the Operator by the end of the working day.
Reporting	■ Operator to report on operations as required.
Responsibility	■ Operator
Corrective Actions	■ Appropriate control measures implemented where infestations occurring.

Appendix 5. Proponent commitments

Sunwater commitments are derived from the mitigation measures referred to in the EIS and Supplementary EIS text and the EMP, which Sunwater will need to incorporate into construction contracts.

Sunwater commits to:

- Finalise the EIS process and further develop the EIS, EMP and supporting documents as necessary in order to finalise the Business Case for the Project.
- Finalise the Business Case in accordance with the Program of Works (**section 1.3.1.1 of the EIS**).
- If the conditions precedent presented in the Business Case are achieved, proceed to implementation. State and Federal Government approval of the EIS is a condition precedent for Business Case approval.
- Develop the detailed design and construction methodologies and inform State and Federal approval bodies of any changes relative to information presented in the EIS (**section 2**) and Supplementary EIS (**Part C**) and follow their direction with respect to any further information requirements prior to construction.
- Finalise the CEMP (**section 29 of the EIS**) by:
  - Undertaking an early contractor involvement process to further develop designs and construction methodologies
  - Completing detailed design and programming of construction works
  - Ensuring compliance with Sunwater's certified EMS
  - Incorporate the outcomes of early contractor involvement in EMP development
  - Liaison with relevant government departments on applicable EMP sections
  - Completion of all sub-plans
  - Submission to State and Federal governments for final approval.
- Liaise with DERM, DEEDI (Fisheries Queensland) and relevant experts as necessary with respect to fishway design and design elements that minimise physical impacts to fauna at the dam (**section 13.2.1 of the EIS**).
- Liaise with DERM, DEEDI and SEWPAC with respect to finalisation of an appropriate offset strategy for vegetation and biodiversity once detailed design has minimised impact to the extent reasonably practicable (**section 10.2.4 and section 11.2.4 of the EIS**).
- Establish community liaison and communication processes that minimise impacts on landholders and maximise benefits for the local community (**section 24.5 and Table 1-6 of the EIS**).
- Construct and operate the infrastructure in compliance with all applicable laws and regulations (**Appendix B of the EIS**).

- Obtain all necessary permits, licences and approvals in time for their appropriate application (**Appendix B of the EIS and Appendix E of the SEIS**).
- Develop Sunwater Operation and Maintenance Manual and Standard Operating Procedures in accordance with Sunwater's EMS and the requirements of the ROL (**section 29 of the EIS**).
- Undertake all monitoring, auditing and reporting to comply with the Final EMP, ROL, Sunwater's EMS and all conditions of approval (**section 29, section 1.1 of the EIS**).

Appendix 6. Fitzroy river turtle and white-throated snapping turtle species management program requirements

(a) Sunwater must prepare a Species Management Program to mitigate impacts to the Fitzroy River turtle and white-throated snapping turtle. The Species Management Program must be submitted to and approved by DERM two months prior to the commencement of construction. The Species Management Program must outline measures to achieve the following:

  (i) minimise impacts to the Fitzroy River turtle and white-throated snapping turtle;

  (ii) strengthens and enhance survival of the Fitzroy River turtle and white-throated snapping turtle in the wild; and

  (iii) achieve a net conservation benefit for the Fitzroy River turtle and white-throated snapping turtle.

(b) The Species Management Program must be prepared and implemented for the construction phase and operational life of the project.

(c) As a minimum, the Species Management Program must address the following:

CONSTRUCTION PHASE

(d) Prior to the closure of the dam wall, develop and conduct in consultation with and to the satisfaction of DERM a baseline study of Fitzroy River turtle and white-throated snapping turtle populations in each tributary upstream of the inundation area, within the inundation area and extending downstream to the Funnel Creek confluence:

  (i) The baseline study must be conducted for a period of at least 1 year prior to the closure of the dam wall and must establish a tagged population of the Fitzroy River turtle and white-throated snapping turtle;

  (ii) The baseline study must use appropriate survey methodology to capture the Fitzroy River turtle and white-throated snapping turtle and must document:

    (A) Morphometric measurements from each turtle (the precise definition of methods shall be developed in consultation with and to the satisfaction of DERM);

    (B) Estimates of age and sexual maturity;

    (C) Estimates of annual nesting and recruitment;

    (D) Evidence of injury and disease evident within the population, including occurrence rates for injured or dead individuals;

    (E) Known or likely nesting areas, including nesting microhabitat, distance from and height above the water to nest

(F) Estimates of predation and other losses of eggs at nesting areas identified in (d)(ii)(E).

(e) Tagging systems shall be integrated with the DERM Freshwater Turtle Tagging Program. Tagging shall include:

(i) Passive Integrated Transponder (PIT) tags and scanners compatible with fish PIT tagging studies. This aspect shall be adequate to monitor turtle passage upstream and downstream of the dam wall;

(ii) Carapace notching using a multiple notching system determined in consultation with DERM. This method shall be sufficient to allow for turtle identification from dry skeletons;

(iii) Numbered monel metal foot tags. Design and number sequence of these tags shall be determined in consultation with DERM.

(iv) Use of these tagging methods do not preclude the use of additional tagging systems.

(f) In order to implement the baseline monitoring program, Sunwater must use its best endeavours to obtain access to properties located between the dam and the Funnel Creek confluence. If access at certain locations is denied, Sunwater shall liaise with DERM to determine the impact to the baseline program and agree appropriate mitigation measures.

(g) Ensure large woody debris (snags) exist in the impoundment either by: not entirely clearing to the full supply level (FSL); or introducing anchored trees, consistent with the standards and processes described within the *Design Guidelines for Reintroduction of Wood to Australian Streams* (Brooks, 2006);

(h) Provide for effective passage of the Fitzroy River turtle and white-throated snapping turtle at temporary and permanent watercourse crossings which minimises injury, entrapment or death.

OPERATIONAL PHASE

(i) Provide for effective turtle passage upstream and downstream of the dam wall which minimises injury, entrapment or death.

(j) Minimise death and injury of turtles aggregated at or within the downstream side of impoundment structures by reducing the velocity of high volume water release events and excluding turtles from outlet structures that produce high velocities

(k) Provide information signage at the proposed recreation area appropriate to minimising death or injury to turtles from boat strike, propeller cuts and fishing activities

(l) Maintain flows that mimic the natural flow requirements, particularly post winter and summer flows, in accordance with the predicted performance of the project against all Fitzroy Basin Water Resource Plan Environmental Flow Objectives (Tables 14-25 to 14-30, chapter 14 of the EIS)

(m) Include a monitoring, reporting and corrective action regime, to be developed in consultation with and to the satisfaction of the Chief Executive administering the *Nature Conservation Act 1992*, to determine impacts to Fitzroy River turtle and white-throated snapping turtle populations, habitat and passage upstream and

downstream of the dam. Monitoring should comprise annual population surveys in each tributary upstream of the inundation area, within the inundation area, and downstream of the dam to the Funnel Creek confluence during the:

(i) Fitzroy River turtle nesting season (September to November)

(ii) white-throated snapping turtle nesting season (April to July)

(iii) Egg hatching season for both species (November to March).

(n) In the event:

(i) the proposed fish transfer device is non-operational for a period of greater than two weeks during the nesting or egg hatching season of the Fitzroy River turtle or white-throated snapping turtle, or

(ii) if monitoring indicates either species' are aggregating near the dam wall but are not using the fish transfer device in significant numbers;

then under advice from DERM, Sunwater must capture and transfer turtles to release points determined in consultation with DERM. The number of individuals to be transferred, their sex and condition must be determined in consultation with DERM. Transfer must continue on one day per fortnight while conditions (i) or (ii) persist or may be ceased earlier if determined to be appropriate by DERM.

(o) Manage the terrestrial zone around the impoundment and downstream of the dam to Funnel Creek to:

(i) Implement management measures to reduce the predation of turtle eggs;

(ii) Avoid damage to nesting habitat from trampling by stock;

(iii) Prevent terrestrial and aquatic weeds from blocking access to suitable nesting habitat; and

(iv) Increase nesting opportunities and the recruitment of hatchlings into the river system.

(p) Significant nesting banks (banks at which multiple nest sites are confimed during the baseline and annual population surveys as specified at (d)(ii)(E) and (m)) identified in tributaries upstream of, within and downstream of the water storage area to the Funnel Creek confluence must be inspected prior to the Fitzroy River turtle and white-throated snapping turtle nesting season each year and any weeds or seedlings must be physically removed (no herbicides shall be employed). Aquatic weeds which may prevent access to the bank must also be removed.

(q) Monitoring and associated reporting required as part of the implementation of the Species Management Program for the Fitzroy River turtle and white-throated snapping turtle must be linked to the conservation objectives included in the Conservation Plan for the Fitzroy River turtle and white-throated snapping turtle in the Fitzroy Basin (refer to Appendix 3, Condition 2(b)).

Definitions for Appendix 6

Morphometric measurements:

- Straight carapace length and width;
- Straight plastron length and width;

- Head length and width;
- Tail length from carapace, plastron and vent;
- Body weight and depth;
- Head-neck length.

A reduced set of morphometric measurements will be acceptable on achieving a statistically significant survey sample size of both sex and maturity class for the Fitzroy River turtle and white-throated snapping turtle. Minimum morphometric measurements shall include:

- Straight carapace length
- Weight
- Tail length from the carapace.

Appendix 7. Fish passage design and implementation process

FISH PASSAGE DESIGN PROCESS

Under the *Fisheries Act 1994* all waterway barrier works require a development permit, and approval will only be given if fish passage is satisfactorily addressed. In most cases for dams, the incorporation of a fishway is the likely method for providing fish passage. For stream crossings, the design of the crossing itself can incorporate elements that increase the potential for fish passage.

The process set out below details the steps DEEDI (Fisheries Queensland) consider necessary for a successful major Fish Passage Design and Implementation Process. This summarises the process used for the design of major fishways in Queensland and it is a highly consultative process. Maximum use should be made of existing expertise among external (overseas and Australian) fishway designers and biologists as this adds to the quality of the outcome. Whilst elements of the stream crossing design process (eg for roads and pipelines) may need to be run separately due to the different engineering and logistical challenges and personnel, the design processes should be integrated as much as possible, to maximise the use of biological and engineering expertise among the key stakeholders.

The requirements of other aquatic fauna such as turtles should also be considered during the Fish Passage Design and Implementation Process to ensure that there are no adverse effects on these animals and that any facilities are complementary and not detrimental to non-target fauna.

It is important that the operations of the dam in terms of water releases, spillway gates, environmental flow provisions, offtake works and fishway are integrated so that no single component compromises the operation of the others.

The timing of the Fish Passage Design and Implementation Process will to a degree depend on the availability of critical data, however the first meeting must be initiated as soon as possible once the data is available or the project is confirmed.

DESIGN STEPS

(a) Collate as much as possible of the following data:

- (i) site locations and photographs.
- (ii) fish assemblages at the site(s), up and downstream of the site(s) and any relevant behavioural data for those species.
- (iii) Fish habitat at the site(s), up and downstream of the site(s) (as above for turtles, platypus etc).
- (iv) Existing hydrological data (eg flow duration curves, Annual Exceedence Probabilities, flow event curves).
- (v) Projected headwater/tailwater levels at a range of flows.
- (vi) Rate of tailwater rise over a range of flows.

(vii) Modelled storage levels at full entitlements scenario over the simulated period.

(viii) Period of no flows.

(ix) Relevant water management impacting on the site(s), eg environmental flow release requirements, WRP/ROP requirements.

(x) Likely dam operation (including gate operation, flow releases, water offtake, inflow/outflow mimicry etc). Also proposed on-site personnel or remote operation.

(xi) Proposed construction methodologies and timing.

(xii) Proposed dam design, including spillway, offtake works, dissipater design and location, and design of associated upstream and downstream gauging structures.

(b) As far as possible this data should be provided for review prior to the first fishway design meeting.

(c) First meeting (once data is collated)

(i) Discuss existing data, identify data gaps.

(ii) Initiate steps to fill data gaps where practicable.

(iii) Identify a date by which additional data will be collected and disseminated (before first site inspection).

(iv) Discuss possible design types (fishways, diversion channel fish-friendly stream crossings).

(v) Agree on how the preferred design types will be arrived at.

(vi) Agree on date for site inspections.

(d) Site inspection

(i) Inspect site of waterway barriers (dam, temporary and permanent crossings etc) and any associated works (eg gauging structures).

(ii) Inspect catchment below site to identify further impediments to fish passage that may be affected by changes in flow regimes.

(iii) Inspect catchment above site where additional instream works may be required eg raising road crossings above FSL.

(iv) Determine how access to fishway will be provided for monitoring and maintenance purposes.

(v) Relate hydrological data to site(s).

(vi) Agree on date for workshop.

DEVELOPMENT OF FISHWAY DESIGN SPECIFICATIONS

The ‘standard’ Fish Passage Performance Criteria from DEEDI (Fisheries Queensland) and submissions from any other stakeholders (eg DERM) will form the basis for discussion of design specifications of the fishway. Fish Passage Performance Criteria for the fishway have been provided here and more specific criteria for stream crossings will be developed once additional information on these has been provided by Sunwater.

DESIGN WORKSHOP

A fishway design workshop shall be held which allows fishway design issues to be identified and discussed with input from all the relevant stakeholders and experts. It is critical that the proceedings and outcomes of the workshop are captured and accurately recorded by a person with sufficient technical understanding. These minutes will constitute an important part of the whole design documentation.

Fish passage issues to be discussed are:

(a) Fishway providing upstream passage across the dam.

(b) Fishway providing downstream passage across the dam.

(c) Spillway, and dissipater design that minimise injury, death and entrapment of fish.

(d) The provision of fish passage across temporary structures associated with the construction of the dam (eg. haul roads, bunds etc) and pipeline.

(e) The provision of fish passage during stream diversion.

(f) Fish passage at stream crossings.

(g) Fish passage provision at other existing waterway barriers or sites within, up or downstream of the dam where passage opportunities are further limited by the presence/operation of the dam.

(h) Interactions between the fishways and other dam components eg intake works, environmental release works etc.

(i) Operation of the dam and fishway design implications.

(j) Concept Design Documentation is to be agreed on and disseminated prior to next meeting.

POST WORKSHOP MEETINGS

(a) Discuss concept designs.

(b) Agree consultative process and contacts for input into the development of the fishway design.

(c) Discuss post-construction monitoring requirements, including design elements related to monitoring for the fishway and, where relevant, stream crossings.

(d) Establish processes for developing post-construction monitoring, budgets for monitoring, monitoring outcomes, contingencies for post-construction adjustments etc.

(e) Establish process for DEEDI (Fisheries Queensland) input into the proposed operation of the dam as it impacts fish passage and fisheries values at the dam wall and below the dam wall.

(f) Establish processes for developing a Fish Passage Operation and Management Plan including operation and maintenance manual, maintenance program, contingency plans for fishway failure, continuous improvement program etc.

MODELLING (ONCE CONCEPT DESIGN DOCUMENTATION IS AGREED TO BY DEEDI (FISHERIES QUEENSLAND))

A scale model will need to be constructed and run under various flow scenarios to evaluate entrance and exit conditions and flow patterns at the dam wall. DEEDI

(Fisheries Queensland) must be present at this modelling exercise. Outcomes of the modelling exercise are then incorporated into the Concept Design Documentation and these are disseminated for acceptance by DEEDI (Fisheries Queensland).

ONGOING INPUT

Changes to the fishway design (including during construction) which may affect the fishway's capacity to pass fish, its operation or monitoring, must be agreed with DEEDI (Fisheries Queensland).

Once Final Fishway Design Documentation is available, this should be disseminated and a meeting date agreed upon.

FINAL DESIGN MEETING(S)

(a) Discuss Final Fishway Design Documentation and agree on any further modifications.

(b) Final Fishway Design Documentation must be provided to DEEDI (Fisheries Queensland) for inspection prior to commencement of fishway construction

(c) Agree process for consultation and close communication between the construction contractors and DEEDI (Fisheries Queensland) and regular (fortnightly) site visits by DEEDI (Fisheries Queensland) during the construction of the fishway and where relevant, stream crossings to avoid unilateral decisions on the fishway by the construction contractors that could affect its capacity to pass fish, its operation or monitoring.

(d) Agree the inspection program during and close to completion of construction.

(e) Outline contents of Fishway Operation and Management Plan for the site for the first edition of the Plan.

(f) Set up ongoing management process for the fishway to deal with issues arising such as:

  (i) monitoring outcomes

  (ii) associated modifications to the operation or structure of the fishway

  (iii) implementation of continuous improvement obligations

  (iv) operating contingencies

  (v) long-term outcomes.

(g) deliver to DEEDI (Fisheries Queensland) by Sunwater, as soon as reasonably possible after commissioning of the dam, a copy of the final 'as built' drawings for the fishway

(h) Agree on commissioning process and key stakeholders.

(i) Consider community education programs relating to the completed fishways and stream crossings to increase public acceptance of the technologies and to improve public ownership of the structures.

KEY STAKEHOLDERS

BIOLOGICAL

(a) Input from DEEDI (Fisheries Queensland) fishway biologists.

(b) Input from DERM aquatic fauna biologists.

(c) Input form DERM WRP/ROP managers.

(d) Expectation that the fishway design engineers (successful tenderers) would have access to a fishway biologist with some experience in major fishway projects and fish passage at stream crossings.

(e) Sunwater may be required to fund additional fishway biological or fishway engineering expertise as required, as identified by DEEDI (Fisheries Queensland), to assist in the assessment of and input into the fishway design.

(f) Where deemed necessary by DEEDI (Fisheries Queensland) (eg for major structures, innovative technology etc), peer review of the fishway design by independent (possibly overseas) fishway biologist with experience in providing fish passage at similar structures and preferably with comparable biota.

ENGINEERING

(a) Engineers with fishway and fish passage design experience.

(b) Construction managers who have experience in constructing and commissioning fishways are preferred.

(c) Where necessary, peer review of the fishway design by independent fishway engineer(s) with experience in providing fish passage at similar structures and preferably with comparable biota.

OPERATIONAL

(a) Input should be sought from dam operators with experience of similar dams (and possibly fishways) to uncover any operational issues that may have been missed by the fishway design engineers or fishway biologists.

(b) The future operator must be involved at every step of the Fish Passage Design and Implementation Process from the beginning.

(c) Input should also be sought from road construction and maintenance experts in relation to any issues arising from design modifications for fish passage at stream crossings.

PROPONENT

The presence of Sunwater at all elements of the Fish Passage Design and Implementation Process ensures that decisions can be made on the fishway more readily (eg in terms of expenditure implications) without constantly having to refer back to the developer for agreement, outside the process.

FISH PASSAGE PERFORMANCE CRITERIA (NON-EXHAUSTIVE)

GENERAL

(a) DEEDI (Fisheries Queensland) advice on fishway design (including capacity and downstream passage) and operation will necessarily be conservative given the current knowledge available, the longevity of water infrastructure and potential changes to the fish communities and fish behaviour over time.

(b) The quality of materials and components used in the construction of the fishway should be commensurate with its intended service life, operation, reliability, eg to the same standard as the outlet works.

(c) The fishway must cater for the whole fish community at each site in terms of size classes, swimming abilities and biomass. This includes all life stages of the fish species at each site.

(d) The fishway must be designed to be operational all year round when there is an inflow into the impoundment or a release from the impoundment, down to dead storage.

(e) The fishway will be required to operate when there are inflows to the dam, above dead storage level. An inflow/outflow operational model will need to be developed for the fishway.

(f) The fishway must be constructed to operate down to 0.5 metres below minimum tailwater (to allow for changes in tailwater levels and modelling errors) and 0.5 metres below minimum headwater drawdown levels (dead storage level or minimum offtake level, whichever is lower and up to a 1 in 50 year flood or drownout (whichever is lower)). (DEEDI (Fisheries Queensland) experience is that tailwaters at sites after weir or dam construction are generally lower than the modelled tailwater and the 0.5 metres below tailwater rule addresses this anomaly).

(g) Other seasonal fish migration requirements must be identified and included in the operating requirements for fishway, irrespective of flows.

(h) All releases from the impoundments must be directed first through the fishway as a priority over the outlet works (design to take account of this operational requirement if necessary), with the fishway being operated whenever a release is made through it, regardless of whether the release volume is less than the optimal minimum release for fishway operation.

(i) The fishway design should minimise the time that it is non-operational due to maintenance issues, such as siltation, debris, breakdowns, sourcing of parts etc.

(j) Fishway release flows must be at design/optimum levels for the fishway operation as opposed to minimum possible water usage.

(k) Adjacent outlet works should be screened or otherwise designed and placed to prevent fish passing through or becoming trapped in these works.

(l) Spillway design, aprons, stilling basins and dissipater design must minimise fish injury, mortality and entrapment

(m) Fishway entrances must be sited where fish can access them over the full operational range of the fishway.

(n) Outlet works need to be positioned so as not to interfere with fish access to the fishway entrance.

(o) Spillway overtopping flows should initiate and terminate adjacent to the fishway or be directed parallel to the fishway entrance.

(p) Spillway flows should be transferred to fishway releases as soon as possible during a flow recession.

(q) There must be a continuous attraction flow at all times at the fishway entrance when the fishway is operating.

(r) Attraction flow velocities must be sufficient and variable to attract fish but not too high for smaller fish to navigate.

(s) Appropriate light levels must be maintained at fishway entrances.

UPSTREAM PASSAGE

(a) Entrance

- (i) the fishway entrance needs to be accessible under all flow conditions within its operating range
- (ii) fish attracted to the spillway must be able to access the fishway without having to swim back downstream
- (iii) water supply for the fishway and attraction flows must be sourced from surface quality (or equivalent during turnover) water.
- (iv) adequate holding chamber dimensions for the fish biomass (for lock, lift, trap and transfer type fishways)
- (v) adequate hydraulic conditions for all fish within the fishway
- (vi) attraction flow diffusers must be fixed on the back wall of the holding chamber (for lock, lift, trap and transfer type fishways) and positioned so as not to create excessive turbulence and recirculation
- (vii) turbulence and velocities need to be balanced to ensure attraction without precluding smaller fish
- (viii) entrance slot is adjustable.

(b) Exit

- (i) fish should exit so as to avoid entrainment in any outlet work screens and avoid being washed back over the spillway during overtopping
- (ii) cover should be provided for fish moving from the exit
- (iii) fish should exit at water level
- (iv) weeds are controlled at the fishway exits and entrances to ensure that fish swim into water free of weed mats
- (v) trash is excluded from the upstream fishway exit and downstream fishway entrance to ensure that fish can access the exits and entrances and that the fishway is not blocked or damaged by trash.

(c) Outlet works

- (i) outlet works should be adjacent to the fishway
- (ii) the orientation of the outlet works water jet is angled so that it does not mask or isolate the entrance to the fishway or impinge on fish moving up the adjacent riverbank
- (iii) high flow (slug release) should not cause confusing flows at the fishway entrance.

(d) Screens

(i) intake screens dimensions must be such that small fish are not drawn through the outlet works and velocities should be low enough that fish are not impinged on the screens.

(e) Tailwater control and crossing structures

(i) any tailwater control structures such as a gauging weir (proposed and existing), rock bar or stream crossings are fitted with fish passage facilities or designed to allow fish passage

(ii) any existing instream structure downstream of the proposed dam, whose barrier effect to fish passage is increased by changes in flow characteristics due to the proposed dam, must be fitted with fish passage facilities

(iii) any proposed associated waterway barrier works (eg stream crossings) must provide for adequate fish passage.

(f) Downstream passage

(i) downstream passage must be provided whenever the upstream fishway is operating

(ii) fish must be delivered into the tailwaters at or below water level over the full range of tailwater levels including with no flow over the spillway

(iii) appropriately screened to prevent blockage by debris but allow fish passage

(iv) spillway design and associated dissipation structures must minimise the potential for fish injury and mortality during passage over the spillway in overtopping flows.

(g) Provision of fish passage during construction

(i) temporary fish passage must be provided during all phases of construction and during the period prior to the filling of the impoundment and operation of the fishway

(ii) stream crossings for construction traffic should be provided for by full channel bridges

(iii) where culvert type crossings are necessary, the culverts should be of suitable dimensions to pass all flows up to drownout without constriction of the river channel

(iv) flow velocities within any culvert crossings must be controlled so as to permit fish passage over the full range of flows.

FISHWAY CONSTRUCTION PRINCIPLES

In the experience of DEEDI (Fisheries Queensland), construction managers and teams that have worked on fishways previously (eg the installation of vertical slots, fishlocks etc) have been far more successful when building subsequent fishways than those who have never built a fishway. Continuity of fishway construction is preferred.

Fish passage must be maintained during the construction of the dam. Provision will need to be made for fish passage through any coffer dams and access causeways and also through diversion channels, where applicable.

Impacts on water quality must be minimised during the construction phase. Poor water quality can impact both on downstream habitat and also on fish passage, as fish may be unwilling to move into poor quality (eg turbid, deoxygenated or different temperature) water.

DEEDI (Fisheries Queensland) fishway biologists will be required on site during construction at the following times:

(a) Where a rock ramp fishway is being built, at the commencement of construction of the rock ramp and also close to completion of the rock ramp; or

(b) For other fishways, during close to completion and at completion of fishway construction so that the general form of the fishway can be checked for visible errors.

(c) At the dry and wet commissioning of any fishway.

Monitoring access and equipment, such as traps, lifting equipment etc will need to be installed and tested as part of the construction phase.

It is important to note that structural adjustments are likely to be required to fishways in almost every case. Generally, these adjustments are not all identified until after the fishway has been completed, and commissioned and operated for a sufficient period to allow a full performance monitoring program of the fishway to be undertaken. This may go beyond the handover period between the developer and owner and allowance will need to be made to pay for and undertake the required adjustments.

FISHWAY OPERATION PRINCIPLES

The optimal operating regime for the fishway will be an outcome of the results of monitoring during both pre and post construction periods as well as a degree of trial and error. It is not expected that the fishway will be optimally operated from day one. However, there are some minimum operating requirements that the designers need to be mindful of:

The fishway should be operated as per the design levels until monitoring results suggest otherwise and DEEDI (Fisheries Queensland) agree to or propose changes.

Other seasonal fish migration requirements must be identified and included in the operating requirements for fishway, irrespective of flows.

The fishway should be operated when there is any release from the impoundment.

PROJECT INFORMATION

Information availability at the commencement of the Fish Passage Design and Implementation Process will vary from site to site and depend on how comprehensive and/or close to completion the impact assessment process is. Information about the dam project relevant to the Fish Passage Design and Implementation Process includes:

(a) Identity of the operator

(b) Access to site and staff during operation

(c) Proposed operation of the dam

(d) Regulatory processes relating to the dam operation, releases etc eg resource operating licences, resource operations planning etc

(e) Final dam design

(f) Fishway design

(g) Spillway and dissipation designs

(h) Gate operation

(i) Weed control/exclusion

(j) Downstream release regime and offtake volumes and timing

(k) Diversion works

(l) Outlet works capacities

(m) Downstream barriers and impact of the dam on fish passage at these.

As the design process proceeds, further information requirements may be identified.

Definitions

Unless the context otherwise requires, references to the singular includes the plural and the other way around.

Certifier means a suitably qualified engineer and/or fishway biologist with experience and expertise in major fishway projects and fish passage at similar structures and at stream crossings and with comparable biota appointed by DEEDI (Fisheries Queensland) and funded by Sunwater to carry out the Independent Certification.

Concept Design Documentation means the concept plans and drawings for the passage of fish upstream and downstream of the Connors River Dam to be further developed in accordance with the Fish Passage Performance Criteria.

Final Fishway Design Documentation means the drawings, specifications and other documents including a detailed description and record of the Fish Passage Design and Implementation Process activities and proponent undertakings developed by Sunwater based on the Fish Passage Design and Implementation Process for, and necessary to effect, construction of the fishway.

Fish Passage Design and Implementation Process means the process for fish passage across the project waterway barrier works set out in Attachment a of this Coordinator-General's report.

Fishway Operation and Management Plan means a document that incorporates all the current operation and maintenance procedures for the Connors River Dam and fishway.

Fish Passage Performance Criteria means the design, operation, management and other relevant criteria identified and utilised through the Fish Passage Design and Implementation Process and its implementation to maintain fish passage upstream and downstream of the Connors River Dam.

Independent Certification means the services to be performed by the Certifier, including:

(a) Certification of the effectiveness of the fishway in satisfying the Fish Passage Performance Criteria

(b) certification that the Final Fishway Design Documentation is generally in accordance with the Fish Passage Design and Implementation Process

(c) certification that the fishway has been constructed in accordance with the Final Fishway Design Documentation

(d) certification that Commissioning has been achieved.

Commissioning means when the fishway is operational.

Appendix 8. Letters from Sunwater

SunWater Limited
PO Box 16926 City East
Brisbane Queensland 4002
www.sunwater.com.au
ACN 131 034 985

Your ref: EPBC 2008/4429
Our ref: 07-008719/001 Doc #10944771
Contact Name: Sean Fleming
Telephone: 07 3120 0200

28 June 2011

Ms Melissa Nichols
Significant Projects Coordination
Office of the Coordinator-General
Department of Employment, Economic Development and Innovation
Queensland Government
PO Box 15517
CITY EAST QLD 4002

Dear Melissa

CONNORS RIVER DAM AND PIPELINES: MINOR PROJECT DESCRIPTION CHANGES

SunWater has progressed the design of the Connors River Dam to Moranbah pipeline in line with the process noted in the referral (EPBC 2008/4429) and EIS. Relative to information provided in those documents and the Supplement to the EIS, SunWater has increased the size of the pumps near the dam, but decreased the number of pump stations. This has allowed, or led to, other design changes from that described in the Supplement to the EIS, as noted below:

- Pump station 2 and the associated 5ML balancing storage has been removed from the project scope.
- The 600ML earthen balancing storage has been replaced with a much smaller 5ML concrete ring tank.
- The pipeline diameter has been increased from 1200mm to 1500mm between the dam and the balancing storage and from 1125mm to 1200mm from the balancing storage to Moranbah.

The attached drawing shows the currently proposed configuration. The footprint of impact has been reduced as a result of these changes, particularly the removal of the large (600ML) balancing storage. The larger pipe diameter does not require a larger construction easement. Similarly the footprint of the pump station near the dam is little altered.

We also note that the early contractor involvement process undertaken in recent months suggests that the preferred contractors may wish to slightly alter some other aspects of the project as presented in documentation to date. The types of possible changes that have been raised to date include the size and shape of the dam construction site footprint, the volume of construction water

and the length of pipeline trench left open at the end of each day. The former is a result of the contractor suggesting a layout of construction site items (batch plants, offices, parking, storage areas, workshops etc) which they believe is safer and more internally efficient. Similarly the contractor suggests the EIS requirement to leave only 50m of pipeline trench open at the end of each day is unnecessarily restrictive and does not conform to current best practice. They suggest much longer lengths be allowed but with a requirement for regularly spaced fauna exit ramps in accordance with recommendations within the APIA guidelines, which were referenced in the EIS.

SunWater concludes that the changes (and possible changes) noted above do not materially alter the conclusions of the EIS (and Supplement) with respect to the potential for impact on Matters of National Environmental Significance. Such relatively minor changes to design, construction methods or operational procedures are likely to continue as the project progresses, if approved. SunWater suggests that such a possibility is taken into account in any approvals granted for the project. SunWater will continue to inform the Coordinator-General's Office of any changes as they come to light.

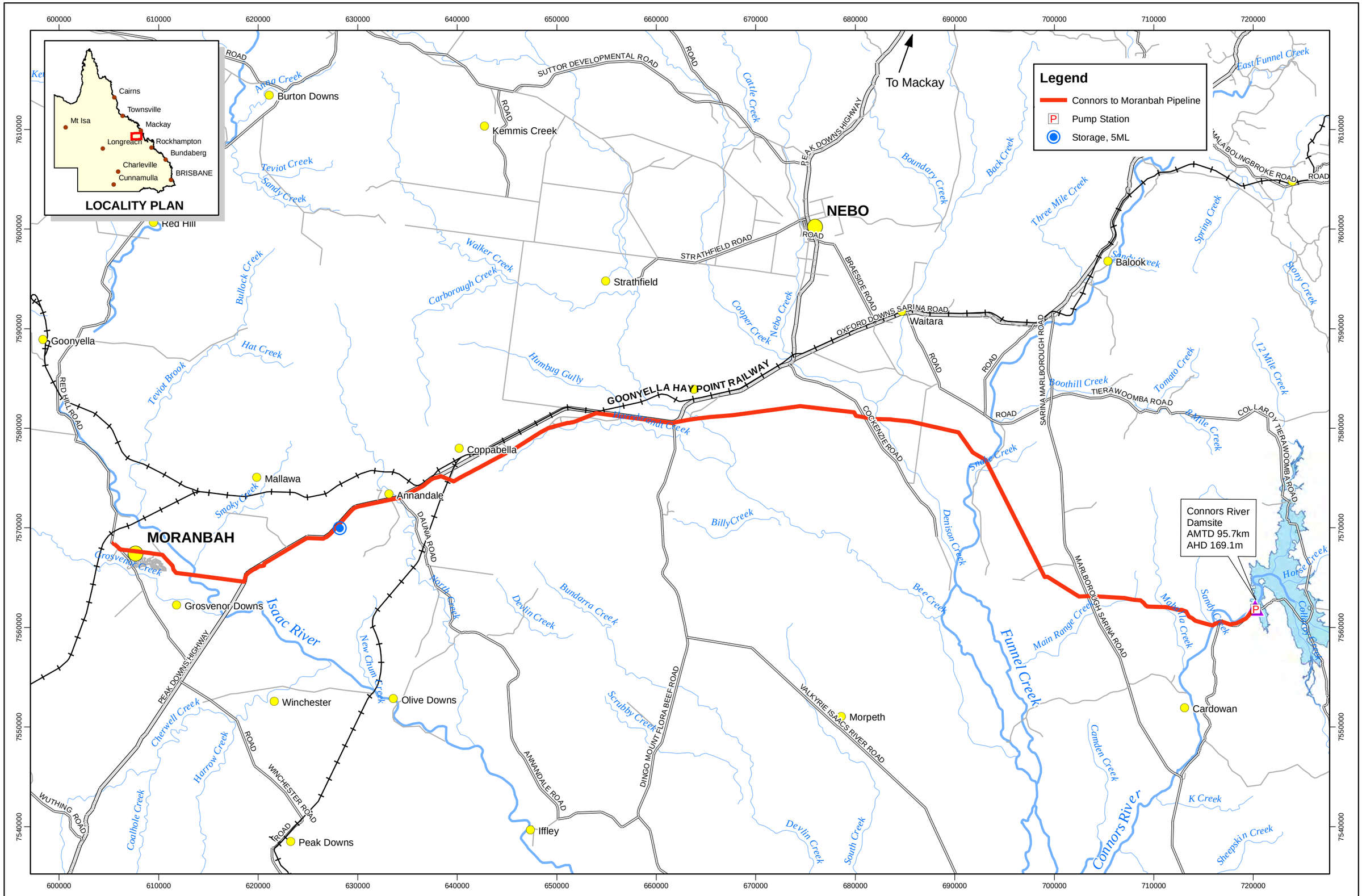
A similar letter to this one has been sent to David Rhind at SEWPAC.

Should you require any further information regarding the above, please don't hesitate to contact me on (07) 3120 0200.

Yours sincerely

Sean Fleming
SENIOR PROJECT MANAGER

Att Connors to Moranbah Pipeline – Location Plan



Document: T:\Asset Solutions\SW-Connors River Dam and Pipelines\P-ASWP-0025-AA-02 Connors to Moranbah Pipeline\Drawings\ArcMap\239595.mxd
Printed: Tuesday, June 28 2011 09:33:58 AM

MAP PRODUCED BY:
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REVISION					DATE
DATE		REMARKS	CKD	PSD	

MAP INFORMATION
Coordinate System: MGA94 Zone 55

N W E S

SCALES (A3 SIZE)
0 5 10 15 20 km
1:350,000

DRAWN	DESIGNED
KFP	
CHECKED	CHECKED
APPROVED	

CONNORS TO MORANBAH PIPELINE
LOCATION PLAN

CONTRACT NUMBER

DRAWING NUMBER
239595

DATE **JUNE 2011**

SunWater Limited
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Brisbane Queensland 4002
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ACN 131 034 985

Our ref: 07-008719/001 Doc 1111278
Contact Name: Sean Fleming
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12 August 2011

Ms Melissa Nichols
Significant Projects Coordination
Office of the Coordinator-General
Department of Employment, Economic Development and Innovation
Queensland Government
PO Box 15517
CITY EAST QLD 4002

Dear Melissa

REQUESTED INFORMATION REGARDING PROJECT CHANGES TO THE CONNORS RIVER DAM AND PIPELINES PROJECT

In response to requests made in your email of 30 June, SunWater provides the following information.

Advise whether this conclusion (changes do not materially alter the conclusions of the EIS) applies to other potential impacts of the project that do not specifically relate to MNES.

No material changes to the conclusions of the EIS are anticipated related to these design developments. Impacts that are largely related to the project footprint (the ground area impacted), such as flora and fauna, noise and dust, land use, soils, stormwater runoff and so on, are all reduced if the footprint is reduced. Removal of the 600 ML balancing storage reduces the footprint by 30 ha hence reducing impact. SunWater confirm our earlier conclusion that no material increase to impact will occur due to project changes described in our correspondence to you dated 28 June 2011. This statement applies to all matters considered in the EIS (not only MNES).

Details of increased capacity (and footprint) of pumps near the dam and confirm (and quantify where necessary) if increased pump size will result in additional environmental impact (for example, noise, air, greenhouse emissions).

It should be noted that section 2.3.2.2 of the EIS forecast this potential change in pump configuration by noting "If possible, fewer pumps to achieve the required duties will be designed into the system". Essentially, this has now been achieved with the added improved environmental outcome of reduced power requirement and therefore reduced greenhouse gas emissions.

Following an optimisation process which considered forecast future power consumption the pipeline configuration has been adjusted to minimise power requirements which in turn results in an

increased pipeline diameter. The adopted arrangement (one pump station) requires approximately 7,500 kW of power whereas to run the three pump station arrangement specified in the EIS requires approximately 13,050 kW of power. This should reduce greenhouse gas emissions (associated with power consumption to run the pumps) by approximately 43% compared against the configuration defined within the EIS.

The footprint of the new pump station arrangement is now directly at the toe of the dam so excavation has been reduced considerably as it is tucked into the dam wall configuration. The pumps will be housed in an enclosed dry well so noise impact should be reduced relative to the EIS case.

SunWater has not identified any other potential changes to previously assessed impacts.

Clarification as to whether the increased pipeline diameter requires a deeper trench, and implications for potential human and fauna safety, stream crossings, additional bedding material requirements, additional trench spoil handling and disposal, and transport and road impacts.

As was noted in Section 2.3.2.2 (p2-49) of the EIS "[t]he diameter of the pipe has little bearing on impact assessment as the required easement width and construction procedures are the same. It does however impact on the amount of bedding sand required".

The pipe transport requirements as described within the EIS will not alter as there will be the same number and type of trucks used to transport the pipe and the same number of pipes on each truck.

The pipeline will require the same depth of cover i.e. the minimum cover remains 900mm. Given the pipe is slightly larger (up to 300mm) the pipeline trench dimensions will remain similar other than being 300mm deeper over the length of the alignment from the dam to the balancing storage, and 75mm deeper beyond that point. The hazards related to human and fauna safety remain the same and will be managed by the processes currently outlined in relevant EMPs. Stream crossing methods are not currently foreseen to alter and there is no change to the easement width so the impact will be the same as expressed in the EIS.

The volume of trench spoil will be increased by approximately 25% for the length of the alignment from the dam to the balancing storage and approximately 7% from then on to Moranbah. As the EIS proposed spreading and compacting excess spoil over the easement, or using the spoil to address local erosion issues, these works do not affect the local road network. The additional spoil should result in little change in final landform, hence no material change in impact levels.

There will be a similar proportional requirement for additional embedment sand, equating to an increase of approximately 150,000 m^3. It should be noted however that the removal of the 600 ML balancing storage removes the need for the proposed clay extraction area near the Isaac River. This volume of clay was estimated at 175,000 m^3. As a result there will be a decrease in transport requirement on the western end of the pipeline route. The EIS transport consultants, SKM, have re-run the models using only the change in bedding sand and produced a replacement for Table 21-7 of

the EIS which is shown below (Table 1). SKM concluded: "Compared to the LOS estimates previously determined in the EIS, the estimated LOS for each affected road does not change with the increase in bedding material delivery".

As the revised road capacity assessment identifies no significant change in the roadway operational conditions during the period of bedding material delivery, no changes or additions are therefore required to the identified mitigation measures stated in Section 19.4.3 of the EIS.

Table 1: Estimated levels of service for affected roads – revised bedding material quantity

	Road	Segment/location	Background traffic			Background traffic plus estimated Project construction traffic		
			2012[1] AADT [vpd]	CV [vpd]	LOS [2]	2012[1] AADT [vpd]	CV [vpd]	LOS[2]
10G	Bruce Highway (Mackay – St. Lawrence)	At St. Lawrence Connection Road	2,550	820	B	2,581	832	B
		Koumala	3,710	740	B	3,758	758	B
		South of Armstrong Beach	4,410	1060	B	4,546	1,120	B
		South of Mackay	13,220	1590	D	13,819	1,913	D
33A	Peak Downs Highway (Clermont - Nebo)	West of Coppabella	4,240	850	B	4,585	997	B
		East of Coppabella	4,050	610	B	4,504	831	B
		East of Bee Creek	3,750	680	B	4,463	1,048	B
		North of Braeside Road	5,970	1010	C	6,791	1,451	C
		Retreat Hotel Permanent Counter	6,450	1100	C	7,390	1,615	C
85C	Fitzroy Developmental Road	South of Middlemount Turnoff	840	210	A	864	222	A
		Valkyrie Permanent Counter	2,060	370	A	2,074	370	A
512	Marlborough – Sarina Road	At Horse Creek	160	30	A	162	30	A
		At Clark Creek	230	40	A	232	40	A
		2km South of Bruce Highway intersection	6,470	520	C	6,472	520	C
		East of Stony Creek	870	120	A	872	120	A
514	Oxford – Sarina Road	East of Denison Creek	1,050	170	A	1,061	170	A
		Range Road - South of Sarina	2,570	210	B	2,584	210	B
5124	St. Lawrence - Croydon Road	At Croydon Range	90	10	A	91	10	A

Source: DTMR 2007 Traffic Census

[1] Background growth based on historical growth rates

[2] Level of Service: A – excellent; B – good; C – satisfactory; D – tolerable; E – congested; F – very congested

As there is no change in the LOS, no other sections of the EIS require change nor does any part of the SEIS. Hence all management procedures, permit application processes, future reports and manuals etc and the process for determining contributions toward road maintenance specified in the EIS and SEIS remain unchanged.

The project has already been defined through the gazetted declaration and publicly notified EIS. Please advise if SunWater would like to make additional changes to the project at this stage.

SunWater wishes to reiterate that the "definition" of the project in all documents to date, including the Project Description within the EIS, has clearly included a margin for change and project development, being variously described as concept or preliminary design phase. The TOR acknowledges this; "[t]he details may vary as the project is refined." In SunWater's experience this is standard process and recognises the evolution of any project as it progresses through project development phases.

As the design develops, any changes to the impacts as assessed in the EIS process will be reassessed at the level appropriate to the extent of change and both the Coordinator-General and any agency involved in approvals will be informed (including SEWPaC where relevant). Clearly, the majority of potential future changes will be developed on the basis that they lead to an overall improvement in the performance of the project and result in decreased, rather than increased impacts.

At this stage SunWater does not wish to make additional changes to the project as defined in EIS and SEIS documentation.

At the Coordinator-General's discretion, we provide draft text below that may suit incorporation as a note to the Project Description:

> *SunWater has advised that the design process for the project has continued during EIS assessment and has notified the Coordinator-General (and SEWPaC) of the following developments since initial EIS and SEIS development:*
>
> - *The originally proposed 7 pumps at the dam pump station have been replaced with 3 larger pumps. This allowed efficiency improvements in pipeline design as noted below;*
> - *The second pump station and associated 5 ML balancing storage is no longer required;*
> - *The 600 ML earthen balancing storage can be replaced with a 5 ML concrete ring tank;*
> - *As a result of the above, there is no requirement for the clay extraction area near the Isaac River;*
> - *The pipeline diameter between the first pump station at the dam and the former 600 ML storage site is increased from 1200 mm diameter to 1500 mm diameter and from this former storage to Moranbah from 1125 mm to 1200 mm.*
>
> *SunWater has assessed the impacts related to these changes and notified the Coordinator-General of the results. While the changes generally reduce impacts, the Coordinator-General*

requested confirmation of impacts with respect primarily to Greenhouse Gas and Transport. Those assessments have been provided by SunWater and are appended as notes to the relevant chapters in this report.

We trust this information satisfies your request (email dated 30 June 2011). Should you require any further information regarding the above, please don't hesitate to contact me on (07) 3120 0200.

Yours sincerely

Sean Fleming
SENIOR PROJECT MANAGER

Appendix 9. World Heritage values

Outstanding example representing a major stage of the earth's evolutionary history

The Great Barrier Reef is by far the largest single collection of coral reefs in the world. The World Heritage values of the property include:

- 2904 coral reefs covering approximately 20,055km^2;
- 300 coral cays and 600 continental islands;
- reef morphologies reflecting historical and on-going geomorphic and oceanographic processes;
- processes of geological evolution linking islands, cays, reefs and changing sea levels, together with sand barriers, deltaic and associated sand dunes;
- record of sea level changes and the complete history of the reef's evolution are recorded in the reef structure;
- record of climate history, environmental conditions and processes extending back over several hundred years within old massive corals;
- formations such as serpentine rocks of South Percy island, intact and active dune systems, undisturbed tidal sediments and "blue holes"; and
- record of sea level changes reflected in distribution of continental island flora and fauna.

Outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment

Biologically the Great Barrier Reef supports the most diverse ecosystem known to man and its enormous diversity is thought to reflect the maturity of an ecosystem, which has evolved over millions of years on the northeast Continental Shelf of Australia. The World Heritage values include:

- the heterogeneity and interconnectivity of the reef assemblage;
- size and morphological diversity (elevation ranging from the sea bed to 1142m at Mt. Bowen and a large cross-shelf extent encompass the fullest possible representation of marine environmental processes);
- on going processes of accretion and erosion of coral reefs, sand banks and coral cays, erosion and deposition processes along the coastline, river deltas and estuaries and continental islands;
- extensive *Halimeda* beds representing active calcification and sediment accretion for over 10 000 years;
- evidence of the dispersion and evolution of hard corals and associated flora and fauna from the "Indo-West Pacific centre of diversity" along the north-south extent of the reef;
- inter-connections with the Wet Tropics via the coastal interface and Lord Howe Island via the East Australia current;
- indigenous temperate species derived from tropical species;
- living coral colonies (including some of the world's oldest);
- inshore coral communities of southern reefs;
- five floristic regions identified for continental islands and two for coral cays;
- the diversity of flora and fauna (refer to Table 28-2 of the EIS for a complete list)
- the integrity of the inter-connections between reef and island networks in terms of dispersion, recruitment, and the subsequent gene flow of many taxa;
- processes of dispersal, colonisation and establishment of plant communities within the context of island biogeography (e.g. dispersal of seeds by air, sea and vectors such as birds are examples of dispersion, colonisation and succession);

- the isolation of certain island populations (e.g. recent speciation evident in two subspecies of the butterfly *Tirumala hamata* and the evolution of distinct races of the bird *Zosterops spp*);
- remnant vegetation types (hoop pines) and relic species (sponges) on islands
- evidence of morphological and genetic changes in mangrove and seagrass flora across regional scales; and
- feeding and/or breeding grounds for international migratory seabirds, cetaceans and sea turtles.

Contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty

The Great Barrier Reef provides some of the most spectacular scenery on earth and is of exceptional natural beauty. The World Heritage values include:

- the vast extent of the reef and island systems which produces an unparalleled aerial vista;
- islands ranging from towering forested continental islands complete with freshwater streams, to small coral cays with rainforest and unvegetated sand cays;
- coastal and adjacent islands with mangrove systems of exceptional beauty;
- the rich variety of landscapes and seascapes including rugged mountains with dense and diverse vegetation and adjacent fringing reefs;
- the abundance and diversity of shape, size and colour of marine fauna and flora in the coral reefs;
- spectacular breeding colonies of seabirds and great aggregations of over-wintering butterflies; and
- migrating whales, dolphins, dugong, whale sharks, sea turtles, seabirds and concentrations of large fish.

Provide habitats where populations of rare and endangered species of plants and animals still survive

The Great Barrier Reef contains many outstanding examples of important and significant natural habitats for in situ conservation of species of conservation significance, particularly resulting from the latitudinal and cross-shelf completeness of the region. The World Heritage values include:

- habitats for species of conservation significance within the 77 broad-scale bioregional associations that have been identified for the property and which include:
    - over 2900 coral reefs (covering 20 055km^2) which are structurally and ecologically complex;
    - large numbers of islands, including:
        - 600 continental islands supporting 2195 plant species in 5 distinct floristic regions;
        - 300 coral cays and sand cays;
        - seabird and sea turtle rookeries, including breeding populations of green sea turtles and Hawksbill turtles; and
        - coral cays with 300-350 plant species in 2 distinct floristic regions;
    - seagrass beds (over 5000km squared) comprising 15 species, 2 endemic;
    - mangroves (over 2070km squared) including 37 species;
    - *Halimeda* banks in the northern region and the unique deep water bed in the central region; and
- large areas of ecologically complex inter-reefal and lagoonal benthos; and
- species of plants and animals of conservation significance.

Appendix 10. Sunwater offset proposal

CONNORS RIVER DAM AND PIPELINES PROJECT
REVISED OFFSET PROPOSAL

PROJECT	Connors River Dam and Pipelines
PREPARED FOR	SunWater Limited
PREPARED BY	Biodiversity and Carbon
DATE	10 November 2011

ecofund queensland

COMMERCIAL IN CONFIDENCE

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ECOFUND TEAM MEMBERS RESPONSIBLE FOR THIS REPORT:

Biodiversity and Carbon

Darren Grover	General Manager
Kate McBean	Project Manager
Rachel Fletcher	Senior GIS Officer
Christopher Ewing	Environmental Analyst

Version: Final			
Reviewed by:	Darren Grover	Approved by:	Peter Stark
Position:	General Manager	Position:	Chief Executive Officer
Signature:		Signature:	
Date:	10 November 2011	Date:	10 November 2011

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

BPA	Biodiversity Planning Assessment
BVG	broad vegetation group
DERM	Department of Environment and Resource Management
EIS	Environmental impact statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
HVR	High value regrowth
MNES	Matters of National Environmental Significance
NA	Not applicable
PMAV	Property Maps of Assessable Vegetation April/July 2011
PR	Performance requirement
QREM	Queensland Regional Ecosystems Mapping Version 6b 2009
RE	Regional ecosystem
SEIS	Supplementary EIS
SEWPaC	Department of Sustainability, Environment, Water, the Arts and Communities
TEC	threatened ecological community
The code	*Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions – version 2*
The project	The Connors River Dam and Pipelines Project
VM Act	*Vegetation Management Act 1999*

1 BACKGROUND

1.1 Connors River Dam and Pipelines Project

The Connors River Dam and Pipelines Project (the project) is located near Mount Bridgett, 110 km due east of Moranbah. The project involves the construction and operation of the Connors River Dam and associated water distribution infrastructure in central Queensland. Water from the dam (up to 49,500 ML per annum) will be transported via pipeline to Moranbah and will service coal mines (and associated communities) in the central Queensland coal basin. In addition, up to 5,000 ML per annum will be available for purchase and use by downstream agricultural users.

The pipeline to Moranbah will be approximately 133 km long and will involve the clearing of 168 ha of remnant vegetation. Infrastructure associated with the project, including access roads, will involve the clearing of approximately 144 ha of remnant vegetation. The dam will inundate an area of approximately 5,850 ha including 2,061 ha of native remnant vegetation (**Figure 1**).

1.2 State significant project

On 7 March 2008, the Connors River Dam and Pipelines project was declared a significant project for which an environmental impact statement (EIS) is required under Part 4 of the *State Development and Public Works Organisation Act 1971*. An EIS has been prepared by SunWater and has been released for public consultation. The EIS describes the project, existing environment, potential impacts and mitigation measures. Public submissions on the EIS have been received by SunWater and a supplementary EIS (SEIS) has been prepared in response to the issues raised, including the requirement for environmental offsets. The SEIS is currently being reviewed by the Queensland Government Coordinator-General. The process also satisfies the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.3 Environmental offset proposal

A draft Strategic Offset Proposal was prepared by Ecofund in April 2011 outlining a strategic approach to acquitting the offset requirements of the project with respect to both Queensland and Australian Government needs. The intent of the strategic approach was to protect and enhance large tracts of remnant and non-remnant vegetation containing the same or similar values as those impacted by the project and to expand the existing protected area estate. The draft proposal was favourably reviewed by Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). The Proposal was submitted to the Department of Environment and Resource Management (DERM) for approval.

Approval of the Proposal was not granted by DERM as it did not strictly comply with the *Policy for Vegetation Management Offsets 2009* and, on this basis, Ecofund has prepared a Revised Offset Proposal. The Revised Offset Proposal identifies a solution for acquitting the offset requirements of the

project based on strict compliance with the *Policy for Vegetation Management Offsets Version 3*. Aspects of the strategic offset proposal have been maintained in order to satisfy requirements under the EPBC Act.

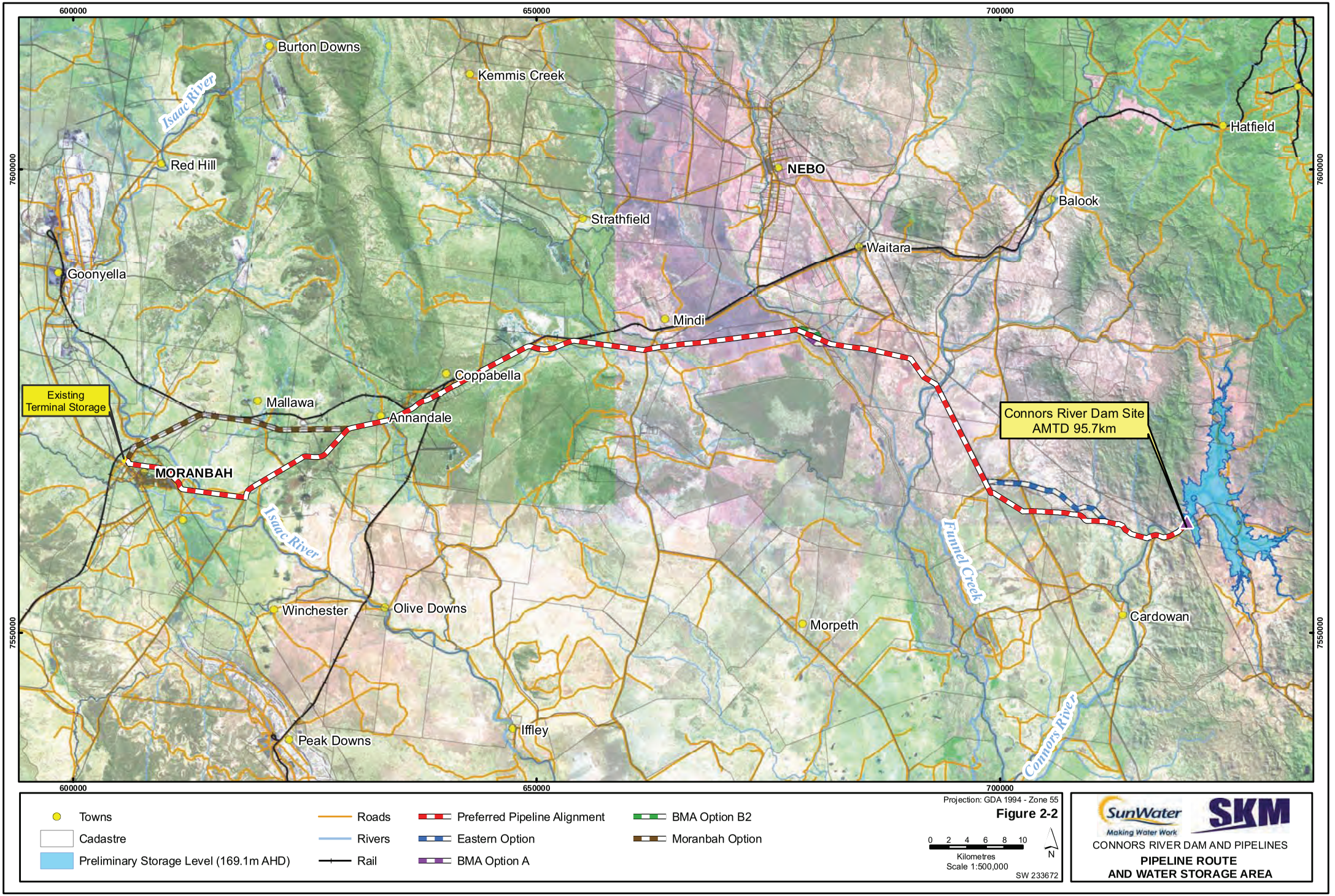


Figure 1: Project overview as presented in EIS

2 METHODS

2.1 Analysis of the impacts and offset requirements of the project

Impact values and the data used to estimate additional impacts were provided by SunWater and Sinclair Knight Merz (lead consultant for the EIS). This included spatial data of the inundation area, pipeline, associated infrastructure and vegetation mapping (compiled by 3D).

Ecofund estimated impacts of the project in relation to two performance requirements (PRs) in the *Regional Vegetation Management Code for Brigalow Belt and New England Tablelands Bioregions – version 2* (the code): PRS.3 –watercourses and PRS.4 – connectivity. For PRS.3 – watercourses, impacts were based on vegetation clearing within stream order specific buffers as per the code. Buffers were created around each stream order based on the centrelines of watercourses mapped by DERM. For PRS.4 – connectivity, Ecofund determined the impacts of the inundation area, pipeline and associated infrastructure based on an assessment against Acceptable Solution (AS) S4 of the code.

Ecofund also estimated the impacts of the project on endangered Brigalow Threatened Ecological Community (TEC) based on EIS (3D) data. Information on the Brigalow regional ecosystems (RE) was obtained from the EPBC Act listing advice[1]. All other impact values, including impacts on endangered and of concern regional ecosystems (PRS.7), and essential habitat (EH; PRS.8), were obtained from the EIS.

Ecofund has used these impacts to determine the offset requirements of the project based on an assessment against the criteria of the *Policy for Vegetation Management Offsets Version 3* and offset requirements for MNES under the EPBC Act.

2.2 Identification of the Queensland Government vegetation offset options of the project

SunWater requested that properties purchased in order to undertake the project, including Ridgeland, Collaroy and Marylands, be assessed first for their potential to offset the impacts of the project. The acquittal of residual offset requirements was sought on other properties within the Brigalow Belt bioregion.

The potential offset areas for impacts to PRS.3, PRS.4, PRS.7 and PR.S8 have been identified on lots with landlease, leasehold or freehold tenure that contain suitable environmental values mapped as non-remnant. These areas do not include HVR vegetation that is endangered or Essential Regrowth

[1] See: http://www.environment.gov.au/biodiversity/threatened/publications/pubs/brigalow-regrowth.pdf

Habitat (ERH), but may include other restricted areas such as slopes greater than 12%, 100 m from a wetland and Stream Protection Zones.

Pre-clear RE mapping (DERM 2009) was used to determine the pre-clear RE and broad vegetation group (BVG) of non-remnant areas suitable for offsets for PRS.7 impacts.

Ecofund has identified offset areas on Ridgeland which are likely to be mapped incorrectly as BVG 16c instead of BVG 9e based on the field surveys undertaken as part of the EIS. That is, ground-truthed vegetation mapping produced by 3D at a larger scale than DERM RE mapping within the inundation area has identified large areas of RE 11.3.4a (BVG 9e) that are incorrectly mapped as RE 11.3.4 (BVG 16c) in the DERM RE mapping. This inaccuracy is unlikely to be limited only to vegetation within the inundation area. Given the proximity of the areas of RE 11.3.4 mapped by DERM within the proposed offsets on Ridgeland to the areas identified as RE 11.3.4a by 3D it is likely that they are in fact RE 11.3.4a. However, only field surveys will determine the precise extent of REs 11.3.4 and 11.3.4a.

2.3 Limitations

The following limitations apply to the potential offset areas identified in this assessment:

- This is a desktop assessment only. The offset potential of the identified areas is subject to on-ground verification of environmental values.
- Some HVR may be restricted areas, although ERH has been considered, slope and stream protection zones have not.
- The potential offset areas may include areas that have conflicting land uses such as agriculture.
- Landholders who own or lease these lots may not be interested in using parts of their land as offsets (though SunWater will be the owner of all properties impacted by the dam in which case this limitation does not apply).
- These areas may be predominantly cleared and therefore may require extensive revegetation.

3 IMPACTS REQUIRING OFFSETS

The impacts of the project requiring offsets are presented in Sections 3.1 - 3.5. The project impacts on endangered and of concern REs, watercourse vegetation, connectivity, EH and MNES. Where possible, the impacts requiring offsets are presented according to infrastructure components as follows:

1. inundation area
2. pipeline
3. associated infrastructure.

3.1 Impacts of the project on of concern and endangered regional ecosystems

The project impacts on approximately 990 ha of vegetation classified as of concern or endangered REs under the VM Act (*Vegetation Management Act 1999*). Of this 990 ha, approximately 907 ha will be impacted within the inundation area (**Table 1**), 45 ha will be impacted by the construction of the pipeline (**Table 2**) and 38 ha will be impacted by the construction of associated infrastructure (**Table 3**). Impacts on of concern and endangered REs do not include impacts that are less than 0.5 ha, as per AS S.7.1 of the code.

Table 1: Impacts of the inundation area on endangered and of concern regional ecosystems

REGIONAL ECOSYSTEM	VM ACT STATUS	BVG	IMPACT AREA (HA)
11.12.8	of concern	13c	1.57
11.3.2	of concern	17a	176.31
11.3.4	of concern	16c	186.57
11.3.4a	of concern	9e	539.30
8.12.16	of concern	7a	3.00
Total			**906.75**

Table 2: Impacts of the pipeline on endangered and of concern regional ecosystems

REGIONAL ECOSYSTEM	VM ACT STATUS	BVG	IMPACT AREA (HA)
11.3.4	of concern	16c	5.02
11.3.4a	of concern	9e	12.76
11.3.2	of concern	17a	25.30
11.3.1	of concern	25a	0.90
11.9.5	endangered	25a	1.31
Total			**45.29**

Table 3: Impacts of associated infrastructure on of concern regional ecosystems

REGIONAL ECOSYSTEM	VM ACT STATUS	BVG	IMPACT AREA (HA)
11.12.8	of concern	13c	19.32
11.3.2	of concern	17a	2.14
11.3.4	of concern	16c	1.17
11.3.4a	of concern	9e	9.22
8.12.16	of concern	7a	5.75
Total			**37.60**

3.2 Impacts of the project on watercourse vegetation

The Project will impact on approximately 1,411 ha of vegetation classified as watercourse vegetation. **Table 4** outlines the impacts of the inundation area, pipeline and associated infrastructure based on stream order classification.

Table 4: Watercourse vegetation impacts - Connors River Dam and Pipelines

STREAM ORDER	INUNDATION AREA (HA)	PIPELINE (HA)	ASSOCIATED INFRASTRUCTURE (HA)	TOTAL (HA)
1	103.82	8.95	11.97	124.74
2	76.89	3.74	2.60	83.23
3	139.05	4.60	1.54	145.19
4	161.78	2.86	2.24	166.88
5	683.72	2.44	-	686.16
6	187.65	6.00	10.20	203.85
7	-	1.30	-	1.30
Total	**1,352.91**	**29.89**	**28.55**	**1,411.35**

3.3 Impacts of the project on connectivity

The scale and location of the project will result in the fragmentation of vegetation, particularly as a result of the inundation of the water storage area and clearing of the pipeline corridor. The total impact on connectivity, based on an assessment of AS S.4 of the code, has been estimated to be 2,373 ha.

3.4 Impacts of the project on essential habitat

The project will impact on approximately 62 ha of vegetation classified as EH for the little pied bat (**Table 5**).

Table 5: Impacts of the project on mapped essential habitat

SPECIES	NATURE CONSERVATION ACT 1992 STATUS	EXTENT (HA)
Little pied bat (*Nyctophilus corbeni*)	Vulnerable	62.36

3.5 Matters of National Environmental Significance

3.5.1 Squatter pigeon and other threatened fauna

Southern squatter pigeon, listed as vulnerable under the EPBC Act, was the only EPBC Act threatened species recorded from the dam and surrounding area. The EIS noted that approximately 1,830 ha of habitat for the squatter pigeon will be impacted by the inundation area plus approximately 166 ha on the current preferred pipeline alignment. The extent of impact was assessed as minimal. Potential habitat for two other threatened fauna species, the Australian painted snipe and red goshawk, will be cleared, however neither species was confirmed as present and potential impacts were assessed as minimal.

3.5.2 *Eucalyptus reveretiana*

This vulnerable species was found near, but not within, the pipeline easement and may be present at points not yet inspected. The risk was considered low.

3.5.3 Fitzroy River turtle

Fitzroy River turtle was found within and downstream of the water storage area. A significant mitigation effort was included in both construction and operation phases of the Project to minimise impacts on the species. The EIS and SEIS concluded that a minor residual impact will exist after mitigation strategies are employed. The length of potentially suitable (Order 4 and larger) riverine habitat impacted is approximately 69.4 km. This will not all be lost to the species as it will be able to use the water storage area, particularly when mitigation strategies are employed.

3.5.4 Brigalow ecological community

The pipeline will impact upon a maximum of 2.21 ha of Brigalow TEC, listed as endangered under the EPBC Act.

4 COMPLIANCE WITH THE REGIONAL VEGETATION MANAGEMENT CODE

Compliance with Part S: Requirements of clearing significant projects of the *Regional Vegetation Management Code for Brigalow Belt and New England Tableland Bioregions Version 2* is summarised below in **Table 6**.

Table 6: Project compliance with performance requirements of the code

PERFORMANCE REQUIREMENT (PR)	PR APPLICABLE TO PROJECT	ACCEPTABLE SOLUTION MET[2]	OFFSET PROPOSED[2]
PR S.1 Limits of clearing	Yes	Yes - clearing will be limited to the extent necessary for the project	No
PR S.2 Wetlands	No - no natural wetlands mapped in project area	NA	NA
PR S.3 Watercourses	Yes	No	Yes
PR S.4 Connectivity	Yes	No	Yes
PR S.5 Soil erosion	Yes	Yes - to be managed in accordance with the project Environmental Management Plan	No
PR S.6 Salinity	No - clearing will not contribute to water logging or salinisation	NA	NA
PR S.7 Endangered and Of Concern REs	Yes	No	Yes
PR S.8 Essential habitat	Yes	No	Yes
PR S.9 Threshold REs	No- no listed REs present	NA	NA
PR S.10 Acid sulphate soils	No - project not within applicable sub-regions and is above 5 m Australian height datum	NA	NA

[2] NA not applicable

5 OFFSET REQUIREMENTS

5.1 *Policy for Vegetation Management Offsets Version 3 (Queensland Government)*

Where the provision of an offset is an acceptable solution to compensate for the unavoidable impacts of a development under the code, the *Policy for Vegetation Management Offsets Version 3* outlines the requirements of a proposed offset area. The policy highlights the following key criteria that must be addressed to ensure a compliant offset:

- **8.1 Criteria 1 – offset limitations:** The proposed offset must be land-based, however may be delivered as either a direct offset, offset transfer, or by an offset payment. The offset may be located on land owned by the applicant or by a third party. The offset must, at a minimum, be the same number of hectares as the area requiring offsetting and if the offset is less than 10 hectares it must be connected to an area of assessable or otherwise protected vegetation that is equal to or greater than 10 hectares in size. The offset must contain functioning regional ecosystems. The offset must not be mapped as remnant vegetation or regulated regrowth that is a restricted area (ERH, stream protection zones, on slopes greater than 12%). The offset cannot be a category A or B area on a Property Map of Assessable Vegetation (PMAV). It cannot be currently protected by an instrument of the State Government, unless the area has a valid clearing approval. It may be sourced from areas identified as Category X areas on a Property Map of Assessable Vegetation (PMAV), or regrowth vegetation that is not a restricted area.
- **8.2.2 Watercourses (PR S.3):** An offset for watercourses must be located within the same bioregion and must be the same or higher stream order as the watercourse proposed for clearing. An offset area for watercourses must be a regional ecosystem associated with a watercourse which assists with maintaining bank stability, water quality, aquatic habitat and terrestrial habitat.
- **8.2.3 Connectivity (PR S.4):** An offset area for connectivity must be located within the same bioregion. It must also be identified on a map within a strategic area or strategic rehabilitation area identified by DERM, or an ecological corridor identified by the Commonwealth, state or local government either on its website or in an approved or publicly available document, or a DERM-approved strategic corridor identified by a recognised organisation or group.
- **8.2.4 Endangered regional ecosystems (PR S.7):** An offset area for an endangered RE must be an endangered RE in the same BVG (at the regional scale of 1:1million) and be located within the same bioregion.
- **8.2.5 Of concern regional ecosystems (PR S.7):** An offset area for an of concern RE must be in the same BVG (at the regional scale of 1:1million), be located within the same bioregion and be the same or higher conservation status as the area proposed for clearing.

- **8.2.6 Essential habitat (PR S.8):** An offset area for EH must be located within the same bioregion. It must include at least three EH factors for the protected wildlife including any that are stated as mandatory for the protected wildlife in the EH database, or be an area utilised by protected wildlife at any stage of its life cycle for which there is recent evidence. The offset must demonstrate that the direct impacts on the protected wildlife are mitigated by the offset area and surrounding environment.
- **8.3 Criteria 3 – obtain ecological equivalence:** Demonstrating ecological equivalence on the proposed clearing area and offset area requires an ecological equivalence assessment of both areas. Ecological equivalence is comprised of two components – ecological condition and special features. Refer to DERMs Ecological Equivalence Methodology for further information located at www.derm.qld.gov.au.
- **8.4 Criteria 4 - ensuring the offset area is legally secured:** All land-based offset areas must be legally secured using a legally binding mechanism such as a covenant, voluntary declaration or nature refuge. The legally binding mechanism must be supported by an offset area management plan. There are three options for delivering an offset under the policy these are direct offsets, offset transfer or offset payments.
- **8.4.1 Direct offsets:** A direct offset is provided by an applicant at the same time as the development application is being assessed. This requires that the offset area, legally binding mechanism and offset area management plan, are assessed prior to a development permit being approved.
- **8.4.2 Offset transfer:** An application may enter into a legally binding contractual agreement with an offset broker for the provision of an offset area as a means of meeting the regulatory performance requirements (PRs) contain in a Regional Vegetation Management Code or Concurrence Agency Policy, and the offset policy.
- **8.4.3 Offset payment:** An offset payment is a financial payment by an applicant to a trust established for land management or nature conservation purposes and approved by DERM.
- **8.6 Criteria 6 - when an offset ceases to have effect:** An offset area remains in effect until the offset area ceases under its terms. This will include the offset meeting any requirements that are stipulated within the development approval, or legally binding mechanism and management plan.

5.2 Draft Environmental Offsets Policy (Australian Government)

The Australian Government Draft Environmental Offsets Policy (DEWR 2007) sets out the use of environmental offsets under the EPBC Act. A compliant offset is required to meet the following objectives:

a) Environmental offsets should be targeted to protected matter being impacted;

b) A flexible approach should be taken to design and use of environmental offsets to achieve long term and certain conservation outcomes that are cost-effective for proponents;

c) To deliver real conservation outcomes;

d) Should be developed as a package of actions that may include both direct and indirect offsets;

e) As a minimum should be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like';

f) Located within the same general area as the development;

g) Should be delivered in a timely manner and be long lasting; and

h) Should be enforceable, monitored and audited.

The Queensland and Australian government offset policies are cognisant of each other, meaning an offset which satisfies the *Policy for Vegetation Management Offsets Version 3* may also be suitable to satisfy the EPBC Act policy or biodiversity offset policy. As such, co-location of offsets is acceptable where the outcome with respect to each policy is achieved. The proposal offered here with respect to impacts on MNES has been structured to comply with each of the points above.

6 OFFSET PROPOSAL – QUEENSLAND GOVERNMENT

6.1 Overview

An offset proposal which satisfies the offset requirements of the project based on the criteria of the *Policy for vegetation management offsets Version 3* has been identified. The Queensland Government offset proposal involves securing approximately 3,430 ha of vegetation across three properties. These properties include two SunWater owned properties (Ridgeland and Marylands) and one privately owned property (Property A). While this is SunWater's preferred structure for securing offsets, other properties identified by Ecofund can achieve the same outcome and will be incorporated if required (that is, if the limitations noted earlier have affect).

All three offset properties are associated with a stream order 5 or greater watercourse enabling co-location of PRS.3 and PRS.7 offsets. Some of these areas are located within the Biodiversity Planning Assessment (BPA) corridor buffers for the Brigalow Belt bioregion, enabling co-location of PRS.4 with PRS.3 and PRS.7. Therefore, offsets for PRS.3, PRS.4 and PRS.7 have been co-located, where possible. The offset for PRS.8 has been co-located with the offsets for PRS.7, based on the presence of suitable REs.

While field assessments have been undertaken on Ridgeland, the assessment of Marylands and Property A is based on desktop analysis only and field assessments will be required to verify the presence of the environmental values on the ground and to undertake ecological equivalence assessments. In addition, Property A is an example of an offset property that could be secured to fulfil the residual offset requirements of the project, and is not necessarily the final property that will be used as part of the offset package. To determine the suitability of this property for use as an offset, factors such as ongoing management requirements as well as a range of non-environmental issues such as landholder agreement, cost, tenure issues, mining interests, and native title will also require consideration.

Once identified, the final offset areas on each property will be secured using an appropriate legally binding mechanism. Offsets on properties that SunWater will be required to purchase as part of the project mean that the proponent will have legally binding tenure. Offset areas on other properties may be secured via a nature refuge agreement. Offset Area Management Plans fulfilling the information requirements outlined in the *Policy for Vegetation Management Offsets Version 3* will also be developed and implemented for each of the secured offset areas.

6.2 Offset properties

6.2.1 Ridgeland

Ridgeland (Lot 4974 PH1462) is a 15,600 ha grazing property containing areas of remnant, HVR and non-remnant vegetation and stream orders ranging from 1 to 6. Initial field investigations have identified the following management issues for the property:

- populations of castor oil plant (*Ricinius communis*) along drainage lines and watercourses
- some areas of heavy lantana (*Lantana camara*) infestation along watercourses.

Approximately 950 ha of non-remnant and HVR vegetation is proposed to be secured on Ridgeland to acquit the offset requirements of the project for impacts on stream order 1 and 2 watercourse vegetation, BVG 13c and EH for the little pied bat. The property will also be used to partially acquit the offset requirements for impacts on stream order 5 or greater watercourse vegetation, connectivity and BVG 16c and 9e (**Figures 2 and 4**).

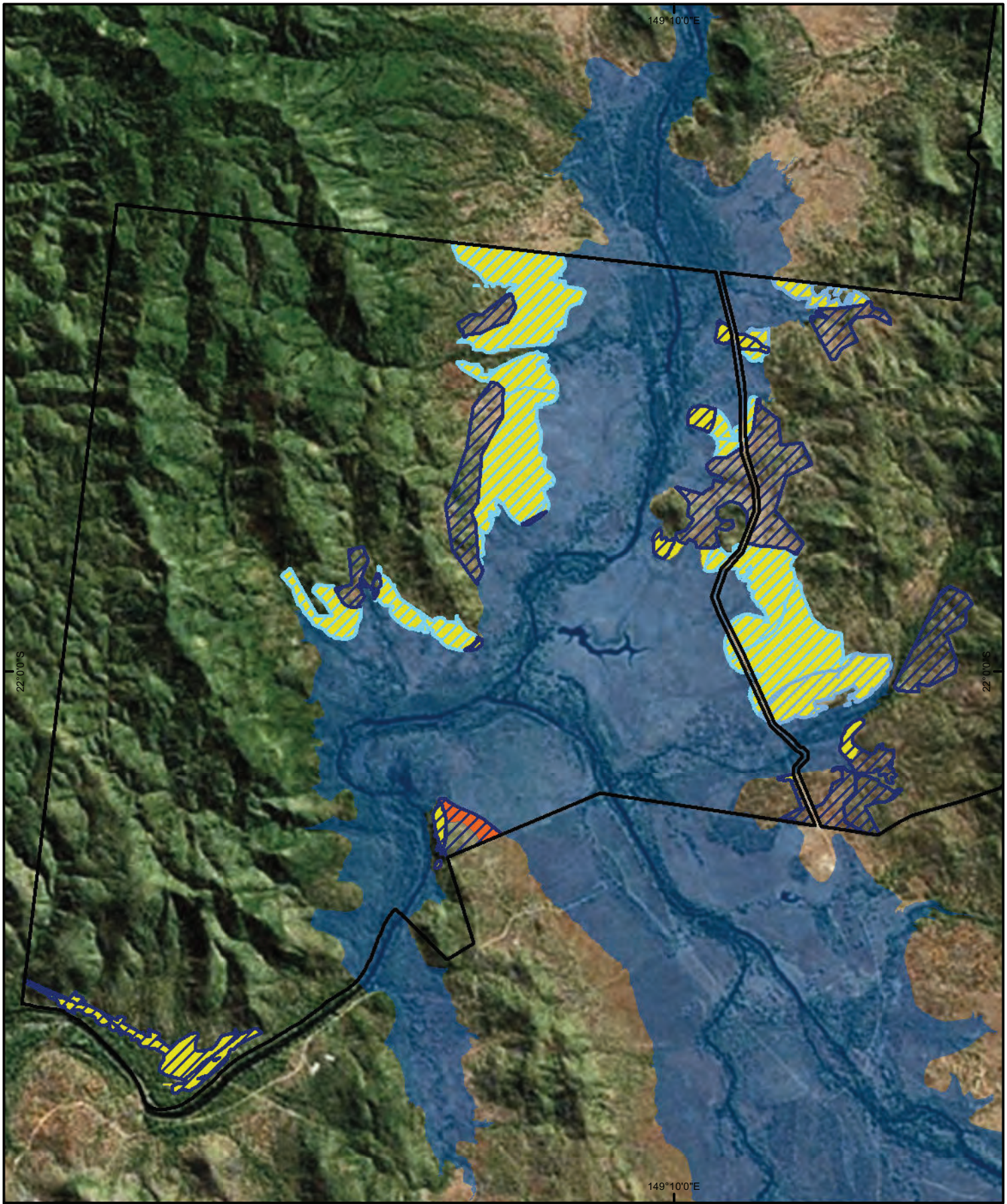
6.2.2 Marylands

Marylands (Lot 4 KL209) is a 21,500 ha grazing property located at the southern end of the inundation area. The property borders the Collaroy and Mountain View properties to the north and contains areas of remnant, HVR and non-remnant vegetation and stream orders ranging from 1 to 5.

It is proposed that approximately 2,260 ha of non-remnant and HVR vegetation will be secured on Marylands to acquit the offset requirement for impacts on stream order 3 and 4 watercourse vegetation and BVG 7a. The property will also be used to partially acquit the offset requirements for impacts on stream order 5 watercourse vegetation, connectivity and BVG 13c, 16c and 9e (**Figures 3 and 4**).

6.2.3 Property A

Property A is a large grazing property located on the Connors River downstream of the dam. The property contains areas of remnant, HVR and non-remnant vegetation and stream orders ranging from 1 to 7. Approximately 215 ha of non-remnant and HVR vegetation is proposed to be secured on the property to acquit the offset requirement of the project for impacts on BVG 17a and 25a.



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LOCATION DIAGRAM

Figure 2: Proposed Qld Government offset areas on Ridgeland

DATA SOURCE:

Cadastral Data © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act Regional Ecosystems V6.1 © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act High Value Regrowth Vegetation Version 2.1 © State of Queensland (Department of Environment and Resource Management) 2011
Protected Areas of Queensland © State of Queensland (Department of Environment and Resource Management) 2011
Inundation area sourced from SunWater (FSL169.1 ALS) 2011
Other vegetation mapping sourced from 3D (veg dam 1999) 2011

- Property boundary
- Inundation area
- PRS.7 - 13c offset
- PRS.7 - 9e/16c & PRS.8 - EH offset
- PRS.3 - SO1 or 2 offset
- PRS.3 - SO 3 or 4 offset
- PRS.3 - SO 5 or greater offset

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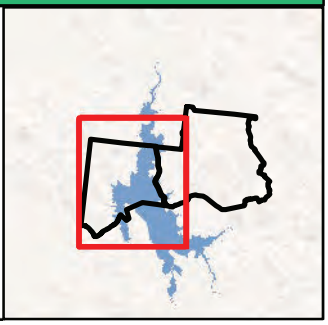

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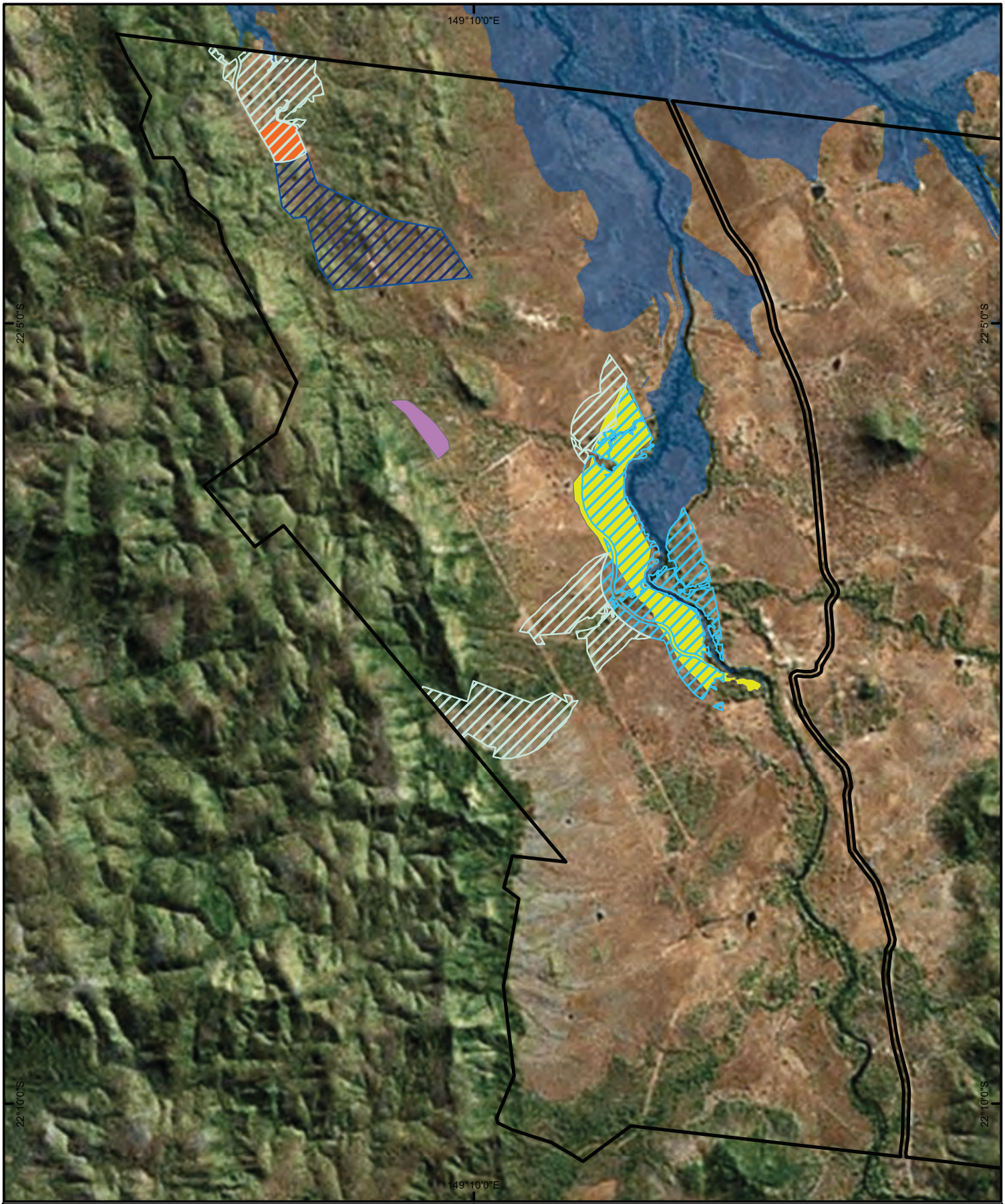

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LOCATION DIAGRAM

Figure 3: Proposed Qld Government Offset areas on Marylands

- Property boundary
- Inundation area
- PRS.7 - 7a offset
- PRS.7 - 16c offset
- PRS.7 - 13c offset
- PRS.3 - Stream order 3 offset
- PRS.3 - Stream order 4 offset
- PRS.3 - Stream order 5 offset

DATA SOURCE:

Cadastral Data © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act Regional Ecosystems V6.1 © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act High Value Regrowth Vegetation Version 2.1 © State of Queensland (Department of Environment and Resource Management) 2011
Protected Areas of Queensland © State of Queensland (Department of Environment and Resource Management) 2011
Inundation area sourced from SunWater (FSL169.1 ALS) 2011
Other vegetation mapping sourced from 3D (veg dam 1999) 2011

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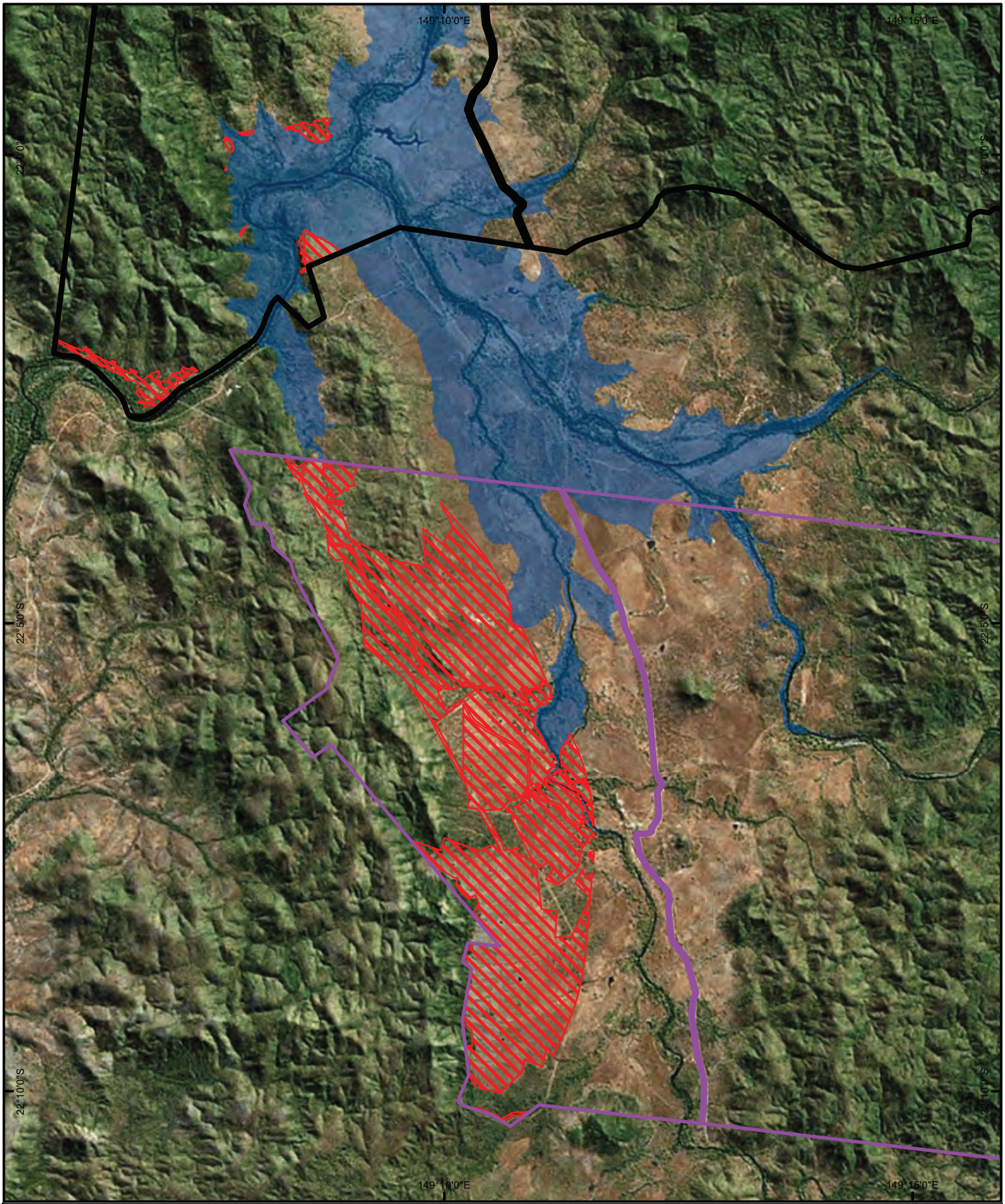

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LOCATION DIAGRAM

Figure 4: Proposed Offset for Connectivity

DATA SOURCE:
Cadastral Data © State of Qld (Department of Environment and Resource Management) 2011
Queensland Biodiversity and Vegetation Offsets Special Features © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act Regional Ecosystems V6.1 © State of Qld (Department of Environment and Resource Management) 2011
Inundation area sourced from SunWater (FSL169.1 ALS) 2011
Other vegetation mapping sourced from 3D (veg dam 1999) 2011

- Ridgeland boundary
- Marylands boundary
- Inundation area
- PRS.4 offset - Connectivity

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Kilometres

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6.3 Offsets for watercourse vegetation

Offsets will be secured on Ridgeland and Marylands to acquit the offset requirements of the project for impacts on watercourse vegetation (**Table 7**).

Table 7: Proposed offsets for watercourse vegetation

STREAM ORDER	OFFSET REQUIREMENT (HA)	RIDGELAND (HA)	MARYLANDS (HA)	OFFSET ACQUITTED
1	124.74	124.74	-	Yes
2	83.23	83.23	-	
3	145.19	-	145.19	
4	166.88	-	166.88	
=>5	891.31	742.79	148.52	
Total	**1,411.35**	**950.76**	**460.59**	

6.4 Offsets for connectivity

Offsets for connectivity have been identified on Ridgeland and Marylands and are located within identified BPA corridor buffers (**Table 8**). It is proposed that 2,373 ha of vegetation will be secured to offset the impacts if the project on connectivity.

Connectivity between existing remnant patches and along riparian corridors will be increased by restoring and managing non-remnant areas until they achieve remnant status. This will be done through actively managing natural regeneration and implementing land management practices (e.g. grazing management, exclusion of livestock, weed control, fire management). The conservation value of the proposed offset options has been acknowledged by DERM which has noted that Ridgeland is considered a priority acquisition for future national park. DERM has also noted that Tierawoomba State Forest, which it considers to be an 'important strategic link for future national park acquisitions area', is proposed for future gazettal as a national park.

Table 8: Proposed offsets for connectivity

OFFSET REQUIREMENT (HA)	RIDGELAND (HA)	MARYLANDS (HA)	OFFSET ACQUITTED
2,373.00	112.55	2,260.45	Yes

6.5 Offsets for endangered and of concern regional ecosystems

Offsets for endangered and of concern REs are proposed to be located on Ridgeland, Marylands and Property A (**Table 9**). Approximately 990 ha of vegetation will be secured across the three proposed offset properties to acquit this offset requirement.

Table 9: Proposed offsets for endangered and of concern vegetation

BVG	VM ACT STATUS	OFFSET REQUIREMENT (HA)	RIDGELAND (HA)	MARYLANDS (HA)	PROPERTY A (HA)	OFFSET ACQUITTED
7a	E	-	-	-	-	Yes
	OC	8.75	-	8.75	-	
9e/16c	E	-	-	-	-	
	OC	754.04	663.26	90.78	-	
13c	E	-	-	-	-	
	OC	20.89	12.64	8.25	-	
17a	E	-	-	-	-	
	OC	203.75	-	-	203.75	
25a	E	2.21	-	-	2.21	
	OC	-	-	-	-	
Total		**989.64**	**675.90**	**107.78**	**205.96**	

6.6 Offsets for essential habitat

Approximately 63 ha of suitable habitat will be secured to counterbalance the impact of the project on EH for the little pied bat (**Table 10**). Essential habitat offsets for the little pied bat will be co-located with offsets for of concern BVG 9e and 16c.

Table 10: Proposed offsets for essential habitat

SPECIES	OFFSET REQUIREMENT (HA)	RIDGELAND (HA)	OFFSET ACQUITTED
Little pied bat	62.36	62.36	**Yes**

7 OFFSET PROPOSAL - AUSTRALIAN GOVERNMENT

7.1 Offsets for Brigalow Ecological Community

Impacts of the Brigalow TEC are proposed to be directly offset on Property A (**Table 11**). The offset assumes a multiplier of 1:5. The property contains approximately 13,000 ha of Brigalow regrowth vegetation based on an assessment of pre-clear REs.

Table 11: Proposed offsets for Brigalow TEC

OFFSET REQUIREMENT (HA)	PROPERTY A (HA)	OFFSET ACQUITTED
11.05	11.05	**Yes**

7.2 Offsets for squatter pigeon and other threatened fauna

Ridgeland is a 15,600 ha grazing property located to the north of the Collaroy property, extending east from the inundation area. Ridgeland is located between Collaroy and Tierawoomba State Forests. The majority of the vegetation on the property is eucalypt woodlands with a grassy understorey. This is highly suitable habitat for the squatter pigeon and the EIS notes a number of observations of the species nearby during field surveys. Therefore it is likely that the remnant and non-remnant areas on the property will provide habitat for the squatter pigeon.

It is proposed that the entire property above the inundation area be used as an offset which equates to approximately 13,000 ha. This is aimed at directly satisfying the requirement related to squatter pigeon but also providing catchment related benefits for Fitzroy River turtle. While the scale of the offset for squatter pigeon is greater than that which may be strictly necessary, SunWater suggests that such a large contiguous area is of substantial environmental benefit to a broad suite of species and communities, including other threatened fauna such as Australian painted snipe and red goshawk. Parts of the property will also be used to satisfy Queensland Government offset requirements.

7.3 Offsets for *Eucalyptus reveretiana*

Offsets identified for the project include 1,411 ha of watercourse habitat, much of which is suitable for *Eucalyptus reveretiana*. As such, collocation with watercourse offsets required under the VM Act is proposed. This habitat is also suited to the Australian painted snipe and red goshawk.

7.4 Offsets for Fitzroy River turtle

7.4.1 Direct offsets for Fitzroy River turtle

The direct offset for Fitzroy River turtle is offered in two geographically distinct areas, upstream of the dam and downstream. The offset involves the protection and management of sections of river and riparian zone (within 50 m of the water) which are known (or likely) to support the species. The offset is restricted to watercourses classified as order 4 or higher because the species has not been found in smaller watercourses in this area and is generally acknowledged as a species that requires permanent watercourses.

Upstream of the dam, the species was found on the properties Undercliff, Ridgeland and Collaroy. Offsets are proposed on these properties as shown in **Table 12** and **Figures 5** to **7**. The length of river upstream of the dam included in this proposed offsets is approximately 24 km.

Downstream of the dam the species has been found at most sites sampled as far as Funnel Creek and also at Tartrus Weir on the Mackenzie River. To maximise the environmental outcomes for the Fitzroy River turtle, as well as meet the requirements of the Coordinator General's report, SunWater will undertake a number of management actions and monitoring programs related to the turtle between the dam and Funnel Creek. In addition to this, a direct offset will be located downstream of Funnel Creek which will further add to the length of river within which habitat protection and / or management actions will be undertaken. The Connors River, as it abuts Property A, is proposed as the offset area to a length of approximately 46 km (**Table 12**). Use of this property still requires agreement with the landowner but if it cannot be satisfactorily achieved, similar lengths of suitable riverine habitat are potentially available on other nearby properties.

Table 12: Stream order lengths associated with direct offsets for the Fitzroy River turtle

STREAM ORDER	UNDERCLIFF (KM)	RIDGELAND (KM)	COLLAROY (KM)	PROPERTY A (KM)
4	6.96	5.48	2.20	-
5	5.43	-	3.71	-
6	-	-	-	1.51
7	-	-	-	44.36
Total	**12.39**	**5.48**	**5.91**	**45.87**

Management measures would include reduction of grazing pressure (primarily through seasonal exclusion of cattle from nesting areas), weed control and feral animal control.

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LOCATION DIAGRAM

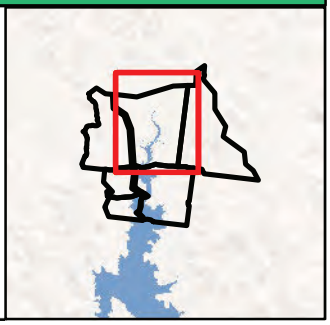

Figure • : Proposed Fitzroy River Turtle offsets on Undercliff

Property boundary
Inundation area
FRT offset - SO 4
FRT offset - SO 5

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0 0.25 0.5 0.75 1
Kilometres

1:35,000

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DATA SOURCE:

Cadastral Data © State of Qld (Department of Environment and Resource Management) 2011
Watercourses Version 2 © State of Qld (Department of Environment and Resource Management) 2009
Vegetation Management Act Regional Ecosystems V6.1 © State of Qld (Department of Environment and Resource Management) 2011

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LOCATION DIAGRAM

Figure • : Proposed Fitzroy River Turtle offsets on Ridgeland

DATA SOURCE:

Cadastral Data © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act Regional Ecosystems V6.1 © State of Qld (Department of Environment and Resource Management) 2011
Vegetation Management Act High Value Regrowth Vegetation Version 2.1 © State of Queensland (Department of Environment and Resource Management) 2011
Protected Areas of Queensland © State of Queensland (Department of Environment and Resource Management) 2011
Inundation area sourced from SunWater (FSL169.1 ALS) 2011
Other vegetation mapping sourced from 3D (veg dam 1999) 2011

- Ridgeland boundary
- Inundation area
- FRT offset - SO4
- FRT offset - SO 5
- Collaroy property

N

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0 0.5 1 1.5 2
Kilometres

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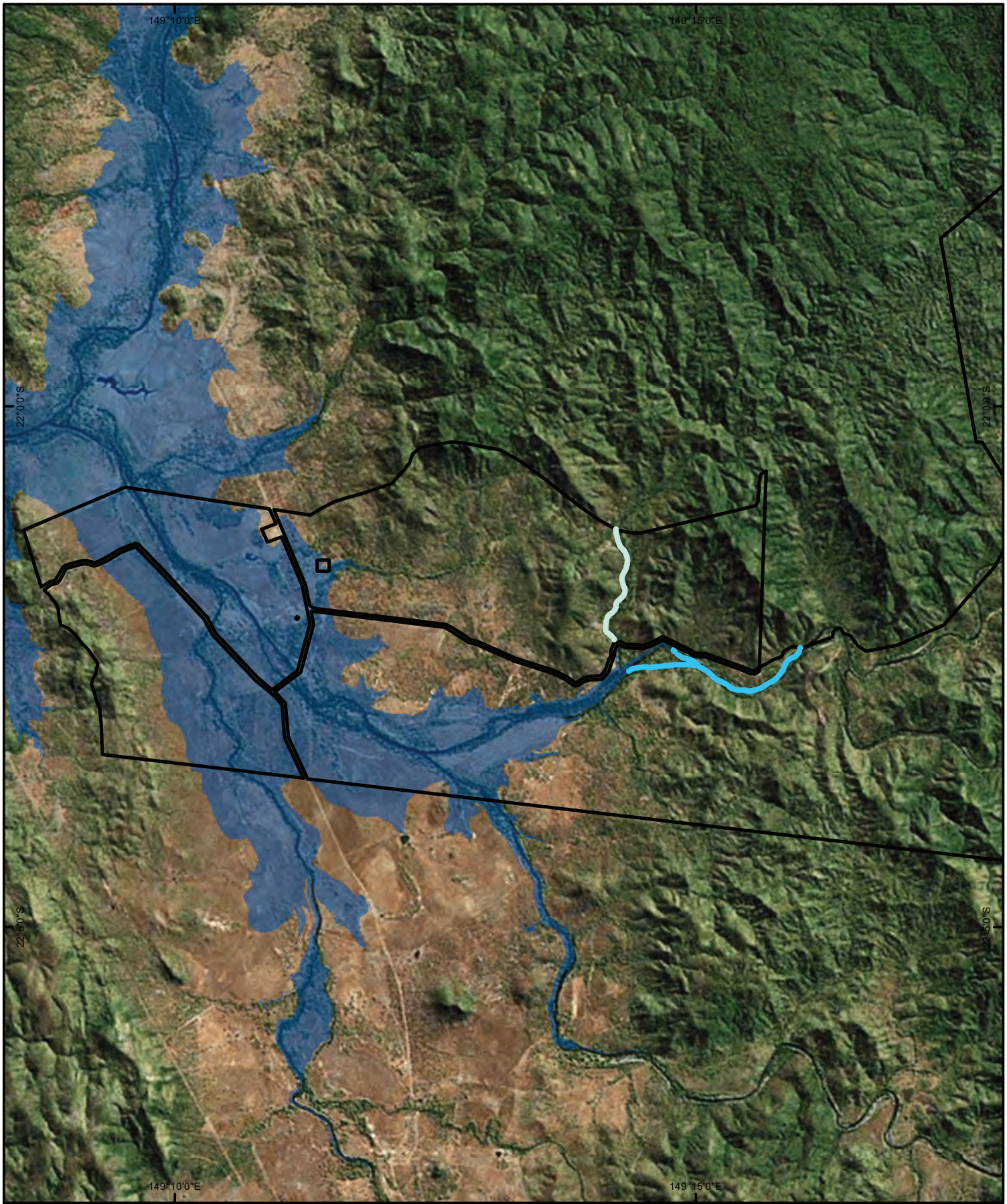

SunWater Pty Ltd - Connors River Dam and Pipeline Project

LOCATION DIAGRAM

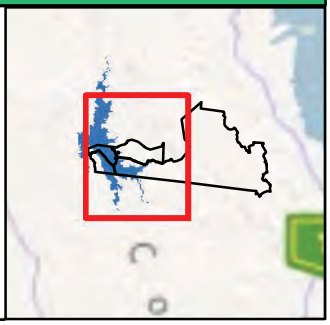

Figure 7: Proposed Fitzroy River Turtle Offset on Collaroy

DATA SOURCE:

Cadastral Data © State of Qld (Department of Environment and Resource Management) 2011
Watercourses Version 2 © State of Qld (Department of Environment and Resource Management) 2009
Vegetation Management Act Regional Ecosystems V6.1 © State of Qld (Department of Environment and Resource Management) 2011

- Property boundary
- Inundation area
- FRT offset - SO 4
- FRT offset - SO 5

N

0 0.5 1 1.5 2
Kilometres

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7.4.1 Indirect offsets for Fitzroy River turtle

With respect to indirect offsets, the conditions of approval within the Coordinator General's report for the project require the development and implementation of a Species Management Program for the Fitzroy River turtle which covers both construction and operational phases. The Species Management Program is described below.

Fitzroy River Turtle Species Management Program Requirements

The following requirements are based on an extract from the draft Coordinator General's conditions. It should be noted that many of the included actions were commitments made by SunWater in the EIS process.

1) The proponent shall prepare a Species Management Program to mitigate impacts to Fitzroy River turtle. The Species Management Program shall be submitted to and approved by DERM two months prior to the commencement of construction. The Species Management Program shall outline measures to achieve the following:

(a) minimise impacts to the Fitzroy River turtle

(b) strengthens and enhance survival of the Fitzroy River turtle in the wild

(c) achieve a net conservation benefit for the Fitzroy River turtle.

2) The Species Management Program shall be prepared and implemented for the construction phase and operational life of the project.

3) As a minimum, the Species Management Program shall address the following:

Construction phase

(a) Prior to the closure of the dam wall, develop and conduct in consultation with and to the satisfaction of DERM a baseline study of Fitzroy River turtle populations within the inundation area and extending downstream to the Funnel Creek confluence:

i. the baseline study shall be conducted for a period of at least 1 year prior to the closure of the dam wall and shall establish a tagged population of the Fitzroy River turtle;

ii. the baseline study shall use appropriate survey methodology to capture the Fitzroy River turtle and shall document:

1) morphometric measurements from each turtle (the precise definition of methods shall be developed in consultation with and to the satisfaction of DERM)

2) estimates of age and sexual maturity

3) estimates of annual nesting and recruitment

4) evidence of injury and disease evident within the population, including occurrence rates for injured or dead individuals

5) known or likely nesting areas, including nesting microhabitat, distance from and height above the water to nest

6) estimates of predation and other losses of eggs at nesting areas identified in (a) ii.5).

iii. tagging systems shall be integrated with the DERM Freshwater Turtle Tagging Program. Tagging shall include:

1) Passive Integrated Transponder (PIT) tags and scanners compatible with fish PIT tagging studies. This aspect shall be adequate to monitor turtle passage upstream and downstream of the dam wall

2) carapace notching using a multiple notching system determined in consultation with DERM. This method shall be sufficient to allow for turtle identification from dry skeletons

3) numbered monel metal foot tags. Design and number sequence of these tags shall be determined in consultation with DERM

4) use of these tagging methods do not preclude the use of additional tagging systems.

(b) In order to implement the baseline monitoring program, SunWater must use its best endeavours to obtain access to properties located between the dam and the Funnel Creek confluence. If access at certain locations is denied, SunWater shall liaise with DERM to determine the impact to the baseline program and agree appropriate mitigation measures.

(c) Ensure large woody debris (snags) exist in the impoundment either by: not entirely clearing to the full supply level (FSL); or introducing anchored trees, consistent with the standards and processes described within the Design Guidelines for Reintroduction of Wood to Australian Streams (Brooks, 2006)

(d) Provide for effective passage of the Fitzroy River turtle at temporary and permanent watercourse crossings which minimises injury, entrapment or death.

Operational Phase

(a) Provide for effective turtle passage upstream and downstream of the dam wall which minimises injury, entrapment or death

(b) Minimise death and injury of turtles aggregated at or within the downstream side of impoundment structures by reducing the velocity of high volume water release events and excluding turtles from outlet structures that produce high velocities

(c) Provide information signage at the proposed recreation area appropriate to minimising death or injury to turtles from boat strike, propeller cuts and fishing activities

(d) Maintain flows that mimic the natural flow requirements, particularly post winter and summer flows, in accordance with the predicted performance of the project against all Fitzroy Basin Water Resource Plan Environmental Flow Objectives (Tables 14-25 to 14-30, chapter 14 of the EIS)

(e) Include a monitoring, reporting and corrective action regime, to be developed in consultation with and to the satisfaction of the Chief Executive administering the *Nature Conservation Act 1992*, to determine impacts to Fitzroy River turtle populations, habitat and passage upstream and downstream of the dam. Monitoring should comprise annual population surveys in each tributary upstream of the inundation area, within the inundation area, and downstream of the dam to the Funnel Creek confluence during the:

    a. Fitzroy River turtle nesting season (September to November)

    b. Fitzroy River turtle egg hatching season (November to March).

(f) Manage the terrestrial zone around the impoundment and downstream of the dam to Funnel Creek to:

    iv. implement management measures to reduce the predation of turtle eggs

    v. avoid damage to nesting habitat from trampling by stock;

    vi. prevent terrestrial and aquatic weeds from blocking access to suitable nesting habitat

    vii. increase nesting opportunities and the recruitment of hatchlings into the river system.

4. Monitoring and associated reporting required as part of the implementation of the Species Management Program for the Fitzroy River turtle shall be linked to the conservation objectives included in the Conservation Plan for the Fitzroy River turtle in the Fitzroy Basin.

The Coordinator Generals report for the project also requires the development of a catchment wide Conservation Plan for the species. The plan is described below (extract from Draft CG conditions).

To ensure the survival and natural development of the Fitzroy River turtle in the Fitzroy Basin, the proponent shall:

a. prepare, at its cost, a Conservation Plan for the Fitzroy River turtle pursuant to Section 112(2) of the *Nature Conservation Act 1992* which specifies research and management measures necessary to ensure the survival and natural development of populations of Fitzroy River turtle
b. within 12 months following commencement of construction of the project, submit the draft Conservation Plan for the Fitzroy River turtle for adoption by the Minister for Environment in accordance with section 120(2) of the *Nature Conservation Act 1992*
c. contribute $250,000 per year for at least 5 years, commencing on the date of adoption of the Conservation Plan, into a fund administered by the DERM for implementing the research and management measures identified in the adopted Conservation Plan
d. facilitate access to Connors River Dam for monitoring of the populations and habitats of turtles. Monitoring shall include both seasonal and event-based actions such as "overtopping" and water releases
e. facilitate access to the findings of SunWater's current Turtleways Investigation and Design Project (a SunWater funded investigation project assessing improved design of water infrastructure to improve the movement of freshwater turtles through, and lessen injury caused by, these structures

The draft Conservation Plan shall be prepared in collaboration with DERM, SEWPaC and the Fitzroy Basin Association. DERM will be the entity responsible for implementing the adopted Conservation Plan for freshwater turtles in the Fitzroy Basin.

8 CONCLUSION

The Connors River Dam and Pipelines Project is located near Mount Bridget, 110 km due east of Moranbah. The project involves the construction and operation of the Connors River Dam and associated infrastructure. The pipeline to Moranbah will be approximately 133 km long and involve the clearing of 168 ha of remnant vegetation. The dam will inundate an area of approximately 5,850 ha including 2,061 ha of native remnant vegetation.

VM Act related offsets will be required to compensate for unavoidable impacts on watercourses (PRS.3), connectivity (PRS.4), endangered and of concern REs (PRS.7) and EH (PRS.8) for the little pied bat. Offsets will also be required for the impacts on squatter pigeon, Fitzroy River turtle and Brigalow TEC, all listed as MNES under the EPBC Act.

The Revised Offset Proposal identifies a solution for acquitting Queensland Government offset requirements in strict compliance with the *Policy for Vegetation Management Offsets Version 3*. It also outlines an offset solution for MNES protected under the EPBC Act.

The offset proposal to satisfy the Queensland Government offset requirements involves securing approximately 3,425 ha of vegetation across three properties: Ridgeland, Marylands and Property A. This involves securing approximately:

- 950 ha of non-remnant and HVR vegetation on Ridgeland
- 2,260 ha of non-remnant and HVR vegetation on Marylands
- 215 ha of non-remnant and HVR vegetation on Property A.

While field assessments have been undertaken on Ridgeland, the assessment of Marylands and Property A is based on desktop analysis only and field assessments will be required to verify the status of the environmental values. Once identified, the final offset areas on each property will be secured using an appropriate legally binding mechanism. Offset Area Management Plans fulfilling the information requirements outlined in the *Policy for Vegetation Management Offsets Version 3* will also be developed and implemented for each of the secured offset areas.

The offset proposal to satisfy the Australian Government offset requirements involves securing approximately 13,500 ha of vegetation, including riverine and riparian areas for the Fitzroy River turtle, across four properties: Ridgeland, Undercliff, Collaroy and Property A. This involves securing approximately:

- 13,000 ha of remnant, HVR and non-remnant vegetation on Ridgeland, including 54 ha of riverine and riparian habitat
- 115 ha of riverine and riparian habitat on Undercliff
- 60 ha of riverine and riparian habitat on Collaroy

- 11 ha of remnant, HVR and non-remnant vegetation and 277 ha of riverine and riparian habitat on Property A.

These habitats will also serve to counterbalance impacts on potential habitat for red goshawk and Australian painted snipe.

The MNES related offset for the Brigalow TEC involves securing at least 11.05 ha of vegetation on Property A. SunWater will secure the entire terrestrial area of the Ridgeland property to provide a 13,000 ha offset area for the squatter pigeon. SunWater will also provide 70 km (500 ha) of riverine and riparian habitat offset areas upstream and downstream of the water storage area for Fitzroy River turtle (Ridgeland, Undercliff, Collaroy and Property A). These offset areas will complement a Species Management Program and catchment wide Conservation Plan which will include significant monitoring and management activities that will enhance the survival of the Fitzroy River turtle in the wild.

APPENDIX 1

Essential habitat factors for the little pied bat

Species	Regional Ecosystem[3]	Vegetation community	Altitude
Little pied bat *Chalinolobus picatus*	11.1.4, 11.2.1, 11.2.2, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.10, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.4, 11.8.5, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.5, 11.9.6, 11.9.7, 11.9.9, 11.9.10, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4! , 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21,	Dry open forest and woodland (e.g. *Eucalyptus melanophloia*, *E. populnea, E. crebra, E. moluccana, E. tereticornis, Corymbia citriodora, C. tessellaris*), in more arid areas found in riparian areas (*E. camaldulensis, E. microtheca*), mulga (*Acacia aneura*) and escarpment (*A. shirleyi*); also brigalow forest, Callitris/Allocasuarina with *E. dealbata/E. fibrosa*, and chenopod shrubland.	Sea level to 850 m

[3] this is a mandatory essential habitat factor, unless otherwise stated.

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Acronyms and abbreviations

The following acronyms and abbreviations are used in this report. Unless indicated, references to the singular includes the plural and vice versa.

Acronym/abbreviation	Definition
µg/m^3	Microgram per cubic metre
µm	micron
ACH Act	*Aboriginal and Cultural Heritage Act 2003 (Qld)*
AEP	annual exceedence probability
AHD	Australian Height Datum
AMTD	adopted middle thread distance
ANCOLD	Australian National Committee on Large Dams
AS	Australian Standard
Bg	Background sound pressure level
BPA	biodiversity planning assessment
CEMP	construction environmental management plan
CG	Coordinator-General
CHMP	cultural heritage management plan
CIPA	Coal Infrastructure Program of Actions
CLR	Contaminated Land Register
CQRWSS	Central Queensland Regional Water Supply Strategy
CSG	coal seam gas
Cth	Commonwealth
dB	Decibels
DCS	Department of Community Safety, Queensland
DEEDI	Department of Employment Economic Development and Innovation
DERM	Department of Environment and Resource Management, Queensland
DES	Department of Emergency Services, Queensland
DO	Dissolved oxygen
EAP	Emergency Action Plan
EC	Electrial conductivity
EFO	environmental flow objectives
EFO	Environmental Flow objectives
EIS	environmental impact statement
EMP	environmental management plan
EMQ	Emergency Management Queensland
EMR	Environmental Management Register
EPA	Environmental Protection Agency (now DERM)

EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPP	environmental protection policy
EPP (Waste)	*Environmental Protection (Waste Management) Policy 2000*
ERA	environmentally relevant activity
FA	*Fisheries Act 1994*(Qld)
FBROP	Fitzroy Basin Resource Operations Plan
FPWFE	first post-winter flow event
FSL	full supply level
GARID	*Guidelines for Assessment of Road Impacts of Development (2006)*
GED	general environmental duty
GHG	Greenhouse gases
GPS	Global positioning system
GQAL	good quality agricultural land
GSP	gross state product
Ha	hectares
HVR	high-value regrowth
Hz	Frequency of vibration
IAS	Initial Advice Statement
IECA	International Erosion Control Association
ILUA	Indigenous land use agreement
IRC	Isaac Regional Council
IROL	Interim Resource Operations Licence
km	kilometres
kV	kilovolt
LGR	Local Government-controlled road
LIPP	local industry participation plan
LWD	large woody debris
MCU	material change of use
$mg/m^2/day$	Micrograms per square metres per day
ML	megalitres
ML/a	megalitres per annum
M m/s	Millimetres per second
MNES	matters of national environmental significance
MRC	Mackay Regional Council
MSCL	mild steel cement lined
NC Act	*Nature Conservation Act 1992* (Qld)
NGA	National Greenhouse Accounts
NOx	Nitrogen Oxide
NTU	Nephelometric turbidity unit

OEMP	Operational Environmental Management Plan
pH	Potential hydrogen
PM_{10}	particles in the air environment with an equivalent aerodynamic diameter of not more than 10 microns.
PMF	Probably Maximum Flood
PMPDF	Probable Maximum Precipitation Design Flood
PVMO	*Policy for Vegetation Management Offsets (Version 3)*
PVMP	Property Vegetation Management Plan
QAS	Queensland Ambulance Services
QATSICH	Queensland Aboriginal and Torres Strait Islander Cultural Heritage
QFRS	Queensland Fire and Rescue Service
QH	Queensland Health
QHA	*Queensland Heritage Act 1992*
QMAN	Quarry material allocation notice
QPS	Queensland Police Service
QPWS	Queensland Parks and wildlife Services
RCC	roller compacted concrete
RE	Regional ecosystem
RIA	Road impact assessment
RMP	Road Use Management Plan
ROL	Regional Operations Licence
ROP	Regional Operations Plan
RPEQ	Registered Professional Engineer of Queensland
RVMC	Regional vegetation management codes
SBMP	Site based management plan
SCR	state controlled road
SDPWO Act	*State Development and Public Works Organisation Act 1971 (Qld)*
SECP	Sediment and Erosion Control Plan
SEIS	Supplementary Environmental Impact Statement
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cth)
SOP	Standing Operating Procedures
SPA	*Sustainable Planning Act 2009 (Qld)*
SWP	Statewide Water Plan
T	Tonne
tCO2-e	tonnes of carbon dioxide equivalent
TI	*Transport Infrastructure Act 1994* (Qld)
TMP	Traffic Management Plan
TMR	Department of Transport and Main Roads, Queensland
TSP	Total Suspended Particulates

URBS	Urban Runoff and Basin System
UXO	Unexploded ordinances
VCMP	Vegetation Clearance Management Plan
VMA	*Vegetation Management Act 1999* (Qld)
VMP	Vegetation Management Plan
VOC	Volatile Organic Compound
WASO	Water Allocation Security Objective
WRP	Water Resource Plan

Glossary

The following is a list of definitions contained in this Coordinator-General's report. Unless the text otherwise requires, references to the singular includes the plural and the other way around.

Term	Definition
assessment manager	For an application for a development approval, means the assessment manager under the *Sustainable Planning Act 2009* (Qld).
AMTD	means adopted middle thread distance, which means the distance in km, measured along the middle of a watercourse, that a specific point in the watercourse is, from: (a) the watercourse's mouth; or (b) if the watercourse is not a main watercourse, the watercourse's confluence with its main watercourse.
bilateral agreement	The agreement between the Australian and Queensland governments that accredits the State of Queensland's EIS process. It allows the Australian Government Minister for the Environment to rely on specified environmental impact assessment processes of the state of Queensland in assessing actions under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).
Commencement of construction'	The date on which Sunwater commences the construction works.
Community and stakeholder management plan	means the plan as defined Appendix 1,Schedule A,Condition 10 of this Coordinator-General's report.
Connors River Dam	means any physical blockage of the Connors River caused by the construction and operation of the Connors River Dam, which alters the natural flow conditions of the Connors River and acts as a barrier to the passage of fish upstream and downstream of the barrier. Connors River Dam includes the Fish Passage Works. For the avoidance of doubt, Connors River Dam does not include minor physical blockages such as culverts, waterway crossings, causeways, bridges and other flow control structures.
construction areas	The construction worksites, construction car parks, and any areas licensed for construction or on which construction works are carried out.
Construction Works	All works necessary for the construction of the project, including, site preparation, public utility works, clearing of vegetation, cut, fill and earth borrowing activities, the dam, the pipeline, and associated works, including waterway crossings, dam recreational facilities and service roads, and excluding Early Site Works.
Contractor	A person or company that undertakes a contract to provide materials or labor to perform a service or do a job.

Term	Definition
controlled action	A proposed action that is likely to have a significant impact on a matter of national environmental significance; the environment of Commonwealth land (even if taken outside Commonwealth land); or the environment anywhere in the world (if the action is undertaken by the Commonwealth). Controlled actions must be approved under the controlling provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).
controlling provision	The matters of national environmental significance, under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), that the proposed action may have a significant impact on.
Coordinator-General	The corporation sole constituted under section 8A of the *State Development and Public Works Organisation Act 1938* and preserved, continued in existence and constituted under section 8 of the SDPWO Act.
Dam community recreational facilities	The facilities as defined by Appendix 2, Part 2, Recommendation 7 of this Coordinator-General's report.
Early site works	means works to prepare the Site for development including, site clearance (including demolition of existing buildings and structures), remediation of contamination and construction of buildings of a temporary nature that are associated with the Project.
environment	As defined in Schedule 2 of the SDPWO Act, includes: • ecosystems and their constituent parts, including people and communities • all natural and physical resources • the qualities and characteristics of locations, places and areas, however large or small, that contribute to their biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community • the social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned in paragraphs (a) to (c).
environmental effects	Defined in Schedule 2 of the SDPWO Act as the effects of development on the environment, whether beneficial or detrimental.
environmentally relevant activity (ERA)	An activity that has the potential to release contaminants into the environment. Environmentally relevant activities are defined in Part 3, section 18 of the *Environmental Protection Act 1994* (Qld).
Ephemeral stream	An ephemeral stream has flowing water only during, and for a short duration after, precipitation events
imposed condition	A condition imposed by the Queensland Coordinator-General under section 54B of the SDPWO Act. The Coordinator-General may nominate an entity that is to have jurisdiction for the condition.

Term	Definition
initial advice statement (IAS)	A scoping document, prepared by a proponent, that the Coordinator-General considers in declaring a significant project under Part 4 of the SDPWO Act. An IAS provides information about: • the proposed development • the current environment in the vicinity of the proposed project location • the anticipated effects of the proposed development on the existing environment • possible measures to mitigate adverse effects.
matters of national environmental significance	The matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999*. The eight matters are: • world heritage properties • national heritage places • wetlands of international importance (listed under the Ramsar Convention) • listed threatened species and ecological communities • migratory species protected under international agreements • Commonwealth marine areas • the Great Barrier Reef Marine Park • nuclear actions (including uranium mines).
MIKE 11	MIKE 11 is a computer program that simulates flow and water level, water quality and sediment transport in rivers, flood plains, irrigation canals, reservoirs and other inland water bodies
nominated entity (for an imposed condition for undertaking a project)	An entity nominated for the condition, under section 54B(3) of the SDPWO Act.
Project	the Connors River Dam and Pipelines project, as described in this *Coordinator-General's report January 2012*, proponent correspondence dated 28 June 2011 and 12 August 2011 (Appendix 8 of this report), the *Supplementary Report to the EIS (February 2011),* the *Environmental Impact Statement (January 2010)* and the *Initial Advice Statement (February 2008)* for the project.
properly made submission (for an EIS or a proposed change to a project)	Defined under section 24 of the SDPWO Act as a submission that: • is made to the Coordinator-General in writing • is received on or before the last day of the submission period • is signed by each person who made the submission • states the name and address of each person who made the submission • states the grounds of the submission and the facts and circumstances relied on in support of the grounds.
proponent	means Sunwater Limited, as the entity responsible for procurement of the Project and which has indicated its intention to seek a contractor to design, construct, maintain and operate the Project.

Term	Definition
Public utility works	means (a) the replacement, modification or relocation of public utilities required as a consequence of the Project; and (b) the construction of new utility infrastructure required for the Project.
Road works	Works as defined in the *Transport Infrastructure Act 1994*.
Rural access road	A road, which can either be bitumen sealed or gravel or a combination of both, and which is predominantly used for access to abutting properties and may also provide access for one activity or function.
significant project	A project declared as a 'significant project' under section 26 of the SDPWO Act.
stated condition	Conditions stated (but not enforced by) the Coordinator-General under sections 39, 45, 47C, 49, 49B and 49E of the SDPWO Act. The Coordinator-General may state conditions that must be attached to a: • development approval under the *Sustainable Planning Act 2009* • proposed mining lease under the *Mineral Resources Act 1989* • draft environmental authority (mining lease) under Chapter 5 of the *Environmental Protection Act 1994* (EPA) • proposed petroleum lease, pipeline licence or petroleum facility licence under the *Petroleum and Gas (Production and Safety) Act 2004* • non-code compliant environmental authority (petroleum activities) under Chapter 4A of the EPA.
Stream order	A measure of the position of a stream (defined as the reach between successive tributaries) within the hierarchy of the drainage network. A commonly used approach allocates order ‘1’ to unbranched tributaries, ‘2’ to the stream after the junction of the first tributary, and so on. It is the basis for quantitative analysis of the network.
Trunk water distribution pipeline	means the 135 kilometre, 1200 to 1500 millimetre diameter, Mild Steel Cement Lined (MSCL) pipeline from the Connors River Dam to Moranbah and associated facilities, including one pump station (three pump configuration) located at the dam wall, one 5 megalitre concrete ring tank balancing storage approximately 20 km from Moranbah, air release valves, control and reflux valves, surge tanks, air cushion standpipes, scour outlets, swab isolation valves, cathodic protection systems, thrust blocks, mechanical and electrical works, fibre optic cable in or adjacent to the pipeline to provide telecommunications for operating the pipeline and a 3 metres wide vehicle access track for inspections and maintenance.

Term	Definition
works	Defined under the SDPWO Act as the whole and every part of any work, project, service, utility, undertaking or function that: • the Crown, the Coordinator-General or other person or body who represents the Crown, or any local body is or may be authorised under any Act to undertake, or • is or has been (before or after the date of commencement of this Act) undertaken by the Crown, the Coordinator-General or other person or body who represents the Crown, or any local body under any Act, or • is included or is proposed to be included by the Coordinator-General as works in a program of works, or that is classified by the holder of the office of Coordinator-General as works.

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