

Executive summary

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E.1 Description of the action

E.1.1 Project proponents and environmental record

The Gladstone Area Water Board (GAWB) and SunWater Limited (SunWater) are joint proponents undertaking technical, environmental, social, cultural and economic investigations for the Lower Fitzroy River Infrastructure Project (Project).

The Project comprises the construction and operation of a raised Eden Bann Weir and construction and operation of a new weir at Rookwood (Rookwood Weir) on the Fitzroy River, Central Queensland.

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GAWB is a Category 1 commercialised Water Authority under the *Water Act 2000* (Qld) and a registered service provider under the *Water Supply (Safety and Reliability) Act 2008* (Qld). GAWB owns and operates Awoonga Dam on the Boyne River along with a network of delivery pipelines, water treatment plants and other bulk water distribution infrastructure in the Gladstone Region in central Queensland. GAWB's corporate objective is to ensure that the long- and short-term water needs of current and future customers are met and environmental (ISO14001:2004), quality (ISO9001:2008), compliance and risk management systems are maintained.

SunWater is a statutory Government Owned Corporation under the *Government Owned Corporations Act 1993* (Qld). SunWater owns and operates the Queensland Government's bulk water supply and distribution infrastructure located throughout regional Queensland, including the existing Eden Bann Weir. SunWater's Environmental Management System ensures that best practice environmental management and compliance is achieved across the business in accordance with ISO 14001:2004.

GAWB and SunWater have good environmental records and neither party has been found to be in contravention of environmental conditions imposed on their projects. GAWB and SunWater are committed to managing and operating their infrastructure in a safe and sustainable manner.

E.1.2 Project rationale

Planning, management and delivery of water to urban, industrial and agricultural communities is the role of State and local governments collaborating to implement water reforms to provide secure water entitlements to users while protecting the natural values and ecosystems of the region.

As subordinate legislation to the *Water Act 2000* (Qld), the Water Resource (Fitzroy Basin) Plan 2011 (Fitzroy WRP) seeks to achieve general and specific outcomes for the sustainable management of water. The Fitzroy Basin Resource Operations Plan (Fitzroy ROP) implements the Fitzroy WRP and defines the rules for allocation and management of water.

The Fitzroy WRP reserves a nominal volume of water (76,000 ML) for strategic water infrastructure on the Fitzroy River as the strategic water infrastructure reserve. The Project is recognised as strategic water infrastructure to which water allocations may be granted.

The Fitzroy ROP specifies that submissions to make unallocated water available from the strategic water infrastructure reserve on the Fitzroy River may be made as follows:

- GAWB: up to 30,000 ML of the reserve for urban and industrial water supplies
- Local government authority: up to 4,000 ML of the reserve for urban water supplies for the Capricorn Coast.

The Fitzroy ROP does not specify the intended use of the remaining 42,000 ML and nominates that any person or entity may make a submission in this regard.

In December 2004 the Queensland Government, in partnership with local government, committed to developing the Central Queensland Regional Water Supply Strategy (CQRWSS) (DNRW 2006), a long term water supply strategy for the region to address the following key issues:

- Continued urban growth and industrial development, particularly in the Lower Fitzroy and Gladstone areas, and mining development in the Bowen and Surat coal basins
- Entitlements in some existing regional water supply systems are at or approaching full usage
- Some existing water supply schemes are performing below water user requirements
- Water demand projections indicate regional supply shortfalls exist to meet urban, industrial, coal mining and agricultural requirements through to 2020.

The CQRWSS identified the Lower Fitzroy System as the next main supply source for urban and industrial needs of the Rockhampton Regional Council (RRC) and Livingstone Shire Council (LSC) local government areas and for the needs of GAWB's supply area. The CQRWSS identified that further infrastructure on the lower Fitzroy River is required in order to provide the appropriate reliability of supply (mainly for high priority water). The Project was identified as appropriate infrastructure to satisfy short-, medium- and long-term term supply requirements.

Cumulatively, the CQRWSS predicted a total shortfall of high priority water for urban and industrial needs in the order of 41,000 ML/a by 2020. Future demand for water resources is predicted to be primarily due to the continued growth of industrial and urban expansion in the Lower Fitzroy and Gladstone areas and potentially some agricultural development within the Fitzroy Agricultural Corridor. In addition to direct increases in demand there is also a potential requirement to improve the level of reliability of the existing water supplies locally and regionally.

Key potential water demand may arise from the following sources:

- GAWB: While not realised, water supply to Gladstone via GAWB's proposed Gladstone-Fitzroy Pipeline (GFP) of 30,000 ML/a is considered a likely first demand for the Project. The Project, together with the GFP, would provide a second water source supply solution for GAWB to improve reliability of supply risks. The GFP Project has received environmental approval from both the Queensland and Commonwealth governments
- RRC: The Fitzroy Barrage currently provides an allocation of 50,000 ML of high priority water to RRC (Fitzroy River Water), of which approximately half is used (DNRW 2006). Subject to the required level of service or the level of performance people can expect from their water supply (yet to be determined), demand for additional yield from the Project may be realised.

RRC, together with the Department of Energy and Water Supply, is currently undertaking a regional water supply security assessment in this regard

- LSC: Water to the Capricorn Coast is supplied through the Rockhampton to Yeppoon pipeline, supplemented with supplies from Waterpark Creek (4,400 ML/a). Discussions with LSC indicate that given the improved reliability and supply is provided from the Fitzroy River, the LSC remains interested in further water resources being made available and/or supply reliability being improved as a result of the Project
- Industry and mining
 - Whilst regional planning for the development of future infrastructure has been undertaken, notably in the form of the Gracemere-Stanwell Industrial Corridor, none of the expected projects have yet materialised, and demands are uncertain. Demand shortfalls in the order of 17,500 ML were predicted by 2020 (DNRW 2006). Nevertheless, RRC is currently promoting the need and desire for this development for economic growth in Rockhampton. Increased industrial demand within the Gladstone region is also expected, and these demands are catered for in the 30,000 ML being sought by GAWB
 - Similarly, while a number of mining and petroleum exploration projects are proposed for the Rockhampton region, projects have not materialised. While some demand for water can be expected in the long term, volumes required are difficult to predict.
- Agriculture
 - In terms of the demand for water from the agricultural sector, the CQRWSS reported that while the majority of demand could be satisfied by the take-up and trading of under-utilised entitlements, some demand from agriculture was predicted (DNRW 2006). With regard to the Project, tradable water allocations have been established for the lower Mackenzie and Fitzroy rivers from Tartus Weir to the Fitzroy Barrage
 - Further to this the Fitzroy Industry and Infrastructure Study (DIP 2007) identified that the potential existed for animal production, fodder crops and some horticulture to be undertaken within the Lower Fitzroy Agricultural Corridor. The study was completed in 2007 but no further implementation plans were developed and no demand profiles were confirmed. More recently, through Regional Development Australia's Growing Central Queensland initiative and RRC's promotion of agricultural development within the region (the Fitzroy Agricultural Corridor) it is possible that some future demand for high priority water will arise.

Consequently, future demands are difficult to predict with any degree of certainty. It is also noted that since the 2004-2007 drought that stimulated investigations into the Project, generally wetter than average weather and widespread flooding has been experienced in the region, until recently when drier conditions have again been prevalent. It is acknowledged that, as at June 2015, the demand for water that the full Project development can deliver is not yet realised. A staged approach to development will enable proponents to respond to potentially smaller demands in the short-term and progressively respond to increasing and/or larger demand requirements over time through intermediate infrastructure builds until full development is reached. The current Project concept/preliminary design is modular to facilitate staging in order to respond quickly and efficiently to deliver water quickly to meet anticipated future demands.

E.1.3 Relationships to other projects

The Project will operate in concert with the existing Fitzroy Barrage with releases from Rookwood Weir to Eden Bann Weir (existing and raised) to the Fitzroy Barrage for abstraction (Chapter 2 Project description).

GAWB has identified the development of the GFP Project as its preferred delivery mechanism for a second water source. The GFP is designed to transfer 30,000 ML of water per annum (and possibly more if required) from the Fitzroy system. Water supply is proposed to be from water secured through development of the Project.

E.1.4 Project alternatives

Project alternatives have been considered with respect to their ability to match immediate demand and then keep pace with emerging demand while ensuring capture of available yield in the system as follows:

- Fitzroy Barrage: Raising the gates of the existing Fitzroy Barrage was considered. This would achieve an additional 8,000 ML/a yield over the base case (existing Fitzroy Barrage and Eden Bann Weir and no Rookwood Weir). It is considered that raising the Fitzroy Barrage will not achieve Project objectives. In addition potentially adverse environmental, economic and social impacts are predicted
- GAWB's second water source options: GAWB's 2004 Strategic Water Plan identified 13 water source augmentations. Evaluation of these options against water quality, security, environmental, social and water pricing criteria resulted in nine options being selected for further assessment comprising weirs on the Fitzroy River, weirs on Baffle Creek, raising Awoonga Dam and/or Castle Hope Dam and a desalination plant (GAWB 2013). Given GAWB's requirement that a contingent supply needs to be chosen based on the lowest preparatory cost but able to deliver certainty of supply within a three year period, GAWB's Strategic Water Plan concludes that the GFP Project (with its link to the Project) is the preferred option
- Water storage infrastructure
 - Nathan Dam on the Dawson River (620 km upstream of the Fitzroy River estuary) is being proposed by SunWater. Water from the dam will be transported via a trunk pipeline to primarily service coal mines and power stations in the Surat Basin, extending to Dalby. Water will also be released downstream to towns along the Dawson River, to new mining customers in the Southern Bowen Basin and to existing and potentially new irrigation customers in the Dawson Valley Water Supply Scheme (SKM, 2010). Nathan Dam has the potential to transfer water to the lower Fitzroy system to meet critical urban supply needs, potentially in response to drought triggers. Given the location of Nathan Dam and distance to the Project, together with anticipated demand from Nathan Dam within the Dawson-Callide and Upper Dawson sub-regions, it is unlikely that supply from Nathan Dam will achieve Project objectives and provide an economically viable solution to long-term water supply requirements in the lower Fitzroy
 - Connors River Dam is proposed by SunWater on the Connors River (562 km upstream of the Fitzroy Barrage). Water from the dam will be transported via pipeline to Moranbah and will service coal mines and communities in the Bowen Coal Basin and surrounds. Downstream releases can be purchased and used by irrigators. Supply from Connors River

- Dam to the lower Fitzroy system to satisfy the projected demands is however not considered viable due to significant transfer losses downstream of the dam
- Fitzroy Gap Dam: Construction of a dam at the Fitzroy Gap immediately upstream of, and within the impoundment of, the existing Eden Bann Weir has been previously considered. Supply from a dam at The Gap will not however achieve Project objectives in the short- to medium term as construction of a 'mega-dam' does not allow for incremental development in response to increasing demand. Environmental impacts on the aquatic ecosystems, terrestrial flora and fauna and loss of land associated with inundation will be considerably more severe than the Project due to impoundment outside of the river bed and banks. The nearness of the existing Eden Bann Weir to the proposed dam site adds further complications. It is likely that the existing impoundment would need to be drained to accommodate construction and this would have the potential to severely disrupt supply to Stanwell Power Station.
 - Non-infrastructure options
 - Short-term water supplies may be achieved through demand management strategies such as pricing, education, rostering, recycling and water use efficiency, combined with research and development programmes that reduce consumption. Demand management alone is not considered sufficient to meet the longer-term needs of the Rockhampton, Livingstone and Gladstone regions water needs and that provision of new infrastructure on the Fitzroy River is required
 - Agricultural demand has the potential to be met through the take up of currently unutilised, or under-utilised, water allocations. Trading is allowed for in the Fitzroy River upstream of the Fitzroy Barrage to facilitate uptake of these allocations
 - Groundwater supply within the Rockhampton, Livingstone and Gladstone regions is limited to primarily stock and domestic purposes and supplies to small towns and is not considered to be a feasible alternative supply to the Project.
 - No development option
 - Limited ability to respond to short- and long-term future demands for water resources will result if the Project is not progressed in preparedness for future demands from existing and new customers, drought and meeting the required service levels
 - Inability to support the GFP Project increases GAWB's inherent existing risk of failure of supply from a single source (Awoonga Dam)
 - The primary objective of the Project is to support industrial and urban growth. The 'no development' option has the potential to inhibit growth locally (Rockhampton and Livingstone local government areas) and regionally (Gladstone local government area). Limiting industrial growth in particular has the potential to adversely impact on the Queensland economy with large scale industrial development potentially seeking alternative locations inter-state due to this water supply constraint.

E.1.5 Regulatory framework and environmental impact assessment process

The Project is being undertaken in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The Project is a ‘controlled action’ requiring assessment and approval under the EPBC Act (EPBC referral 2009/5173). The nominated assessment approach is by environmental impact statement (EIS). In June 2010, guidelines for an EIS were issued in relation to matters of national environmental significance (MNES). The relevant controlling provisions in relation to MNES are:

- World Heritage properties
- National Heritage places
- Listed threatened species and communities
- Listed migratory species.

The Project is also a ‘coordinated project’ under the *State Development and Public Works Organisation Act 1971* (Qld) requiring an EIS for which terms of reference (ToR) were finalised in April 2012.

As at 10 January 2014, the Project transitioned to assessment through the new bilateral assessment process executed between Queensland and Commonwealth governments. As a result, a single EIS addresses both State ToR and Commonwealth Guidelines. To facilitate this process draft ToR were re-issued and finalised in September 2014.

Table E-1 provides a summary of the structure of the draft EIS.

Table E-1 Draft EIS structure

Volume 1 Part B of the ToR (focussing on State matters)		Volume 2 – Part C of the ToR (focussing on MNES)		Volume 3 – Appendices (supporting material)	
E	Executive summary	E	Executive summary	A	Final terms of reference
1	Introduction	1	Description of the action	B	Terms of reference cross-reference
2	Project description	2	Project description	C	Glossary and abbreviations
3	Legislation and project approvals	3	Planning and approvals	D	Study team
4	Climate, natural hazards and climate change	4	Consultation	E	Proponents' environmental policies
5	Land	5	Alternatives to the Project	F	Consultation report
6	Flora	6	Methodology	G	Land - detailed mapping
7	Aquatic ecology	7	Existing environment	H	An assessment of the potential implications on native vegetation and terrestrial ecosystems (Nangura 2007)
8	Terrestrial fauna	8	General impacts	I	Flora - detailed mapping
9	Surface water resources	9	World Heritage properties and National Heritage places	J	Eden Bann Weir baseline aquatic ecology report

Volume 1 Part B of the ToR (focussing on State matters)		Volume 2 – Part C of the ToR (focussing on MNES)		Volume 3 – Appendices (supporting material)	
10	Groundwater resources	10	Threatened species and ecological communities	K	Rookwood Weir baseline aquatic ecology report
11	Water quality	11	Migratory and marine species	L	Fitzroy River turtle (<i>Rheodytes leukops</i>) technical report
12	Air quality	12	Cumulative and consequential impacts	M	Fitzroy River turtle (<i>Rheodytes leukops</i>) species management program
13	Greenhouse gas emissions	13	Environmental Management System	N	Eden Bann Weir baseline terrestrial fauna report
14	Noise and vibration	14	Offsets	O	Rookwood Weir baseline terrestrial fauna report
15	Waste	15	Conclusion	P	Surface water resources supporting material
16	Transport	16	Information sources and reference list	Q	Traffic and transport supporting material
17	Cultural heritage			R	Social impact assessment report
18	Social impact			S	Economic assessment report (Commercial in confidence)
19	Economics			T	Counter-terrorism and critical infrastructure protection reports (Commercial in confidence)
20	Hazard and risk			U	EPBC Protected Matters Search Tool Results
21	Cumulative impacts			V	IQQM yield assessment (Commercial in confidence)
22	Offsets			W	Project commitments
23	Environmental Management Plan			X	Fish passage technical report
24	Conclusions and recommendations			Y	Consolidated mitigation measures for impacts on matters of national environment significance
25	References				

E.1.6 Consultation

Guided by the core values and principles of the International Association of Public Participation, a public consultation program is being implemented as part of the Project EIS to enable a structured process to facilitate open, meaningful and accountable public consultation and engagement with relevant stakeholders during the preparation of the EIS for the Project.

A variety of communication tools were developed to facilitate a two-way flow of information between the Project team and stakeholders and assisted in capturing stakeholder feedback throughout the EIS process, as depicted in Figure E-1. An indicative list of the stakeholders is provided in Table E-2. Table E-3 shows the sequencing of consultation phases undertaken and proposed in relation to the Project EIS.

Figure E-1 EIS consultation activities and communication tools



Table E-2 Project stakeholders

Stakeholder category	Member list (non-exhaustive)
Internal stakeholders	
Project partners	SunWater and GAWB Boards, Executive Management Teams, Project Control Groups, Project Technical Teams
GHD and sub-consultants	Project Manager, assessment teams, consultation team, sub-consultants
External stakeholders	
Commonwealth Government	Departmental ministers, elected representatives, Government departments and authorities
Queensland Government	Premier and departmental ministers, elected representatives, State departments and authorities
Local government	RRC, LSC, Central Highlands Regional Council (CHRC), Woorabinda Aboriginal Shire Council (WASC), Gladstone Regional Council
Community and business	Directly affected landholders, local residential areas, environmental groups, local business, industry/peak bodies, community/interest groups, cultural heritage representatives, health and educational institutions, recreational groups, media, utility service providers

Table E-3 Consultation phases

Period	October 2008 – August 2009	August 2009 – June 2015	Q3 2015	Q3-Q4 2015
Phase	Phase 1 Scoping and planning	Phase 2 EIS development	Phase 3 Public exhibition	Phase 4 Evaluation and EIS finalisation
Summary of Activities	<ul style="list-style-type: none"> • Identification of stakeholders and establishment of stakeholder database • Issue/risk assessment • Preparation of information materials (including website, 1800 number and reply paid post facilities) • Consultation plan preparation and approval (internal) • Preparation of land access protocols, media protocols etc. 	<ul style="list-style-type: none"> • Production and distribution of Project new sletters and updates • Maintain website, 1800 number and reply paid post facilities and stakeholder database • Stakeholder briefings • Landholder meetings • Community information sessions • Management of enquiries and media relations 	<ul style="list-style-type: none"> • Production and distribution of Project new sletters and updates • Maintain website, 1800 number and reply paid post facilities and stakeholder database • Community and agency information sessions • Management of enquiries and media relations 	<ul style="list-style-type: none"> • Close out activities • Production and distribution of Project new sletters and updates • Maintain website, 1800 number and reply paid post facilities and stakeholder database • Consultation evaluation • Public notification of EIS assessment outcomes
Regulatory consultation requirements	Consultation plan	Prepare consultation report for the draft EIS	Public display of draft EIS Community information sessions and regulatory agency briefings	Prepare response to draft EIS submissions as directed by Coordinator-General requirements

To date (scoping (Phase 1) and EIS development (Phase 2)) (Table E-3), approximately 8,800 newsletters have been distributed, workshops and briefings have been held, including 250 telephone discussions and 52 face-to-face meetings, and three community information sessions hosted where people could 'drop in' and talk to the Project team. Feedback forms have also been used and all stakeholder feedback, both positive and negative, was recorded in the Project stakeholder database.

At the conclusion of the public exhibition period (Phase 3) (Table E-3), stakeholder and community feedback will be reviewed and addressed as necessary, including the provision of additional information as required. Following completion of the EIS, consultation will focus on maintaining the relationships established during the draft EIS consultation, through the 'holding period' until such time as a Project development trigger is realised. At this time, consultation will mainly focus on construction related matters before moving into an operation planning phase.

Any submissions regarding this draft EIS should be addressed to:

The Coordinator-General

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Website: www.statedevelopment.qld.gov.au/lower-fitzroy

E.2 Project description

Key Project components include the following:

- Eden Bann Weir
 - Eden Bann Weir Stage 2 (EB2) – a raise of the existing Eden Bann Weir (herein termed as Stage 1 with an existing full supply level (FSL) of 14.5 m Australian Height Datum (AHD)) (EB1) to a new FSL of 18.2 m AHD and associated impoundment of the Fitzroy River
 - Eden Bann Weir Stage 3 (EB3) – the addition of 2 m high flap gates to Stage 2 to achieve FSL 20.2 m AHD and associated impoundment of the Fitzroy River.
- Rookwood Weir
 - Rookwood Weir Stage 1 (RW1) – a new build to FSL 45.5 m AHD, saddle dams and associated impoundment of the Fitzroy, Mackenzie and Dawson rivers
 - Rookwood Weir Stage 2 (RW2) – the addition of 3.5 m high flap gates to Stage 1 to achieve FSL 49.0 m AHD and associated impoundment of the Fitzroy, Mackenzie and Dawson rivers.
- Fish passage and turtle passage infrastructure (fish locks and a turtle bypass).

The Project is expected to be staged, with sequencing and timing dependant on a number of demand triggers including existing and new consumers, drought conditions and security of supply requirements.

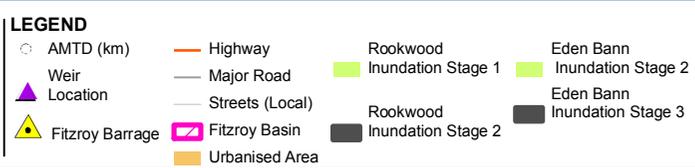
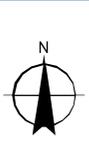
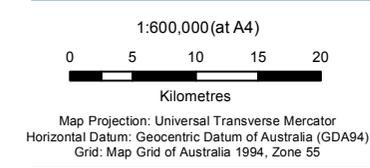
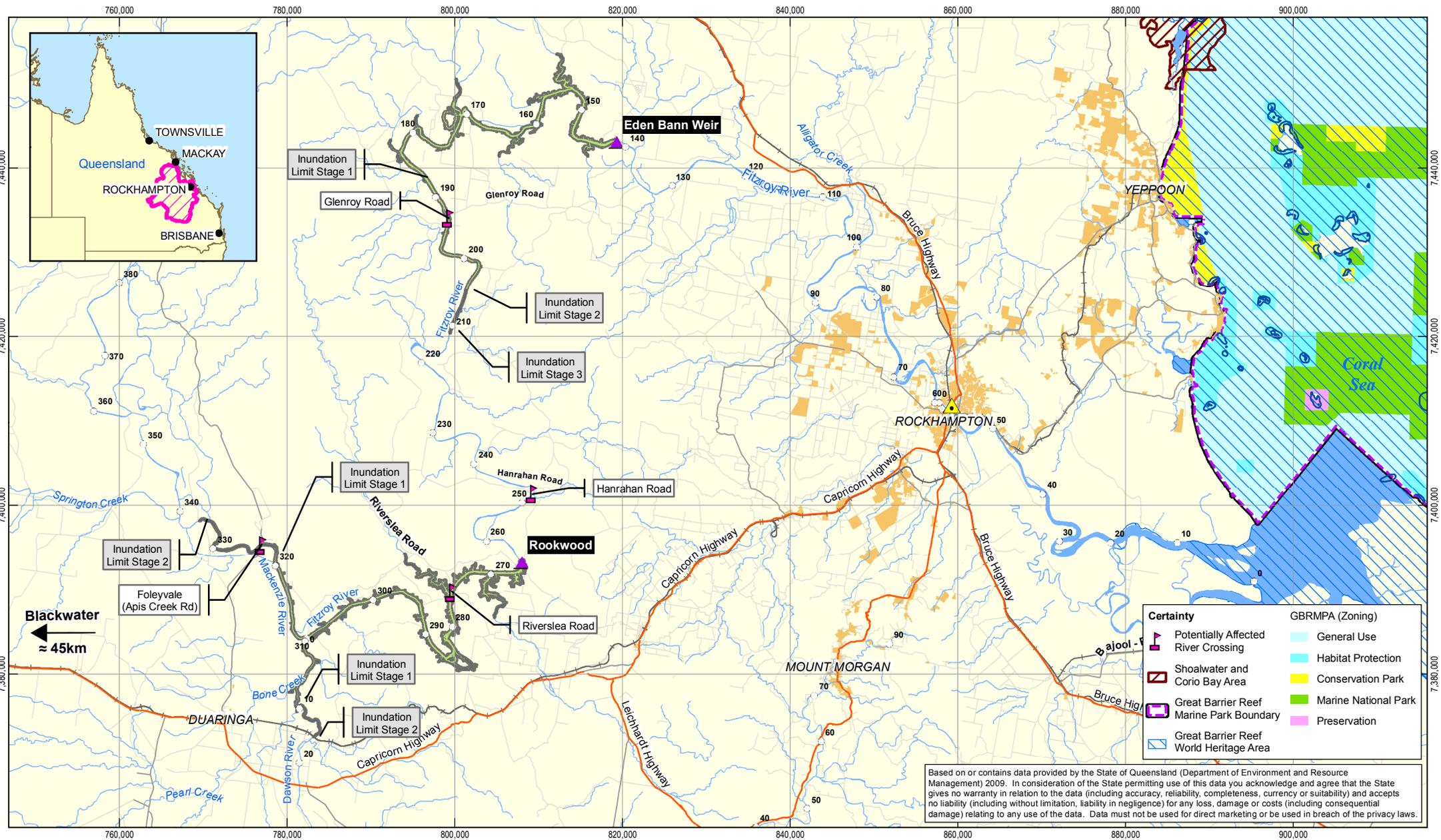
Other infrastructure components associated with the Project include:

- Upgrades to and construction of access roads (public and private) to and from the weir sites and upgrades to intersections for construction and operation
- Construction of low level bridges in areas upstream of weir infrastructure impacted by the impoundments, specifically at Glenroy, Riverslea and Foleyvale crossings
- Installation of culverts at Hanrahan Crossing downstream of Rookwood Weir to facilitate access during operational releases
- Relocation of existing and/or installation of new gauging stations on the Fitzroy, Mackenzie and Dawson rivers
- Removal and decommissioning of existing low level causeways and culverts at river crossings described above
- Water supply for construction will be sourced directly from the Fitzroy River and the Mackenzie River and will not require the construction of additional water supply infrastructure. Operational water for services/facilities at the weir sites will be provided through rainwater harvesting systems. Drinking water will be delivered to the site during construction and operation.

For the purposes of assessment, the Project is divided into the following areas:

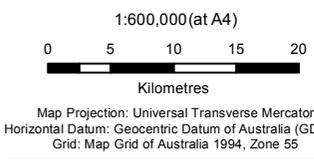
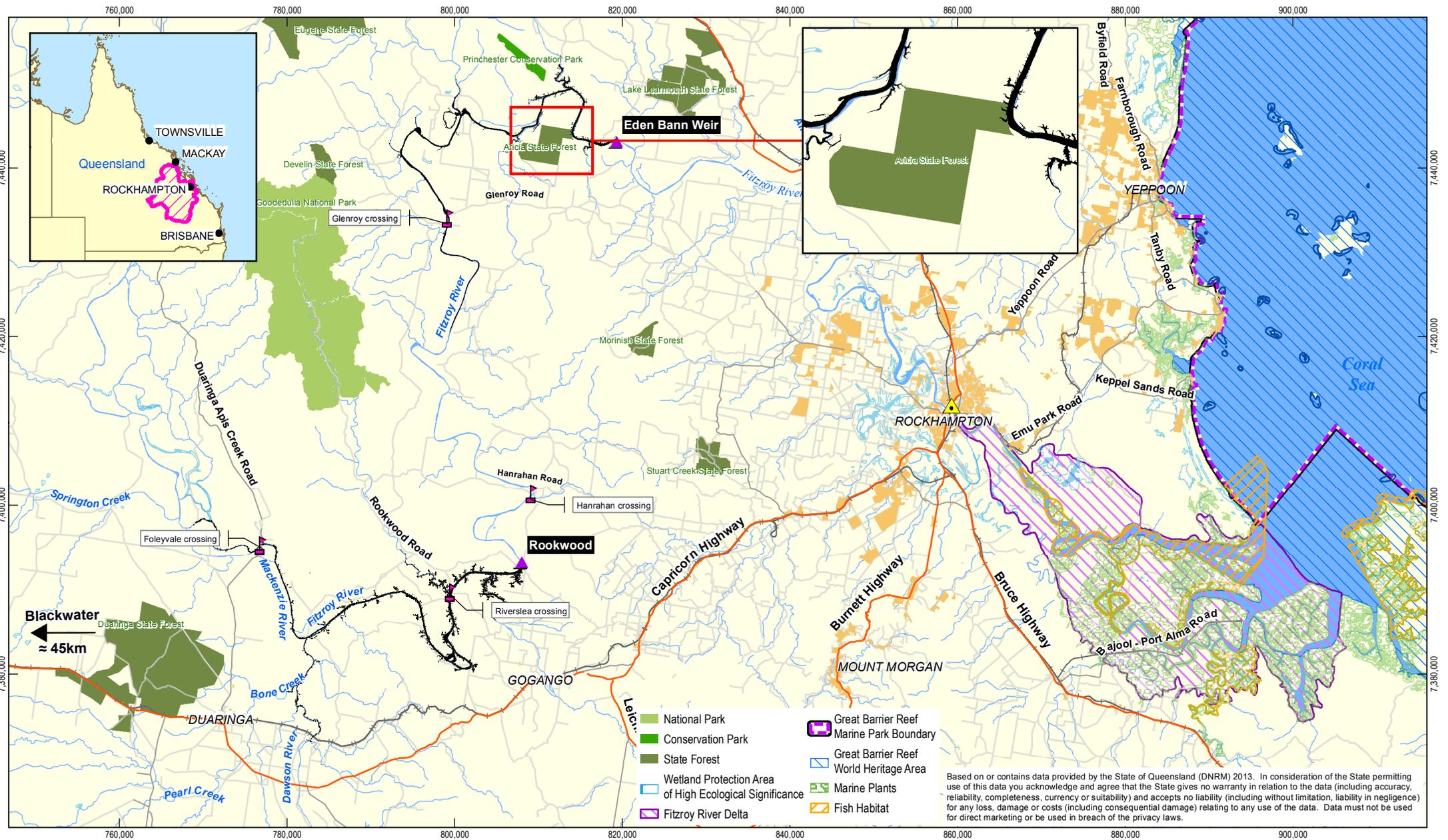
- Project footprint
 - Weir infrastructure - permanent weir wall and abutments, spillway, fish and turtle passage infrastructure, control room and amenities, immediate downstream protection areas and saddle dams, as applicable
 - Weir construction area incorporating the weir infrastructure area in addition to other in stream works such as coffer dams and excavations and areas adjacent to the river for the establishment of site facilities, as applicable to Eden Bann Weir and Rookwood Weir
 - Weir impoundment comprising the area within the riverbed and banks inundated at FSL and adjacent riparian areas that will be the subject of a water storage easement
 - Weir access roads (public and private, including intersection treatments)
 - River crossings comprising Glenroy, Riverslea, Foleyvale and Hanrahan crossings inclusive of road approaches.
- Downstream riverine areas comprising river sections downstream of Rookwood and Eden Bann weirs to the Fitzroy Barrage, excluding existing impoundments
- Downstream estuarine/marine areas comprising areas downstream of the Fitzroy Barrage to the Great Barrier Reef Marine Park.

Figure E-2 shows the location of Project and its key components. Figure E-3 and Figure E-4 show the Project construction areas relative to Eden Bann Weir and the proposed Rookwood Weir, respectively.



Gladstone Area Water Board, SunWater Job Number | 41-20736
Lower Fitzroy River Infrastructure Project Revision | G
Date | 31 Oct 2014

Project Location **Figure E-2**



LEGEND	
	Weir Location
	River Crossing
	Fitzroy Barrage
	Highway
	Major Road
	Streets (Local)
	Railway
	Waterway
	Fitzroy Basin
	Urbanised Area
	Impoundment Area

- National Park
- Conservation Park
- State Forest
- Wetland Protection Area of High Ecological Significance
- Fitzroy River Delta
- Great Barrier Reef Marine Park Boundary
- Great Barrier Reef World Heritage Area
- Marine Plants
- Fish Habitat

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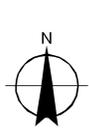
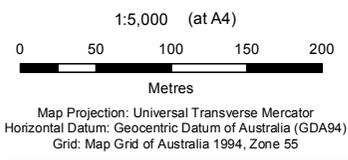
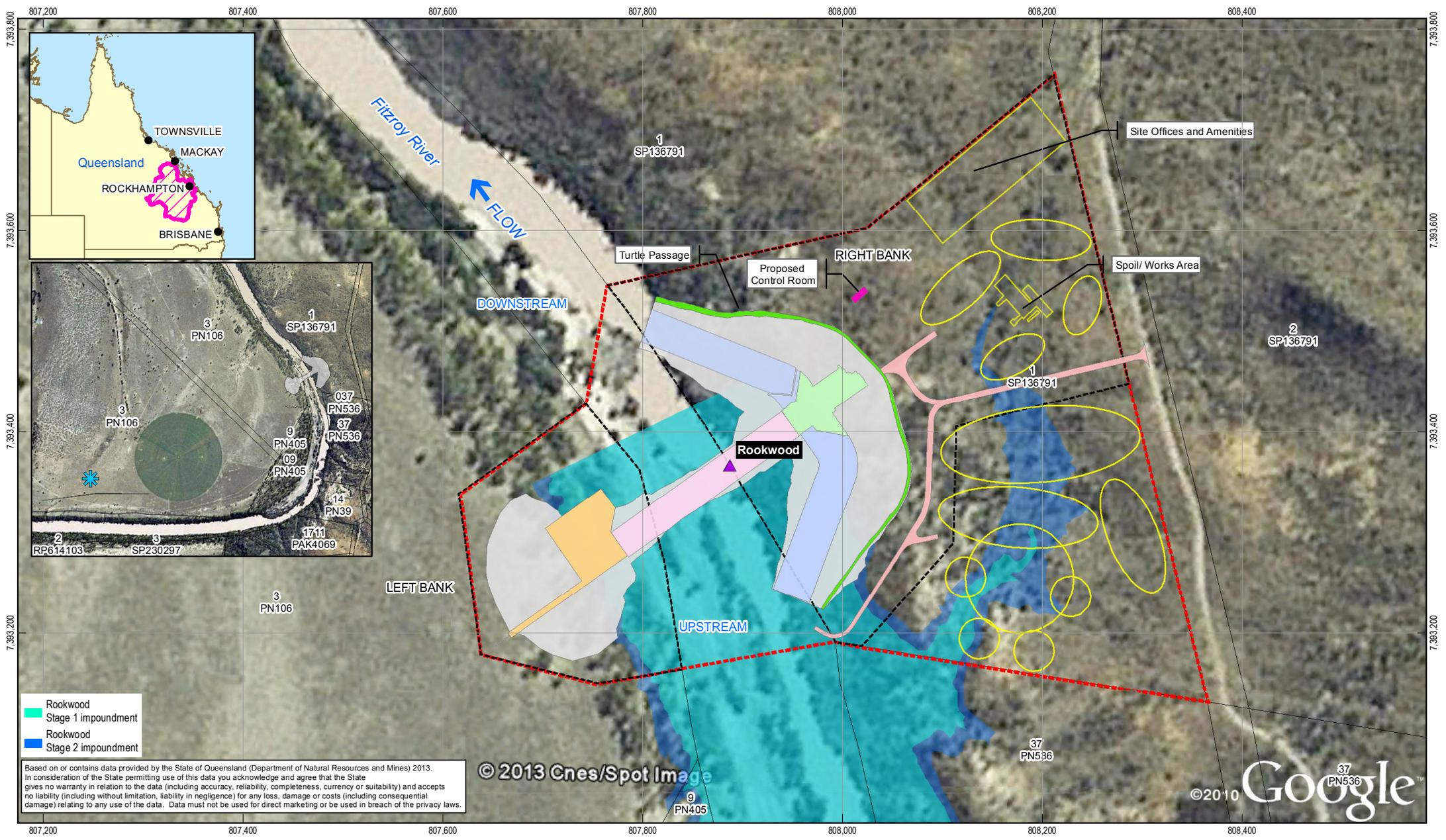
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 Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways (2007); Sunwater: Waterways, Weir Locations - 2008; DNRM: Railways, Roads, Fitzroy River Delta - 2010, WPA - 2011, Protected Areas, Marine Plants, Fish Habitat, High Significance Wetlands, Great Barrier Reef WHA - 2012; © Copyright Commonwealth of Australia (GBRMPA): GBRMP Boundary (2011); GHD: Impoundment Area, Crossings (2012). Created by: MS *See Appendix for disclaimers and copyrights.



Gladstone Area Water Board, SunWater Job Number 41-20736
 Lower Fitzroy River Infrastructure Project Revision C
 Date 31 Oct 2014

Reserves, protected areas and sensitive environmental areas **Figure E-3**

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LEGEND	
	Weir Location
	Fitzroy Basin
	Construction Area
	Channel
	Outlet works and fishway
	Proposed Control Room
	Spillway
	Turtle Passage
	Proposed Property Acquisition Boundary
	Rookwood Weir proposed structure
	Abutment, Wide Rock filled mattress
	Access Roads
	Saddle Dam



Gladstone Area Water Board, SunWater Job Number 41-20736
 Lower Fitzroy River Infrastructure Project Revision D
 Date 30 Oct 2014

Rookwood Weir construction area

Figure E-4

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 Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Waterways (2007); Sunwater: Waterways, Weir Locations - 2008; Google: Google Imagery Extraction 19/02/2013; GHD: Proposed Weir. Created by: MG *See Appendix for disclaimers and copyrights.

Operationally, the Project comprises the maintenance and management of the weir infrastructure, private access roads and impoundments, inclusive of a flood buffer. Water releases will be made through 'run of river' methods and no water distribution infrastructure is required as part of the Project. Water releases will be made to satisfy environmental flow and water allocation security objectives in accordance with the Fitzroy WRP. Operating regimes will be developed and implemented through the Fitzroy ROP. The overall storage and release strategy is proposed to operate as follows, subject to the Fitzroy WRP and subsequent Fitzroy ROP provisions:

- Nominal full supply levels will be maintained at Eden Bann Weir and the Fitzroy Barrage through releases from Rookwood Weir
- Once the Rookwood Weir storage is emptied, nominal full supply would be maintained at the Fitzroy Barrage through releases from Eden Bann Weir
- Once the storages at Rookwood Weir and Eden Bann Weir have been emptied, drawdown at the Fitzroy Barrage will occur.

For both Eden Bann Weir and Rookwood Weir, all equipment on the weir will be controlled by hydraulics from a control room located on the embankment. A supervisory control and data acquisition (SCADA) system is proposed to be used to facilitate the monitoring, controlling and alarming of the weirs from a central location (likely to be at Rockhampton from where SunWater currently operates the existing Eden Bann Weir). Grid power will be used as the primary power source, with a standby generator as backup. The proposed infrastructure has been designed to reduce maintenance requirements and to allow adequate access for maintenance activities when they are required.

The development of weir infrastructure (and associated works), the resultant storage of water (inundation of the river bed and banks) and the transfer of water between storages through 'run of river' methods on the Fitzroy River comprise the scope of the Project. Abstraction, transmission and distribution to end users are not considered as part of the proposed Project and are subject to their own environmental investigations and approvals where applicable. This includes the GFP Project described earlier.

Environmental design features of the Project include modified and new fishways; outlets that facilitate a range of release volumes; outlets with selective offtakes; screens, surface treatments, stilling basins and operation of the outlets to allow controlled incremental release of water; turtle passage infrastructure; construction programme and staging to avoid or minimise impacts on fish passage; provision of low level bridges to provide improved access to the road network and improved immunity of river crossings during floods.

Construction (per stage) is programmed to occur over at least two dry seasons. A contract start time for EIS reporting purposes has been set so that site activities, particularly those related to the riverbed activities can commence at the end of the wet season due to the unpredictability and magnitude of the flows during the wet season.

The milestones and timeframes for the Project are as follows, noting that an actual start date will be determined by a demand trigger coinciding with seasonal factors as explained above:

- Preparatory and early works (15 to 18 months prior to Quarter (Q)1 Year 1)
- Contract award (Q1 Year 1)
- Commencement of construction (start-Q1 Year 1)

- Spillway concrete complete (start-Q4 Year 2)
- Commencement of impounding (mid-Q4 Year 2)
- Weir practically complete (end-Q4 Year 2).

Impoundment is expected to occur within a single wet season during which commissioning will take place.

While the design life of the Project is 100 years, it is anticipated that the weir infrastructure will be maintained and operational after this period. As such, prescriptive planning for decommissioning and rehabilitation cannot be undertaken at present as best practice standards and legislative requirements are likely to change over the life of the Project. Management obligations for the infrastructure continue in accordance with approval requirements until such time as the infrastructure is decommissioned and rehabilitated. These responsibilities remain with the owner of the infrastructure.

E.3 Existing environment

E.3.1 Local climate and seasonal conditions

The Rockhampton region experiences hot summer months from November to April followed by a cooler, usually dry period from May to October. Seasonal irregularity is a defining feature of the study area, with long dry spells often followed by intense wet season rainfalls. The Fitzroy River has a long and well-documented history of flooding. Major floods can result from either the Dawson or the Mackenzie rivers although significant flooding in the Rockhampton area can also occur from heavy rain in the local area below Riverslea Crossing.

The Project area is located within the Australia Eastern Region for cyclone activity and the cyclone season occurs each year from November through to April. The region also experiences severe storms which occur on average at least twice per year during spring and summer months. Like much of Queensland, the Project area frequently experiences drought conditions, notably during the period between 2000 and 2007.

E.3.2 Land use and land tenure

Eden Bann Weir is located on the Fitzroy River bounded by the RRC local government area (LGA) and the LSC LGA. The Rookwood Weir site is located on the Fitzroy River within the RRC LGA. The impoundment associated with Rookwood Weir borders two parcels of WASC land and sections of CHRC land.

The Project is located in a rural area. The main activity occurring on properties affected by the Project is cattle grazing, breeding and fattening. There is some crop cultivation for grains and a small number of properties with irrigation licences. The most common use of the river is for stock watering with cattle generally accessing the water directly or via pump/trough systems. SunWater own and operate the existing Eden Bann Weir. Reserves (primarily for the purposes of camping, water, roads and stock) are locally impacted by the Project. In the order of 4 ha of the Aricia State Forest will be impacted as a result of Eden Bann Weir impoundment.

E.3.3 Air quality

The Project area is remote and rural in nature, not located within or in proximity to industrial, manufacturing or mining zones and not associated with feedlots or intensive cropping. Land use at both Eden Bann Weir and the proposed Rookwood Weir site comprise broad scale cattle grazing operations. Ambient background levels of gaseous pollutants and odours are considered to be negligible but the 'natural' dust load is considered to be important for the assessment.

E.3.4 Surface water resources

The Fitzroy Basin is large and consists of six major sub-catchments for the purposes of water resource planning, namely: Isaac / Connors; Nogoia; Comet; Mackenzie; Dawson; and Fitzroy.

Although sparsely populated, the Fitzroy Basin has been largely modified for human land use practices with agricultural production accounting for almost 90 per cent of land use with 81.7 per cent being livestock grazing (Johnston et al. 2008). Other notable land uses include State Forest, nature conservation and mining (Johnston et al. 2008). Existing mining activities are concentrated in the northern and western parts of the Basin.

In order to support human activities in a climatically-variable system, rivers within the Fitzroy Basin are heavily regulated through infrastructure within water supply schemes. The following water supply schemes are relevant to the Project and/or the Project areas:

- Dawson Valley Water Supply Scheme: proposed Nathan Dam, Glebe Weir, Gylanda Weir, Orange Creek Weir, Theodore Weir, Moura Weir and Neville Hewitt Weir
- Nogoia Mackenzie Water Supply Scheme: Fairbairn Dam, Selma Weir, Bedford Weir, Binegang Weir and Tartrus Weir
- Lower Fitzroy Water Supply Scheme: Eden Bann Weir
- Fitzroy Barrage Water Supply Scheme: Fitzroy Barrage.

The Fitzroy sub-catchment is dominated by the Fitzroy River that forms from the confluence of the Mackenzie and Dawson rivers, and flows out to the Great Barrier Reef World Heritage Area (GBRWhA). The Dawson sub-catchment dominates the south eastern part of the Fitzroy Basin. The Dawson River originates in the Carnarvon and Expedition Ranges north of Injune, from where it flows to the south east towards Taroom before changing to a northerly course until it meets the Mackenzie River. The Mackenzie River forms from the confluence of the Nogoia and Comet Rivers.

Flows in the Mackenzie River (and subsequently the Fitzroy River) are erratic and largely driven by cyclonic action, severe storms and tropical low pressure systems characteristic of the north of the Fitzroy Basin. Consequently flows are highly variable and unpredictable. In general average monthly flow volumes show a consistent seasonal pattern of high summer flows and low winter flows on the Fitzroy and Mackenzie rivers, peaking at around 1,200,000 ML per month and 900,000 ML per month, respectively, and falling to almost zero flow in the winter months. This seasonality in flow is less marked on the Dawson River and may reflect differences in localised climatic conditions. The Dawson sub-catchment does not typically experience regular intense rainfall events associated with cyclones and is rather susceptible to severe thunderstorms particularly during the summer months (SKM 2012). Flows are markedly reduced, peaking at around 120,000 ML per month.

E.3.5 Water quality

Water quality in the Project area is heavily influenced by anthropogenic factors in the catchment area, principally as a result of its large agricultural production base.

Water quality is described relative to water quality objectives (WQOs) defined in Schedule 1 of the Queensland Environmental Protection (Water) Policy for sub-basins and specific to water types in order to protect aquatic ecosystems and human use environmental values. Relative to the Project, Eden Bann Weir (Fitzroy River at The Gap) is defined as a freshwater lake or reservoir; the Fitzroy River at Riverslea, the Dawson River at Beckers and the Mackenzie River at Coolmaringa are defined as fresh waters/main trunk waters.

Water quality characteristics are summarised:

- Consistent with the fact that most Fitzroy soils are alkaline (DERM 2008) pH recorded across the Project area is alkaline in nature. Periodic increases in pH were recorded as a result of mine dewatering activities
- Existing turbidity levels within the Fitzroy, Dawson and Mackenzie rivers are greater than WQOs objectives as a result of sediment entering the waterways from runoff and erosion. This is consistent with generally high turbidity levels observed within the Fitzroy, Mackenzie and Dawson rivers and as reported for other storages in the Fitzroy Basin
- Salinity levels are recorded as below WQOs for all areas, except at Riverslea during high flows
- Temperature ranges are between 21°C and 26°C. Within the existing Eden Bann Weir slight reductions in temperature are recorded over depth showing limited stratification
- Dissolved oxygen (DO) levels are within WQOs for all fresh waters/main trunk waters. Within the existing Eden Bann Weir DO oxygen levels are slightly below WQOs however outflows downstream achieve WQOs. DO within the Eden Bann Weir impoundment decreases only slightly with depth suggesting a low level of stratification
- Nutrient levels (total nitrogen and total phosphorous) are above WQOs at all locations. At the existing Eden Bann Weir inflow nutrient levels are consistent with those recorded within the impoundment
- Blue green algae biovolumes within the existing Eden Bann Weir are generally low and chlorophyll a levels are below WQOs. In Dawson River, no potentially toxic blue green algae have been recorded in Neville Hewitt Weir (upstream of the Project) since sampling began in 2002 (SunWater 2011).

E.3.6 Threatened species and ecological communities

Terrestrial ecology

Desktop assessments, vegetation mapping, field surveys and bio-condition assessments were undertaken to determine existing terrestrial fauna and flora values and potential impacts on fauna and flora values as a result of the Project. The following sensitive environmental areas relating to flora values occur in the Project footprint:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) threatened ecological community (TEC), listed as endangered under the EPBC Act
- Black ironbox (*Eucalyptus raveretiana*), listed as vulnerable under the EPBC Act

- Endangered, of concern and least concern regional ecosystems (REs)
- Squatter pigeon (southern) (*Geophaps scripta scripta*), listed as vulnerable under the EPBC Act.

The Project is located in the Brigalow Belt bioregion characterised by the presence of Brigalow (*Acacia harpophylla*) and a high level of habitat loss. In particular, the lowlands (alluvial and clay plains) and riparian zones have been extensively cleared for agriculture. Within the Brigalow Belt bioregion, the Project footprint is located within five subregions: the Marlborough Plains, Mount Morgan Ranges, Boomer Range, Isaac-Comet Downs and the Dawson River Downs subregions.

A population of black ironbox occurs along Melaleuca Creek (associated with the proposed Rookwood Weir impoundment). The population includes a reasonable proportion of larger mature trees and a patchy mix of younger trees and saplings. The population does not appear to be in any rapid state of decline albeit at the southern extent of its natural range. However, this population is currently facing the threat of habitat disruption from a rubber vine infestation though it is currently healthy. Black ironbox was recorded along several creeks near to but outside of the Eden Bann Weir impoundment.

Remnant vegetation is typically fragmented across the landscape as a result of historic clearing. Patches of high value regrowth are mapped by DNRM (2011) along the Fitzroy, Dawson and Mackenzie rivers within the Project footprint. The bio-condition assessment of regrowth areas found that habitat elements essential for long-term recovery were lacking or highly degraded and it was noted that many sites would be unlikely to recover rapidly without management (Nangura 2007). Introduced plants and weeds are ubiquitous across the Project area.

Squatter pigeon was identified within Project areas during wet and dry season surveys.

Terrestrial fauna habitats are highly seasonal, responding to changes in rainfall and river flow. Ephemeral off-stream water bodies and creeks represent sensitive terrestrial fauna habitats within the Project footprint. Such habitats provide resources for a wide array of animals, including amphibians (breeding and foraging), reptiles (foraging), ground-dwelling mammals (foraging), microchiropteran bats (foraging) and birds (foraging and nesting amongst dense riparian vegetation).

Ecological resources and habitats critical to the long-term viability of conservation significant terrestrial species are unlikely to occur within the Project footprint. Nonetheless, fragmented habitats that occur within and adjacent to the Fitzroy River are likely to provide resources for small localised populations of threatened species, as well as a wide diversity of common, generalist species that are tolerant of a modified landscape matrix. Since much of the lowland landscape has been cleared for agricultural development, riparian habitat corridors perform a valuable role, maintaining connectivity between habitat remnants.

Aquatic ecology

Aquatic habitats in the Fitzroy, Mackenzie and Dawson rivers are highly dynamic. The temporal distribution and spatial extent of the aquatic habitat types are related to fluctuating water levels driven by factors such as seasonal rainfall, water storage management, water extraction, evaporation and ground seepage. Climate, hydrological regime and past and present land use practices have all influenced the diversity and abundance of aquatic species within the Project footprints.

The impoundment created as a result of the existing Eden Bann Weir is the dominant aquatic habitat type within the Eden Bann Weir Project footprint. Upstream of the impoundment, the Fitzroy River exists as a series of pool-riffle-run sequences. A number of creeks and off-stream water bodies provide further aquatic habitat beyond the main channel of the rivers.

To document the known aquatic ecology values within the Project footprint, a desktop and field assessment was undertaken, Survey timing and design considered seasonal variation and the ecology of targeted threatened species.

No EPBC Act listed fish species have been previously recorded or are predicted to occur.

The Fitzroy River turtle (*Rheodytes leukops*) (listed as vulnerable under the EPBC Act) is endemic to the Fitzroy Basin catchment with the species distribution extending downstream to the Fitzroy Barrage (most notably at Alligator Creek) and upstream into the Dawson, Nogoia and Connors rivers. The Fitzroy River turtle is known from sites within the Project footprint. Important habitats comprising type localities and essential habitat are present and the Project footprints support isolated nesting in a number of areas.

E.3.7 Downstream threatened, migratory and marine species

EPBC Act Protected Matters searches undertaken for the Project identified 14 migratory species that are potentially present within or near the Project footprint. Of these, four species are known to occur in the Project footprint:

- Estuarine crocodile and estuarine crocodile (*Crocodylus porosus*)
- White-bellied sea-eagle (*Haliaeetus leucogaster*)
- Rainbow bee-eater (*Haliaeetus leucogaster*)
- Great egret, white egret (*Ardea alba*).

Of the 49 marine species identified through the EPBC Act Protected Matters searches, only two listed marine bird species, the magpie goose (*Anseranas semipalmata*) and the osprey (*Pandion haliaetus*), were predicted to occur within the Project footprint.

A number of migratory and marine species were predicted to occur downstream of the Project within the estuarine/marine environment, including a number of migratory, marine, wetland and terrestrial birds (including yellow chat (Dawson) (*Epthianura crocea macgregori*) (listed as critically endangered under the EPBC Act); the estuarine crocodile; marine turtles; dugongs, whales and dolphins.

The yellow chat (Dawson) is known from eight sites including three within the Fitzroy Delta. The wetland habitat of the yellow chat (Dawson) is dependent on surface / overland flow and is threatened by modifications to hydrological regimes through flow reductions into catchments (Houston and Melzer 2008).

E.3.8 World Heritage and National Heritage places

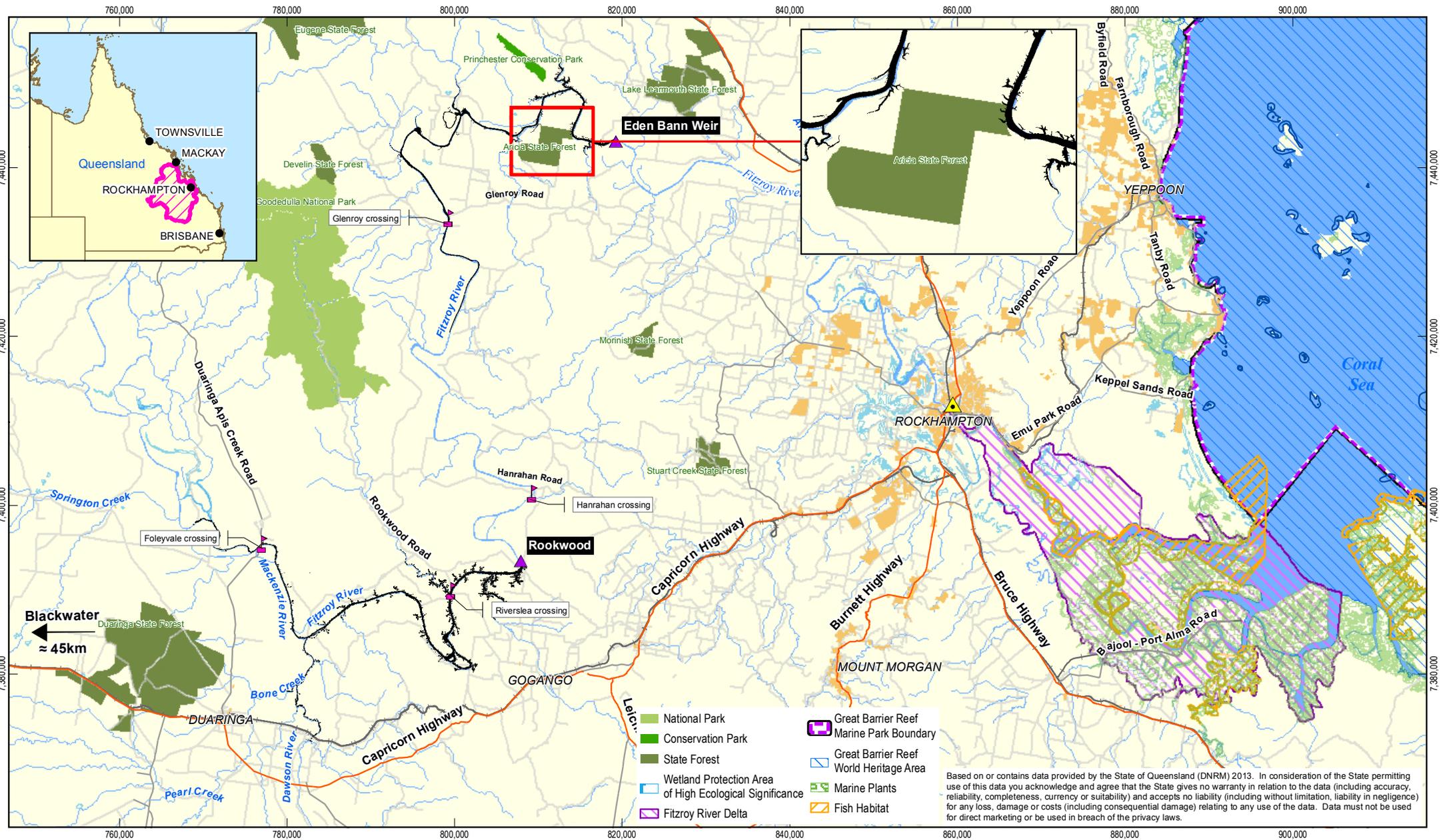
The environment downstream of the Project footprint comprises the Fitzroy Barrage impoundment, the Fitzroy River estuary and Fitzroy River Fish Habitat Area (FHA-072), Keppel Bay, the Great Barrier Reef World Heritage Area (GBRWHA), the Great Barrier Reef Marine Park (GBRMP) and Great Barrier Reef Coast Marine Park (GBR Coast MP).

The Great Barrier Reef was inscribed on the World Heritage list in 1981 and the National Heritage list in 2007. In 1975 a marine park was established around the Great Barrier Reef. The GBRMP is a multiple-use area supporting a range of communities and industries. The GBRMP is covered by a zoning plan with 33 per cent of the GBRMP afforded marine national park status. Special Management Areas have also been created. The GBR Coast MP is a State marine park running the length of the GBRMP providing protection for Queensland tidal lands and tidal waters. The GBR Coast MP supports the creation of a zoning system within, and complimentary to, the GBRMP; habitat protection, conservation park, marine national park and preservation zones. Thirty-five onshore catchment areas drain into the GBRWHA, including the Fitzroy Basin.

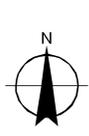
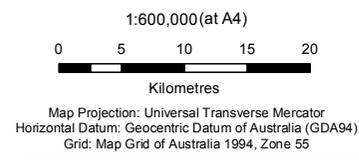
The Fitzroy River downstream of Eden Bann Weir has been highly impacted by human land-use, comprising alluvial plains that have been extensively cleared for grazing, agriculture and urban development. The impoundment created as a result of the Fitzroy Barrage is the dominant aquatic habitat type in this section of the Fitzroy River. Natural pools and riffle and run habitats are also present. The Fitzroy River downstream of Eden Bann Weir supports a number of old oxbow lakes and off-stream billabongs. Many of these are identified as Great Barrier Reef wetland protection areas. There are several creeks joining this section of the Fitzroy River, the largest of which is Alligator Creek. The river banks in the vicinity of the Fitzroy River and Alligator Creek junction provide nesting habitat for conservation significant turtle species.

The aquatic environment downstream of the Fitzroy Barrage is tidally dominated and fresh water entering the estuary is regulated by releases from the Fitzroy Barrage. Events sufficiently large enough to produce major delivery of fresh water downstream occur only one to two times per year. The Fitzroy River discharges into the southern end of the Great Barrier Reef at Keppel Bay in the Capricorn-Bunker Group. Sensitive environmental areas occurring within or adjacent to the aquatic environments downstream of the Fitzroy Barrage are shown on Figure E-5.

The waters within the Fitzroy River estuary provide habitat for a range of marine species that are also known to occur throughout the wider coastal waters of northern Australia. Specifically, the area is known to support a low to medium density dugong population (Marsh et al. 2005; Grech and Marsh 2007), marine turtles and coastal dolphin species. The Fitzroy River estuary region is a habitat of relatively important conservation value for the Australian snubfin dolphin (*Orcaella heinsohni*) (Cagnazzi 2013). The area also supports internationally and nationally important populations of migratory shorebirds and a valuable commercial and recreational fishery exists within the region, recognised through the establishment of the Fitzroy River Fish Habitat Area.



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LEGEND	
	Weir Location
	River Crossing
	Fitzroy Barrage
	Highway
	Major Road
	Streets (Local)
	Railway
	Waterway
	Fitzroy Basin
	Urbanised Area
	Impoundment Area



Gladstone Area Water Board, SunWater Lower Fitzroy River Infrastructure Project
 Job Number: 41-20736
 Revision: C
 Date: 09 Jan 2014

Reserves, protected areas and sensitive environmental areas **Figure E-5**

The Great Barrier Reef Report Card 2012/2013 indicates that the Fitzroy region's inshore water quality is poor. The Fitzroy Basin and estuary has been identified as one of the major sources of pollutants into the Great Barrier Reef lagoon (The State of Queensland 2013a) and is one of 11 priority reef catchments monitored for water quality under the Queensland Government's Paddock to Reef Program (Turner et al. 2013). The 2013 risk assessment rated the Fitzroy region as presenting a high risk to water quality with the main pollutant being sediment from grazing (State of Queensland 2013a). Key threats to the reef water quality overall include nitrogen, sediment and pesticides.

The Great Barrier Reef Report Card 2011 (State of Queensland 2013b) indicates that the Fitzroy region's inshore water quality declined from moderate to poor for the 2010/11 period representing a departure from the relatively stable condition experienced since 2005/6. This decline is attributed to flooding associated with extreme weather events over the 2010/11 summer that resulted in much higher than normal discharges from most catchment rivers.

The Fitzroy River transports sediments and nutrients, from natural and anthropogenic sources, from the upstream catchment to its various estuaries and eventually Keppel Bay (Webster et al. 2006). It is estimated that prior to European settlement approximately one million tonnes per annum of suspended sediment was transported via waterways of the Fitzroy Basin compared to recent long-term estimates of between 3 to 4.5 million tonnes per annum (Johnston et al. 2008; Packett et al. 2009). Sediments delivered to the Fitzroy River estuary are derived almost exclusively from erosion in the upper Fitzroy Basin (Douglas et al. 2005). Turner et al. (2013) reports that during the 1 July 2010 to 30 June 2011 period (monitoring year) the highest estimated total suspended solid yields were obtained from the Comet River (82 t/km²), followed by the Dawson River (63 t/km²) and the Theresa Creek (20 t/km²) sub-catchments.

Transport of sediments from the Fitzroy Basin catchment to the Fitzroy River estuary and Keppel Bay primarily occurs during episodic, generally short-lived flood events in the wet season. The strong tidal, shallow-water environment that characterises Keppel Bay results in sediments remaining in a constant state of suspension and re-suspension (Webster et al. 2006). As a result suspended sediment concentrations remain high year-round, particularly near the mouth of the Fitzroy River where tidal flows are particularly vigorous (Webster et al. 2006). This in turn severely limits opportunities for primary producers (i.e. phytoplankton, algae, seagrass and coral) to inhabit the Fitzroy River delta environment.

E.3.9 Socio-economic environment

The local study area consists predominantly of large, rural agricultural (cattle grazing) land holdings. Settlement in the area is sparse and scattered. Apart from basic infrastructure and services such as utilities, roads and crossings, and police services and primary schools further afield, there are no community services or facilities available in the local study area. To access most types of services, residents in the local and regional study area travel to Rockhampton.

The roads and crossings over the Fitzroy, Mackenzie and Dawson Rivers are particularly important to the community, as they provide the only direct access to Rockhampton for many residents. The Capricorn Highway passes through the local study area and intersects with the Bruce Highway in Rockhampton.

Some of Queensland's largest power stations are located in and around the regional study area. These include the Stanwell, NRG Gladstone and Callide power stations, which produce the

majority of the State's power. Ergon Energy is the major distributor of energy in the region. Fitzroy River Water (a business unit of RRC) supplies water and sewerage services in the Rockhampton area and bulk water to the former Fitzroy Shire and de-amalgamated Livingstone Shire.

E.3.10 Cultural heritage

Native title searches revealed that a number of native title claims exist (or did exist) over the Project area including:

- Eden Bann Weir
 - Darumbal People QC2012/008, QUD6131/1998 (comprising combined claims QC1997/021, QUD6131/1998 and QC1999/001, QUD6001/1999)
- Rookwood
 - Darumbal People (former uncombined claim QC1997/021, QUD6131/1998)
 - Gangulu People (former claim QC97/36; QUD6144/1998)
 - Kangoulu People (former claim QC98/25; QUD6195/1998)
 - Ghungalu People (former claim QC99/16; QUD6226/1998).

A portion of the Rookwood Project footprint was not the subject of a claim. Following public notification and discussion with the aforementioned parties, the Jetimarala People were identified as custodians.

Field survey results have identified locations that possess a range of cultural places and values that constitute Aboriginal cultural heritage as defined in the *Aboriginal Cultural Heritage Act 2003* (Qld). These areas and objects include stone artefact scatters, shell middens, and scarred trees as well as places of traditional significance. CHMPs have been prepared in consultation with Aboriginal endorsed parties and approved by State Government, providing management and mitigation measures to protect Indigenous cultural heritage values. GAWB and SunWater are committed to the implementation of these CHMPs and protection of Indigenous cultural heritage values.

No places of non-Indigenous cultural heritage significance occur in close proximity to the Project footprint.

E.4 Potential impacts, protection measures, safeguards and offsets

E.4.1 General impacts

Raising Eden Bann Weir and construction of Rookwood Weir are each scheduled in four phases dictated by alternating wet and dry seasons over an approximate two to two-and-a-half-year period. During construction downstream flows (and operational releases as applicable to the existing Eden Bann Weir) will be maintained and it is not expected that flows will be adversely impacted. In accordance with Queensland Fisheries requirements to maintain fish movement upstream and downstream during construction at Eden Bann Weir the following actions will be undertaken:

- The existing fish lock and outlet structure will remain operational throughout construction.
- At weir closure (completion of spillway construction) the existing and new fish movement structures are fully operational.

Analysis of surface water flows pre- and post-development indicate marginal to no significant changes to flow regimes upstream, within and downstream of Eden Bann Weir and the proposed Rookwood Weir. Statistical analysis shows that for all years analysed, releases from the Project at its upper limits of development (that is EB3 and RW2), do not significantly influence flows at the end of the system downstream of the Fitzroy Barrage. This indicates that under the upper limit development scenario, minimal impacts on flow are expected to occur during years of high flow. During years of extreme low flow, significant differences between the base case and development scenario arise due to an initial reduction in flow followed by the release of small volumes of water under the development scenario during months that had zero or very little flow under the base case or no development scenario.

With regard to water supply, the Project is committed to maintaining existing supply reliability for current water allocation licensees within the Lower Fitzroy Water Supply Scheme and the Fitzroy Barrage Water Supply Scheme.

Seasonal base flow EFOs will be met for all theoretical yields during the January to April water flow season. During the May to August and September to December water flow seasons, the existing system (EB 1) does not meet the seasonal base flow objectives. All proposed infrastructure staging scenarios comply with medium to high flow EFOs except the upper limit development scenario (RW2+EB3). The upper limit scenario failed (slightly) against the 20 year daily flow volume objective.

Once demands for the Project are realised and development of a specific infrastructure scenario is triggered, detailed design and further modelling will be required to ensure compliance with the underlying Fitzroy WRP requirements. Since changes to existing operational rules are also likely to be required, a ROP amendment will be sought, again requiring compliance with WRP objectives. Consideration will be given to parameters such as reduced yield volumes and operating regimes and rules to satisfy flow requirements.

A raised Eden Bann Weir (Stage 2) has a small influence on water levels upstream during smaller magnitude floods (1 in 2 and 1 in 5 year AEP events). Negligible increases in water level are associated with higher magnitude floods as the weir is drowned by these flood flows.

Rookwood Weir influences water levels upstream of the site during smaller magnitude floods (1 in 2 and 1 in 5 AEP events). The impact of the weir during larger magnitude events is small to negligible as the weir is drowned by these flood flows.

Sediment management on the Fitzroy River is to be achieved by transmission of the full sediment load under or through the weirs. Both the raised Eden Bann Weir and a new Rookwood Weir will allow sediment to be swept over the weir. Aside from local areas of lower velocity around weir structures where local deposition at the upstream face can be expected (and low level outlets are provided to assist in flushing any accumulated sediment downstream), the weirs are expected to provide unimpeded transfer of sediment down the river.

High flow velocities have the potential to scour banks downstream of the weir infrastructure. While it is possible that some localised erosion may occur immediately downstream of the weir sites, it is considered that the potential contribution to current sediment load will be negligible due to the very small area likely to be affected. Further, erosion protection works immediately downstream of the weirs in risk areas will reduce the potential for scour and erosion thereby minimising the potential to increase sediment loads.

Bank slump within the weir impoundment has the potential to occur as a result of the bank soil becoming saturated through inflows followed by rapid drawdown and releases. Bank slump in downstream river reaches has the potential to occur in areas of scouring as a result of releases from the weir. Retention of riparian vegetation on banks and slopes is proposed for the Project. Retention of vegetation will help to protect the river banks from scouring when water levels rise. Vegetation on the banks and in riparian zones acts to bind and reinforce the bank and prevent slumping.

Construction activities may create short-term, localised impacts on water quality, such as erosion, run-off and sedimentation and have the potential to introduce pollutants (hydrocarbons). However, the quantum of this impact on areas downstream of the Project is expected to be minimal. Potential impacts will be minimised by undertaking in-stream works during drier periods and sequencing works to account for periods of high flows and rainfall events.

In terms of operational impacts, it is evident from existing conditions that water quality in the Project area is heavily influenced by anthropogenic factors in the catchment area and these existing impacts on water quality will persist. Existing turbidity levels within the Fitzroy, Dawson and Mackenzie rivers are greater than WQOs as a result of sediment entering the waterways from runoff and erosion. The Project itself is not expected to alter the sediment load within the system and apart from local areas of lower velocity around weir structures such as towers and intakes, the weirs are expected to provide unimpeded transfer of sediment downstream.

Prior to the first fill it is not intended to clear vegetation from within the watercourse. Consequently that vegetation will decay over time releasing methane, carbon dioxide and nutrients and reducing dissolved oxygen levels in the water column. While localised short-term increases in nutrient levels, as well as increased turbidity and reduced DO are expected to occur, wet season in flows, overtopping of the spillway, operational releases and releases through fishways and outlet works will dilute and flush nutrients and materials within and from the impoundment. As a consequence, effects on downstream water quality are expected to be minor in the initial operational phase and it is not expected that elevated levels will persist for extended durations.

Stratification will be impeded by the continued drawdown of water over a period of approximately eight months every year, thus reducing time at depth. Differential (multi-level) offtakes will facilitate that water released through outlet works is mixed, improving the DO (together with mediating temperature) to achieve the WQOs. The potential for blue green algae blooms to occur within the impoundments is considered to be low. A water quality monitoring program including pre-, during and post-construction will be implemented and monitoring of blue green algae would be conducted.

During construction, localised dust impacts are anticipated at each weir site, river crossings and along access roads. Sensitive receptors have been identified at Eden Bann Weir, Glenroy Crossing, Riverslea Crossing and Gogango. Flora and fauna habitat in close proximity to the construction areas has also been considered. Management and mitigation measures are proposed and incorporated into the environmental management plan (EMP). Potential operational air quality impacts associated with the Project are considered negligible and restricted to maintenance activities.

While impoundment associated with the weir developments has the potential to disrupt terrestrial fauna movement corridors through fragmentation of riparian habitat, bioregional corridors of local, regional and state significance, will still prevail directly adjacent to the high water level of the

inundation area. This is particularly notable immediately upstream of Eden Bann Weir on the northern bank and near Princhester and Marlborough Creeks. It is also notable in the upper reaches of the proposed Rookwood Weir impoundment, namely along the northern bank of the upper Fitzroy River, the eastern bank of the lower Mackenzie River, and the lower Dawson River. As inundation will be more extensive in the lower reaches of the impoundment, the persistence of these mapped corridors is important. Furthermore, large tracts of state significant bioregional corridor are mapped as occurring in the regional landscape, to the northeast, north and west (Goodedulla National Park and Duaringa State Forest) of the Project footprint. This is considered to be advantageous to more mobile species, particularly birds.

Introduced plants and weeds are ubiquitous across the Eden Bann and Rookwood study areas. A Weed Management Plan would be prepared and implemented to prevent the introduction of new weed species into the area and minimise the spread of weeds within the sites.

The need to clear remnant vegetation to facilitate construction activities at the weir sites, along existing and new access roads and at river crossings has been avoided as far as is practicable. Further opportunities for avoidance of endangered and of concern REs, in particular, associated with construction activities and access will be considered during detailed design. Inundation of riparian vegetation is an unavoidable consequence of the Project.

To mitigate the loss of vegetation resulting from construction site clearing activities, the following measures would be implemented:

- Clearing for site works will be restricted to the smallest practical area and the amount of time the area is cleared prior to construction will be minimised
- Clearly demarcate no-go areas of highly sensitive vegetation, including all vegetation not to be cleared
- Where practicable, revegetation activities would be commenced in and adjacent to construction areas as soon as possible after the completion of construction
- Temporarily disturbed areas will be rehabilitated to replicate as closely as possible the habitat resources available prior to construction.

Potential impacts to terrestrial fauna during construction and operation of the Project include:

- Fauna injury and mortality
- Disruption to behaviour of localised wildlife assemblages
- Loss of terrestrial habitat
- Fragmentation of riparian habitat, loss of movement corridors and connectivity
- Increased predation and competition
- Degradation of habitats (including water quality)
- Alteration to flow regimes.

To address these impacts, mitigation measures include undertaking pre-clearing surveys (within construction footprints) and development of species management plans, weed and pest control measures, revegetation activities, and the preparation of dust, weed and other relevant management plans. With the above mitigation and management measures in place, adverse impacts on terrestrial flora and fauna are not anticipated as a result of the Project.

Direct impacts associated with the Project include the permanent loss of approximately 1.4 ha of aquatic habitat within the construction footprints. The area of habitat to be impacted is relatively small in size in relation to that available within the immediate area and as such the loss of habitat is not considered significant. Impacts to aquatic ecological values that may occur as a result of Project construction activities include: the degradation of habitat, increased injury and mortality, and the restriction of fauna movement. These impacts will be localised, restricted to the duration of the construction period.

The Project will result in the inundation of an additional 114.5 km of natural riverine habitat, increasing the area of impacted habitat within the sub-catchment by 10 per cent. Alteration of natural riverine habitats within the Project footprints will reduce the heterogeneity of the river system and therefore the diversity of habitats available to aquatic fauna. Aquatic species are expected to persist, particularly within the shallow littoral habitats along the perimeter of the inundated areas and within the upper reaches. An increase in deep water habitat and linear shoreline is likely to benefit the population of estuarine crocodile within the existing Eden Bann Weir. The Project will result in the inundation of known and potential Fitzroy River turtle nesting habitat.

During operations, new fish passage infrastructure will maintain upstream and downstream fauna movement. Key management objectives through the Project design phase included minimising the potential risk of fauna injury and mortality associated with the in-stream. A specifically designed turtle passage facility (turtle ramp) will also be constructed at Eden Bann Weir and Rookwood Weir to mitigate the potential impacts of the Project on turtle movement and population fragmentation.

Base water flows are predicted to be retained during the dry season resulting in a decrease in the frequency and duration of no flow periods. The operation of the weirs is also likely to result in a reduction in the frequency and magnitude of small – medium downstream flood flows. The maintenance of flows during the dry season has the potential to improve the quality of aquatic habitat downstream by reducing the duration and severity of pool isolation and prolonging the presence of flowing riffles zones and runs. An alteration in the magnitude and timing of downstream flows does, however, have the potential to impact fish movement and turtle nesting.

Analysis of data for flows downstream of the Fitzroy Barrage revealed that there are no statistical differences between current modelled flow regimes and the flow regimes projected with any additional infrastructure associated with the Project in place. Impacts to the sensitive environmental areas and conservation significant species in the areas downstream of the Fitzroy Barrage including the delta are therefore not anticipated.

The most significant benefit of the Project will be the increase in availability and reliability of water. The Project will facilitate and enable development in the region, thus benefiting the regional, state and national economies. The Project will provide regional and local employment and business opportunities. The economic assessment identified that the primary benefit of the Project is an increase in availability of high priority (high reliability) water to be sold to industrial and residential uses. The value of which is likely to increase as the Project progresses in the future. Other benefits include the reduced need for water management and contingency strategies and an increase in employment and use of local suppliers during construction. The benefit cost analysis found that all the investment scenarios that were considered provided a net gain to society.

Impacts within the local study area may include loss of land currently used for grazing, agricultural infrastructure, severance of and/or loss of access to land, cattle bogging and changes to water allocations. Improved flood immunity of several river crossings will facilitate the movement of people, machinery and equipment and stock in periods of flooding and maintain access to services and facilities such as schools and health facilities, social and recreational clubs and networks. Further impoundment of water will benefit the taking of water for stock and domestic use by riparian landholders in the local study area (in accordance with the *Water Act 2000* (Qld)), through provision of a more constant and reliable supply.

Consultation with landholders and local community members has revealed widespread aspirations for benefits from the proposed Project (in particular construction of Rookwood Weir) to flow to the local community. These include aspirations for additional water entitlements and expectations that river crossings will be improved. While these aspirations in themselves do not constitute an impact, the way in which they are addressed by the Project will potentially affect the local community's perception about the Project and its proponents, either positive or negative depending on whether the Project meets their expectations or not.

During construction impacts arising as a result of increased traffic volumes (noise, dust and risk of accidents) will be managed through the EMP.

E.4.2 World Heritage properties and National Heritage places

The Project is located 141.2 km AMTD upstream of the GBRWHA and will not have any direct impact on the GBRWHA. Potential indirect impacts on the Great Barrier Reef resulting from changes to flow and water qualities have been assessed as follows:

- Modelling and statistical analysis has shown that there are no significant differences between current modelled freshwater flow regimes and the flow regimes projected with any additional infrastructure associated with the Project in place
- While it is possible that some localised erosion may occur at the weir sites during operation, it is considered that the potential additional contribution to the current sediment load entering the GBRWHA will be negligible
- Other than from decaying vegetation, the Project will not directly contribute nutrients downstream of the Fitzroy River and subsequently the GBRWHA. Water quality impacts as a result of decaying vegetation will be short-term during the initial years of operation and will not persist into long-term operations
- Weir design and operations will seek to reduce the potential for the release of poor quality water, through measures such as multi-level off takes. Discharges of poorly oxygenated water to the GBRWHA are not expected
- Aside from local areas of lower velocity around weir structures such as towers and intakes, the weirs are expected to provide unimpeded transfer of sediment down the river.

It is concluded that with management and mitigation measures in place no significant impacts to the GBRWHA are expected as a result of the Project. Furthermore, based on the assessment of potential indirect impacts against GBRWHA values the Project will not significantly impact directly or indirectly on the World or National Heritage values of the Great Barrier Reef.

E.4.3 Threatened species and ecological communities

Conservatively, approximately 20 ha of Brigalow TEC will be impacted as a result of the Project in stages as per Table E-4.

Table E-4 Brigalow TEC impacted

Stage	Brigalow TEC offset provision
Eden Bann Weir Stage 2	Construction activities: nil offsets Impoundment: up to 0.3 ha
Eden Bann Weir Stage 3	Construction activities: nil offsets Impoundment: up to 0.4 ha
Rookwood Weir Stage 1	Construction activities: up to 1.4 ha Impoundment: up to 2.3 ha
Rookwood Weir Stage 2	Construction activities: up to 0.2 ha Impoundment: up to 15.5 ha

The impacted areas of Brigalow TEC are not considered to constitute critical habitat and, taking in to consideration the fragmented and disturbed nature of the Brigalow communities within the Project footprint, the representation of this community within the surrounding landscape and the relatively small proportion potentially impacted, the Project is not considered likely to have a significant impact on this ecological community. However, where loss due to impoundment and clearing is unavoidable, offsets are proposed.

No critically endangered or endangered species have a high potential to occur in the Project footprint.

Squatter pigeon (southern), black ironbox and the Fitzroy River turtle are vulnerable species known to occur within the Project footprint:

- Squatter pigeon: Squatter pigeon (southern) is not uncommon in open woodland and grassland habitats in the region and within the Project footprint. In the order of 21.5 ha of squatter pigeon (southern) habitat will be impacted by the Project. Squatter pigeon (southern) within the Project footprint are not considered to be part of an 'important population' and the area does not represent 'habitat critical to the survival of the species'. Suitable habitat for the species persists outside of Project areas in large fragments on low rocky hills and uncleared alluvial plains. Further, access to water is an important determinant of habitat utilisation for the species and the impoundments are likely to therefore provide benefits. Implementation of EMPs during the construction and operation phases of the Project will further avoid, mitigate and manage impacts arising from direct injury, habitat clearing and predation. It is not considered that the Project will have a significant impact on the squatter pigeon (southern)
- Black ironbox: It is estimated that 100 black ironbox trees will be impacted by impoundment associated with Rookwood Weir Stage 2 and approximately 40 trees will be impacted by impoundment associated with Rookwood Weir Stage 1. An offset is proposed to mitigate the unavoidable loss of these trees as a result of impoundment
- Fitzroy River turtle: Lack of recruitment into the population is reported by Limpus et al. 2011 as being the greatest threat to survival of the species, with nest predation by feral animals

and trampling by cattle being the primary factor in poor survival of egg clutches. Unmitigated impacts on the Fitzroy River turtle arising as a result of the Project are likely to be analogous to those caused by current threatening processes, namely the loss of riffle zone habitat, loss of nesting habitat, reduced water quality, the creation of movement barriers, increased injury and mortality and increased predation. A species management programme for the Fitzroy River turtle has been developed to provide a framework for the management of impacts on the species throughout the life of the Project. Significant residual impacts are considered likely to remain in relation to operation of the Project and offsets are proposed. Hydrological flow analysis indicates that the Project will maintain flows to the Fitzroy River Barrage but will not increase impoundment levels thus the Project is not expected to impact on Fitzroy River turtle habitat located 40 km downstream of the Project at Alligator Creek.

The Project is not predicted to significantly alter downstream environmental flows and/or degrade downstream water quality. The Project is unlikely to result in the downstream loss or fragmentation of habitats, increase predation or introduce and spread invasive weeds. No direct or indirect impacts on threatened species predicted to occur downstream of the Project are anticipated.

E.4.4 Downstream threatened, migratory and marine species

The Project is not considered likely to have a significant impact on the estuarine crocodile. Short-term impacts to nesting habitat are expected to be ameliorated by the creation of new nesting habitat over a time frame which is unlikely to detrimentally affect the viability of the population (namely due to the species' longevity). The existing Eden Bann Weir impoundment is a highly productive system for crocodiles and supports the most notable estuarine crocodile population in the Fitzroy Basin. The provision of similar habitat upstream of the existing Eden Bann Weir impoundment and upstream of Rookwood may allow for a higher carrying capacity for the species in the area.

While utilised by a number of common migratory and marine bird species, the landscape matrix within and adjacent to the Project footprint is fragmented and disturbed. As such, the woodland, forest and aquatic habitats within the Project footprint are not considered critical breeding, foraging, roosting or shelter habitat for the migratory species known to occur within or near to the Project footprint. No impacts on migratory marine birds are predicted.

While a number of migratory marine species were predicted to occur downstream of the Project footprint based on the EPBC Act Protected Matters Search Tool, most would not occur in the freshwater section of the river between Eden Bann Weir and the Fitzroy Barrage. Similarly, a number of the migratory marine species predicted to occur downstream of the Fitzroy Barrage are unlikely to use habitats within the Fitzroy River estuary and if present are likely to be only transient visitors.

The Fitzroy River area does not contain habitat critical to the survival of loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), hawksbill turtle (*Eretmochelys imbricate*) or olive Ridley turtle (*Lepidochelys olivacea*). Nesting habitat for the flatback turtle (*Natador depressus*) exists on Curtis Island and Peak Island adjacent to the Fitzroy River estuary. The Project will not significantly alter existing conditions downstream of the Project, therefore the nesting habitats on Curtis Island and Peak Island will not be impacted by the Project. It is unlikely that porbeagles (*Lamna nasus*), whale sharks (*Rhincodon typus*) or killer whales (*Orcinus orca*) would use habitats downstream of the Project footprint. Bryde's whales

(*Balaenoptera edeni*) and humpback whales (*Megaptera novaeangliae*), if present, are likely to be only transient visitors.

The Project will not alter downstream flows or impact habitat within the Fitzroy River estuary and no long term changes to water quality are anticipated. Accordingly no significant indirect impacts on Australian snubfin dolphin and Indo-Pacific humpback dolphin are predicted.

The Fitzroy River estuary provides habitat observed to support low density dugong populations (Marsh et al. 2005; Grech and Marsh 2007). As for protected dolphin species, no downstream impacts to flows or water quality are predicted which could potentially affect habitat dugong are dependent upon. Accordingly, no significant impacts on dugongs are predicted.

The yellow chat (Dawson) is known from downstream estuarine sites within the Fitzroy Delta. Hydrological flow analysis indicates that the Project is not expected to influence localised drainage and inflows, or impact on water quality, to these wetland habitats that support the sub-species. It is considered that the development of the Project and subsequent uses of the downstream storage at the Fitzroy Barrage will not impact on yellow chat (Dawson) habitat.

The Fitzroy River system is representative of a modified environment and no significant change to downstream environments is anticipated as a result of the Project. Therefore no significant impacts to downstream migratory and marine species are expected.

E.4.5 Cumulative and consequential

Current pressures on the Fitzroy Basin catchment include land degradation, habitat disturbance and alteration and impacts to water quality resulting primarily from agricultural and mining activities. Similarly, threatening processes identified within the Brigalow belt bioregion include vegetation clearing, linear infrastructure development, urban development, mining, grazing, altered water flows, impoundments and reduced water quality.

The assessment of the Project's contribution to cumulative impacts takes into consideration the relative size, scale, proximity and nature of activities. Due to the localised and short term nature of the Project's construction impacts and the lack of other proposed projects within the vicinity of the Project footprint, the Project's contribution to cumulative impacts will mostly occur during the operational phase or as a result of impoundment. Through the assessment, it was determined that there is the potential for the Project to contribute to the cumulative impacts on MNES as follows:

- Minor contribution to a cumulative loss of Brigalow TEC based on a five per cent contribution to a minor overall impact, and implementation of mitigation management and particularly offset actions
- Cumulative impacts on the Fitzroy River turtle as a result of:
 - Cumulative loss/alteration of aquatic habitat within the catchment study area including the loss of turtle nesting habitat and the conversion of riffle-run habitat to impounded habitat
 - Cumulative risk of injury and mortality to aquatic fauna from the operation of water infrastructure within the catchment
 - Cumulative impact on aquatic fauna movement in the catchment.

In order to minimise its contribution to cumulative impacts, the Project has sought to avoid, mitigate, manage and, where necessary, offset impacts associated with Project activities.

The Project's objective is to provide water storage infrastructure on the Fitzroy River with the primary aim of securing the strategic water infrastructure reserve; a nominal volume of 76,000 ML (for supplemented allocations). The consequence of the increased water security in the region is that it will assist primarily in facilitating industrial, urban and residential development in the Lower Fitzroy and Gladstone areas and potentially some agricultural development within the Fitzroy Agricultural Corridor.

Growth within the region will occur within the State and local government planning frameworks namely the Central Queensland Regional Plan and local planning schemes, that include planning controls for urban (industrial and residential) and some types of intensive rural (agricultural) development within the overall context of sustainable development. Environmental approvals will also be required under the *Environment Protection Act 1994* (Qld) (EP Act) for intensive agricultural activities such as feedlots. Where potential impacts to MNES are considered likely, assessment under the EPBC Act would be required. Larger scale development; such as intensive agriculture and/or major industrial development would be expected to trigger the requirement for referral under the EPBC Act (where MNES had the potential to be affected) in addition to local and State approval requirements.

There is the limited potential for the Project to facilitate consequential development that is not accommodated through existing planning and development schemes and could proceed through alternate means of water supply. Further, management of the effects of agricultural development within GBRWHA catchments is being improved in recent years as a result of direct regulation at Local, State and National government level, as well as adoption of management practices through the implementation of actions identified in the Reef 2050 Long Term Development Plan (Commonwealth of Australia 2015) and specific programs such as the Reef Water Quality Protection Plan (State of Queensland 2013). With the implementation of environmental permitting requirements for intensive activities and the land management practices being adopted throughout the region, it is considered that the Project is unlikely to have a significant consequential impact on relevant MNES.

E.4.6 Environmental management

An EMP has been developed for the Project, addressing the environmental management commitments for the construction and operational phase of the Project.

The EMP has been developed to:

- Build on the commitments to environmental performance made in the Project EIS
- Provide a framework to protect the environmental values potentially affected by the Project
- Set out environmental management obligations for environmental authorities and permits to assist the authorities when developing project approvals.

The EMP will be developed in more detail and as a stand-alone document as the Project progresses into detailed design, construction and operation. A construction EMP and operation EMP will be developed and implemented based on this EMP.

E.5 Conclusions and recommendations

The outcomes of specialist studies, community consultation and stakeholder engagement, along with regulatory requirements, codes and guidelines all form the framework for development of the Project commitments made by GAWB and SunWater. These commitments range from broad social, cultural and economic commitments, through to measures required to protect environmental values specific to the Project area. They include further investigations, field work and monitoring required at various stages of the Project. These documented commitments are a part of an ongoing strategy to meet EIS obligations.

The EMP presents a range of management and mitigation measures to be implemented during construction and operation of the Project. Where significant residual impacts remain, despite mitigation and management measures being implemented, offsets are proposed.

Based on the findings of the EIS and given implementation of the EMP and offsets strategy, it is considered that the Project can be undertaken without unacceptable social, environmental or cultural impacts. The Project also presents a range of opportunities and positive benefits to regional, State and national economies.

The analysis of the core objectives of the EPBC Act and principles of ecologically sustainable development demonstrates the Proponent's commitment to incorporate sustainability considerations throughout design, construction, operation and decommissioning of the Project. In conclusion, this EIS demonstrates that an iterative planning approach has been taken to the design and development of the Project, effectively integrating both environmental and social considerations into decision making for the Project and supporting the objectives of ecologically sustainable development.