21. Cumulative impacts

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21.1 Introduction

21.1.1 Overview

The purpose of this chapter is to provide an assessment of the cumulative impacts of the Lower Fitzroy River Infrastructure Project (Project). Project impacts are assessed with consideration to existing and proposed activities in the region. The assessment addresses Part B, Section 9 of the terms of reference (ToR) for the environmental impact statement (EIS). A table cross-referencing the ToR requirements is provided in Appendix B.

21.1.2 Background

Cumulative impacts can be defined as successive and combined impacts (positive or negative) of one or more projects upon the society, economy and the environment (Franks et al. 2010). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or from a combination of concurrent effects from a single action or from the cumulative impacts resulting from a range of projects. Impacts may arise from other projects being developed within the same area or over a similar timeframe of operation to the project being assessed. Cumulative impacts may be positive or negative.

Cumulative effects are most evident under the following conditions:

- Spatial crowding or temporal overlap between existing development and operations and new developments
- Repeated removal or addition of resources due to existing and proposed development operation
- Repeated alteration of the landscape in the development area (Cooper 2004).

21.1.3 Objective

The objective of this assessment is to identify the potential cumulative impacts upon existing environmental values as a result of constructing and operating the Project and other proposed projects within relevant study areas. The assessment is to be undertaken considering the following:

- Impacts on a local and regional level
- Accumulation of impacts over time
- Exacerbation of impacts in intensity or scale, frequency or duration
- Consideration of the Project either in isolation or combination with other known existing or planned projects.

21.1.4 Methodology

Evaluation of cumulative impacts has been undertaken using existing data and data gathered as part of technical studies undertaken for the EIS. Detailed information on specific technical study areas can be found within the respective EIS chapters. Information on other projects in the region that are either planned, under development or in operation was drawn from information available in the public domain at the time of preparation of this assessment.

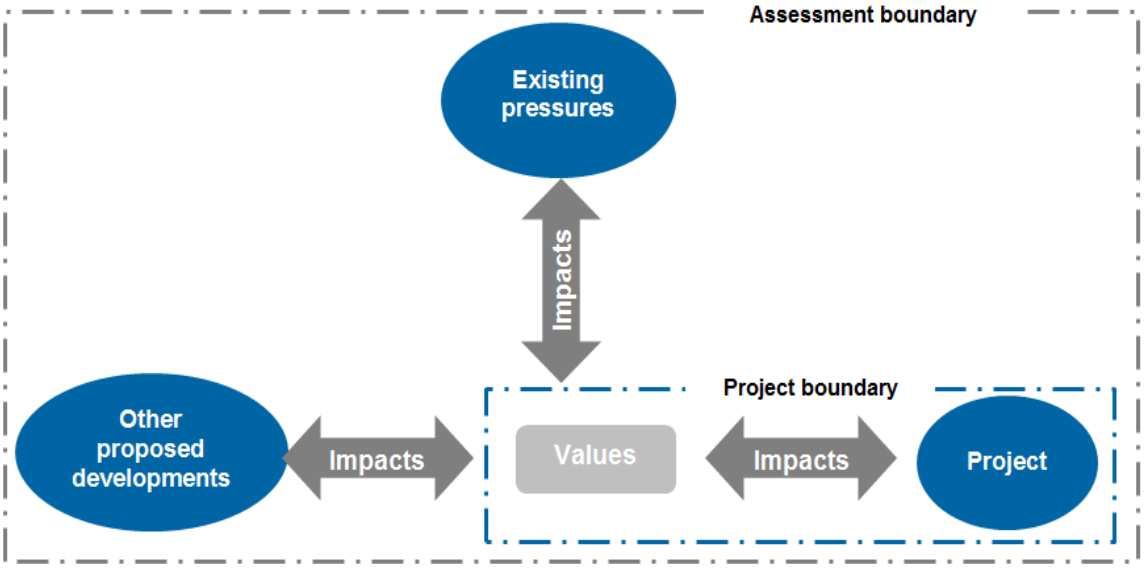
The methodology for undertaking the cumulative impact assessment is based on an internationally recognised process (Council of Environmental Quality 1997) but modified to reflect

the scale of the Project in the context of current and likely future pressures on environmental values.

The following process has been developed for undertaking the assessment of cumulative impacts (Figure 21-1):

- Define environmental values and boundaries (study areas) of the assessment
- Identify pressures on environmental values from current activities within identified study areas (baseline conditions)
- Identify cumulative impacts of the Project (in isolation) on environmental values
- Identify future pressures on environmental values from proposed developments
- Assess the Project's contribution to cumulative impacts on environmental values.

Figure 21-1 Cumulative impact assessment



Environmental values for the cumulative impact assessment are as follows:

- Land
- Terrestrial ecology
- Aquatic ecology
- Surface water resources
- Water quality
- Air quality
- Greenhouse gas (GHG) emissions
- Noise and vibration
- Waste
- Transport
- Cultural heritage
- Social values
- Economic values.

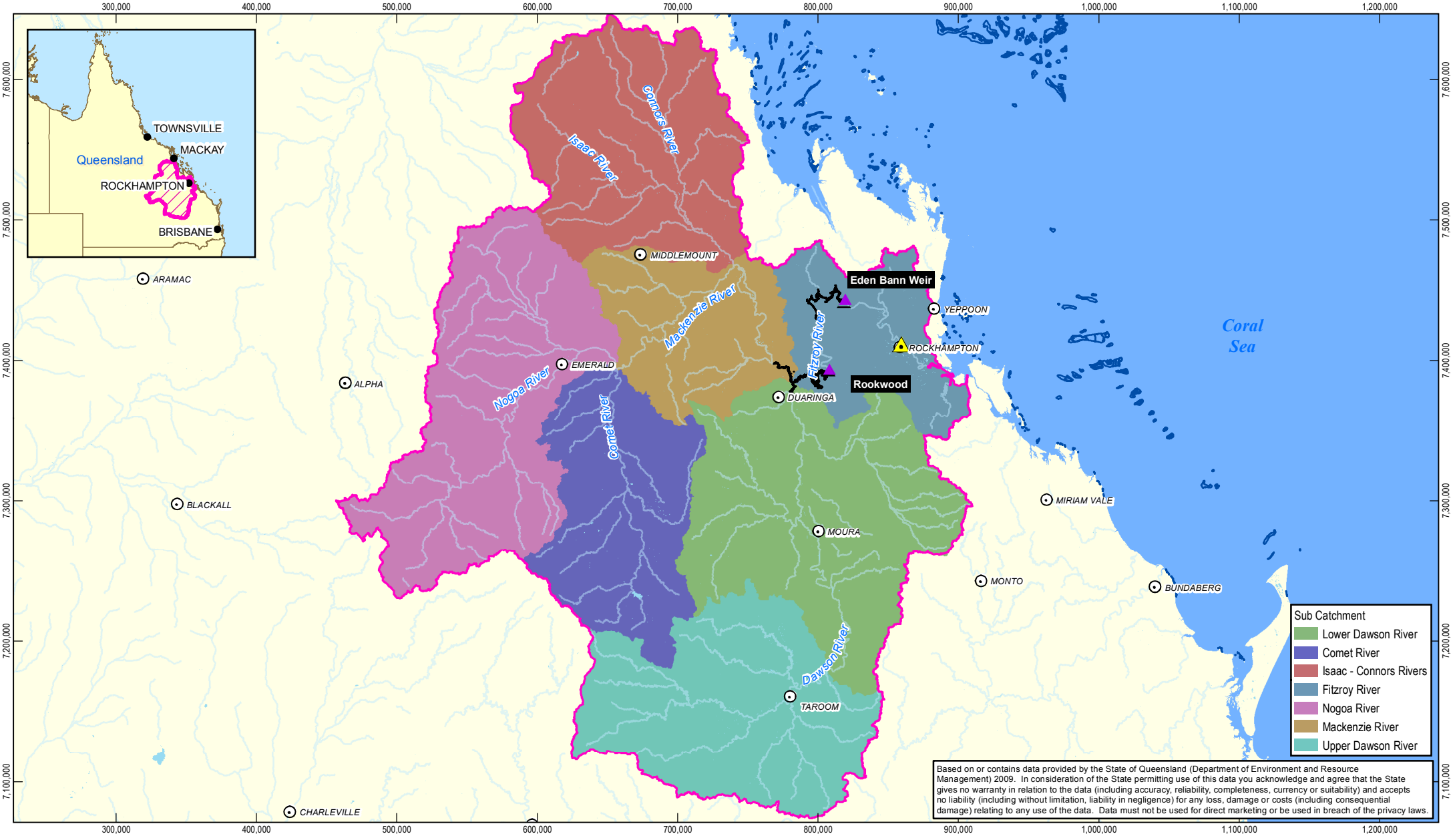
Cumulative impacts on matters of national environmental significance are assessed in Volume 2, Chapter 12 Cumulative and consequential impacts.

Boundaries necessary for adequate assessment of cumulative impacts vary between environmental values. As such, a number of study areas are relevant to the assessment of the Project's contribution to cumulative impacts as follows:

- Catchment study area: Defined as the Fitzroy Basin catchment comprising the Comet River, Dawson River, Fitzroy River, Isaac River, Mackenzie River and Nogoa River sub-catchments. This study area is particularly relevant for assessing cumulative impacts on aquatic ecology, water quality and surface water resources (Figure 21-2) with a focus on areas within and downstream of the Project footprint.
- Regional study area and wider area of influence: Defined as communities which may be affected by the Project or that provide a broader context for the Project such as higher order social infrastructure services and source of labour and areas to which Project influence would extend. This includes Rockhampton Regional Council, Livingstone Shire Council, Central Highlands Regionals Council, Woorabinda Aboriginal Shire Council local government areas and Gladstone Regional Council local government area within the wider area of influence. This study area reflects the study areas identified in Chapter 18 Social impact and is relevant for assessing cumulative socio-economic impacts (Figure 21-3).
- Bio-subregion study area: Defined as the subregions within the Brigalow Belt bioregion which are directly impacted by the Project footprint. This includes the Marlborough Plains, Mount Morgan Ranges, Boomer Range, Isaac-Comet Downs and the Dawson River Downs subregions. Subregions not directly impacted by the Project footprint have been excluded as the assessment of impact is based on the proportion of impacted vegetation occurring in the subregion. This study area is relevant for assessing cumulative impacts on terrestrial ecology (Figure 21-4).
- Local study area: Defined as properties directly affected by or adjacent to the weir infrastructure, impoundments, access roads, crossings and associated construction areas. The local study area includes the town of Gogango. The local study area is shown in Figure 21-5 and Figure 21-6 for Eden Bann Weir and Rookwood Weir respectively. This study area is relevant for assessing cumulative impacts on landowners, rural land use practices, and the local community.

Proposed projects within the study areas were identified as known potential future projects that are accessible in the public domain (mainly government websites). It is important to note that not all of the listed projects are likely to proceed in the short to medium term. Sources included:

- Department of Natural Resources and Mines (DNRM) industry updates:
  - Queensland's coal seam gas overview (January 2014) (DNRM 2014a)
  - Queensland's mineral, coal and petroleum operations and resources map (DNRM 2014b)
  - Queensland's coal - mines and advanced projects (October 2013) (DNRM 2013a)
  - Queensland's coal development projects (Quarter 4, 2013) (DNRM 2013b)
  - Central Queensland energy and mineral development projects (Quarter 3) (DNRM 2013c)
- Department of State Development Infrastructure and Planning (DSDIP) for 'coordinated projects' currently undergoing assessment under a statutory process such as the *State Development and Public Works Act 1971* (Qld)
- Department of Environment and Heritage Protection (DEHP) current and concluded EIS processes under the *Environmental Protection Act 1994* (Qld)
- Department of the Environment for actions referred and/or undergoing assessment under a statutory process such as the *Environment Protection Act 1994* (Qld) or *Environment Protection and Biodiversity Conservation Act 1999* (Cth).



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir Location
- Fitzroy Barrage
- Waterway (Major)
- Waterway (Minor)
- Fitzroy basin catchment
- Lakes
- Impoundment area

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision D
Date 27 Aug 2014

Catchment study area

Figure 21-2

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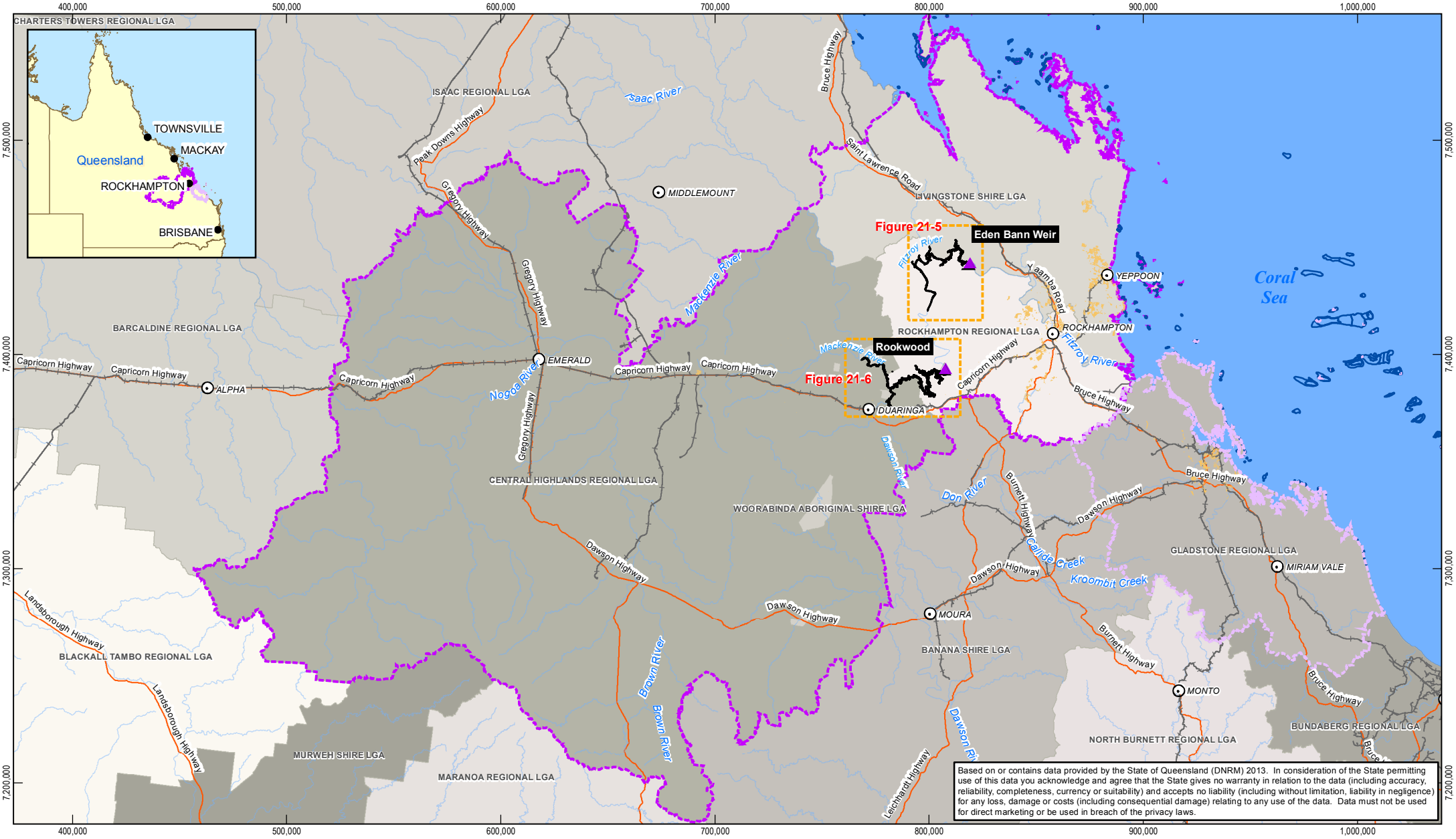
Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways (2007); Sunwater: Weir Locations - 2008; DERM: Sub-catchments - 2012. Created by: AJ/MS *See Appendix for disclaimers and copyrights.



Based on or contains data provided by the State of Queensland (DNRM) 2013. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.

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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

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LEGEND

- Weir Location
- Populated Places
- Railway
- Waterway (Major)
- Highways (National)
- Urbanised Area
- Impoundment Area
- Reef
- Regional Study Area
- Wider Area of Influence
- Local Study Area

Gladstone Area Water Board

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision B
Date 13 Feb 2015

Regional study area

Figure 21-3

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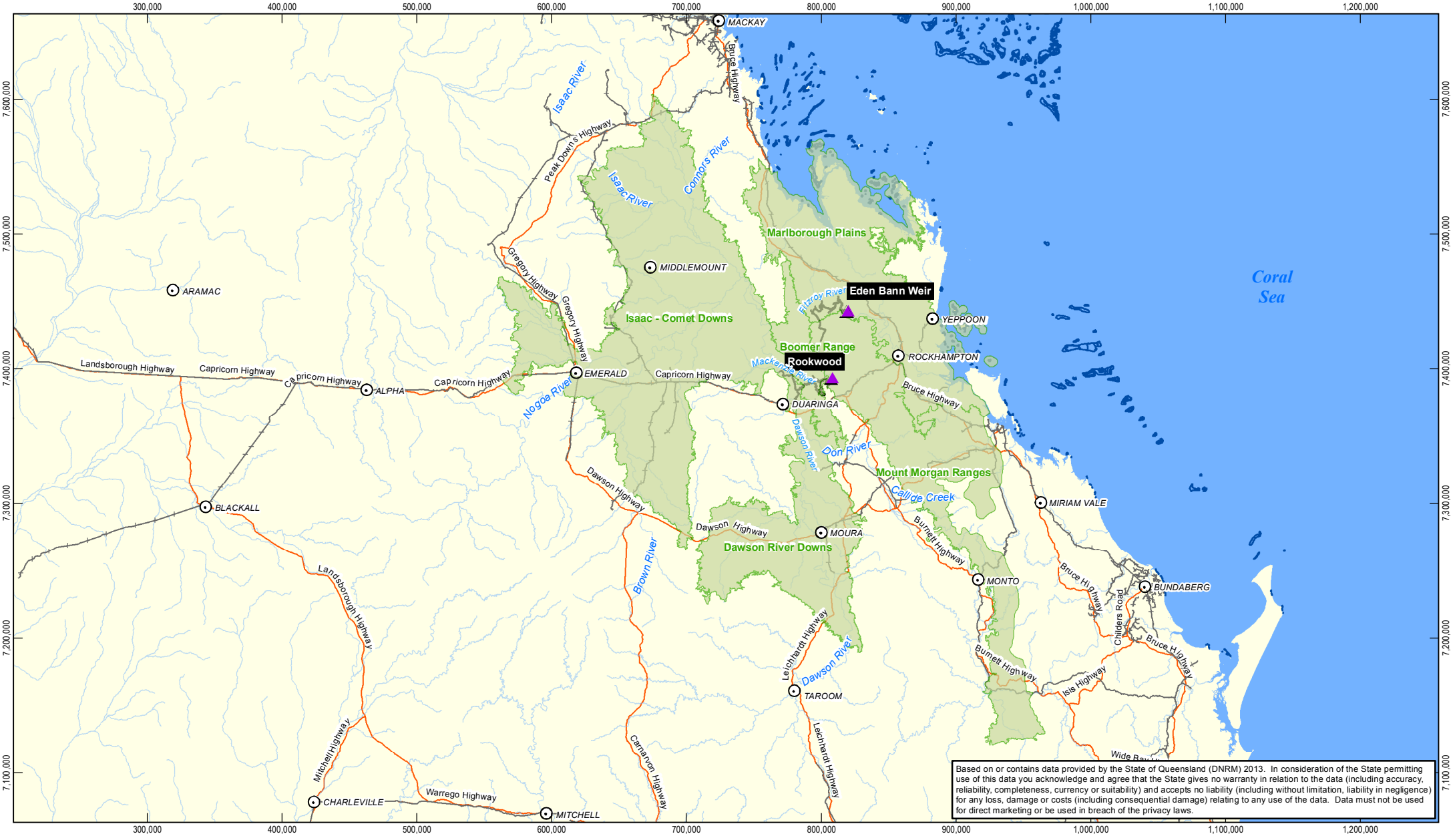
Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways (2007); Sunwater: Weir Locations (2008); DNRM: Railways, Roads (2010), LGA Boundaries (2014); © Copyright Commonwealth of Australia (ABS):
Local Study Area, Regional Study Area (2011), Wider Area of Influence (2014). Created by: MS *See Appendix for disclaimers and copyrights.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir Location
- Populated Places
- Railway
- Waterway (Major)
- Highways (National)
- Impoundment Area
- Reef
- Bio-subregion study area

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Gladstone Area Water Board

SunWater Making Water Work

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision B
Date 27 Aug 2014

Bio-subregion study area

Figure 21-4

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Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways (2007); Sunwater: Weir Locations (2008); DNRM: Railways, Roads, Bioregions (2010)
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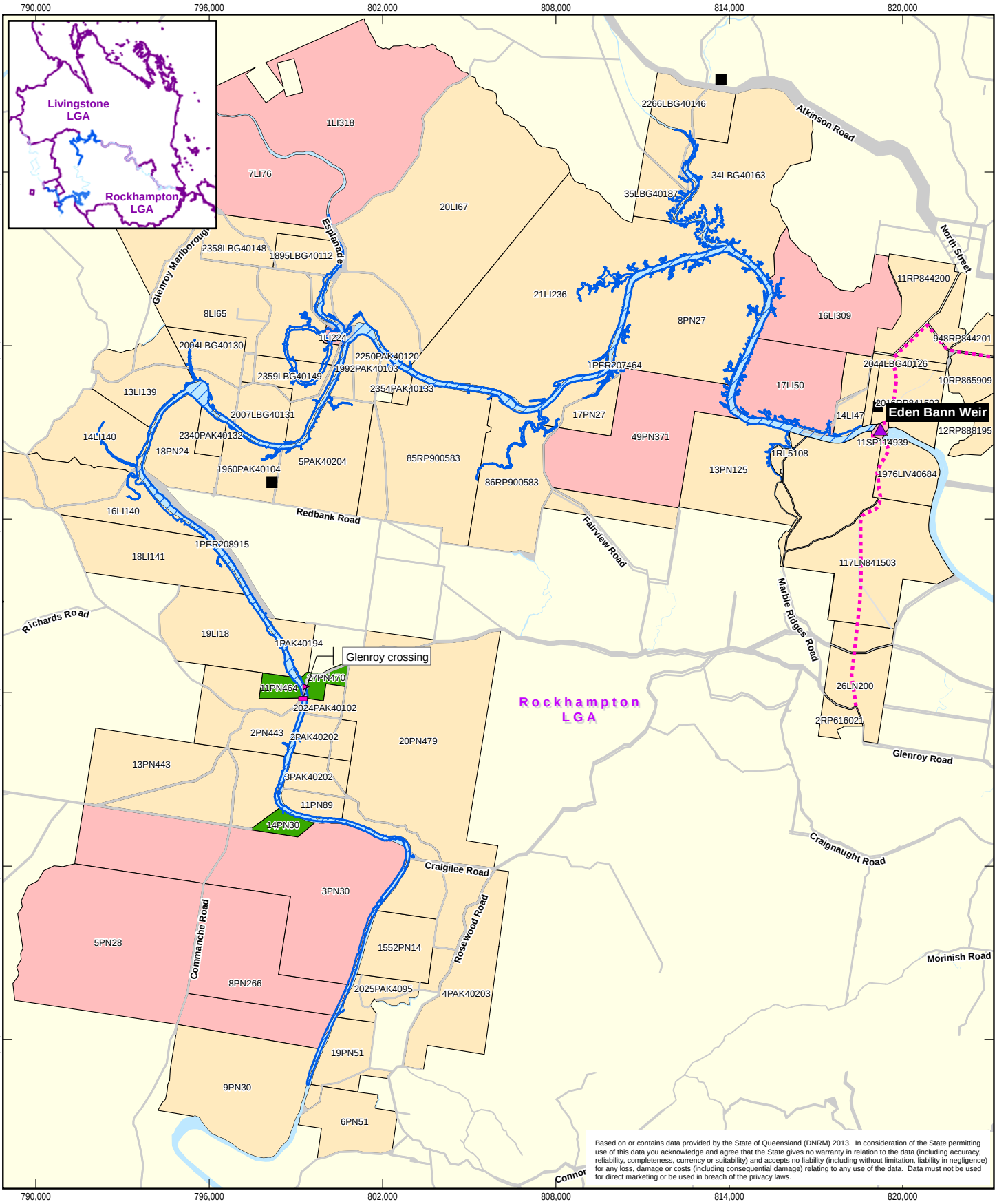

LEGEND

- Weir Location
- Homestead
- River Crossing
- Access Road
- Secondary Roads
- Minor Road/Road Easement
- Proposed Eden Bann Upper Impoundment Limit
- Local Government Area
- Tenure
- Freehold
- Lands Lease
- Reserve
- Road Easement
- Waterway

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Gladstone Area Water Board, Sunwater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision C
Date 11 Feb 2015

Eden Bann Weir local study area

Figure 21-5

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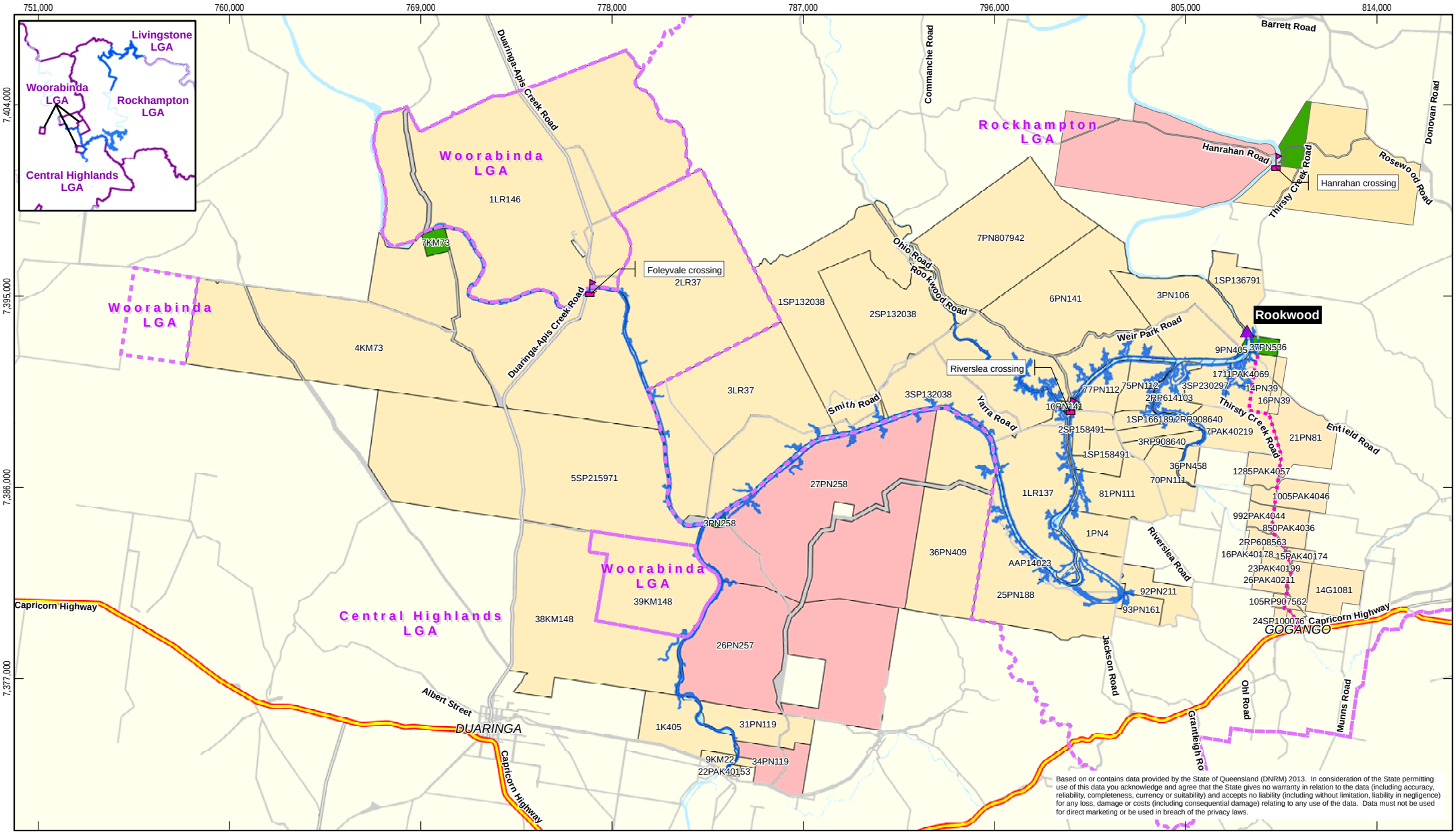
Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Homesteads(2007); Waterways (2007); Sunwater: Waterways, Weir Locations - 2008; DNRM: LGA (2014); Roads - 2010, DCDB - 2013/2014. GHD: Access Roads (2013). Created by: MS *See Appendix for disclaimers and copyrights.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir Location
- River Crossing
- Access Road
- Major Road
- Secondary Roads
- Minor Road/Road Easement
- Proposed Rookwood Upper Impoundment Limit

Tenure

- Freehold
- Lands Lease
- Reserve
- Road Easement
- Waterway
- Local Government Area

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Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision D
Date 11 Feb 2015

Rookwood Weir local study area

Figure 21-6

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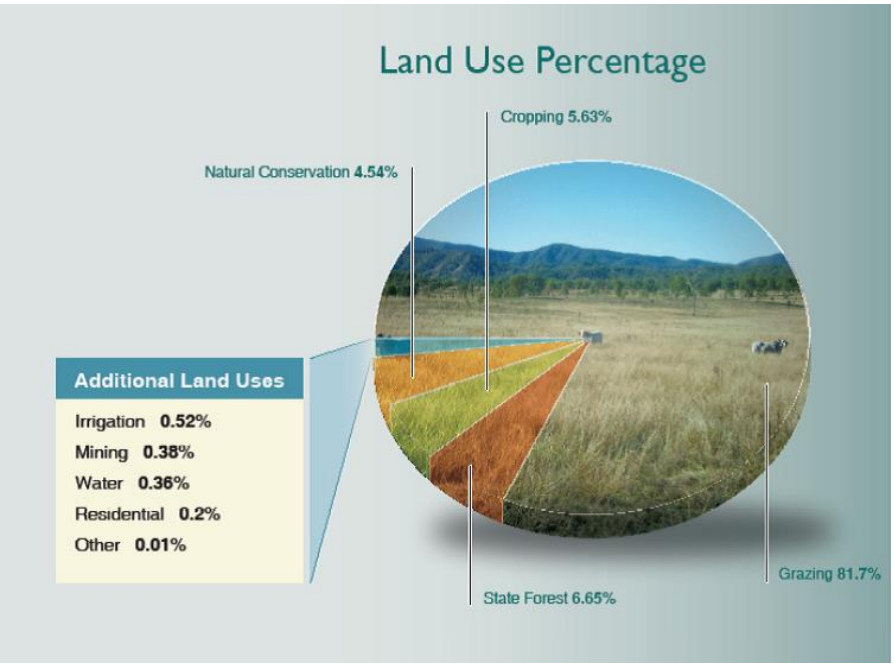
21.2 Existing pressures

21.2.1 Catchment pressures

The Fitzroy Basin catchment extends over approximately 142,000 km^2 of central and eastern Queensland near the Tropic of Capricorn. The catchment is the second largest in Australia and opens onto the Great Barrier Reef World Heritage Area GBRWHA), the Great Barrier Reef Marine Park (GBRMP) and the Great Barrier Reef Coast Marine Park (GBR Coast MP). The Fitzroy River estuary also supports a valuable commercial and recreational fishery as recognised through the establishment of the Fitzroy River Fish Habitat Area (FHA-072).The catchment is dominated by agriculture which accounts for almost 90 per cent of land use. Figure 21-7 provides an overview of land use in the catchment. Water resources within the catchment are highly regulated with seven dams (large and small), 13 weirs and a large tidal barrage. The catchment is home to significant terrestrial floral and faunal assemblages with populations of threatened species and internationally significant wetlands.

Figure 21-7 Land use in the Fitzroy Basin catchment



Source: FBA 2008

Current pressures on the catchment have been well documented in the literature (Hart 2008; FBA 2008; Coastal CRC Technical Reports). Many pressures are the result of land clearing and degradation impacts including all forms of soil erosion by water and soil fertility decline. The decline in water quality is also a concern with the Fitzroy River occasionally experiencing high levels of sediment (turbidity), pesticide and nutrient levels, toxic algal blooms and widespread occurrence of exotic weeds (Millar et al. 2001). Riverine and riparian areas in the Fitzroy Basin catchment have been disturbed by agricultural and extraction activities and the estuary hinterlands have generally been cleared for grazing and urban development.

Existing developments and activities within the catchment are shown in Figure 21-8 and summarised as follows:

- In the order of 46 coal mines and 12 other mines including limestone, gold, chrysoprase, bentonite, salt, sapphire, sandstone, marble and zeolite mines
- Coal seam gas (CSG) extraction and associated pipelines within the Bowen Basin CSG area.
- Two coal-fired power stations
- Seven dams, 13 weirs and a large tidal barrage
- Existing road transport infrastructure
- Rail infrastructure including the Blackwater System, Central West System, Goonyella System, Moura System and North Coast Line
- Gracemere Industrial Area.

It should be noted that small projects, agricultural development and urban centres and associated pressures are not captured in this list, however the impacts from these activities are a significant contributor to pressures on the catchment and are considered in Section 21.5.

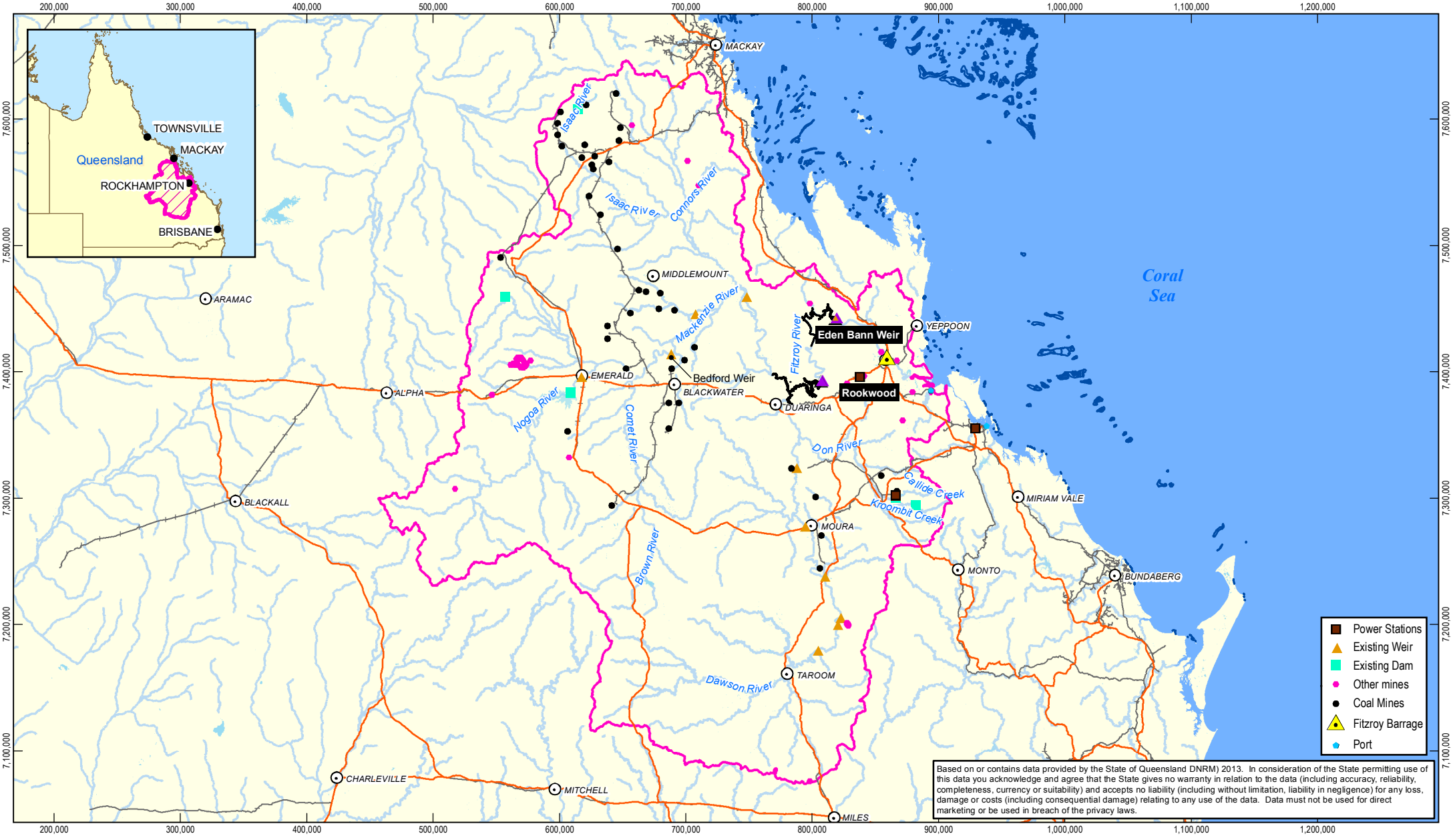
While there are a large number of mines operating within the Fitzroy Basin catchment, mining only accounts for 0.38 per cent of land use within the catchment as shown in Figure 21-7. Nevertheless, mining within the catchment is an important external influence particularly in regard to fragmented land clearing, erosion and water quality impacts.

No existing mines are located in close proximity to either the proposed Eden Bann Weir or Rookwood Weir Project footprints. The closest operating mines are the Baralaba coal mine approximately 70 km south west of the Rookwood Weir site and the Cook, Yarrabee and Jellinbah coal mines located approximately 110 km west of the Rookwood Weir site near Blackwater.

Existing water storage infrastructure within the Fitzroy Basin catchment has reduced the connectivity of aquatic fauna habitat by restricting the upstream and downstream movement past in-stream structures. As a result, aquatic habitat within the Fitzroy, Dawson and Mackenzie sub-catchments is now fragmented between storages. Existing infrastructure currently impacting aquatic fauna movement and habitat within each river is detailed in Table 21-1.

Table 21-1 Current level of impoundment of main rivers relative to the Project

River	Existing infrastructure	Length of river (km AMTD)	Level of impoundment (km AMTD)	Percentage (%)
Dawson River	Neville Hewitt Weir, Moura Weir, Theodore Weir, Orange Creek Weir, Gyranda Weir, Glebe Weir	356. 5	125.2	35
Nogoa and Mackenzie Rivers	Tartrus Weir, Bingegang Weir, Bedford Weir, Fairbairn Dam	427.2	143.7	34
Fitzroy River	Eden Bann Weir, Fitzroy Barrage	250.7	97.6	39



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir Location
- Populated places
- Waterway (Major)
- Highways (National)
- Railway
- Fitzroy Catchment
- Impoundment Area
- Lakes

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision B
Date 03 Nov 2014

Existing activities

Figure 21-8

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21.2.2 Regional pressure

The Central Queensland region (incorporating the regional study area plus Banana Shire Council) is one of the most prosperous regions in the state (DSDIP 2013). The regional economy expanded by an average of 10.3 per cent per annum over the 10 years to 2011 compared with 8.8 per cent growth for the state (DSDIP 2013). The region has seen strong growth in employment and household incomes over this period and together with increases in the non-resident workforce population, this growth is driving demand for housing and construction, retail trade, and services and utilities, including education, health care, electricity and water (DSDIP 2013).

The prominent industries in the region are agriculture and resources although the region is also one of the state's major regional manufacturing and construction hubs, with activity focussed mainly around the cities of Rockhampton and Gladstone (DSDIP 2013). The region is serviced with an extensive transport network including roads, rail and ports that link the region internally and to surrounding regions (DSDIP 2013).

21.2.3 Bio-subregion pressures

The Brigalow Belt bioregion contains a variety of landscapes ranging from rugged ranges and undulating hills to valleys and flat alluvial plains. This bioregion is characterised by the presence of Brigalow (*Acacia harpophylla*). The bioregion is also characterised by a high level of habitat loss. In particular, the lowlands (for example alluvial and clay plains) and riparian zones have been extensively cleared for agriculture. Vegetation and fauna communities associated with these landscapes have therefore declined significantly. Threatening processes identified within the bioregion include: vegetation clearing, linear infrastructure development, urban development, mining, road maintenance, grazing, altered water flows, impoundments, reduced water quality, altered fire regimes, weeds and pests (DERM 2008).

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. Table 21-2 provides the pre-clear, 2001 and 2011 extent of endangered, of concern and least concern regional ecosystems (REs) within the bio-subregion study area. The area and percent loss between 2001 and 2011 shows a continued decrease in extent.

Table 21-2 Extent of regional ecosystems within the bio-subregion study area

Regional ecosystems	Pre-clear area (ha)	Remaining 2001		Remaining 2011		Loss since 2001	
		ha	%	ha	%	ha	%
Endangered	2,069,892	129,847	6.3	125,766	6.1	4,081	3.1
Of concern	1,228,070	247,745	20.2	243,278	19.8	4,467	1.8
Least concern	3,054,162	1,481,110	48.5	1,453,355	47.6	27,755	1.9

21.2.4 Local pressures

Land use within the local study area is dominated by agricultural practices, particularly cattle grazing and breeding as well as some crop cultivation. While woodland vegetation in the riparian zone and adjacent alluvial floodplain has been retained in many places, significant tracts of land behind this vegetated buffer have been cleared (either partially or completely) to facilitate agricultural production. Rocky hills and ranges which are unsuitable for grazing retain relatively larger, better connected patches of woodland vegetation. The most common use of the river is for stock watering with cattle generally accessing the water directly or via pump/trough systems.

The large rural properties common to the Project areas are generally served by unsealed roads, often single lane, branching from the major arteries of the Bruce and Capricorn Highways.

No rail infrastructure traverses the Project footprint. The Blackwater System operates in the vicinity of the Project. An active (boomed) level crossing traverses Third Street/Riverslea Road at Gogango on route to Rookwood Weir and a high level rail crossing traverses the Dawson River outside of the Rookwood Weir Project footprint.

There are no existing water or gas pipelines traversing the local study area. Two power lines cross the Eden Bann Weir impoundment, one immediately upstream of the weir at approximately 142 km adopted middle thread distance (AMTD) and one at approximately 208 km AMTD. No power lines traverse the proposed Rookwood Weir impoundment.

Land use and existing infrastructure within the local study area is detailed in Chapter 5 Land.

21.3 Cumulative Project impacts

Table 21-3 provides a summary of cumulative impacts of the Project on existing environmental values. Cumulative impacts of the Project are considered in terms of potential impacts across various environmental values and how the Project affects these cumulatively.

The Project is not considered to impact significantly on the existing use of rural land for rural purposes. A minor loss of land that may currently be used for rural production, based on land as mapped within the banks of the Fitzroy, Dawson and Mackenzie rivers will be lost within the Project footprint.

As reported in Chapter 18 Social impact, the Project has the potential to affect the ability of landholders to graze livestock over the area between the high and low bank outside their legal riparian boundary, to affect stock ingress to and egress from the river, and to access water for livestock. Further loss of access to land and loss of access within properties and between properties may impact the ability of landholders to productively manage their operations. The extent of these cumulative impacts will be taken into consideration when negotiating individual landholder compensation.

There is the potential for short term cumulative impacts on landholders and the local community as a result of construction related activities such as the combined effect of noise, dust and traffic generation particularly at Gogango. The Project is likely to be staged in response to demand triggers (Chapter 1 Introduction). Consequently construction related impacts will occur on multiple occasions within the Project footprints (Chapter 2 Project description). With management measures in place it is not considered that the Project will have a significant impact in relation to cumulative impacts to landholders and the local community.

Table 21-3 The Project's potential cumulative impacts on environmental values

Values / Impacts	Visual / landscape	Lighting	Land disturbance/ erosion	Contaminant release	Loss of land	Loss of access to land	Altered access to river	Terrestrial habitat loss / degradation / fragmentation	Aquatic habitat loss / alteration / degradation	Fauna injury and mortality	Introduction of weeds/pests	Restriction of fauna movement	Altered stream flow patterns	Reduced water quality	Air quality / dust generation	Noise and vibration	Waste generation and disposal	Road/crossing access	Traffic and traffic safety	Local employment and business opportunities	Increase demand for services
Amenity	✓	✓													✓	✓					
Land (soils and agricultural land)			✓	✓	✓																
Social (landholders and rural land use practices)			✓		✓	✓	✓				✓							✓	✓		
Terrestrial ecology (terrestrial habitat and fauna)		✓	✓	✓				✓		✓	✓				✓	✓			✓		
Aquatic ecology (aquatic habitat and fauna)		✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓					
Surface water resources (stream flow)													✓								
Water quality			✓	✓									✓	✓							
Social (local community (including Gogango))															✓	✓		✓	✓	✓	
Social (regional community)																	✓	✓	✓	✓	✓
Cultural heritage values			✓																		

Construction activities will cause a temporary localised and intermittent increase in light, noise and vibration adjacent to construction sites. This has the potential to cause short-term disruption to the behaviour and activities of nearby wildlife (aquatic and terrestrial) and deter wildlife from foraging, drinking or nesting within the vicinity of construction activities. Cumulative impacts on terrestrial flora and fauna during construction may also arise from land disturbance, erosion, contaminant release, terrestrial habitat loss and degradation, increased risk of fauna injury and mortality and encroachment of feral animal species. With management measures in place it is not considered that the Project will have a significant impact in relation to cumulative impacts to nearby wildlife.

Potential cumulative impacts on water quality resulting from land disturbance, erosion, contaminant release, altered flow patterns and vegetation decay within the impoundments would contribute to cumulative impacts on aquatic habitat and fauna. Cumulative impacts on aquatic fauna may also occur as a result of habitat loss, alteration and degradation as well as restricted movement upstream and downstream of the weir infrastructure, increased risk of fauna injury and mortality and increased pest and weed species. With management measures in place it is not considered that the Project will have a significant impact in relation to cumulative impacts to aquatic fauna.

Potential cumulative Project impacts are addressed through the avoidance, mitigation and management of individual impacts (Chapter 23 Environmental Management Plan). Cumulative Project impacts on the Fitzroy River turtle (*Rheodytes leukops*) will be mitigated and managed through the species management program developed for the Project (Appendix M) and residual impacts are addressed through the provision of offsets (Chapter 22 Offsets).

21.4 Proposed developments

All proposed developments listed in Table 21-4 occur, at least in part, within the catchment study area, regional study area and wider area of influence, bio-subregion study area and local study area as shown in Figure 21-9. These include:

- Approximately 30 mining projects, mainly around Moranbah (Isaac River) or Blackwater (Mackenzie River) but with one approved large mine in the Upper Dawson sub-catchment (Wandoan)
- CSG resource extraction (Bowen Gas Project and the Santos GLNG Gas Development Project) and gas pipelines (Central Queensland Gas Pipeline and Arrow Bowen Pipeline Project)
- Central Queensland Integrated Rail Project (CQIRP) and the Surat Basin Rail Project
- Connors River Dam and Pipelines Project, Nathan Dam and Pipelines Project and Gladstone-Fitzroy Pipeline Project.

Of these, approximately 15 mining projects, all four gas projects and the Gladstone-Fitzroy Pipeline Project are located, at least in part, within the bio-subregion study area. Approximately 13 mining projects, all four gas projects and the Gladstone-Fitzroy Pipeline Project are located, at least in part, within the regional study area.

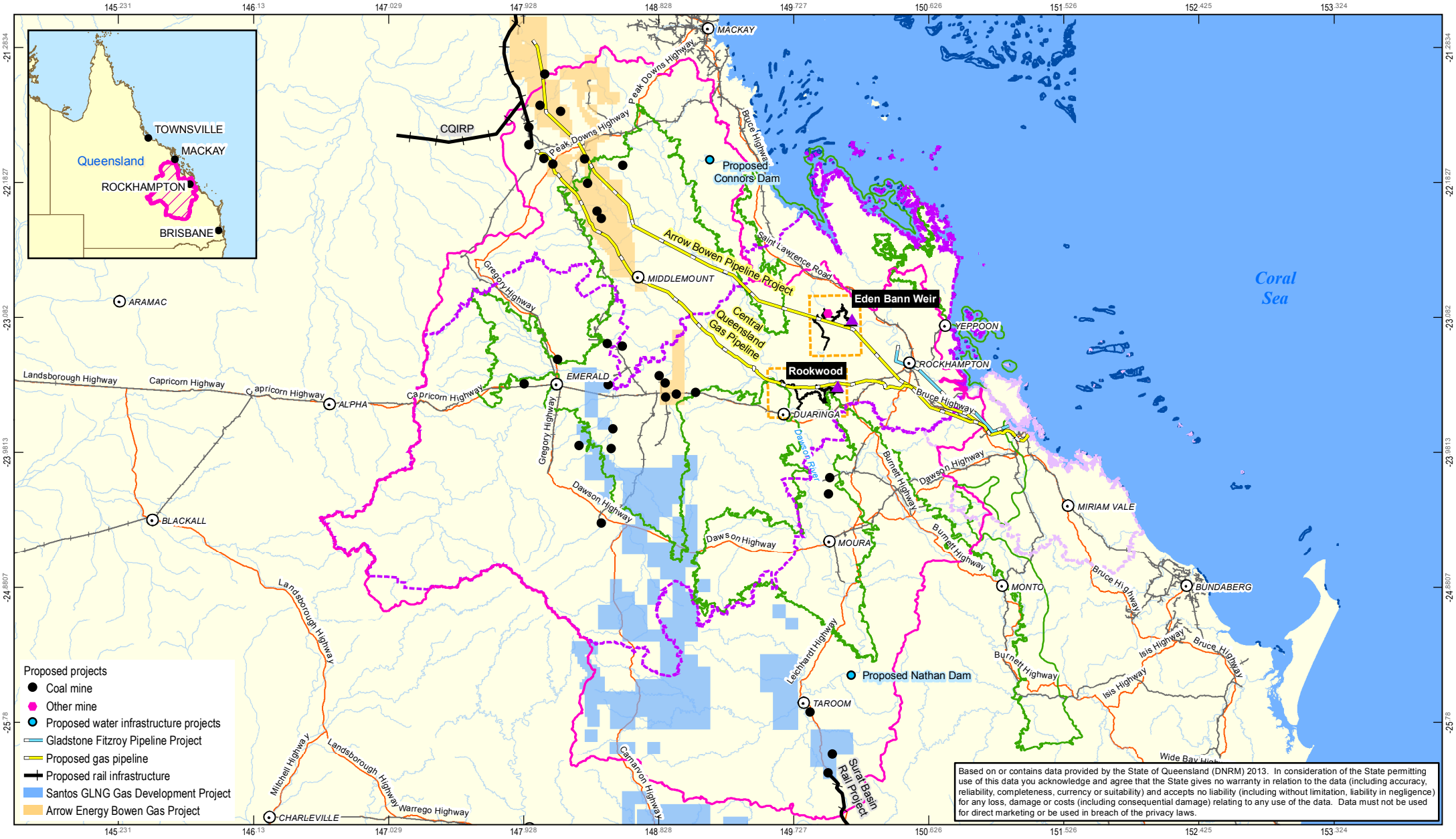
Table 21-4 Proposed projects

Project^	Approximate distance from Project*	Proponent	Project type	Project status/ timing
Mining projects proposed				
Baralaba North Continued Operations	70 km south west	Cockatoo Coal Limited	Open-cut coal mine expansion	2015
Baralaba South Coal Project	80 km south	Wonbindi Coal Pty Ltd	Open-cut coal mine (4.7 Mtpa)	Unknown
Belview Project	105 km west	Stanmore Coal	Underground coal mine	2017
Bluff Coal Project	95 km west	Carabella Resources Ltd	Open-cut coal mine (1.5 Mtpa)	2014
Codrilla Coal Mine Project	195 km north west	Coppabella and Moorvale Joint Venture	Open-cut coal mine (4 Mtpa)	Approved
Curragh South	115 km west	Peabody Energy Corp	Open-cut coal mine	Unknown
Curragh West	120 km west	Westfarmers Resources	Open-cut coal mine	Unknown
Dysart East Coal Project	185 km north west	Dysart Coal Management	Coal mine	2014
Ellensfield Coal Mine Project	250 km north west	Ellensfield Coal Management Pty Ltd	Underground coal mine (3 Mtpa)	Unknown
Fairhill Coking Coal	150 km west	Fairhill Coking Coal Pty Ltd	Open-cut coal mine	2015
Marlborough mine project	Adjacent to the Project footprint	Gladstone Pacific Nickel (Marlborough Nickel)	Nickel and cobalt laterite mine	Unknown
Grosvenor West Project	255 km north west	Carabella Resources Limited	Coal mine (3.5 Mtpa)	2015
Integrated Isaac Plains Project	235 km north west	Vale Australia	Coal mine expansion (+2 Mtpa)	Approved
Mackenzie North	155 km west	Jellinbah Group	Open-cut coal mine (2 Mtpa)	Unknown
Minyango Project	115 km west	Caledon Resources	Underground coal mine (7.5 Mtpa)	Approved
Moorvale West	220 km north west	Peabody Energy Corp	Coal mine	Unknown
Moranbah South Project	240 km north west	Anglo American Metallurgical Coal	Underground coal mine (18 Mtpa)	2020
New Lenton Coal Project	280 km north west	New Hope Corp. Ltd	Open-cut /underground coal mine (5 Mtpa)	2016
North Surat-Collingwood Coal Project	270 km south west	Cockatoo Coal Limited	Open-cut coal mine (6 Mtpa)	2015

Project^	Approximate distance from Project*	Proponent	Project type	Project status/ timing
North Surat – Taroom Coal	240 km south west	Cockatoo Coal Limited	Open-cut coal mine (8 Mtpa)	2018
Olive Downs North	205 km north west	Peabody Energy Ltd	Coal mine (2 Mtpa)	Unknown
Meteor Downs South (Orion Downs)	160 km south west	U & D Mining Industry Pty Ltd	Open-cut/underground coal mine (2.5 Mtpa)	Unknown
Red Hill Mine	260 km north west	BHP Billiton Mitsubishi Alliance	Open-cut/underground coal mine (+8 Mtpa)	2020
Rolleston Coal Expansion Project	190 km south west	Rolleston Coal Joint Venture	Open-cut coal mine expansion (+10 Mtpa)	2020
Springsure Creek Coal Project	180 km south west	Springsure Creek Coal Pty Ltd	Underground coal mine (11 Mtpa)	Approved
Talwood Coal Project	265 km north west	Aquila Resources Ltd	Underground coal mine (3.6 Mt)	Unknown
Taroborah Coal Project	210 km west	Shenhuo International Group	Open-cut/underground coal mine (5.1 Mtpa)	2017
Teresa Coal Project	190 km west	Linc Energy	Underground coal mine (8 Mtpa)	2015
Togara North Project	155 km south west	Xstrata Coal Ltd	Underground coal mine (up to 6 Mtpa)	2015
Wandoan Coal Project	285 km south	Wandoan Joint Venture	Open-cut coal mine (30 Mtpa)	On hold
Willunga	190 km north west	Peabody Energy Ltd	Open-cut coal mine (3 Mt)	2015
Wilton Coal Project	160 km west	Wilton Coking Coal Pty Ltd	Open-cut mine	2015
Proposed gas projects				
Arrow Bowen Pipeline Project	Project footprint	Arrow Energy Pty Ltd	CSG pipeline	Approved
Bowen Gas Project	90 km west	Arrow Energy Pty Ltd	CSG extraction	Approved
Central Queensland Gas Pipeline	Project footprint	Central Queensland Gas Pipeline Pty Ltd	Gas pipeline	Approved
Santos GLNG Gas Development Project	125 km south west	Santos GLNG	CSG extraction	2016
Proposed transport infrastructure projects				
Surat Basin Rail Project	Wandoan to Banana	Surat Basin Rail Pty Ltd	Railway line	On hold
Central Queensland Integrated Rail Project	260 km north west	Aurizon Holdings Limited	Railway line	Unknown

Project^	Approximate distance from Project*	Proponent	Project type	Project status/ timing
Proposed water infrastructure projects				
Connors River Dam and Pipeline	200 km upstream	SunWater Ltd	Dam and pipelines	Approved
Gladstone – Fitzroy Pipeline	70 km downstream	Gladstone Area Water Board	Water pipeline (buried)	Approved
Nathan Dam and Pipelines	200 km upstream	SunWater Ltd	Dam and pipelines	2018

*Approximate distance from nearest weir site



1:3,750,000 (at A4)

0 25 50 75 100

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Weir
- Location
- Populated Places
- Railway
- Waterway (Major)
- Highways (National)
- Impoundment Area
- Reef
- Catchment study area
- Regional Study Area
- Wider Area of Influence
- Bio-subregion study area
- Local Study Area

Gladstone Area Water Board

GHD CLIENTS | PEOPLE | PERFORMANCE

SunWater Making Water Work

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision B
Date 29 Aug 2014

Proposed developments

Figure 21-9

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While there are a large number of proposed mining projects within the catchment, bio-subregion and regional study area, only the Marlborough mine project (approved under Environmental Authority MIM800078102) occurs within proximity to the Project, ML80074 is granted to Marlborough Nickel Pty Ltd on land adjacent to the present Eden Bann Weir impoundment and ML80134 has been applied for in relation to a pipeline that would traverse the Fitzroy River (Chapter 5 Land). Mining has not commenced and it noted that the EIS related to the slurry pipeline and refinery associated with the proposed mine (albeit under separate environmental approvals) has lapsed. Further no publically available project details are available in relation to the proposal.

The development of mines and associated infrastructure depends largely on market factors so it is difficult to assess the possible temporal overlap with the Project. Consequently, it is expected that many of the projects proposed (Table 21-4) will not eventuate, or have or will be delayed as is currently evident.

The Fitzroy Agricultural Corridor was developed as part of the Fitzroy Industry and Infrastructure Study which was concluded in 2007. The study recommended the development of the Fitzroy Agricultural Corridor in an area within 10 km of the Fitzroy River between the junction of the Dawson and Mackenzie Rivers and lands around the existing Eden Bann Weir. The proposed agricultural corridor would develop intensive livestock industries, particularly beef cattle feedlots, with some opportunistic irrigated horticulture. 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 Rockhampton Regional Council's promotion of agricultural development within the region (the Fitzroy Agricultural Corridor) it is possible that some agricultural development will arise.

The proposed Arrow Bowen Pipeline Project would traverse the existing Eden Bann Weir impoundment at 182 km AMTD on the Fitzroy River (Chapter 5 Land). The Central Queensland Gas Pipeline would traverse the Fitzroy River at 264.5 km AMTD approximately 2 km downstream of Rookwood Weir (Chapter 5 Land). It also traverses Melaleuca Creek and the Mackenzie River at 320 km AMTD. No other proposed developments are located within the local study area.

21.5 Project's contribution to potential cumulative impacts

Table 21-5 provides an assessment of the Project's contribution to cumulative impacts on environmental values resulting from a range of proposed project developments (as identified in Section 21.4). Through the assessment it was determined that there is the potential for the Project to contribute to the cumulative impacts as follows:

- Cumulative loss of remnant vegetation within the bio-subregion study area
- Cumulative loss/alteration of aquatic habitat at 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
- Cumulative impacts on the Fitzroy River turtle.

Table 21-5 Project's contribution to cumulative impacts

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
Land	Scenic amenity and lighting	Landscape change and visual impact to potential receptors Lighting impacts	Land surrounding the Project footprint is predominately cleared for grazing. Minor loss of naturalness from existing Eden Bann Weir. There are no planned projects within immediate proximity to the Project footprint that would impact on the same scenic amenity and lighting values.	The additional permanent infrastructure on the Fitzroy River resulting from the Project is considered to be of low sensitivity due to limited view points and the small number of people accessing these view points. No cumulative impacts on scenic amenity are anticipated as there are no other proposed projects in vicinity. Lighting at the weir sites during operations will be limited to directional sensor activated lighting for safety and security purposes. No cumulative impacts from lighting are anticipated.
	Topography, geology and soils	Erosion Impacts on agricultural land	Erosion and salinity impacts from vegetation clearing and land use changes within the catchment. Impacts on agricultural land as a result of current and planned water infrastructure and mining and gas extraction activities.	Localised stability and erosion impacts during construction and operation of the Project are not expected to contribute significantly to cumulative impacts. As inundation will be confined to the bed and banks of existing watercourses, the area of inundation is considered to have limited agricultural potential (Chapter 5 Land). The Project would not contribute to cumulative impacts on agricultural land.
	Contaminated land	Disturbance of previously contaminated land Release of new contaminants	Localised contamination from activities associated with agriculture.	Existing potential contamination within the Project footprint is localised and will be managed prior to construction. There is a low risk of contamination resulting from spillages/accidents during construction or operation of the Project. No cumulative impacts are anticipated.
	Land use	Impacts on land use	Land surrounding the Project footprint is predominately cleared for grazing and some crop cultivation. Land owned by Marlborough Nickel for the Marlborough mine project, while currently under grazing, is covered by an environmental authority permitting mineral extraction.	The Project will result in minor, localised impacts to rural land use practices (Chapter 5 Land). If the Marlborough mine project were to proceed it would impact on current rural land use. The Project would not contribute significantly to cumulative impacts.

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
Terrestrial ecology	Flora	Loss of remnant vegetation Loss of conservation significant flora	Current and future vegetation clearing within the bio-subregion study area (Section 21.2.3) associated with agriculture, mining activities, pipelines, water infrastructure and transport infrastructure.	The unavoidable loss of vegetation within the Project footprint includes the loss of endangered, of concern and least concern regional ecosystems and high value regrowth. Based on an assessment of publically available information for approved projects within the bio-subregion study area[1], the Project will contribute to a minor cumulative loss of remnant vegetation as follows: Remnant vegetation / Project total / Other projects / Cumulat endangered REs / 26 ha / 34 ha / 60 ha of concern REs / 240 ha / 380 ha / 420 ha least concern REs / 1681 ha / 359 ha / 2040 ha The cumulative total equates to approximately 0.05, 0.17 and 0.14 per cent of the bio-subregion study area extent, respectively (Table 21-2).
	Biodiversity and connectivity	Habitat fragmentation and loss of connectivity Introduction of weeds and non-native plants	At a local level, habitat connectivity has been impacted on in lower lying areas by vegetation clearing for agriculture. There are no known existing or planned projects within immediate proximity to the Project that would cause the loss of riparian vegetation. The proposed Arrow Bowen Pipeline Project and Central Queensland Gas Pipeline Project would have direct impact to areas of riparian habitat where they cross the Fitzroy River, Melaleuca Creek and Mackenzie River.	While the impoundments have the potential to disrupt connectivity between riparian habitats, bioregional corridors of local, regional and state significance, will still prevail directly adjacent to the high water level of the impoundment. 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 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 the impoundment is more extensive in the lower reaches, the persistence of these mapped corridors is important. Furthermore, large tracts of state significant bioregional corridor are mapped as occurring in the regional landscape (Chapter 8 Terrestrial fauna).

[1] Minyango Project, Arrow Bowen Pipeline Project, Central Queensland Gas Pipeline and the Gladstone to Fitzroy Pipeline.

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
			The Marlborough mine project is located on land adjacent to the Fitzroy River and Marlborough Creek. Current and planned catchment activities have the potential to introduce and/or spread weeds.	If the Marlborough mine project were to proceed, potential impacts on state significant habitats and bioregional corridors near Marlborough Creek may occur. Similarly the proposed gas pipelines may have minor impacts to riparian vegetation and habitat connectivity. Cumulatively however, the Project would not contribute significantly to this impact. Increased risk of invasive species will be managed via a Project Weed and Pest Management Plan.
	Terrestrial fauna	Injury and mortality Disruption to behaviour Encroachment of feral animal species Impacts on conservation significant species	Pressure from terrestrial habitat disturbance associated with existing and proposed activities within the bio-subregion study area. The Marlborough mine project is located on land adjacent to the Fitzroy River and Marlborough Creek.	Potential impacts on terrestrial fauna species during construction and initial filling would be localised and short term and would not contribute significantly to cumulative impacts. With mitigation and management measures in place, adverse impacts on conservation significant terrestrial fauna species are not anticipated as a result of the Project (Chapter 8 Terrestrial fauna). The Project would not contribute significantly to cumulative impacts on conservation significant terrestrial fauna species. If the Marlborough mine project were to proceed potential impacts on terrestrial fauna may occur. However, it is considered unlikely to impact on the same conservation significant species as the Project given the presence of different habitat types. The Project would not contribute cumulatively to impacts on terrestrial fauna.

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
Aquatic ecology	Aquatic habitat	Loss/alteration of aquatic habitat Inundation of turtle nesting habitat Habitat degradation Increased weed and pest species	Existing dams and weirs have altered aquatic fauna habitat within the catchment. Turtle nesting habitat throughout the Fitzroy Basin catchment is impacted by adjacent land use practices and is, in general, highly disturbed. Current and future catchment activities including mining, agriculture and the operation of water infrastructure can degrade aquatic habitat quality and have the potential to introduce and/or spread weed and pest species. The proposed Nathan Dam and approved Connors River Dam would alter aquatic habitat.	In combination with the proposed Nathan and approved Connors River dams the Project would contribute to a cumulative loss/alteration of aquatic habitat including the loss of turtle nesting habitat (not associated with Nathan Dam) and the conversion of riffle-run habitat to impounded deep water habitat. Suitable turtle nesting habitat is expected to be naturally created in flood deposition areas over time. The existence of aggregated nesting in the upper reaches of the Fitzroy River Barrage and the Tartrus Weir impoundment demonstrate the ability of species to colonise new habitat where suitable conditions occur. The turtle species have also demonstrated adaptability to fluctuations in nesting habitat conditions following natural events such as flooding (Chapter 7 Aquatic ecology). Currently approximately 36 per cent of the Fitzroy, Dawson and Mackenzie sub-catchments have been impounded as a result of in-stream water infrastructure (Table 21-1). The Project will result in the inundation of an additional 113 km, increasing the area of impacted habitat within the sub-catchment by approximately 10 per cent. In combination with Nathan Dam (7 per cent increase) and approved Connors River Dam (5 per cent increase) the total increase in impoundment area would be approximately 22 per cent. Localised short term habitat degradation as a result of construction activities would not contribute significantly to cumulative impacts.

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
	Aquatic fauna	Fauna injury and mortality Restriction of movement Impacts on conservation significant species	Existing and proposed dams and weirs can cause fauna injury and mortality. Existing infrastructure within the Fitzroy Basin catchment has reduced the connectivity of aquatic habitat by restricting the upstream and downstream movement of aquatic fauna past in-stream structures. The Fitzroy, Dawson and Mackenzie sub-catchments is fragmented into the twelve separate habitat areas located between each storage. The proposed Nathan Dam and approved Connors River Dam would create additional barriers to movement for aquatic fauna. Nest predation (greatest current threat), loss of habitat, alteration of natural flow regime, movement barriers, physical injury and mortality; poor water quality, and trampling by cattle currently threaten the Fitzroy River turtle. The approved Connors River Dam would impact on Fitzroy River turtle habitat at the upper extent of the species range.	Specific features have been incorporated into the design of the weirs to avoid/minimise risk of aquatic fauna injury and mortality (Chapter 7 Aquatic ecology). However, the Project will contribute to a cumulative risk of injury and mortality from the operation of water infrastructure at a catchment level (in combination with existing infrastructure and the proposed Nathan Dam and approved Connors River Dam). While fish passage infrastructure has been designed to provide passage for 95% of flows (Chapter 7 Aquatic ecology) and a turtle passage facility has been incorporated into the Project design, the Project will create an additional barrier for movement of aquatic fauna and will contribute to a cumulative impact on aquatic fauna movement in the catchment (in combination with existing infrastructure and the proposed Nathan Dam and approved Connors River Dam, each of which also incorporate fish passage infrastructure). The Project in combination with the approved Connors River Dam will contribute to cumulative impacts on the Fitzroy River turtle. However, the approved Connors River Dam is not assessed as having a significant residual impact. Impacts on the Fitzroy River turtle are addressed through the species management program developed for the Project and the provision of offsets (Appendix M and Chapter 22 Offsets).

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
Surface water resources	Stream flow	Altered stream flow patterns	In order to support human activities (i.e. agriculture, mining, industry, urban centres) in a climatically-variable system, section of some rivers within the Fitzroy Basin have been heavily regulated with dams, weirs and other water storage infrastructure (e.g. Fitzroy Barrage).	Cumulatively the Project will contribute to the level of impoundment within the Fitzroy Basin Catchment (Table 21-1), reducing lotic environments. However, analysis of the integrated quantity and quality model (IQQM) flow data revealed that there were no significant differences at the end of the system (downstream of the Fitzroy Barrage) between current modelled flow regimes and the flow regimes projected with Project infrastructure in place (Chapter 9 Surface water resources). That is no significant flows into the GBRWHA, GBRMP, GBR Coast MP or Fitzroy River FHA, The IQQM accounts for all existing water allocations and includes the proposed Nathan Dam and approved Connors Dam and requires the consideration of environmental flow releases.
Water quality		Reduced water quality (erosion, sedimentation, dissolved oxygen (DO), turbidity, nutrients, blue green algae)	Existing water quality is heavily influenced by anthropogenic factors in the catchment. Water quality impacts arise from mine water releases during flood events, mainly in relation to raised salinity levels. Increased sedimentation and nutrient release associated with mining activities and agriculture also impact water quality in the catchment.	Localised short term water quality impacts during construction would not contribute significantly to a cumulative impact at a local or catchment level. The Project's contribution to sediment load during operation is considered negligible. It is acknowledged that short term impacts to water quality will occur during the first filling period with regards to nutrients and subsequently DO and turbidity (Chapter 11 Water quality). Weir design and operations will reduce the potential for the release of poor quality water, through measures such as multi-level offtakes. The Project will not contribute significantly to cumulative impacts on water quality within the Project footprint and in downstream reaches, including the GBRWHA, GBRMP, GBR Coast MP and Fitzroy River FHA.
Air quality		Dust generation and human health risk Dust impacts on flora and fauna	Air quality impacts from power generation and mining activities within the regional study area. Dust generation from agriculture and associated clearing.	Localised short term air quality impacts during construction would not contribute significantly to a cumulative impact on air quality within the local study area and the nearest sensitive receptor of Gogango.

Environmental value	Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
		Except for the existing road and rail related air quality impacts, there are no known projects within immediate proximity to the Project that would impact on the identified sensitive receptors during construction.	
GHG emissions	Emission of GHGs	GHG emissions associated with existing mining, power generation and agricultural activities. Additional GHG emissions from new projects and vegetation clearing.	Emissions from the Project during construction will be low and negligible during operations. It will not contribute significantly to cumulative GHG emissions (Chapter 13 Greenhouse gas emissions).
Noise and vibration	Impacts at sensitive receptors Impacts to native fauna and livestock	Except for the existing road and rail related noise and vibration there are no known projects within immediate proximity to the Project that would impact on the identified sensitive receptors during construction.	There are no other construction projects in proximity (including at Gogango) which the Project would contribute noise and vibration impacts to. As such, localised short term noise and vibration impacts during construction would not contribute significantly to cumulative impacts within the local study area.
Waste	Waste generation, management and disposal	Operational waste resulting from mining activities and power generation within the regional study area.	Minor waste quantities generated during construction would not contribute significantly to a cumulative impact on waste disposal facilities.
Transport	Road/crossing access and flood immunity Traffic impacts	Increasing pressure on transport infrastructure due to increased activities within the regional study area. At a local level roads are characterised by poor flood immunity and variable road condition.	Road upgrades and augmentations are proposed as part of the Project. The contribution of localised short term traffic impacts during construction of the Project to cumulative pressure on transport infrastructure is insignificant (Chapter 16 Transport), with no other project proposed to utilise the same local roads.
Cultural heritage	Impacts on Indigenous cultural heritage Impacts on non-Indigenous cultural heritage	Cumulative impacts on cultural heritage occur due to increased activity and associated land disturbances. There are no known existing or planned projects within immediate proximity to the Project that would impact on the same cultural heritage values through land disturbance.	Additional infrastructure on the Fitzroy River and potential inundation could impact on areas and objects of Indigenous cultural heritage significance within the local study area however cumulative impacts are not anticipated. No impacts on non-Indigenous cultural heritage are anticipated as a result of the Project and therefore the Project will not contribute to cumulative impacts on non-Indigenous cultural heritage.

Environmental value		Potential cumulative impacts	Pressure from current and other planned activities	Project's contribution to cumulative impacts
Social	Landholders	Impacts on landholders (loss of land and access, productivity, lifestyle, weed and pests)	Other than the two proposed gas pipelines traversing the Project footprint (Section 21.4), there are no known existing or proposed projects within immediate proximity to the Project that would affect the same properties impacted by the Project footprint.	Minor impacts to landholders as a result of the Project are not expected to contribute significantly to a cumulative impact on these landholders. Impacts, to the same landholders associated with proposed pipeline projects are expected to be minimal (limited to easements) and as such there would be an insignificant cumulative impact.
	Local community	Workforce, local employment and business opportunities	Local and regional employment and business opportunities associated with current and future infrastructure development, mining projects, pipelines, power generation and agriculture.	The Project will contribute to local employment and business opportunities.
	Social infrastructure	Impacts on demand for community services and facilities	Increasing pressure on community services, facilities and emergency services as a result of current and future infrastructure development, mining projects, pipelines, power generation and agriculture.	Potential, short term increase in demand on community services, facilities and emergency services during construction will not contribute significantly to cumulative impacts within the local or regional study area.
Economic		Economic benefits to local, regional and state economics	Economic benefits associated with current and future infrastructure development, mining projects, pipelines, power generation and agriculture.	The Project would contribute to consequential cumulative economic benefits through the provision of water infrastructure that will support community and industry growth and improve the security of water supply for existing water resource users.

Due to the localised and relatively short term nature of the Project's construction impacts and the lack of other proposed projects that may be developed simultaneously 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. It is acknowledged that as the Project is likely to be staged in response to demand triggers (Chapter 1 Introduction) that construction related impacts will occur on multiple occasions within the Project footprints (Chapter 2 Project description). However, for the purposes of the assessment it was assumed that construction at all sites will occur simultaneously. It is considered that this assumption from a cumulative perspective would determine a 'maximum' impact and therefore a conservative approach to assessment has been adopted. The likelihood of construction occurring across all sites simultaneously is considered negligible.

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 (Chapter 22 Offsets and Chapter 23 Environmental management plan). Impacts on the Fitzroy River turtle are mitigated and managed through the species management program developed for the Project (Appendix M). Residual impacts on the Fitzroy River turtle are addressed through the provision of offsets (Chapter 22 Offsets).

21.6 Summary

A cumulative impact assessment has been undertaken to identify the potential cumulative impacts upon existing environmental values as a result of constructing and operating the Project in conjunction with other proposed projects within relevant study areas.

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. Land use within the local study area is dominated by agricultural practices, particularly cattle grazing and breeding as well as some crop cultivation.

Without the implementation of mitigation and management measures, the Project would result in cumulative impacts on landholders and rural land use practices, the local community including Gogango as well as aquatic and terrestrial ecology. Potential cumulative impacts will be avoided, mitigated and managed through the measures implemented for individual impacts.

The assessment of the Project's contribution to cumulative impacts takes into consideration the relative size, scale, proximity and nature of the Project in relation to other existing and potential development activities. Due to the localised and short term nature of the Project's construction impacts and the absence 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 as follows:

- Cumulative loss of remnant vegetation within the bio-subregion study
- 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. Specific features have been incorporated into the design of the weirs to avoid/minimise risk of aquatic fauna injury and mortality

- Cumulative impact on aquatic fauna movement in the catchment. The cumulative impact is considered minor based on implementation of fish passage infrastructure to minimise overall impacts.
- Cumulative impacts on the Fitzroy River turtle. Impacts on the Fitzroy River turtle are addressed through the species management program developed for the Project and the provision of offsets.

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.