

Lower Fitzroy River Infrastructure project

Coordinator-General's evaluation report on the environmental impact statement

December 2016

The Department of State Development

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Contents

Synopsis.....	vi
1. Introduction	1
2. About the project.....	2
2.1 The proponents	2
2.2 Project description.....	2
2.3 Project development stages	5
2.4 Infrastructure requirements	7
2.5 Project need	8
2.6 Dependencies and relationships with other projects	9
2.7 Project alternatives.....	10
2.8 Water infrastructure funding	10
3. Environmental impact statement assessment process.....	11
3.1 Coordinated project declaration	11
3.2 Terms of reference	12
3.3 Review of the EIS.....	12
3.4 Additional information to the draft EIS.....	12
3.5 Review of the AEIS	13
3.6 Commonwealth assessment	13
4. Project approvals	15
4.1 State government approvals	17
5. Evaluation of environmental impacts.....	19
5.1 Land	19
5.2 Water resources	26
5.3 Water quality	33
5.4 Matters of state environmental significance	43
5.5 Social impacts	68
5.6 Cultural heritage.....	74
5.7 Economic impacts	77
5.8 Traffic and transport	80
5.9 Air quality	86
5.10 Waste management	89
5.11 Noise and vibration	90
5.12 Hazard and risk	93
6. Matters of national environmental significance	97
6.1 Introduction	97
6.2 Project description.....	97
6.3 Project location.....	98
6.4 World Heritage properties	99
6.5 National Heritage places	112
6.6 Listed threatened species and communities	112
6.7 Listed migratory species	141

6.8	Principles of ecologically sustainable development	143
6.9	Coordinator-General's overall conclusion	144
7.	Conclusion	148
Appendix 1.	Imposed conditions—Eden Bann Weir	150
Appendix 2.	Imposed conditions—Rookwood Weir	155
Appendix 3.	Stated conditions—Eden Bann Weir	159
Appendix 4.	Stated conditions—Rookwood Weir	164
Appendix 5.	Recommended conditions for the Commonwealth Minister for the Environment and Energy	169
Appendix 6.	Coordinator-General's general recommendations—Eden Bann Weir	180
Appendix 7.	Coordinator-General's general recommendations—Rookwood Weir	185
Appendix 8.	Proponents' commitments	190
Appendix 9.	Threat abatement plans, species recovery plans and conservation advices	195
Appendix 10.	Statement of Outstanding Universal Value—Great Barrier Reef	207
Appendix 11.	Facilitated Agricultural Development—technical note	213
	Acronyms and abbreviations	215
	Glossary	218

Figures

Figure 2.1	Project location	4
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Tables

Table 4.1	Approvals required for the project to proceed	15
Table 5.1	Project tenure	23
Table 5.2	Regulated vegetation within the project footprint	44
Table 5.3	Protected flora species potentially occurring in the project area	48
Table 5.4	NC Act listed bird species potentially occurring in the project area	51
Table 5.5	NC Act listed mammal species potentially occurring in the project area	54
Table 5.6	NC Act listed reptile species potentially occurring in the project area	58
Table 5.7	NC Act listed aquatic freshwater species potentially occurring in the project area	59
Table 5.8	Construction traffic generation for Eden Bann Weir	80
Table 5.9	Construction traffic generation for Rookwood Weir	81
Table 5.10	Air quality sensitive receptors	87
Table 5.11	Noise and vibration sensitive receptors	91

Table 6.1	Estimated changes in pollutants resulting from conversion of land use from grazing to irrigated broadacre and irrigated tree cropping	108
Table 6.2	EPBC Act listed threatened flora species potentially occurring in the project area	115
Table 6.3	EPBC Act listed threatened mammals potentially occurring in the project area	119
Table 6.4	EPBC Act listed threatened reptiles potentially occurring in the project area	121
Table 6.5	EPBC Act listed threatened birds potentially occurring in the project area	122

Synopsis

Project and process

This report evaluates the potential impacts of the Lower Fitzroy River Infrastructure project (the project) in accordance with section 35 of the *State Development and Public Works Organisation Act 1971*¹ (Qld) (SDPWO Act).

The proponents, Gladstone Area Water Board (GAWB) and SunWater Limited (SunWater), propose to raise the existing Eden Bann Weir and construct a new weir at Rookwood on the Fitzroy River in central Queensland.

Eden Bann Weir is located approximately 62 km north-west of Rockhampton and the proposed Rookwood Weir site is approximately 66 km south-west of Rockhampton.

The project is located within the local government areas of Rockhampton and Livingstone Shire and borders the Woorabinda Aboriginal Shire and sections of the Central Highlands Region.

The project would require capital expenditure of \$495 million. It would require a peak construction workforce of 150 if both weirs are built simultaneously and would provide five direct operational jobs.

The project seeks to address future water demands from urban populations, industry and agriculture within the region. Together, the weirs would supply 76,000 megalitres per annum (ML/a), of which up to 42,000 ML/a may be allocated for irrigated agriculture.

The proponents have advised that construction staging for each weir would be determined by the demand for water from industrial, residential and agricultural users. Eden Bann Weir would include raising the existing weir with a full supply level (FSL) of 15.5 m Australian Height Datum (AHD) (Stage 1) to a new FSL of 18.2 m AHD (Stage 2), then raising the structure to FSL of 20.2 m (Stage 3). Rookwood Weir would include constructing a new weir which would be built to FSL of 45.5 m AHD (Stage 1) then raising the structure to FSL of 49.0 m (Stage 2).

The EIS examined the impacts of the scenarios of both stages of both weirs being constructed and operated either separately or simultaneously.

In undertaking my evaluation, I have considered the environmental impact statement (EIS) documentation, issues raised in submissions during the public consultation periods, the additional information to the draft EIS, further documents provided by the proponents and the community, and advice I have received from relevant Commonwealth, State and local government agencies.

The following provides an overview of the main issues addressed in my evaluation.

Land impacts

At the project's maximum development, the construction of both weirs would inundate up to 1,920 hectares of rural land predominantly used currently for beef cattle grazing. I

¹ Pursuant to section 197 of the SDPWO Act, the version of the Act in force prior on 30 September 2014 applies for the evaluation of the project.

note that the proponents have contacted all 58 directly impacted landholders about the project and have committed to continue to negotiate individually with them on issues relating to the possible loss of land, impacts on agricultural activities and possible loss of productivity.

I am satisfied that the potential impacts of the project on the following matters would be adequately managed through the proponents' draft environmental management plan (EMP):

- land contamination
- inundation of Arica State Forest
- soil erosion
- securing relevant tenure for impacted land.

Water resources

Construction of the project would temporarily disrupt river flows, which could interfere with aquatic habitats near to and downstream of construction activities. Waterway barrier works approvals required under the *Fisheries Act 1994* would ensure that project structures would be designed, built and operated to avoid or sufficiently mitigate the potential impacts of weir construction on water flow disruptions.

The EIS identified the potential impacts of construction and operational activities on local surface water and groundwater resources and described the measures required to properly manage those impacts.

The proponent commitments detailed in the draft EMP can sufficiently mitigate the potential impacts of the project on public infrastructure during minor flood events and on river morphology. The proponents will also negotiate with relevant landholders on compensation agreements for any possible impacts of minor floods on their properties.

Approvals required under the *Water Act 2000* will also ensure that the proponents would:

- develop and implement operating rules for each weir designed to meet the environmental flow and water supply objectives in the relevant Water Plan
- maintain water supply reliability to existing users impacted by the project or compensate them accordingly.

Water quality

The EIS has identified the potential impacts of construction and operational activities on water quality and that the proposed management commitments outlined in the draft EMP would mitigate those impacts.

I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- implement a water nutrient monitoring program to measure changes that may arise from the decay of vegetation within the impoundments
- use the results of that program to inform any potential management or offset program

- develop and implement a land management code of practice that is to be attached as a condition of sale of water for irrigated agriculture aimed at achieving the water quality objectives of the Reef 2050 Long Term Sustainability Plan
- implement a water quality monitoring program that would inform a future water quality offsets program if required by the Commonwealth Environment Minister to address any impacts of consequential facilitated agricultural development (FAD) on water quality entering the Fitzroy River.

With the implementation of the proponents' commitments and the conditions I have recommended to the Commonwealth Environment Minister, the potential impacts of the project on water quality in the Fitzroy River and the GBRWHA would be acceptable.

Matters of state environmental significance

Powerful owl

In the EIS the proponents have adequately identified the potential impacts of the project on the powerful owl. The project could potentially impact 1,243 ha of foraging and 512 ha of nesting habitat. I have recommended a condition to the Commonwealth Environment Minister requiring the proponents to provide offsets for the red goshawk, and my stated condition for regulated vegetation and connectivity offsets would mitigate impacts on the powerful owl nesting habitat.

Regulated vegetation

I am satisfied that the proponents have adequately identified the potential impacts on regulated vegetation including 240 ha of 'of concern' and 26 ha of 'endangered' regional ecosystems. To ensure the project does not have any adverse impacts on regulated vegetation I have stated conditions requiring the proponents to limit disturbance to regulated vegetation, and provide offsets to compensate for the significant residual impacts on regulated vegetation.

In line with my recommended conditions to the Commonwealth Environment Minister, the proponents can co-locate offsets for regulated vegetation with offsets for the threatened ecological community, powerful owl, red goshawk and connectivity areas.

Vegetation connectivity

The proponents have adequately identified the potential impacts on 1,947 ha of connected vegetation areas. To ensure the project does not have any adverse impacts on connectivity, I have stated conditions requiring the proponents to limit disturbances to existing vegetation, and provide offsets for the significant residual impacts on vegetation connectivity.

White-throated snapping turtle

The proponents have adequately identified the potential impacts on the white-throated snapping turtle.

The project would have very similar impacts on the white-throated snapping turtle as for the Fitzroy River turtle. Therefore, I consider that the recommended conditions to the

Commonwealth Environment Minister for the Fitzroy River turtle would address impacts on the white-throated snapping turtle.

Waterways providing for fish passage

The proponents have adequately identified the potential impacts on fish passage. The construction of Rookwood Weir and the raising of Eden Bann Weir would each create a barrier to fish passage in the Fitzroy River and would also result in the modification of and fragmentation of 942 ha of fish habitat. To mitigate adverse impacts on fish passage and habitat I have stated conditions requiring the proponents to construct fish passage infrastructure at both weirs, and provide financial or direct offsets for the significant residual impact on fish habitat.

Social and economic impacts

The project would deliver net social and economic benefits to the region and State through increased local employment, use of local suppliers, expenditure in the region and the provision of a secure water supply for industrial, urban and agricultural uses.

The benefit-cost analysis found that under all development scenarios, the project would provide a net gain to the region and State, with a benefit-cost ratio of 2.9 for several of the development scenarios considered.

The proponents have committed to sourcing the majority of employees from within the regional area, with a small proportion of highly specialised workers being sourced from elsewhere in Queensland. The proponents have committed to develop and implement a recruitment plan as a mitigation and management strategy prior to construction that would detail:

- workforce participation strategies providing employment opportunities and programs for indigenous and minority groups
- the use of local recruiting agencies and strategies giving preference to maximising opportunities for local employment
- provision of appropriate arrangements with contractors and suppliers to facilitate local employment and business opportunities.

To ensure the delivery of social and economic benefits through the project stages, I have imposed a condition requiring the proponents to provide an annual social impact management report for a period of five years from the commencement of construction of each weir. That report will require the proponents to demonstrate how they have addressed any stakeholder and community issues such as:

- land access
- land acquisition and compensation
- local and regional training and employment
- any impact on local and regional housing markets
- community health, safety and wellbeing.

I have also imposed a condition requiring the proponents to review the social impact assessment for the project if construction does not commence within two years of the

notification of this report, to ensure it reflects the social and economic circumstances of that time.

Traffic and transport

The EIS presented findings of hydraulic modelling that showed the annual average time of closure for upgraded river crossings during flood events would be reduced after the construction of the proposed weirs and upgraded river crossings.

I am satisfied that the proponents' commitments would maintain or improve the existing road network during construction and operation of the project, both upstream of the weirs during flood events and downstream of the weirs during water releases.

For Eden Bann Weir, these commitments include the construction of a new 12 km access road to the southern bank of the weir and measures to mitigate impacts on existing roads. These measures would include upgrades to the Bruce Highway and Atkinson Road intersection at Canoona, and the Glenroy Crossing. For Rookwood Weir, there would be upgrades of the intersection of the Capricorn Highway and Third Street at Gogango, Thirsty Creek Road, and the Hanrahan, Riverslea and Foleyvale Crossings.

I have also made recommendations that the proponents maintain the safety, condition and efficiency of state-controlled and local roads, develop road-use and traffic management plans and enter into an infrastructure agreement with the Department of Transport and Main Roads (DTMR). I am satisfied that these measures and the proponents' commitments in the draft EMP would avoid, manage or mitigate potential project impacts on traffic and transport.

Air quality, noise and vibration impacts

With the exception of the Third Street and Capricorn Highway intersection upgrade at Gogango, I am satisfied that the air and noise emissions and ground vibration generated by the construction works required for both weirs would be within acceptable limits. I have made a recommendation that the proponents' dust and noise management measures for the intersection at Gogango be approved by DTMR prior to the commencement of construction of that intersection upgrade.

Matters of national environmental significance

The project is a controlled action and the relevant controlling provisions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- listed threatened species and communities (sections 18 and 18A)
- listed migratory species (sections 20 and 20A).

The potential impacts on matters of national environmental significance (MNES) have been assessed in accordance with the bilateral agreement between the Queensland and Australian governments and, other than for the indirect effects of potential facilitated agricultural development, the proponents have adequately identified the potential impacts of the project on the controlling provisions and proposed mitigation measures to address impacts. Furthermore, the Australian Government Department of the

Environment and Energy advised on 1 December 2016 that the Commonwealth Environment Minister had the required information to make a decision under the EPBC Act.

GBRWHA—consequential water quality impacts

In view of my findings described in the water quality section, I consider that conditions I have recommended to the Commonwealth Environment Minister to mitigate or offset any impacts on water quality would ensure that the outstanding universal values of the GBRWHA would be maintained.

Threatened species and communities

Brigalow threatened ecological community

The EIS indicated that approximately 20 ha of brigalow EC is likely to be impacted by the project.

The EIS has adequately identified the potential impacts on the brigalow EC. To ensure that the project does not have an unacceptable impact on this EC, I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- limit disturbance to the brigalow EC
- undertake a pre-clearance survey to determine the actual area of the brigalow EC that would be impacted and would inform the offset requirement for that EC
- provide offsets to compensate for the significant residual impact on brigalow EC
- exclude fire from areas of brigalow EC within the project and offset areas.

Black ironbox

The proponents have adequately identified the potential impacts of Rookwood Weir on the protected black ironbox. In the development of Stage 2 of Rookwood Weir approximately 100 black ironbox trees could be impacted. To ensure that the proposed action does not have an unacceptable impact on the black ironbox, I have recommended to the Commonwealth Environment Minister conditions requiring the proponents to undertake a pre-clearance survey to determine the actual number of trees that would be impacted, and use the results of that survey to inform the offset requirement for the species.

Red goshawk

I am satisfied that the proponents have adequately identified the potential impacts on the red goshawk. The EIS estimates that up to 1,243 ha of potential foraging habitat and 972 ha of potential nesting habitat would be impacted. To ensure that the proposed action does not have an unacceptable impact on the red goshawk, I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to limit disturbance to red goshawk nesting habitat, and provide offsets to compensate for the significant residual impact of 972 ha on potential nesting habitat.

To deliver a strategic environmental benefit and reduce duplication I have also recommended that offsets for the red goshawk be co-located with offsets for a number of State matters, including regulated vegetation, connectivity areas and the powerful owl.

The proponents would be required to identify and secure suitable offset sites to meet the offset obligations for these matters.

Fitzroy River turtle

The proponents have adequately identified the potential impacts on the Fitzroy River turtle. The project could have a significant residual impact on 942 ha of aquatic habitat and would be expected to result in the inundation of up to 80 per cent of nests within the impoundments.

To compensate for the unavoidable loss of turtle nesting habitat within the impoundments, the proponents have committed to a nest protection program as part of their offset obligations. The proponents have also proposed a financial settlement offset to compensate for the significant residual impact on aquatic habitat for the Fitzroy River turtle.

In addition to offsets, I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- conduct a baseline study to determine turtle movement patterns, home range and seasonal variations to develop performance criteria for turtle passage infrastructure on both weirs
- construct infrastructure on both weirs to allow for safe turtle passage
- restrict activities associated with the construction of Glenroy Crossing outside of the peak turtle nesting and hatching seasons
- regulate water levels within Eden Bann Weir to minimise the risk of inundating turtle nests within the impoundment
- regulate water levels downstream of both weirs to minimise the risk of inundating turtle nests downstream of the impoundment.

The conditions I have recommended for the Fitzroy River turtle should appropriately manage the project's impacts on this species.

Coordinator-General's conclusion

I consider that the environmental impact assessment requirements of the SDPWO Act for the Lower Fitzroy River Infrastructure project have been met and that sufficient information has been provided to enable a thorough evaluation of the potential impacts of the project.

I conclude that there are significant local, regional and state benefits to be derived from the project and that any adverse environmental impacts can be acceptably avoided, minimised, mitigated or offset through the implementation of the measures and the proponents' commitments outlined in the EIS documentation. The conditions I have specified in this report have been formulated in order to further manage all impacts associated with the project.

Accordingly, I recommend that the project proceeds subject to the conditions and in accordance with the recommendations set out in the appendices of this report. In addition, I require the proponents' commitments to be fully implemented.

My report will be provided to the Commonwealth Environment Minister, pursuant to section 36(2) of the State Development and Public Works Organisation Regulation. My report will inform the assessment decision by the Minister on the controlled actions for the project in accordance with section 133 of the EPBC Act.

A copy of this report will be provided to the proponents and the relevant state government agencies, and will also be made publicly available at www.statedevelopment.qld.gov.au/lower-fitzroy



Barry Broe
Coordinator-General

8 December 2016

1. Introduction

This report has been prepared pursuant to section 34D of the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act) and provides an evaluation of the environmental impact statement (EIS) for the Lower Fitzroy River infrastructure project (the project).

It is not intended to record in this report all the matters that were identified and subsequently addressed. Rather, it concentrates on the substantive issues identified during the EIS process and the measures and conditions required to address the impacts. This report:

- summarises the key issues associated with the potential impacts of the project on the physical, social and economic environments at the local, regional, state and national levels
- presents an evaluation of the project, based on information contained in the EIS, additional information to the draft EIS (AEIS), submissions made on the EIS and AEIS during public consultation periods and information and advice from advisory agencies and other parties
- imposes conditions and makes recommendations under which the project may proceed
- documents the proponents' commitments.

2. About the project

2.1 The proponents

The Gladstone Area Water Board (GAWB) and SunWater Limited (SunWater) are the proponents for the project.

GAWB commenced operations in October 2000 as a Category 1 commercialised water authority under the *Water Act 2000* (Qld) and is also a registered service provider under the *Water Supply (Safety and Reliability) Act 2008* (Qld) (WSSR Act). GAWB owns and operates the 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.

SunWater is a statutory Government Owned Corporation under the *Government Owned Corporations Act 1993* (Qld). SunWater owns and operates the bulk water supply and distribution infrastructure located throughout regional Queensland, including the existing Eden Bann Weir.

2.2 Project description

The proponents propose to raise the existing Eden Bann Weir and construct a new weir at Rookwood on the Fitzroy River, central Queensland. The existing Eden Bann Weir (Stage 1) was built in 1994 to a height of 14.5 metres (m) Australian Height Datum (AHD) and currently operates in conjunction with the Fitzroy Barrage water infrastructure in Rockhampton.

The key project components include:

- raising the existing Eden Bann Weir with an existing FSL of 14.5 m AHD to a new FSL of 18.2 m AHD (Stage 2), then constructing gates and raising the structure to FSL of 20.2 m AHD (Stage 3)
- constructing a new weir at Rookwood which would be built to a FSL of 45.5 m AHD (Stage 1), then constructing gates to raise the weir to FSL 49 m AHD (Stage 2)
- constructing fish and turtle passage infrastructure at each weir
- the capture and storage of all high priority unallocated water resources available in the Fitzroy system (nominal volume of 76,000 megalitres [ML]) as the strategic water infrastructure reserve
- upgrading state, local and private roads, bridges and crossings to maintain connectivity of the road network after inundation
- constructing low level bridges at Glenroy, Riverslea and Foleyvale crossings situated upstream of weir infrastructure
- installing culverts at Hanrahan crossing situated downstream of Rookwood Weir.

The project does not include water delivery infrastructure (e.g. pipes) to supply water to users. Such works would require separate approvals not assessed in this report.

Separate to this project, GAWB is proposing to build a 115 kilometres (km) underground pipeline to enable the transfer of 30,000 megalitres of water per annum

(ML/a) from the lower Fitzroy River to Gladstone. For this water allocation to be made available, the Gladstone-Fitzroy Pipeline project (GFP) relies on the delivery of additional water infrastructure in the Fitzroy River including the raising of the existing Eden Bann Weir and the construction of the Rookwood Weir.

The raising of the Eden Bann Weir is expected to require a peak workforce of approximately 40 people for 12 months. Construction of the Rookwood Weir is likely to require a peak workforce of approximately 60 people for 12 months. Construction of each of the river crossing sites would require a total workforce of approximately 50 people over a period of 12 months. In total, a peak workforce of approximately 150 people across both weir sites is anticipated over a two-year construction period if both weirs are constructed simultaneously. However, it is anticipated the project would be staged in response to demand triggers and as such, workforce profiles would differ, depending on the stage of each weir being built.

2.2.1 Location

The project is located on the lower Fitzroy River, within the Fitzroy sub-catchment, central Queensland (refer to Figure 2.1). The Fitzroy River forms at the confluence of the Mackenzie (flowing from the north) and Dawson (flowing from the south) rivers flowing out into the Coral Sea including the Great Barrier Reef World Heritage Area (GBRWHA) and the Great Barrier Reef Marine Park (GBRMP). The Fitzroy River passes through the city of Rockhampton, which lies approximately 59 km from the river mouth.

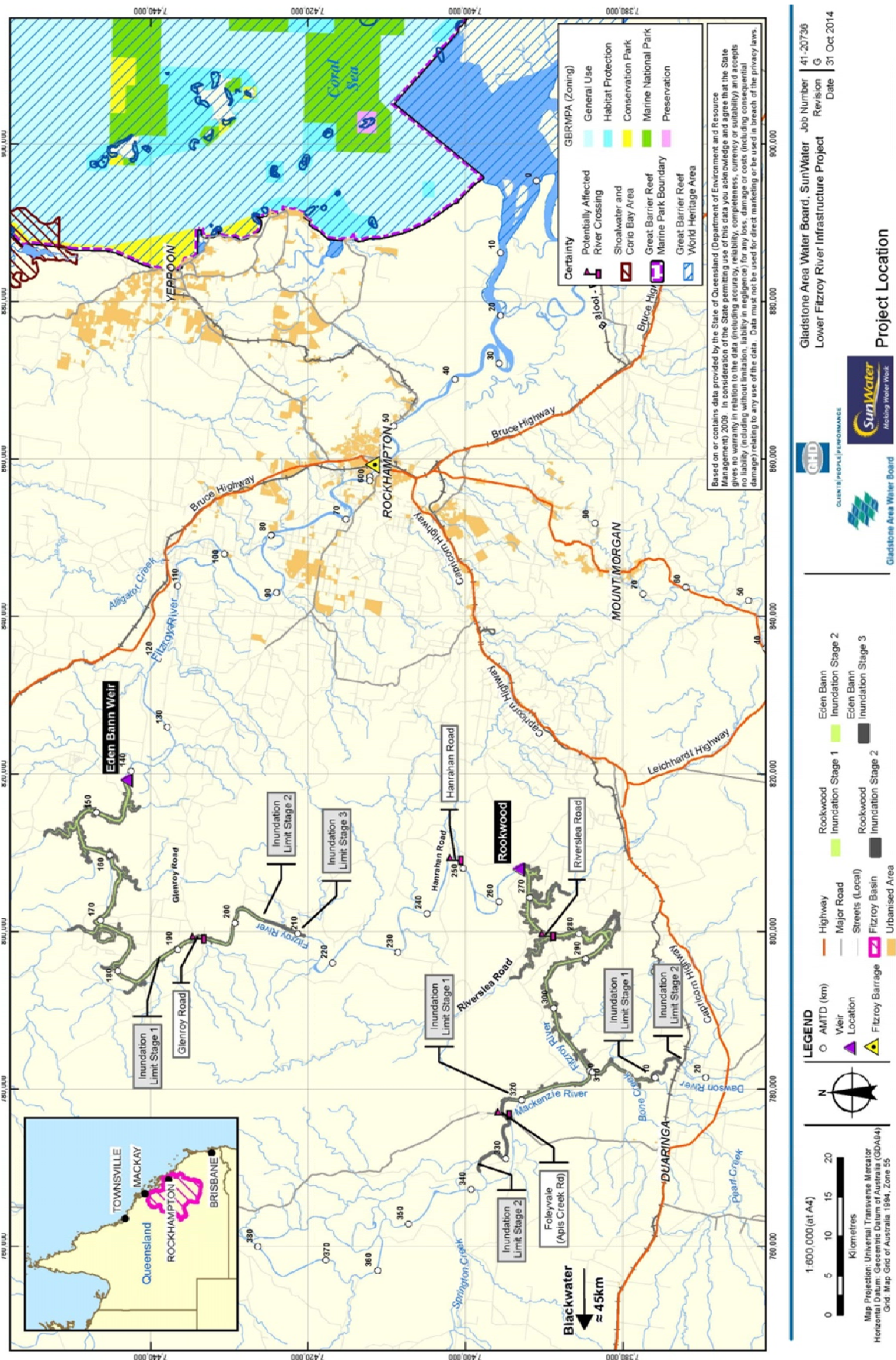


Figure 2.1 Project location

Eden Bann Weir is located approximately 62 km north-west of Rockhampton in central Queensland on the Fitzroy River at 141.2 km adopted middle thread distance (AMTD) from the coast. The Eden Bann Weir footprint falls within the Rockhampton Regional Council (RRC) and Livingstone Shire Council (LSC) local government areas (LGAs). SunWater currently owns and operates Eden Bann Weir under a Perpetual Lease (Lot 11 SP114939).

Land either side of the weir is held in freehold. The Fitzroy River is Unallocated State Land (USL). The Eden Bann Weir impoundment, as part of the watercourse, holds no specific tenure. At FSL, the Eden Bann Weir impoundments would include land in freehold and leasehold tenure on the river banks.

The proposed Rookwood Weir site is located on the Fitzroy River at 265.3 km AMTD from the coast and approximately 10 km downstream from the Riverslea Road river crossing. The site is approximately 15 km north of Gogango adjacent to Thirsty Creek Road. Gogango is approximately 66 km south west of Rockhampton along the Capricorn Highway. The Rookwood Weir footprint lies within the RRC LGA. The Rookwood Weir impoundment borders the Woorabinda Aboriginal Shire Council LGA and sections of Central Highlands Regional Council LGA.

At FSL the Rookwood Weir impoundments (Stage 1 and Stage 2) would encompass land currently in freehold and leasehold tenure on the river banks.

2.3 Project development stages

2.3.1 Construction

The project is proposed to be staged, with the sequencing and timing of each stage dependent on a number of demand triggers, including the proponents' decisions, existing and new consumers, drought conditions and security of supply requirements. The timing of construction of each stage of each weir would be driven primarily by commercial response to these demand triggers and availability of capital.

If Eden Bann Weir is raised and Rookwood Weir is constructed simultaneously, a two-year construction timeframe is anticipated. Both weirs can be constructed in four alternate wet and dry phases.

During construction, power would be generated by diesel generators at Rookwood and existing reticulated supply at Eden Bann. Water would be pumped from the impoundment/pools immediately upstream of the site.

Project development stages include the following:

Eden Bann Weir²

- Stage 1:
 - existing FSL 14.5m AHD
 - 35,980 ML existing storage

² The existing Eden Bann weir is called 'stage 1'.

- 670 hectares (ha) impoundment area at FSL
- Stage 2:
 - a raise of the existing Eden Bann Weir to FSL 18.2 m AHD
 - 67,690 ML storage at FSL
 - 1,170 ha impoundment area at FSL
- Stage 3:
 - the addition of two-metre-high flap gates to achieve FSL 20.2 m AHD
 - 91,450 ML storage at FSL
 - 1,690 ha impoundment area at FSL.

Rookwood Weir

- Stage 1:
 - a new build to FSL 45.5 m AHD
 - 65,400 ML storage at FSL
 - 1,430 ha impoundment area at FSL
- Stage 2:
 - the addition of 3.5-metre-high flap gates to achieve FSL 49.0 m AHD
 - 117,290 ML storage at FSL
 - 1,930 ha impoundment area at FSL.

Any combination of the above development stages may occur in order to meet water demand triggers.

2.3.2 Operation

The proponents expect that filling the infrastructure to FSL can be achieved at both weirs within a single wet season. During wet seasons, the weir storages capture and retain river flows allowing for releases through the dry season to meet regulated environmental flow requirements.

To achieve the project objectives of capturing and storing all unallocated but available water, development of both the Eden Bann Weir raises and Rookwood Weir construction has been assumed. The project would operate in conjunction with the existing Eden Bann Weir and Fitzroy Barrage.

On this basis, the overall storage and release strategy is proposed to operate in accordance with the Water Resource (Fitzroy Basin) Plan 2011 (Fitzroy Basin WRP) and the Fitzroy Basin Resource Operations Plan (Fitzroy Basin ROP) provisions:

- nominal FSLs would 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 would occur.

2.4 Infrastructure requirements

Weir infrastructure would comprise the permanent weir wall and abutments, spillway, fish and turtle passage infrastructure, control room and amenities, immediate downstream protection areas and saddle dams.

Each weir construction area incorporates the weir infrastructure footprint and other in-stream works such as coffer dams and excavations and areas adjacent to the river for the establishment of site facilities.

Each weir impoundment comprises the area within the riverbed and banks inundated at FSL and adjacent riparian areas that would be the subject of a water storage easement.

Other project-specific infrastructure components and services include:

Eden Bann Weir

- upgrade to the Bruce Highway and Atkinson Road intersection at Canoona
- upgrades to Eden Bann Road
- construction of a new 12 km private access road to service the southern bank of the Eden Bann Weir
- construction of a low level bridge upstream of the weir impoundments at Glenroy crossing
- removal and decommissioning of existing low level causeways and culverts at Glenroy crossing
- an electrical plant (control room) to be established at the weir site.

Rookwood Weir

- upgrade of Thirsty Creek Road to improve water course crossings
- upgrade to the Capricorn Highway and Third Street intersection at Gogango
- construction of low level bridges in areas upstream of the weir impoundment at Riverslea and Foleyvale crossings
- installation of culverts at Hanrahan Crossing downstream of Rookwood Weir to facilitate access during operation releases
- removal and decommissioning of existing low level causeways and culverts at Riverslea and Foleyvale crossings
- relocation of existing gauging station
- an electrical plant (control room) to be established at the weir site.

2.4.1 Power supply

Power supply would be required at both weirs for the construction and operation of electrical plant infrastructure components which include a control room, fishway valves and motors for flap gates.

Power supply during the construction phase at both weirs would be facilitated through the use of diesel generators and existing reticulated supply at Eden Bann Weir.

Capacity upgrades would be undertaken and the proponents would seek separate approvals which are not addressed as part of this report to meet power supply requirements.

2.4.2 Telecommunications

Each weir site would have a control room serviced by a landline and internet communications. The Eden Bann Weir currently operates in this manner. During construction, mobile phone coverage would be supplemented by satellite communication facilities if mobile phone coverage is poor.

2.4.3 Resource extraction areas

Potential resource extraction areas for the supply of construction materials have been identified in close proximity to the weirs. The proponents would investigate possible extraction of resources owned by the state government. These extraction activities would be subject to subsequent environmental approvals not addressed in this report. The haulage distance of extracted material to both weir sites is not expected to exceed 1 km.

The proponents are unlikely to source material from commercial quarry operators with existing licences. However, if quarry materials are sourced for the project, the proponents would engage with Department of Transport and Main Roads (DTMR) and the relevant local governments about impacts on road use.

2.5 Project need

The project seeks to address the potential demands from urban populations, industry and agriculture within the Gladstone and Rockhampton regions and along the Capricorn coast to secure future water supply and improve water security in the short to medium term.

In 2006, the Central Queensland Regional Water Supply Strategy³ (CQRWSS) identified the project as a means of meeting short-to-medium-term urban and industrial demand for water in the Lower Mackenzie-Fitzroy sub-region. One of the key issues for the strategy to address is that projected water demand from urban, industrial, coal mining and agricultural sectors predicts a regional water supply shortfall through to 2020.

The CQRWSS identified the lower Fitzroy system as the next main supply source of urban and industrial needs of the RRC and LSC LGAs and for the needs of GAWB's supply area. It was also identified that further infrastructure on the lower Fitzroy River is required in order to provide appropriate reliability of supply for high priority water.

The CQRWSS predicted that future demand for water resources would be principally driven by growth in the industrial and urban sectors in the Gracemere-Stanwell

³ Central Queensland Regional Water Supply Strategy December 2006, Department of Natural Resources and Water 2006. Viewed on 10 November 2016, <http://www.gawb.qld.gov.au/documents/40241572/40254757/CQRWSS%20Report.pdf>

Industrial Corridor, Gladstone region and lower Fitzroy areas. It was also identified that there would be potential demand for agriculture development along both banks of the Fitzroy River, known as the Fitzroy Agricultural Corridor (FAC), for intensive livestock and horticulture enterprises which is dependent on availability of appropriate land, market conditions and water systems to manage water use.

Along with water allocation trading and water efficiency gains, the CQRWSS identified that longer term urban, industrial and agricultural demands can be met through the project operating in conjunction with the Fitzroy Barrage, Awoonga Dam and the proposed Nathan Dam and Pipelines project (NDP).

The Fitzroy WRP identifies that a nominal volume of 76,000 ML is available for allocation from the Fitzroy River as supplemented water from the strategic water infrastructure reserve. GAWB, through its strategic planning, has also identified the project as a component of its drought management strategy and to facilitate growth in demand in the Gladstone region.

Separate to this project, GAWB has obtained State and Commonwealth environmental approvals for its proposed GFP project which will transfer water between the Fitzroy and Boyne catchments, considered likely by the proponents to be the first demand trigger for the project to supply water. The Fitzroy Basin ROP nominates 30,000 ML/a as the Gladstone Reserve from the Fitzroy River for this purpose.

The EIS identified other key water supply demand triggers that may arise from the following sources:

- RRC and LSC may seek additional water from the project
- industrial activities from the Gracemere-Stanwell Industrial Corridor
- proposed mining and petroleum exploration projects for the Rockhampton region
- potential demand from the agricultural sector within the FAC.

While some demand for water from mining and related industries can be expected in the long term, volumes required are difficult to predict. A staged approach to project development has therefore been proposed, which would enable the proponents to respond to smaller water supply demands in the short term and progressively increase to larger water supply demand until full project development is reached.

2.6 Dependencies and relationships with other projects

To ensure future water demand is met and the overall performance of the lower Fitzroy River system is improved, the project would need to operate in conjunction with other central Queensland water infrastructure. This includes the existing Fitzroy Barrage on the Fitzroy River and the Awoonga Dam; and other proposed water infrastructure in the Fitzroy catchment such as the proposed NDP project, the proposed Connors River Dam and Pipelines project (CRDP) and the GFP project.

Notably, the project would operate in conjunction with the existing Fitzroy Barrage with water released from both weirs to flow to the Fitzroy Barrage for abstraction and distribution to various consumers.

2.7 Project alternatives

The EIS considered a number of project alternatives with respect to their ability to match immediate and emerging water demands while ensuring capture of available yield in the lower Fitzroy system.

To reliably meet the long-term water supply needs of the region, the CQRWSS identified that further water storage infrastructure, such as the raising of the Eden Bann Weir and the construction of the Rookwood Weir, would be required on the lower Fitzroy River.

The EIS determined that alternative water storage projects such as the NDP and the CRDP would not achieve the water demand requirements in the Lower Fitzroy region and that the Fitzroy Barrage, in isolation, would not provide a solution for the regional demand for water.

2.8 Water infrastructure funding

In May 2016, the Australian Government announced that it would provide up to \$130 million (M) to build the project, contingent on the project obtaining the necessary environmental approvals and acceptance of a viable business case. In July 2016, the Australian Government also announced that the National Water Infrastructure Development Fund would provide \$2 M to conduct feasibility and business case work for the project. The business case is now being developed by Building Queensland, which works closely with Queensland government departments, government-owned corporations, statutory authorities and the proponents.

3. Environmental impact statement assessment process

In undertaking this evaluation, I have considered the following:

- initial advice statement
- the EIS and technical reports
- issues raised in submissions on the EIS
- other correspondence received after the submission period of the EIS
- the AEIS
- issues raised in submissions on the AEIS
- an addendum to the AEIS provided by the proponents on 9 August 2016 (published on the Coordinator-General's website)
- technical reports
- advice from the proponents
- advice from the Australian Government Department of the Environment and Energy (DEE)
- state agency advice from:
 - Department of Agriculture and Fisheries (DAF)
 - Department of Education and Training (DET)
 - Department of Energy and Water Supply (DEWS)
 - Department of Environment and Heritage and Protection (DEHP)
 - Department of Health—Queensland Ambulance Services
 - Department of National Parks, Sport and Racing (DNPSR)
 - Department of Natural Resources and Mines (DNRM)
 - Department of State Development (DSD)
 - Department of Infrastructure, Local Government and Planning (DILGP)
 - DTMR
 - Department of Science, Information Technology and Innovation (DSITI)
 - Public Safety Business Agency
 - Queensland Fire and Emergency Services.

The steps taken in the project's EIS process are documented on the project's webpage at www.statedevelopment.qld.gov.au/lower-fitzroy

3.1 Coordinated project declaration

On 6 May 2011, the then Coordinator-General declared this project to be a 'significant project'⁴ under section 26(1)(a) of the SDPWO Act. This declaration initiated the

⁴ Amendments to the SDPWO Act in December 2012 resulted in the replacement of the term 'significant project' with 'coordinated project'.

statutory environmental impact evaluation procedure of Part 4 of the Act, which required the proponents to prepare an EIS for the project.

3.2 Terms of reference

The draft terms of reference (TOR) for the EIS for the project were released for public and advisory agency comment from 12 November 2011 to 16 December 2011. Submissions were received from advisory agencies, non-government organisations and the general public.

The final TOR were prepared, having regard to comments received, and issued to the proponents on 27 April 2012.

The draft TOR for an EIS were subsequently amended to include both Commonwealth and State requirements to enable the project to transition to the assessment bilateral, and released for further comment from 19 July 2014 until 18 August 2014. Eight submissions were received on the re-issued draft TOR.

The re-issued final TOR were approved by the Coordinator-General on 3 September 2014.

3.3 Review of the EIS

A preliminary draft EIS, prepared by the proponents, was reviewed for technical adequacy by advisory agencies including DEE.

An updated draft EIS was submitted by the proponents addressing issues identified in the technical agency review and was publicly notified from 18 July 2015 to 31 August 2015.

Submissions were received and copies forwarded to the proponents and DEE. Further submissions were received following the conclusion of the public comment period and I have considered these submissions in my evaluation of the project. The most prominent issues raised in public submissions and from advisory agencies included:

- surface water resources impacts
- clarification on the environmental flow calculations and impact on ecological assets
- inundation impacts and loss of land
- water quality impacts on the GBRWHA from potential agricultural activities
- the potential impacts to threatened species.

3.4 Additional information to the draft EIS

On 6 November 2015, I requested the proponents submit additional information regarding:

- environmental flow objectives (EFOs) (volume and timing of water releases and impacts on ecological assets)
- impacts on water quality from potential intensive agriculture development

- impacts on the habitat of the red goshawk and the powerful owl and possible offsets
- offsets strategy for the Fitzroy River turtle, white-throated snapping-turtle and brigalow threatened ecological community (brigalow EC)
- turtle passage design effectiveness (overtopping of weir and turtle injury)
- inclusion of the white-throated snapping-turtle in the species management program
- management of fishway maintenance and repair programs
- development of a fish monitoring program that monitors the success of the fish locks.

3.5 Review of the AEIS

On 12 May 2016, the proponents provided the AEIS; and I approved its release for public and agency comment between 28 May 2016 and 27 June 2016. Submissions were received, including submissions from community organisations and government advisory agencies.

Copies of the submissions were forwarded to the proponents and to DEE.

On 9 August 2016, the proponents provided further information (an addendum) in response to issues raised in submissions on the AEIS. The proponents provided clarification on issues raised including:

- impacts on the habitat of the red goshawk and the powerful owl and possible offsets
- offsets strategy for the Fitzroy River turtle, white-throated snapping-turtle and brigalow EC
- commitment to further analysis and assessment to validate predicted results with impacts associated with facilitated agricultural development (FAD)
- commitments to benefiting the *Reef 2050 Long Term Sustainability Plan* (Reef 2050 Plan) targets and water quality improvement with regard to potential FAD.

After reviewing the proponents' response to my request for additional information and submissions, I accepted the revised draft EIS as the final EIS on 14 September 2016.

This report has reviewed the revised draft EIS, properly made submissions and other material relevant to the project and I consider that all submissions made on the draft EIS and AEIS have been satisfactorily addressed.

3.6 Commonwealth assessment

3.6.1 Matters of national environmental significance

The Commonwealth has accredited the State of Queensland's EIS process, conducted under the SDPWO Act, under a bilateral agreement between the Commonwealth and the Queensland Government. Under the agreement (made under section 45 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act)), if a controlled action is a 'coordinated project for which an EIS is required' under the SDPWO Act, certain types of projects do not require assessment under Part 8 of the

EPBC Act. The agreement enables the EIS to meet the impact assessment requirements of both Commonwealth and Queensland legislation.

Under Part 4 of the SDPWO Act and section 36 of the State Development and Public Works Organisation Regulation 2010, the Coordinator-General must ensure the assessment report evaluates all relevant impacts that the action has, will have, or is likely to have, and provide enough information about the action and its relevant impacts to allow the Commonwealth Environment Minister to make an informed decision whether or not to approve the action under the EPBC Act.

The controlled action may be considered for approval under section 133 of the EPBC Act, once the Commonwealth Environment Minister has received the Coordinator-General's EIS evaluation report (prepared under section 34D of the SDPWO Act).

On 7 January 2010, the Commonwealth Environment Minister's delegate determined that the project is a 'controlled action' under the EPBC Act (EPBC ref. 2009/5173).

The relevant controlling provisions under the EPBC Act are:

- World Heritage properties, sections 12 and 15A
- National Heritage places, sections 15B and 15C
- listed threatened species and communities, sections 18 and 18A
- listed migratory species, sections 20 and 20A.

On 7 January 2010, the delegate under the EPBC Act decided that a coordinated (parallel) environmental assessment approach was to be undertaken. On 3 September 2014, the delegate under the EPBC Act decided that the project assessment be transitioned to the bilateral agreement.

Section 6 of this report (Matters of national environmental significance [MNES]) explains the extent to which the Queensland Government EIS process addresses the actual or likely impacts of the project on the MNES covered by each controlling provision.

DEE, on behalf of the Commonwealth Environment Minister, advised on 1 December 2016 that, in accordance with the Queensland bilateral agreement, there was adequate information for the Commonwealth Environment Minister to make a decision under the EPBC Act. The Commonwealth Environment Minister will use the information in Section 6 of this report to make an informed decision whether or not to approve the controlled action under the EPBC Act, and if so, apply conditions to the approval necessary to protect MNES.

4. Project approvals

Following the release of this report, the proponents would be required to obtain statutory approvals from Australian, state and local government agencies before the project can proceed. Table 4.1 provides a list of approvals required for either the Eden Bann Weir raising, and/or Rookwood Weir construction to proceed. Unless otherwise stated below, the following statutory approvals are required for both weirs. The proponents acknowledge that further information may be required to support lodgement of applications for these subsequent approvals.

Table 4.1 Approvals required for the project to proceed

Project component/ activity	Relevant approvals	Legislation	Authority
Whole of project	EPBC Act approval of controlled action	EPBC Act	DEE
Eden Bann Weir raising ⁵	Material change of use (MCU) under Rockhampton Region Planning Scheme 2015 for Eden Bann Weir	<i>Sustainable Planning Act 2009</i> (SPA)	RRC
Quarrying and sand extraction activities	MCU for environmentally relevant activities	<i>Environmental Protection Act 1994</i> (EP Act), SPA and Sustainable Planning Regulation 2009 (SP Regulation)	DEHP, State Assessment and Referral Agency (SARA)
Vegetation clearing	Operational works for clearing of native vegetation	<i>Vegetation Management Act 1999</i> (VM Act) and SPA	DNRM, SARA
Eden Bann Weir	Operational works that is the construction of a referable dam (for Eden Bann Weir)	SPA and SP Regulation <i>Water Supply (Safety and Reliability) Act 2008</i> (WS Act)	DEWS, SARA
Weir construction	Operational works for constructing or raising waterway barrier works	<i>Fisheries Act 1994</i> (Fisheries Act), SPA and SP Regulation	DAF, SARA
Dredging	Development permit for the removal of quarry material (dredging) in a watercourse	Water Act, SPA and SP Regulation	DNRM, SARA
Weir and bridge construction	Operational works for taking or interfering with water from a watercourse	Water Act, SPA and SP Regulation	DNRM, SARA

⁵ The land on which the full footprint of Rookwood Weir is located is designated as water infrastructure under the Livingstone Shire Planning Scheme 2005, so an MCU approval is not required.

Project component/ activity	Relevant approvals	Legislation	Authority
Whole-of-project construction	Reconfiguration of a lot	<i>Land Act 1994</i> , SPA and SP Regulation	Relevant regional or shire council (potentially four LGAs)
Whole of project	Building works	<i>Building Act 1975</i> , SPA and SP Regulation	Regional Council/private certifier
Construction	A cultural heritage management plan	<i>Aboriginal Cultural Heritage Act 2003</i> (ACH Act)	Department of Aboriginal and Torres Strait Islander Partnerships
Construction on state-owned land	Evidence of a resource entitlement	SPA, Land Act, Water Act and <i>Transport Infrastructure Act 1994</i> (TI Act)	Relevant government department
Taking of water during project construction	Water permit	Water Act, Fitzroy Resource Operations Plan (ROP)	DNRM, SARA
Taking of water during project operation	Water licence	Water Act, Fitzroy Resource Operations Plan (ROP)	DNRM, SARA
Whole of project	Riverine protection permit	Water Act	DNRM, SARA
Vegetation clearing	Permit to clear native plants	<i>Nature Conservation Act 1992</i> (NC Act)	DEHP
Removal of native fauna	Damage mitigation permit	Nature Conservation (Wildlife Management) Regulation 2006	DEHP
Tampering with a protected animal breeding place	Species management program	Nature Conservation (Wildlife Management) Regulation 2006	DEHP
Quarrying and sand extraction from state land	Sales permit	<i>Forestry Act 1959</i>	DAF
Quarrying in the waterway (which is the property of the State)	Quarry material allocation notice	Water Act, SP Act and SP Regulation	DNRM
Dam safety management	Certificate of failure impact assessment (required to be undertaken prior to the submission of the Operational Works application for a referable dam for Eden Bann Weir)	WS Act	DNRM

Project component/ activity	Relevant approvals	Legislation	Authority
Contaminated land or materials	Disposal permit to remove and treat or dispose of contaminated soil from land on the Environmental Management Register or Contaminated Land Register	EP Act	DEHP
Roadworks—state- controlled roads	Road corridor permit	TI Act	DTMR, SARA
Traffic impacts	Oversize load permit	TI Act	Queensland Police Service (QPS)
Roadworks—local roads	Approval for carrying out works on a road or interfering with a road or its operation	<i>Local Government Act 2009</i> , Local Law No. 1 (Administration) 2011	RRC and LSC
Whole of project (where applicable)	Flammable and combustible liquids licence	<i>Workplace Health and Safety Act 2011</i> (WHS Act)	Department of Justice and Attorney- General (JAG)
Whole of project (where applicable)	Notification of hazardous chemicals in excess of manifest quantities or Major Hazard Facility	WHS Act	JAG
Whole of project	Amendment to Fitzroy Resource Operations Plan (ROP)	Water Act	DNRM
Whole of project	Resource Operations Licence (ROL)	Water Act	DNRM
Whole of project (where applicable)	Building works	Building Act, SPA and SP Regulation	Regional Council/private certifier

4.1 State government approvals

4.1.1 Community infrastructure designation

The proponents have stated their intention to seek a community infrastructure designation (CID) under SPA for the proposed area of land for each weir. A CID may exempt the proponents from obtaining some development approvals for assessable development under the relevant planning scheme and for reconfiguring lots. In the event of a CID for the project or for either weir component, the conditions stated, imposed or recommended in appendices 1–4 and 6–7 of this report should be treated as recommended requirements under section 43 of the SDPWO Act.

4.1.2 Recent changes to the Water Act

The capture and retention of river flows for the project is provided for in the existing Fitzroy Basin WRP which governs the management, allocation and sustainable management of water to meet environmental protection requirements and the future water supply needs of the region. Following changes to the Water Act, which commenced on 6 December 2016, water allocation and management requirements for the project will be incorporated into a new statutory 'Water Plan' under that Act.

For the purpose of this report, all references to and obligations under the Fitzroy Basin WRP or the Fitzroy Basin ROP should be read as applicable under the relevant provisions of the Water Act at the time.

4.1.3 Conditions in this report under the SDPWO Act

Approval requirements for each weir are similar, but not identical. Consequently, I have imposed, stated or recommended conditions for each weir separately.

I have a head of power under section 54B of the SDPWO Act to impose conditions for matters where conditions cannot be applied through approvals under other legislation. Imposed conditions are provided in appendices 1 and 2 of this report.

I have a head of power under section 39 of the SDPWO Act to state conditions for the assessment manager for matters subject to a MCU approval under SPA. Stated conditions are provided in appendices 3 and 4 of this report.

I consider that there are some matters for the management of potential impacts of this project for which no statutory head of power exists. As these cannot be implemented as either stated or imposed conditions, I have made recommendations in Appendix 6, and Appendix 7 of this report to address those matters. While those recommendations have no statutory authority, the relevant stakeholders, including the proponents, have agreed to implement them.

4.1.4 Transport Infrastructure Act

The project would require road corridor permits for roadworks in state-controlled road corridors from DTMR and oversize load permits from the QPS issued under the TI Act. Section 49 of the TI Act prohibits enforcement of conditions stated by the Coordinator-General under the SDPWO Act. Therefore, I have made recommendations to DTMR about matters that should be managed in relation to road impact assessment, road-use management plans, road works and infrastructure agreements under the TI Act in Part A, Schedule 2 of appendices 6 and 7 of this report.

5. Evaluation of environmental impacts

5.1 Land

The project is located in a rural area, with beef cattle grazing being the predominant land use. There is some crop cultivation for grains and a small number of properties have irrigation licences. The most common use of the Fitzroy River is for stock watering with livestock generally accessing the river directly or via pump/trough systems.

At full supply, the project would result in the inundation of 1,920 ha of land. The proponents have assessed the impacts as they relate to scenic amenity and lighting, topography, geology and soils, contaminated land sites, land use and tenure.

5.1.1 Submissions received

The key issues regarding land impacts raised in submissions on the EIS and AEIS included the following:

- loss of agricultural land, including Class A and Class B agricultural land
- impacts on agricultural activities including risks to livestock
- compensation for impacted landholders
- inundation of Aricia State Forest
- potential land contamination.

I have considered each submission and the responses provided by the proponents in my evaluation of the project and my assessment is provided in the relevant sections below.

5.1.2 Impacts and mitigation

Scenic amenity and lighting

The EIS reported that the weir sites and predicted impoundments are bordered by large rural properties. Public access and viewpoints within the project area are limited to river crossings at Glenroy, Riverslea and Foleyvale with relatively low usage. Viewpoints at the weir sites are restricted through private access. There are no houses with views of the weir sites or crossings.

While there would be some changes to the visual landscape and amenity of the area, these changes have been assessed as negligible as they would be viewed by a limited number of residents, farm workers and road users with short-term viewing periods. The project was assessed in the EIS as having negligible visual impacts and no mitigation measures are proposed.

The EIS found that no homesteads would be impacted by light pollution at Rookwood Weir. However, unmitigated lighting during construction could potentially disrupt nocturnal fauna behaviour and impact one homestead near Eden Bann Weir.

Proposed mitigation measures for construction lighting include:

- restricting project activities to daylight hours to ensure limited lighting impacts during construction and operation
- avoiding night works during turtle nesting periods
- using directional sensor-activated lighting at both Eden Bann Weir and Rookwood Weir during operations to reduce sky glow
- avoiding installing lighting within the impoundment or at river crossings
- notifying the Eden Bann Homestead at least 7 days in advance, advising the date, time, duration and nature of any night works.

Project lighting during operations would be limited to directional sensor activated lighting for safety and security purposes.

Coordinator-General's conclusion

My evaluation of the EIS found that the project would have negligible visual impacts on scenic amenity and I concur with the proponents' finding that no mitigation measures are required. I have given regard to the finding that unmitigated lighting could have adverse impacts on nocturnal fauna behaviour and one homestead near Eden Bann Weir. I therefore expect the proponents to fulfil their commitment to further refine and then implement the draft EMP to ensure that all mitigation measures for lighting are implemented appropriately.

Topography, geology and soils

The EIS undertook a desktop assessment to establish existing environmental values for topography, geology and soil.

Topography

The EIS reported that the Fitzroy River flows through both undulating and relatively level grazing country. The Eden Bann and Rookwood weir sites lack significant local topographical features and the project is not expected to adversely impact upon the local topography. Inundation associated with the project is contained within the river bed and banks and is not anticipated to impact topographical features. Accordingly, no mitigation measures are proposed.

Geology

The EIS found that Eden Bann Weir has geological conditions conducive to raising the weir by another 5–10 m. Initial geotechnical investigations undertaken at the proposed Rookwood Weir site found that geological conditions support the construction of a roller-compacted concrete weir structure. The proponents propose to undertake further geotechnical investigations to support the detailed design phase.

The project site has the potential to contain fossils within sedimentary rock in the vicinity of the Riverslea and Foleyvale Crossings. These areas are located above the reservoir level and it is not expected that the project would result in any significant loss of scientific knowledge. Therefore, no mitigation measures are proposed.

Soils

The EIS found that some soils on the Eden Bann Weir and Rookwood Weir sites are prone to dispersion, which may lead to erosion. Other soils were identified as being susceptible to accumulating high levels of salt in the topsoil and root zones. No salinity outbreaks were reported in land appropriate for irrigation in the project area, however some soils display moderate to high levels of soluble salts in subsoils. The EIS proposed that soil surveys and site investigations would be undertaken prior to the construction of each project stage.

Construction activities and vegetation clearing within the development footprints have the potential to cause erosion and land instability. Without appropriate mitigation measures, sediments could potentially be released to surface waters and adversely impact upon water quality and aquatic ecosystems. Measures to control impacts on water quality and aquatic ecosystems are discussed in sections 5.3 and 6. The results of soil surveys and investigations to be undertaken prior to construction would inform the development of drainage control plans and erosion and sediment control plans.

During the operational phase of the project, there is potential for water releases to cause erosion downstream. The weir designs have incorporated measures to minimise the impact of erosion from water releases. The results of the proponents' soil studies and assessments undertaken prior to construction would further inform the development of stormwater management plans, rehabilitation plans and operational erosion control measures.

The EIS reported that erosion is not expected to occur within the impoundment areas upstream of the weirs. Vegetation within the impoundments would be retained to assist in maintaining the short-term stability of the banks as the impoundment fills. Retaining vegetation would also assist in the facilitation of the long-term regeneration and regrowth of riparian vegetation along the river banks. Impacts on water quality as a result of inundated vegetation decaying are discussed in Section 5.3. Impacts on marine fauna resulting from inundated vegetation decaying are discussed in Section 5.4.

Acid sulfate soils (ASS) are not expected to be encountered during construction activities as excavation below 5 m AHD is not anticipated. The EIS reported that if ASS or potential ASS is found, an ASS management plan would be developed based on the requirements of the *Queensland Acid Sulfate Soil Technical Manual*.

Coordinator-General's conclusion

I have assessed the EIS and am satisfied that no mitigation measures are required to mitigate impacts to topography and geology in the project area. I note that project activities could potentially cause erosion and land instability and I therefore expect the proponents to fulfil their commitments to addressing these potential impacts through:

- undertaking physical model studies prior to construction to inform erosion protection works downstream
- undertaking a geomorphological assessment prior to inundation to refine predictions in relation to potential impacts such as sedimentation, erosion-prone soils and bank slump

- implementing the soil management program described in the draft EMP.

I also expect the proponents to undertake rehabilitation and remediation works as required.

Land contamination

Potential land contamination impacts within the project site may result from the disturbance and inundation of existing contaminated land. Contamination may also result from project activities as a result of unintended spillages or accidents.

Effective management of potential contaminants is required to prevent impacts to land, water and human health. Potential sensitive receptors within the project areas include the Fitzroy, Mackenzie and Dawson Rivers and groundwater within nearby utilised aquifers.

The EIS identified potential contamination sites based on historical and desktop information. The proponents propose to undertake site investigations for potential contamination sites prior to construction to prevent the release of existing contaminants to the environment and protect the quality of water in the reservoirs. If site investigations indicate potential or actual contamination, a site management plan, remediation action plan and a contaminated sites construction management plan would be prepared and implemented.

There are no sites recorded on EHP's Contaminated Land Register (CLR) within the project footprint, however the EIS investigations found a number of possible contamination sites and areas of interest, including:

- eleven possible contamination sites and areas of interest within the Eden Bann Weir impoundment area and within 500 m of the FSL, of which:
 - nine sites are located within the 500 m impoundment buffer
 - one site is located within the impoundment area for Eden Bann Weir Stage 3
 - one site is located at the existing Eden Bann Weir
- six possible contamination sites and areas of interest within the Rookwood Weir impoundment area and within 500 m of the FSL, of which:
 - four sites are located within the impoundment buffer
 - two sites are located within the construction footprint.

Potential contamination sites included above-ground storage tanks and sheds that may hold hydrocarbons, herbicides and pesticides and livestock dips or spray races. Historically, these livestock dips contained chemicals such as arsenic, dichlorodiphenyltrichloroethane (DDT) and other hazardous chemicals. Four allotments are listed on DEHP's Environmental Management Register (EMR) for containing a livestock dip or spray race.

One submitter raised concerns regarding the EIS finding that there were no contaminated sites recorded on the CLR within the project footprint. The submitter also raised concerns regarding the potential mobilisation of salts due to intensified agricultural activity, sediments from legacy land clearing and metals such as Cadmium from poor quality superphosphate applied liberally during the Brigalow Scheme. The

proponents have committed to undertake site investigations at sites of potential contamination prior to construction to prevent the release of any existing contaminants to the environment and to protect local water quality.

Coordinator-General's conclusion

Whilst it is unlikely that project activities would require notification on the CLR, in the event it would be required, the EP Act specifies how the proponents would meet requirements in relation to the investigation, management and remediation of contaminated land. The proponents are also required to obtain a disposal permit to remove and treat or dispose of contaminated soil from land on the EMR or CLR. I also expect the proponents to fulfil their commitment to addressing potential impacts by implementing the contaminated land management program described in the draft EMP.

Land use and tenure

Impacts

Sunwater owns and operates Eden Bann Weir. The tenure for the Eden Bann Weir and proposed Rookwood Weir is described in Table 5.1.

Table 5.1 Project tenure

Project tenure	Eden Bann Weir	Rookwood Weir
Fitzroy, Mackenzie and Dawson Rivers	Unallocated state land	Unallocated state land
Weir and infrastructure	Perpetual lease	Proponents propose to acquire perpetual lease
Impoundment	No specific tenure	No specific tenure
Weir—adjoining land	Freehold	Freehold
Access road	Easement	Proponents propose to negotiate easement

The proponents propose to extend the perpetual lease at Eden Bann Weir to include raised embankments with ancillary work areas retained for operations. A total of 58 landholders would be impacted by the proposal. The existing Eden Bann Weir (Stage 1) impoundment impacted 11 landholders across 33 allotments and the proposed works would result in further impacts on these landholders.

Raising the Eden Bann Weir to Stage 2 would impact an additional nine landholders and 19 allotments. The addition of gates for Stage 3 would impact an additional five landholders and seven allotments. A total of 757 ha of land would be inundated equating to one per cent loss of total land holdings for both Eden Bann Weir stages. The proposed southern bank access road would traverse three freehold lots with easements to be negotiated.

The proponents also propose to acquire a long-term or perpetual lease over Rookwood Weir and the associated infrastructure. The Stage 1 inundation would impact 26 landholders across 38 allotments. Raising the weir to Stage 2 would impact an additional seven landholders across 12 allotments. A total of 1,163 ha of land would be

inundated equating to a one per cent loss of total land holdings for both Rookwood Weir stages. Two properties within the Stage 2 impoundment are estimated to lose 25 per cent and 26 per cent of their landholdings respectively.

An easement would be negotiated over freehold land at Lot 1 on SP136791 to accommodate a new access road. Raising the weir to Stage 2 would not further impact the access road footprint, nor require additional tenure negotiations.

No specific tenure is required for either weir impoundment as it is not possible for the state government to grant land interests in state land that is also part of the watercourse.

The EIS reported that landholders have the right to graze livestock over the area between the high and low bank outside their legal riparian boundary, to ingress and egress the river and to access water for livestock. Several landholders made submissions raising concerns about potential impacts to livestock, fencing, access to river frontage and the requirement for adequate compensation. In a submission on the EIS, one submitter noted that a number of tenure issues may arise as a result of the proposed development including impacts to roads, stock routes and state leases.

Mitigation

The proponents have undertaken extensive stakeholder consultation and community engagement as detailed in the project's social impact assessment (SIA) discussed in Section 5.5 (Social impacts).

The proponents have contacted all directly impacted landholders about the project and have committed to negotiate individually with them on issues relating to the loss of land and/or loss of access to land, weed spread due to project activities and impacts on productivity. The following factors would be taken into account in calculating appropriate landholder compensation:

- area of riparian land inundated and determined to be non-river
- loss of stock watering points
- increased need for fencing to prevent stock losses
- increased risk of stock losses due to the provision of more potential nesting places for crocodiles
- cost of relocating irrigation pumps to higher ground
- changed weed and pest control management requirements.

Two management plans have been proposed as mitigation measures to reduce potential impacts on landholders. A stakeholder engagement plan would guide adequate, timely and regular communication with stakeholders including information on project status, water allocations and management of key project impacts. The proponents have also committed to develop a project land access and acquisition strategy that would manage land access, loss of land, compensation and potential impacts on existing and future water allocations. The strategy includes the development and implementation of a weed management plan to prevent the introduction of new weed species and the spread of declared weeds. The emphasis of the strategy would be to secure land by agreement.

Agricultural land classes

The EIS reported that fragmented strategic cropping land is mapped along the Fitzroy, Mackenzie and Dawson rivers. Strategic cropping land impacted by construction activities is limited to the following sites:

- approximately 0.4 ha along the new right bank access at Eden Bann Weir
- approximately 0.5 ha along a river boundary at the Rookwood Weir
- approximately 3.7 ha at the Glenroy, Riverslea, Foleyvale and Hanrahan Crossings.

Inundation predicted to result from the project is confined to the river bed and banks and is not expected to impact on strategic cropping land and the productive capacity of the surrounding land. Negligible impacts on landholdings are predicted.

Submitters on the EIS queried the potential impacts on the highly productive soils of Class A and Class B agricultural land. One submitter identified that approximately 565 ha of Class A and Class B agricultural land was contained within the proposed impoundment area. The submitter also identified the potential for agricultural land to become fragmented as a result of the need for construction of a new access road to the Eden Bann Weir right bank.

The EIS reported that the proponents consulted with DNRM on the submission and a revised calculation determined that approximately 102 ha of Class A and B agricultural land would be potentially impacted by the project at its maximum extent. This impact is considered to be relatively low and no further mitigation or management is required. Landholders would also benefit from the new opportunities for agricultural development presented by the project.

Aricia State Forest

One submitter contended that, given a portion of the Aricia State Forest would be permanently inundated by the Eden Bann Weir impoundment, revocation of the inundated area and a buffer area from the State Forest may be required. DNPSR advised that a revocation would require a resurveying of the boundary between the State Forest and the watercourse. Compensation may need to be paid to DNPSR for the loss of the resource. The EIS reported that the project proponents would continue to liaise with DNPSR and DNRM to determine the most appropriate method of addressing any loss of land.

Coordinator-General's conclusion

The EIS has identified the potential land use and tenure impacts associated with the project. I have accepted the proposed management measures and noted the proponents' commitments to:

- negotiate individually with directly impacted stakeholders (including landholders) and develop and implement a project land access strategy, land acquisition strategy and compensation strategy
- obtain relevant land tenure in accordance with the applicable legislation at the appropriate time and by the appropriate entity.

I am satisfied that these management measures and commitments would reduce impacts to landholders as much as practicable. I expect that potential impacts to landholders would be further reduced through field planning, project refinements during detailed design and implementation of the avoidance and mitigation measures proposed in the EIS. I also recognise that a range of commitments relating to land impacts would be addressed within the project's final EMP.

5.2 Water resources

The EIS identified potential impacts of the project on surface water, groundwater and floodplains including changes to flows, flood extent and river morphology. It also addressed impacts associated with greater inundation areas on existing infrastructure and operational management strategies.

My evaluation of the potential impacts of the project focuses on the following higher risk matters:

- construction:
 - disruption and diversion of flows from the weirs and associated infrastructure
 - temporary water drawdown around weir construction works
- operational water releases from the weirs, especially with respect to management of:
 - impoundment and downstream inundation
 - river flow patterns and river morphology.

Potential water resource management impacts related to water quality matters are addressed in Section 5.3 of this report. Potential water resource management impacts related to aquatic fauna are addressed in Section 5.4 (Matters of state environmental significance) and Section 6 (MNES).

5.2.1 Submissions received

Key issues raised in submissions on the EIS and AEIS regarding potential impacts on water resources included:

- impacts on ecological assets (i.e. environmental values, including the biological function of riparian, aquatic, estuarine flora, fauna and habitat) resulting from changes to the flow regime
- flow impacts on the riverine and estuarine ecology and hydrodynamics, and on the Great Barrier Reef (GBR) in low-flow years and during drought periods due to the capture of low to medium flows in these years
- impacts on low flow or no flow (waterhole) water entitlement that may limit the ability of the existing users to extract water.

I have considered each submission and the responses provided by the proponents in my evaluation of the project and provided responses in relevant sections below.

5.2.2 Impacts and mitigation

Construction

The EIS reported that the Stage 3 raising of the existing Eden Bann Weir and the Stage 2 construction of Rookwood Weir would be undertaken over a two-year period if constructed simultaneously. The four phases of construction would be aligned to alternating wet (typically December to March) and dry (typically April to November) seasons.

The EIS reported the following three potential impacts on water resources arising from construction activities.

Disruption and diversion of flows from weir infrastructure

During construction activities, flow disruption could interfere with aquatic species and habitats, including fish and turtle passage near to and downstream of each weir.

To mitigate this potential impact, the proponents have proposed strategies in the draft EMP for the project. These strategies include boarding or sandbagging the weirs and using coffer dams to divert and maintain flows within the river channel. For Eden Bann Weir, the existing fish lock and outlet structure would also remain operational and would be operated to assist with flow management. I accept that the proposed strategies would adequately mitigate the potential impacts of flow diversions.

Flood events may scour bed and bank material around construction works or damage partially built structures. However, I accept that the probability of flood events adversely impacting construction during the dry seasons would be low and that the measures proposed above to maintain river flows during construction, as committed in the draft EMP, are adequate.

I also accept that waterway barrier works approvals required under the Fisheries Act would provide the statutory mechanism to ensure that these structures are designed, built and operated to avoid or sufficiently mitigate the potential impacts of construction of the weir on water flow disruptions.

Disruption and diversion of flows from associated infrastructure

An increased inundation area and changes to surface flow would impact on public and private infrastructure, such as roads, river crossings and stream gauges.

Three low level causeways would be replaced by:

- low level bridges at:
 - Glenroy Crossing upstream of Eden Bann Weir, and
 - Riverslea and Foleyvale Crossings upstream of the Rookwood Weir site.

Hanrahan Crossing, downstream of the Rookwood Weir, would be augmented with new culverts to accommodate operational releases.

The stream gauges at The Gap and Riverslea owned by DNRM would require reinstatement and recalibration. I accept that, if construction is conducted in accordance with the draft EMP, flows would not be adversely impacted by the construction works associated with these upgrades.

I am satisfied that the commitments made by the proponents in the draft EMP would avoid or adequately mitigate any potential impacts of construction of associated infrastructure on surface water resources.

Groundwater and river drawdown

Construction of each weir would require dewatering of excavations, with groundwater temporarily stored in a sediment basin for release to the Fitzroy River once acceptable water quality has been achieved. Those works would be subject to a permit under the Water Act.

There is a low risk of temporary drawdown of surface aquifers in the immediate vicinity of each weir construction site. The EIS concluded that no bores near Eden Bann Weir and one bore near Rookwood Weir would be impacted by such drawdown. The proponents have commenced discussions with the one impacted licence holder and committed in the draft EMP to mitigate or compensate this impact.

The proponents have also made commitments to enter into negotiations with this licence holder to restore the loss of supply or provision of alternative compensatory measures as agreed between the parties in accordance with the Water Act. Therefore, I am satisfied that these measures would be sufficient to deal with any potential impacts of groundwater drawdown on this one licence holder.

Operation

Operation of the weirs

Modelling undertaken for the EIS predicts that each weir would fill within two months of completion of construction and full supply volumes and overtopping would occur annually. The EIS reported the following potential impacts to water resources arising from the operation of the project.

Under usual operating arrangements for the supply of water to the Fitzroy Barrage (the principal offtake for urban and industrial users), the Rookwood Weir storage would be released to the Eden Bann Weir, which would be drawn down when the Rookwood Weir is depleted.

Under average weather conditions, each weir would make slow regulated releases to the river throughout the dry season. Water releases would occur as necessary to satisfy EFOs and water allocation security objectives (WASOs) in accordance with the Fitzroy WRP.

EFOs are set as the frequency and quantity of flows from weir water releases required to maintain key ecological functions. To the extent possible, water releases from each weir would be similar to the natural downstream river conditions through each season.

WASOs are set as the frequency and quantity of flows from weir water releases required to maintain supply to existing water licence holders downstream of each weir. For users that hold flood harvest licences, EFO and WASOs are usually similar. Where the proponents are not able to maintain existing supply to licence holders, make good or compensation provisions of the Water Act would apply. I accept the information in the EIS that, in almost all cases, water supply to those impacted licence holders could

be drawn from the relevant weir. I also consider that the proponents' commitments to enter into one-on-one landholder negotiations, as described in Section 5.5 of this report, would be adequate to address these matters.

Groundwater

There are no management requirements or specific ecological outcomes defined in the Fitzroy WRP groundwater management area. There are 37 registered bores within 5 km of the Eden Bann Weir and 66 registered bores within 5 km of the proposed Rookwood Weir. They are used for stock and domestic supply.

Local groundwater levels are expected to rise as a result of the increase in recharge associated with the impounded water on the underlying alluvium and fractured rock aquifers. The EIS predicts that any increase in groundwater levels is not expected to be maintained for any significant period of time due to gradual water releases throughout the year.

One existing bore would be inundated by the operation of the proposed Rookwood Weir. I am satisfied that the compensation process required under the Water Act and consultation with the license holder similar to those described above would adequately address this matter.

Inundation and operational strategy

The area of inundation associated with the raising of Eden Bann Weir to Stage 2 would increase to 1,170 ha (from the existing 670 ha), with the extent of upstream inundation increasing by 21 km AMTD from 43 km to 64 km. Stage 3 would inundate a further 6 km to a total of 70 km of river length and a total inundation area of 1,690 ha.

Rookwood Weir Stage 1 would inundate 67 km of river and an area of 1,430 ha. Stage 2 would inundate a further 18 km to a total of 85 km of river length and a total inundation area of 1,930 ha. The Rookwood Weir would inundate the lower reaches of the Mackenzie and Dawson Rivers that are within the Mackenzie and Dawson sub-catchments.

The impoundment and inundation of an additional 112 km of river habitat over both weirs would result in the conversion of natural habitats from a flowing state to a non-flowing state consisting of deep, wide river channels at each impoundment. The aquatic ecology impacts associated with impoundment are addressed in sections 5.4 (Matters of state environmental significance) and 6 (MNES) of this report.

The EIS concluded that no crossings downstream of Eden Bann Weir would be adversely impacted by releases from this weir.

For Rookwood Weir, the predicted increase in inundation areas and alteration of surface flows would require the upgrading of the associated roads and river crossings. Some private access tracks would be impacted. The proponents have commenced discussions with affected landholders and mitigation measures would be put in place through individual compensation negotiations (see Section 5.5).

The operational regime would be subject to the provisions of the Fitzroy Water Plan and an operations manual for each weir.

I am satisfied that the measures described in the draft EMP and in Section 5.5 of this report in relation to interactions with landholders would adequately manage the potential impacts of inundation on infrastructure and properties.

Altered stream flow patterns

The Integrated Water Quantity and Quality Model (IQQM) was used in the EIS to:

- simulate daily stream flows
- determine project yields
- determine whether proposed water extractions would meet EFOs and WASOs for surface water in the existing Fitzroy WRP.

IQQM is a software tool used to simulate stream flows, water storages and release management, water extractions, water demands and other hydrologic events. It is commonly used in Australia⁶ to plan and evaluate water resource management policies at the river basin scale and can be applied to regulated and unregulated streams.

For both stages of both weirs, the model predicted that there would be either marginal or no difference in downstream flow patterns between the base case and the development scenario releases. The modelling also predicted that water flows downstream of the weirs are more likely to increase during the dry season, and have the potential to improve aquatic habitat.

The EIS reported that base flow EFOs are not currently met in most years for the existing Eden Bann Weir for the months May to August and September to December. The analysis also shows that EFOs for those months would not be met for any of the proposed weir development scenarios. However:

- while EFOs are key to the management of environmental impacts of water storages, adherence to EFOs stated in operations plans are not mandatory under the Water Act
- the project's impact on flows would not be significantly different from the existing state
- as discussed in sections 5.4 and 6 of this report, I have imposed and recommended conditions to the Commonwealth Environment Minister requiring the proponents to maintain impoundment water levels as high as possible before turtle nesting.

In addition, I have made general recommendations that the proponent regulate water releases from the weirs to manage downstream flows to minimise inundation of turtle nests and to maintain aquatic habitat.

Water operations plans also aim to ensure that natural stream-flow conditions are maintained to continue supply to existing licenced users. However, the EIS noted that the project may reduce supply to a small number of existing entitlement holders upstream and downstream of each weir. In addition to their obligations under the Water Act, the proponents have committed in the EIS to either guarantee existing supply reliability to these entitlement holders or compensate them accordingly.

⁶ <http://wetlandinfo.ehp.qld.gov.au/wetlands/what-are-wetlands/definitions-classification/classification-systems-background/methods/iqqm-data-assumptions.html>, viewed 2 December 2016.

Based on these considerations, I have stated a condition requiring the proponents to develop and implement a Resource Operations Licence Holder's Operation Manual for each weir that, to the extent practicable, meets the EFOs and WASOs in the relevant Fitzroy Water Plan.

Altered flood flow regimes

Flood hydrological investigations and hydraulic modelling were undertaken for both weirs. The potential impacts to the access and use of riparian land as a result of changed flood levels are discussed in Section 5.1 of this report.

The EIS reported that both weirs are in-river structures designed to be overtopped and inundated in flood events and are therefore not designed for flood mitigation. The EIS also reported that smaller floods such as 1-in-2 annual exceedance probability (AEP) events have a greater peak water level difference than larger floods that overtop the weirs. That is, there is a small measurable influence of each weir on flood extents of neighbouring properties during the small events, but no significant impact during major flood events. To illustrate this, the estimated rise in flood afflux compared to the base case would be:

- 3.6 m immediately upstream of Stage 3 of Eden Bann Weir for a 1-in-2 AEP event, reducing to 2.6 m 13 km upstream and 0.3 m 54 km upstream
- 5.0 m immediately upstream of Stage 2 of Rookwood Weir for the 1-in-2 AEP events, reducing to 0.6 m 40 km upstream
- zero at Rookwood Weir Stage 3 during a 1-in-20 AEP event (with the weir wall being overtopped by 0.3 m).

I am satisfied that these predictions have been adequately addressed in:

- the design of associated infrastructure for the project such as upgrades of public bridges, causeways and culverts
- discussions with relevant stakeholders about mitigation requirements for gauging stations and private infrastructure and access roads.

For example, the Riverslea Crossing would be inundated during a 1-in-2 AEP event for Stage 1 of the Rookwood Weir, but the proposed bridge designed for a 1-in-5 AEP event would significantly improve flood immunity and road network connectivity at this point.

The EIS reported no significant impact of minor flooding on high-use public infrastructure. For example, the post-development afflux of both weirs for the 1-in-2 AEP event at the Capricorn Highway intersection with the Dawson River is estimated to be only 0.09 m, with afflux at the Foleyvale Crossing (on the Mackenzie River) estimated to be only 0.22 m.

Therefore, I consider that:

- the weirs would not have a significant residual impact on public infrastructure during flood events
- minor residual land inundation would occur on some riverside properties upstream of both weirs during smaller flood events, and the measures proposed, such as

enhanced culverts and causeway crossings, and compensation agreements with landholders (described in Section 5.5 of this report) would be sufficient.

Changes to river morphology

Independent of the project, high levels of sediment movement, especially during flood events, is a major issue for the management of the Fitzroy River and the health of the GBR. All project infrastructure would be subject to potential damage by high volume and high velocity flood flows, which would also scour downstream river banks.

The silty sands around the Rookwood Weir site have been identified as highly erodible. Bank slumping within both impoundments could occur as a result of saturated bank soil combined with rapid drawdown and water releases.

Management strategies for both weirs rely primarily on transmission of sediment over the weirs. In areas of lower velocity, there would be local deposition of sediment at the upstream face of the weirs with low-level outlets assisting to flush this sediment downstream.

To manage any erosion impact, the proponents propose to use engineered structures to stabilise and protect the slopes on the left bank of each weir. To refine these protective measures, the proponents have committed in the draft EMP to undertake further hydraulic modelling based on more intensive geomorphic surveys during the detailed design phase.

The EIS stated that a monitoring program would be developed to monitor areas upstream and downstream of the weirs for potential erosion and bank slump. The draft EMP describes corrective actions for scouring, erosion and slumping, including rehabilitation and restoration of impacted areas in accordance with a soil management plan.

I consider that the measures proposed by the proponents in the draft EMP would be sufficient to manage and/or mitigate the potential impacts of each weir on river morphology. These measures include rehabilitating and restoring any areas subject to scouring, erosion or slumping.

5.2.3 Coordinator-General's conclusion

I am satisfied the EIS identified the potential impacts of construction and operational activities on local surface water and groundwater resources and described the measures required to properly manage those impacts.

I also accept that the proponents' commitments detailed in the draft EMP would:

- sufficiently mitigate the potential impacts of the project on public infrastructure during minor flood events and on river morphology
- result in the proponents negotiating appropriately with relevant landholders on compensation agreements for impacts of minor floods on their properties.

I am satisfied that approvals required under the Water Act will ensure that the proponents would:

- develop and implement operating rules for each weir designed to meet the EFOs and WASOs in the relevant Water Plan
- maintain water supply reliability to existing users impacted by the project or compensate them accordingly.

5.3 Water quality

The EIS reported potential impacts on existing water quality and described methods by which these impacts can be avoided, mitigated and managed. Impacts on surface and groundwater resources are addressed in Section 5.2 (Water resources). Impacts on aquatic fauna are addressed in Section 5.4 (Matters of state environmental significance) and Section 6 (MNES).

This section evaluates the potential impacts of the project on water quality of the receiving environment resulting from construction, filling of each weir impoundment, and operation. This section also evaluates the potential consequential impacts on water quality from the use of water from the weir impoundments for irrigated agriculture.

5.3.1 Submissions received

Key issues raised in submissions on the EIS and AEIS regarding potential impacts on water quality included:

- elevated nutrient levels and increased sediment loads in water flowing to the GBRWHA
- potential increases in blue-green algae blooms
- increased sediment, nutrients and farm chemicals from FAD.

I have considered each submission and the responses provided by the proponents in my evaluation of the potential impacts of the project and my assessment is provided below.

5.3.2 Impacts and mitigation

Surface water in the project location is already degraded. The concentrations of nutrients within the existing Eden Bann impoundment are currently greater than the water quality objectives (WQOs) of the Environmental Protection (Water) Policy 2009 (Fitzroy River Sub-basin [2011])⁷ (Water EPP for the Fitzroy River Sub-basin) due to land-use practices within the Fitzroy Basin, together with high sediment and erosion loads during flood events.

Without the implementation of appropriate measures, the project has the potential to further reduce the quality of water entering the Fitzroy River.

⁷ https://www.ehp.qld.gov.au/water/policy/pdf/plans/fitzroy_fitzroy_river_wqo_290911.pdf, viewed 11 November 2016.

Construction

My analysis and findings for this section of the report are similar for both Eden Bann and Rookwood Weirs.

The EIS identified three possible impacts on water quality arising from construction activities: ground disturbance and vegetation removal; in-stream works; and contaminant spillage. The EIS concluded that the impacts of these activities would be temporary, localised and unlikely to have a significant impact on water quality in the Fitzroy River.

The secondary and tertiary permits or approvals required for the construction works for the weirs have industry standard or model conditions. These include:

- operational works approvals under SPA for constructing or raising a waterway barrier (Fisheries Act)
- permit for the removal of quarry material (dredging) in a watercourse (Water Act)
- operational works for taking or interfering with water from a watercourse (Water Act)
- quarrying and sand extraction from state land (Forestry Act).
- ground disturbance and vegetation removal.

I am satisfied that, for the potential construction impacts of the project, approvals under those statutes would ensure compliance with the proponents' commitments in the draft EMP.

Ground disturbance and vegetation removal

Ground-disturbing actions and subsequent run-off may reduce water quality due to increased turbidity, resulting in decreased oxygen levels and light penetration. The proponents' draft EMP details the measures proposed to avoid or limit erosion and turbidity. These measures include:

- erosion and sediment control consistent with the practices described in accepted guidelines⁸
- stabilisation of existing slopes
- undertaking the more significant ground-disturbing activities, such as embankment excavations and construction of coffer dams, during drier periods
- minimising clearing of vegetation for access and site facilities
- diverting flows around disturbed areas and treating site-affected water
- installing and maintaining floating booms downstream of the works supporting silt curtains weighted to the river
- dust control
- reinstating disturbed areas as soon as possible after work is complete.

⁸ e.g. the IECA (2008) *Best Practice Erosion and Sediment Control Guideline*; and the Queensland Division of the Australian Institute of Engineers' (1996) *Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites*.

In-stream works

In-stream works, including earthworks and dewatering of foundations, could lead to increased turbidity and sedimentation. The proponents have committed in the draft EMP to avoid or limit erosion and sedimentation by:

- basing detailed construction plans on geomorphic site assessment at key locations
- using diversions to divert clean water away from construction areas
- using sediment basins to capture turbid water until sediment has settled
- capturing, treating and testing construction-affected water prior to release back to the watercourse
- undertaking rehabilitation and restoration of any areas, especially river banks that have been subject to erosion or slumping.

Contaminant spillage

The use of construction machinery has the potential to result in the release of contaminants such as fuels and lubricants to the waterway. The proponents have committed in the draft EMP and their contaminated land management program to avoid contamination of waterways by:

- storing and handling contaminants such as hydrocarbons in compliance with Australian standards, including:
 - AS 1940:2004 – *The storage and handling of flammable and combustible liquids*
 - AS 1678.5.1.002-1998 *Emergency procedure guide – Transport Ammonium nitrate*
 - AS 2187:1998 *Explosives – Storage, transport and use and*
 - AS 4326-2008 *The storage and handling of oxidising agents.*
- restricting servicing and refuelling to bunded areas well away from flood-prone areas.

Conclusion—construction

I am satisfied that the EIS has adequately evaluated the impacts of the construction of the project on water quality in the Fitzroy River.

I am also satisfied that implementation of the measures committed to by the proponents in the draft EMP would be adequate to avoid or sufficiently limit pollution of the Fitzroy River due to construction activities. Permits required for the construction works for the weirs would ensure compliance with the commitments in the draft EMP.

Operation

Mobilisation of nutrients from decaying vegetation

The proponents propose to conclude final construction works at the end of a dry season in time for each weir to fill during the following wet season. Vegetation would not be cleared within the watercourse prior to the filling of the water impoundment. Accordingly, there would be slow decomposition of plant and other organic material and subsequent release of nutrients within the impoundment.

The 'Full Carbon Accounting Model'⁹ was used to model rates of decay of organic matter and the subsequent release of nutrients. Results indicate that approximately half the total nitrogen (TN) and total phosphorus (TP) would be released during the first year of impoundment. This is predicted to be 458 tonnes (t) of TN and 90 t of TP from Eden Bann Weir; and 645 t of TN and 127 t of TP from Rookwood Weir. Decaying vegetation would also increase water turbidity and reduce dissolved oxygen (DO). These predicted water quality changes have the potential to impact downstream environments.

New water storages generally have inundated organic matter decay rates that are high during the first year after inundation and then decline to background levels over about six years. The background loads of TN and TP in the lower Fitzroy River are approximately 13,000 t/a and 3,500 t/a respectively.

Modelling undertaken for the EIS predicts that, in the first year after filling, TN levels at the Fitzroy Barrage would be increased by approximately 8.5 per cent above background levels in the first year after filling if both Eden Bann and Rookwood Weirs are fully developed at the same time and by approximately 2.6 per cent over the whole six-year period.

I note that, as approximately half of the nutrient increase from decaying vegetation is attributable to each weir, the highest peak nutrient loads would be halved if construction of the two weirs were to be separated by more than two years and halved again if the two stages of each weir development were to be separated by more than two years.

Management of nutrient levels by water release strategies

If not adequately mitigated, downstream impacts from increased water nutrient levels may include decreased DO and increased:

- algal development
- water turbidity
- damage to corals
- seagrass growth
- freshwater conditions unfavourable to some species of flora and fauna (including turtles)
- water supply treatment costs.

Downstream increases in nutrient levels would occur mostly as short-duration events with each water release. Under normal operating conditions, wet season inflows would allow nutrient concentrations to be diluted by flushing. Conversely, prolonged dry weather would make it more difficult to manage.

The proponents have committed to develop operational strategies for both weirs during the detailed design phase to manage the quality of water released and to respond to

⁹ <https://www.environment.gov.au/climate-change/greenhouse-gas-measurement/land-sector>, viewed 23 November 2016.

the results of water quality monitoring programs. The operating rules for each weir would be subject to the approval of the chief executive under the Water Act.

Water release strategies can dilute or flush nutrients under certain conditions, but they cannot reduce overall nutrient loads. Therefore, while the Water Act provides a statutory control mechanism over water releases, I consider that use of water release management in isolation would be insufficient to adequately mitigate the overall increase in nutrients caused by the decay of organic matter within the impoundment, especially during the first few years of operation of each weir. Therefore, I consider that the further management measures described below are required.

Existing models and offset calculators

The data provided in the AEIS for nutrient concentrations was for TN and TP. Much of these total quantities of nitrogen and phosphorus are not immediately bioavailable (i.e. able to be taken up by aquatic plants). As the rates of conversion of the different species of nutrients vary widely with a range of water conditions, there are currently no reliable conversion equations that can be applied in this case.

The University of Queensland and James Cook University (JCU) are currently developing a prototype 'Reef Trust Offsets Calculator'¹⁰ for determining financial liability for marine biodiversity offsets voluntarily delivered through DEE Reef Trust.

Discussions with DEE, the GBR Marine Park Authority (GBRMPA), EHP and NRM during the EIS process also considered application of this calculator to determine an offset for the increase in nutrients arising from decaying vegetation in the impoundments. However, I consider that this calculator is not sufficiently developed for this purpose.

I have recommended a condition to the Commonwealth Environment Minister (Appendix 5) requiring the proponents to measure any actual nutrient increases caused by each weir impoundment and report this information to EHP and DEE. I have also recommended a condition requiring that the results of this monitoring inform future offsets requirements for water quality impacts on the GBRWHA, should it be determined by the Minister that offsets are required.

General water quality impacts from the operation of the weirs

The EIS stated that the operational strategies for Rookwood Weir and the raised Eden Bann Weir would be similar to the existing Eden Bann Weir. The EIS identified the following water quality impacts arising from the operation of the weirs.

Dissolved oxygen

Low DO levels are unfavourable for most marine flora and fauna and may result in a decrease in species abundance and diversity and increase the risk of blue-green algal bloom. DO levels in the impoundments are predicted to be less than un-impounded reaches due to sections of the river changing from shallow, faster-flowing to deep,

¹⁰ <http://nesptropical.edu.au/wp-content/uploads/2016/07/NESP-TWQ-3.12-FINAL-REPORTa.pdf>, viewed 20 November 2016.

slow-flowing pools. DO would also be less than the WQOs for impoundments in the current Fitzroy Basin WRP.

DO levels would vary through the water column, leading to slight temperature-stratification of water within each impoundment during the warmer months of September to January. The eight-month draw-down period for the operation of the weirs is predicted to reduce the opportunity for stratification. The proposed use of differential (multi-level) offtakes would also facilitate the mixing of waters and reduce the negative impacts of the project on DO levels.

Turbidity

Existing turbidity levels for the Fitzroy River are greater than WQOs of the Water EPP for the Fitzroy River Sub-basin due to high sediment loads entering the upper catchments from runoff and erosion. The project is not expected to change the existing sediment load within the Fitzroy River. The EIS identified that the weirs have been designed to provide unimpeded transfer of sediment downstream except for areas of lower velocity around weir structures such as towers and intakes.

Blue-green algae

Blue-green algae has the potential to occur within impoundments and in the Fitzroy Barrage due to a combination of factors, including still or slow-flowing water, warm surface water and increased nutrient levels. I note that nutrient levels are likely to peak in the first year of operation creating an elevated risk of this event occurring in the warmer months prior to the wet season.

In response to a submission about potential blue-green algal blooms, the draft EMP was amended by the proponents to include specific measures to manage that risk. Preventative and treatment options include manipulating flows to prevent the build-up of blue-green algae or to disperse blooms; or in extreme circumstances the use of mechanical methods to mix water and reduce the impact of temperature stratification. The proponents have also committed to the development and implementation of a monitoring program and emergency plans for blue-green algal blooms.

Erosion and downstream sedimentation

A low level of localised erosion and sedimentation downstream of each weir may occur due to changes to river morphology and bank slumping. However, I accept the evidence presented in the EIS that the project's contribution to sediment loads would be negligible and that the project would not be expected to adversely impact existing sediment movement within the system.

The weirs are designed to provide unimpeded transfer of sediment over the weir face and low-level outlets would also assist in flushing sediment downstream.

Management actions, including erosion protection works downstream of the weir sites are described in Section 5.2 of this report (Water resources).

Conclusion—operation

I consider that the measures described in the EIS and committed to by the proponents in the draft EMP would be adequate to avoid or sufficiently mitigate the potential

impacts of the project with respect to DO, water turbidity, blue-green algae development in the impoundments and downstream erosion. These measures would be required to be implemented through new operating plans that would be subject to approval and enforcement under the Water Act.

Consequential impact of FAD

Background

The EIS provided an analysis of potential impacts on water quality to the GBR as a result of agricultural development potentially facilitated by the project.

There is a regulatory regime for the use of water for industrial, residential and intensive animal husbandry, which assess the potential impacts of the use of water for those purposes. For example, cattle feedlots are regulated under the EP Act, subject to an environmental authority (EA) and an enforcement regime for unauthorised water releases.

There are statutory reef protection regulations for sugarcane and grazing in the high priority GBR catchments of the Wet Tropics, Burdekin and Mackay Whitsundays¹¹. I note that the Queensland Government is currently exploring options for further application of similar regulatory measures for new agricultural development of land within the GBR catchment.

Investigations such as the 2010 *Fitzroy Industry and Infrastructure Study*¹², identified land within the Fitzroy region as potentially suitable for irrigated agricultural development.

If not properly managed, water provided by the project for irrigated cropping is likely to exit farm properties carrying sediment, nutrients and farm chemicals in overland flow and leaching nutrients and chemicals into shallow aquifers. However, with higher water prices and increasing pressure from the broader community to improve agricultural practices, application of new technologies and water capture and re-use practices are becoming commonplace.

This view is reinforced by information in the 2015 Reef Report Card.¹³ I note that marine condition adjacent to the Fitzroy River remains poor and the report card concludes that progress towards reducing nutrient, pesticide and sediment pollutant loads to the GBRWHA remains low. However, the report card states that ‘... management improvements that are relatively simple to implement and present little perceived production risk, adoption can be fostered through awareness activities and modest extension efforts’.

However, the report card also notes that:

- little progress has been made to improve the quality of water entering the GBR from the Fitzroy catchment (e.g. less than ten per cent reduction in nutrients)
- marine conditions adjacent to the Fitzroy River remains poor.

¹¹ <https://www.qld.gov.au/environment/agriculture/sustainable-farming/reef-initiatives/> viewed 1 December 2016.

¹² www.rdafcw.com.au/growing_central_queensland/fitzroy-infrastructure-industry-study-2010

¹³ State of Queensland 2016, Great Barrier Reef Report Card 2015: Results, p2, viewed 22 November 2016, <http://www.reefplan.qld.gov.au/measuring-success/report-cards/2015/assets/gbr-2015report-card-detailed-results.pdf>

The Reef 2050 Long-Term Sustainability Plan

The proposed use of water from this project has the potential to impact the GBR, and my evaluation includes consideration of any relevant government policies that apply to the quality of water flowing to the GBR.

The Reef 2050 Plan¹⁴ is the overarching framework for the future protection and management of the GBR. It includes targets for water quality improvements, an implementation plan and an outline of an integrated monitoring and reporting program. The Queensland and Australian Governments have also developed the *2013 Reef Plan* to protect the GBR from land-based sources of dispersed pollution. The *2013 Reef Plan* informs the Reef 2050 Plan.

While both reef plans refer to programs aimed at achieving water quality improvements, neither stipulate whether individual projects subject to government development approvals must deliver net water quality improvements in their own right. Consequently:

- I have had regard for the potential impacts of the facilitated use of water from the project on the quality of water flowing to the GBR
- I conclude that these potential impacts cannot be quantified at present because the future agricultural development scenario that may be pursued by multiple third parties cannot yet be specified.

Analysis in the AEIS

The EIS and AEIS provided an assessment of potential consequential impacts of FAD on water quality flowing into the Fitzroy River. The modelling considered different land-use types and the potential changes in run-off of sediment and nutrients.

The modelling concluded that FAD from the project has the potential to increase loads of sediment in the lower Fitzroy River by 0.02 per cent and of total nutrients by 0.1–0.5 per cent. The AEIS concluded that the predicted proportional increases in the generated loads into the system from potential FAD would be very low and the consequential downstream impact on water quality in the GBR would be negligible.

However, relevant state and Commonwealth agencies agreed that a more rigorous investigation was required, which:

- applied modelling tools used by government for GBR water quality planning
- used an agricultural development scenario considered most probable by regional agricultural experts
- adopted assumptions for each model parameter considered by relevant experts as most appropriate analysis
- ensured the review of modelling methodology and model outputs by relevant government agencies.

¹⁴ <http://www.environment.gov.au/marine/gbr/long-term-sustainability-plan>, viewed 21 November 2016.

Analysis subsequent to the AEIS

Following analysis of submissions received on the AEIS, the proponents agreed to undertake an additional modelling study subject to the four requirements outlined above. This study is detailed in the technical note presented as Appendix 11 to this report.

An expert government panel was assembled to advise, monitor and review the modelling. The panel consisted of representatives from the Office of Coordinator-General, DAF, DNRM, EHP and DEE. The panel also received advice from scientists at DSITI.

The panel agreed that it would be reasonable for the modelling to assume:

- all 42,000 ML/a of unallocated water is used for agriculture (i.e. the most precautionary volume from the impact assessment perspective)
- cattle feedlot development to a total of 40,000 head (which was assumed to have no impact on water quality flowing to the river due to regulatory controls)
- 1,600 ha of irrigated broad-acre cropping for fodder and grain crops on alluvial flats
- 1,400 ha of irrigated tree crops (e.g. macadamia and avocado) on the better quality adjacent lower hills.

The modelling tool used is regularly applied by government agencies for policy, planning and program work for the GBR Marine Park. The model compared new FAD land uses against the dominant existing land use (cattle grazing).

My interpretation of the technical note is that changing land use from grazing to broad-acre cropping on the river flats, and to tree cropping on the more arable hills would marginally increase herbicide and pesticide loads, but it would not necessarily increase sediment and nutrient loads.

Amongst the assumptions applied to the modelling were adoption of common contemporary good farming practices (e.g. grass inter-rows between tree-crop rows, or engineered structures to capture and re-use overland flow on broad-acre crops). There appears to be no barrier to such practices being required as a condition of the sale of water from the weirs to new FAD.

In light of the uncertainties associated with analysis of the potential impacts of FAD on the GBR, I consider that precise prediction of pollutant outcomes cannot be made at this stage. Therefore, I consider that it would be unreasonable to identify, at present, specific offsets that the proponents must provide to counter the potential impacts of FAD. Consequently, I have recommended to the Commonwealth Environment Minister (Appendix 5) conditions that apply to both weirs requiring the proponents to:

- undertake a long-term monitoring program of water quality in the lower Fitzroy River and key sub-catchments affected by land use change to irrigated cropping
- any future water quality offset requirement be determined by the Commonwealth Environment Minister
- make the sale of water from the two weirs for irrigated agriculture conditional on the use of best practicable farm management as described within a 'land use code of practice'.

Sections 5.4 and 6 of this report document extensive requirements for the provision of environmental offsets for impacts on listed threatened species, ecological communities and vegetation connectivity. A considerable part of these offsets would require the re-establishment and protection of riparian and adjacent vegetation. These offsets would provide substantial water quality improvements by reducing gully erosion and filtering sediment and nutrients. Consequently, I consider that these offsets should be taken into account when determining any water quality offset measures.

Therefore, the level and type of such offset should be:

- contingent upon the results of the water quality monitoring required by that condition
- net of any water quality benefits arising from offsets provided by the proponents for other environmental values.

Also, I consider that the offset requirement attributable to each weir should be proportional to the volume of water allocated to irrigated agriculture from that weir.

Conclusion—potential impacts of FAD

I consider that I have had appropriate regard to the potential impacts of FAD on the quality of water flowing to the GBR.

Consequently, I have recommended to the Commonwealth Environment Minister (Appendix 5) conditions requiring the proponents to:

- develop and implement a land management code of practice that is to be attached to future water licences as a condition of sale to prospective agricultural users
- implement a water quality monitoring program that would inform a future water quality offsets program if required by the Minister.

5.3.3 Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts of construction and operational activities on water quality and that the proposed management commitments outlined in the draft EMP would mitigate those impacts.

I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- implement a water nutrient monitoring program to measure changes that may arise from the decay of vegetation within the impoundments
- use the results of that program to inform any potential management or offset program
- develop and implement a land management code of practice that is to be attached as a condition of sale of water for irrigated agriculture
- implement a water quality monitoring program that would inform a future water quality offsets program if required by the Commonwealth Environment Minister to address any impacts of FAD on water quality entering the Fitzroy River.

I am satisfied that, with the implementation of the proponents' commitments and the conditions recommended to the Commonwealth Environment Minister, the potential impacts of the project on water quality in the Fitzroy River would be acceptable.

5.4 Matters of state environmental significance

This section addresses the potential impacts of the project on matters of state environmental significance (MSES). Impacts on MSES that are also listed as MNES under the EPBC Act are addressed in Section 6.

The MSES found within the project area are:

- regulated vegetation ('endangered' and 'of concern' regional ecosystems [REs] and essential habitat for threatened flora and fauna), and wetlands and watercourses (wetlands of high ecological value)
- vegetation connectivity areas
- protected habitat (protected plants and animals)
- the protected GBR Coast Marine Park
- fish habitat areas (FHAs).

5.4.1 Submissions received

Key issues raised in the submissions on the EIS and AEIS regarding potential impacts on MSES include:

- offset requirements for the red goshawk and powerful owl
- offset requirements for regulated vegetation and ecological connectivity
- potential impacts on the koala, ghost bat and platypus
- adequacy of the proposed offsets for the Fitzroy River turtle and white-throated snapping turtle
- water quality impacts on the GBR associated with decaying vegetation and FAD
- offset requirement for impacts on barriers to fish and turtle passage.

I have considered each submission and the responses provided by the proponents in my evaluation of the project and my assessment is provided in relevant sections below.

5.4.2 Regulated vegetation

Background

Under the Queensland *Environmental Offsets Policy Significant Residual Impact Guideline*, regulated vegetation is defined as a prescribed RE that:

- is an 'endangered' or 'of concern' RE, as defined under the VM Act
- intersects with watercourses on the vegetation management watercourse map or with wetlands on the vegetation management wetland map
- is an essential habitat for wildlife declared endangered or vulnerable under the NC Act.

The definition of a prescribed RE in the Environmental Offsets Regulation 2014 does not include regrowth vegetation.

Regional ecosystems

The REs within the project footprints that meet the regulated vegetation definition are provided in Table 5.2.

Table 5.2 Regulated vegetation within the project footprint

RE type	VM Act class	Definition	Location
11.3.1	Endangered	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	Eden Bann Weir and Rookwood Weir
11.3.38	Endangered	<i>Eucalyptus tereticornis</i> , <i>Melaleuca viridiflora</i> , <i>Corymbia tessellaris</i> and <i>Eucalyptus fibrosa</i> subsp. (Glen Geddes) tall woodland with a grassy ground layer. Occurs on alluvial plains and broad drainage lines derived from serpentine	Eden Bann Weir
11.3.38a	Endangered	Riverine wetland or fringing riverine wetland. <i>Melaleuca bracteata</i> low woodland	Eden Bann Weir
11.3.2	Of concern	<i>Eucalyptus populnea</i> woodland on alluvial plains	Eden Bann Weir and Rookwood Weir
11.3.3	Of concern	<i>Eucalyptus coolabah</i> woodland on alluvial plains	Eden Bann Weir and Rookwood Weir
11.3.3c	Of concern	Palustrine wetland. <i>Eucalyptus coolabah</i> woodland to open-woodland with a sedge or grass understorey in back swamps and old channels	Eden Bann Weir
11.3.4	Of concern	<i>Eucalyptus tereticornis</i> and/or <i>Eucalyptus</i> spp. Tall woodland on alluvial plains	Eden Bann Weir and Rookwood Weir
11.11.10	Of concern	<i>Eucalyptus melanophloia</i> woodland on deformed and metamorphosed sediments and interbedded volcanics	Eden Bann Weir

Essential habitat

Eden Bann Weir

The EIS indicated that there is mapped essential habitat for a number of threatened flora species within the Eden Bann Weir impoundment area including:

- Two areas of essential habitat for *Macrozamia serpentina* and *Capparis humistrata* along the Fitzroy River (147–148 km AMTD). While the mapped areas generally support the essential habitat factors for *Macrozamia serpentina*, no individuals were identified in this area during field surveys. The closest individual was located 230 m away from the impoundment. Essential habitat factors for *Capparis humistrata* are absent from the project area and the closest individual was recorded 250 m away from the project area.
- An area of essential habitat for *Macrozamia serpentina* is located along the Fitzroy River (154–156 km AMTD). The EIS indicated that the area supports essential

habitat factors for this species and that individuals have been recorded in adjoining habitat.

- *Macrozamia serpentina*, *Capparis thozetiana*, *Pimelea leptospermoides* and *Stackhousia tryonii* is located along Marlborough Creek (171 km AMTD). The EIS indicated that, although the area supports habitat factors, no individuals of these species were identified in this area during surveys.

Existing RE mapping also indicates that there is mapped essential habitat for the Fitzroy River turtle along the Fitzroy River in the vicinity of Glenroy Crossing within the proposed Eden Bann Weir impoundment.

Rookwood Weir

Existing RE mapping indicates there is mapped 'essential habitat' for the ooline (*Cadellia pentastylis*) along the Mackenzie River within the Rookwood Weir impoundment. The EIS indicated that 'essential habitat factors' for this species are absent in this area and the closest record of this species is 25 m away from the mapped area.

Watercourse vegetation

Based on existing RE mapping, around 650 ha of watercourse vegetation REs occur within the impoundments and weir construction footprints.

Impacts and mitigation

Regional ecosystems

The EIS stated that at the upper limits of development, the following REs would be lost as a result of the project:

- 26 ha (7 ha Eden Bann and 19 ha Rookwood) of 'endangered' REs
- 240 ha (43 ha Eden Bann and 197 ha Rookwood) of 'of concern' REs
- 1,681 ha (611 ha Eden Bann Weir and 1070 ha Rookwood) of 'least concern' REs.

These impacted REs are also considered to provide potential foraging and nesting habitat for the red goshawk and the powerful owl and form part of a riparian corridor that provides ecological connectivity along the river.

Approximately 20 ha of the EPBC Act listed endangered brigalow (*Acacia harpophylla* dominant and co-dominant) (brigalow ecological community [EC]), which is associated with the endangered RE 11.3.1, would be potentially impacted by the project. The brigalow EC has been discussed in more detail in Section 6 of this report (MNES). In that section, I concluded that the project would not be expected to have an adverse net impact on the brigalow EC, provided that the proponents undertake the proposed mitigation measures documented in their commitments (Appendix 8), in addition to the conditions I have recommended to the Commonwealth Environment Minister.

I have also recommended conditions to the Minister requiring the proponents to provide offsets to compensate for the loss of this EC.

Essential habitat

Eden Bann Weir

The EIS indicated that the project is expected to impact on mapped essential habitat for: *Macrozamia serpentine* (27 ha); *Capparis thozetiana*, *Pimelea leptospermoides* and *Stackhousia tryonii* (3.6 ha); and *Capparis humistrata* (13.5 ha).

These areas are unlikely to support populations of these species that are sustainable over the longer term and the proponents have committed to undertake pre-clearance surveys and undertake avoidance, mitigation or relocation actions where practicable. In addition, impacts on the mapped areas of the 'essential habitat' would be compensated by offsets for regulated vegetation and the brigalow EC.

The EIS also indicated that up to 12.8 ha of mapped 'essential habitat' for the Fitzroy River turtle would be impacted by the Eden Bann Weir impoundment. This would be compensated through offsets provided for impacts to aquatic habitat. I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to provide offsets for the loss of 942 ha of aquatic habitat for the Fitzroy River turtle. This area would also include the 12.8 ha of mapped essential habitat.

Rookwood Weir

The EIS indicated that up to 11.1 ha of mapped essential habitat for the ooline would be impacted by the project. This would be compensated through offsets for regulated vegetation. In addition, the conditions I have recommended requiring offsets for residual impacts on the brigalow EC would also benefit the ooline, as that EC is known to support this species.

Watercourse vegetation

A proportion of the impacted remnant REs are mapped as watercourse vegetation. Based on surveys undertaken by the proponents, a total of 650 ha (211 ha Eden Bann Weir and 439 ha Rookwood Weir) of watercourse vegetation is expected to be directly impacted by the project. A large proportion of this vegetation would be inundated (up to 208 ha for Eden Bann and 436 ha for Rookwood). This vegetation overlaps with the connectivity area and protected wildlife habitat (e.g. red goshawk) that I have required the proponents to offset.

Significant residual impacts and offsets

The project is expected to have a significant residual impact on:

- 26 ha (7 ha Eden Bann and 19 ha Rookwood) of 'endangered' REs
- 240 ha (43 ha Eden Bann and 197 ha Rookwood) of 'of concern' REs
- 650 ha (211 ha Eden Bann and 439 ha Rookwood) of watercourse vegetation.

The impacted areas mapped as essential habitat for *Macrozamia serpentina*, *Capparis humistrata*, *Capparis thozetiana*, *Pimelea leptospermoides* and *Stackhousia tryonii* and *Cadellia pentastylis* and watercourse vegetation also physically overlap with impacted REs. As such, I consider that the impacts on these areas of essential habitat would be compensated through offsets provided for the impacted REs.

In addition, the proponents have committed to undertake pre-clearance surveys for all threatened species of flora and would be required to implement appropriate measures to protect any identified individuals (e.g. translocation into suitable areas outside of the impact area).

I have stated a condition that the proponents provide offsets to compensate for the significant residual impacts on regulated vegetation. In addition, I have recommended conditions to the Commonwealth Environment Minister requiring offsets for residual impacts on the brigalow EC and the red goshawk. The offsets for these matters would overlap with other offsets and the proponents may co-locate offsets for regulated vegetation, the brigalow EC, protected wildlife habitat and connectivity areas.

Coordinator-General's conclusion

I consider that the project is unlikely to have an adverse impact on regulated vegetation provided that the proponents' avoidance and mitigation measures are implemented, along with the conditions I have stated and recommended in this report.

5.4.3 Connectivity areas

Background

Under the Queensland *Environmental Offsets Policy Significant Residual Impact Guideline*, 'connectivity areas' are defined as areas of remnant vegetation outside urban areas containing prescribed REs that are required for ecosystem functioning.

Matters related to connectivity are regulated under the VM Act. The EIS indicated that existing connectivity in the project area has been previously impacted by vegetation clearing and agriculture, particularly in the low-lying areas. Vegetation surveys undertaken for the EIS concluded that some connectivity has been maintained along the riparian fringes of the river. These areas are considered to provide an important ecological role, providing a level of connectivity between habitat remnants.

Impacts and mitigation

The proposed raising of Eden Bann Weir and construction of Rookwood Weir would result in the impoundment and subsequent loss of riparian vegetation along the main Fitzroy River channel and in the lower reaches of tributaries and adjoining creeks. The EIS indicated that approximately 1,947 ha of vegetation is expected to be lost. This includes approximately 661 ha at Eden Bann Weir and 1,286 ha at Rookwood Weir.

The loss of this riparian vegetation has the potential to disrupt connectivity between and surrounding the project footprint. The reduced occurrence of shallow water and seasonally dry riverine habitats would also be expected to reduce the ability of terrestrial fauna to move back and forth across the river. This is considered to be a significant residual impact.

Coordinator-General's conclusion

I consider that the project is unlikely to have an adverse impact on connectivity areas, provided that the proposed avoidance and mitigation measures are undertaken by the proponents, in addition to the conditions I have stated in this report. I have stated a

condition requiring the proponents to provide offsets for connectivity areas. I note that the proponents may co-locate offsets for regulated vegetation, protected wildlife habitat and connectivity areas.

5.4.4 Protected wildlife habitat—protected plants

Background

Targeted surveys were undertaken for 28 endangered, vulnerable and near-threatened flora species, which were predicted to occur within the project area (based on existing records of the presence of suitable habitat). The listing status, under the Nature Conservation (Wildlife) Regulation 2006, for *Actephila sessilifolia*, *Aponogeton queenslandicus*, *Atalaya calcicola*, *Dichanthium setosum*, *Eucalyptus raveretiana*, *Gossypium sturtianum*, *Macropteranthes fitzalanii*, *Marsdenia hemipteran*, *Paspalum scrabbrifolium*, *Marsdenia brevifolia* and *Parsonsia lenticellata* has been reclassified to least concern since the draft EIS was released. These species are therefore not discussed further in the following section. The listed species which are relevant to this evaluation are provided in Table 5.3.

Table 5.3 Protected flora species potentially occurring in the project area

Common name Species name	NC (Wildlife) Regulation listing status	EPBC Act listing status
Serpentine endemics		
<i>Bursaria reevesii</i>	Vulnerable	Not listed
<i>Capparis humistrata</i>	Vulnerable	Not listed
<i>Capparis thozetiana</i>	Vulnerable	Vulnerable
<i>Cerbera dumicola</i>	Vulnerable	Not listed
Glen Geddes bloodwood <i>Corymbia xanthope</i>	Vulnerable	Vulnerable
Marlborough blue <i>Cycas ophiolitica</i>	Endangered	Endangered
Three-veined Hakea <i>Hakea trineura</i>	Vulnerable	Vulnerable
<i>Macrozamia serpentina</i>	Endangered	Not listed
<i>Marsdenia brevifolia</i>	Vulnerable	Vulnerable
<i>Neoroepera buxifolia</i>	Vulnerable	Vulnerable
<i>Pimelea leptospermoides</i>	Near threatened	Vulnerable
<i>Pultenaea setulosa</i>	Vulnerable	Vulnerable
<i>Stackhousia tryonii</i>	Near threatened	Not listed
Quassia <i>Samadera bidwillii</i>	Vulnerable	Vulnerable
Semi-evergreen and vine-thicket species		
Dansiea <i>Dansiea elliptica</i>	Near threatened	Not listed

Common name <i>Species name</i>	NC (Wildlife) Regulation listing status	EPBC Act listing status
Ooline <i>Cadellia pentastylis</i>	Vulnerable	Vulnerable
Southern bonewood <i>Macropteranthes leiocaulis</i>	Near threatened	Not listed
Alluvial and clay plain species		
Carnarvon fan palm <i>Livistona nitida</i>	Near threatened	Not listed

The results of the targeted surveys indicated that no sustainable populations of the species listed in Table 5.3 are considered likely to occur in the proposed weir footprints.

Impacts and mitigation

Serpentine endemics

Plants that grow only in serpentine soils are commonly called 'serpentine endemics'. *Bursaria reevesii*, *Capparis humistrata*, *Capparis thozetiana*, *Cerbera dumicola*, *Corymbia xanthope*, *Cycas ophiolitica*, *Hakea trineura*, *Macrozamia serpentina*, *Marsdenia brevifolia*, *Neoroepera buxifolia*, *Pimelea leptospermoides*, *Pultenaea setulosa*, *Stackhousia tryonii* and *Samadera bidwillii* are all serpentine endemics and therefore typically have a greater preference for serpentine soils which are not found in the weir footprint. While incidental plants may occur in the weir footprints more sustainable populations would be expected to occur in the surrounding serpentine hills above the weir footprints. Based on these observations it is considered that these populations are not expected to be impacted by the raised water levels associated with the impoundments.

Semi-evergreen and vine-thicket species

Dansiea elliptica (dansiea) and *Macropteranthes leiocaulis* (southern bonewood) were recorded in areas that would be well above the expected raised water levels. Most of the Fitzroy River banks are a silty alluvium and not typical substrate for these species.

Cadellia pentastylis (ooline) is known to occur in the brigalow community to the north of the proposed Rookwood Weir site and a small population has previously been recorded along the banks of the Mackenzie River in the upper reaches of the proposed weir site at FSL 49. The EIS concluded that this population is unlikely to be affected by raised water levels as the water would remain in the bed of the Mackenzie River near the upper limit of the Rookwood Weir impoundment.

Alluvial and clay plain species

While there is potentially suitable habitat for *Livistona nitida* (Carnarvon fan palm) in the weir footprints (associated with the presence of low lying alluvial soils), no individuals were identified during targeted surveys.

Only one of the species for which targeted surveys were undertaken: black ironbox, is considered likely to be impacted by the project. This plant is listed as 'vulnerable' under the EPBC Act and is discussed in Section 6 of this report.

Coordinator-General's conclusion

I am satisfied that the EIS has identified and assessed the project's potential impacts on protected plants. I note the proponents' commitment to undertake pre-clearance surveys and measures to protect any identified protected plants. I consider the project is unlikely to have an adverse impact on protected plants, provided the proposed avoidance and mitigation measures and commitments are implemented by the proponents.

5.4.5 Protected wildlife habitat—protected animals (terrestrial)

Under the Queensland Environmental Offsets Regulation 2014 'protected wildlife habitat' is defined as:

- an area of essential habitat on an essential habitat map for an animal or plant that is endangered or vulnerable wildlife
- an area of habitat (e.g. foraging, roosting, breeding habitat) for an animal that is an endangered, vulnerable or special least concern animal.

Under the NC Act, special least concern includes least concern birds which are listed under international agreements such as the Japan–Australia Migratory Bird Agreement (JAMBA), China–Australia Migratory Bird Agreement (CAMBA), Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA) and the Bonn Convention.¹⁵

Birds

Nine threatened bird species are identified as potentially occurring in the project area. These species are listed in Table 5.4.

The EIS also identified the black-necked stork, black-chinned honeyeater, cotton pygmy-goose and square-tailed kite as potentially occurring in the project area. However, listing status for these species under the NC Act, has been reclassified to 'least concern' since the draft EIS was released and these species are therefore not discussed further in this report.

¹⁵ These conventions are accessible on the DEE website:
<http://www.environment.gov.au/biodiversity/migratory-species/migratory-birds>

Table 5.4 NC Act listed bird species potentially occurring in the project area

Common name <i>Species name</i>	NC (Wildlife) Regulation listing status	EPBC Act listing status
Powerful owl <i>Ninox strenua</i>	Vulnerable	Not listed
Red goshawk <i>Erythrotriorchis radiatus</i>	Endangered	Vulnerable
Squatter pigeon <i>Geophaps scripta scripta</i>	Vulnerable	Vulnerable
Star finch <i>Neochmia ruficauda ruficauda</i>	Endangered	Endangered
Capricorn yellow-chat <i>Epthianura crocea macgregori</i>	Endangered	Critically endangered
Coxen's fig parrot <i>Cyclopsitta diophthalma coxeni</i>	Endangered	Endangered
Southern black-throated finch <i>Poephila cincta cincta</i>	Endangered	Endangered
Australian painted snipe <i>Rostratula australis</i>	Vulnerable	Endangered
Black-breasted button-quail <i>Turnix melanogaster</i>	Vulnerable	Vulnerable

While the EIS indicated that the project area provides potentially suitable habitat for a number of these species, it is considered that the following species are unlikely to occur because there are no existing records and no individuals were identified during field surveys:

- Star finch—there are a number of existing records of this species in the Fitzroy River area near Rockhampton approximately 50 km south-east of the Eden Bann Weir. The EIS indicated that there is potentially suitable habitat in the project area associated with reed beds and tall grasses along the river edge and within the side tributaries.
- Southern black-throated finch—there are a number of existing records of this species in the Fitzroy River area approximately 50 km south-east of the Eden Bann Weir. The EIS indicated that there is potentially suitable habitat in the project area associated with grassy woodland and riverine vegetation.
- Australian painted snipe—there are a number of existing records of this species in the Fitzroy River area approximately 50 km south-east of the Eden Bann Weir. The EIS indicated there is potentially suitable habitat in the project area (associated with REs 11.3.3 and 11.3.25), which may occur among the reeds in shallow water along the edge of the river and adjacent billabongs. While the project is expected to result in the loss of vegetation, which is likely to support the Australian painted snipe (11.3.3 and 11.3.25), I have required the proponents to provide offsets to

compensate for the loss of this vegetation. These offsets would be expected to provide a benefit to this species.

The project area is assessed as providing limited habitat and there are no existing records from the project area for the following species:

- Black-breasted button-quail—this species is more commonly associated with vine forest and thicket vegetation communities which are not found within the project footprint. There are a number of existing records of this species in the Fitzroy River area approximately 50 km south-east of the Eden Bann Weir.
- Coxen's fig-parrot—not assessed in the EIS. The closest record of this species is approximately 60 km north-east of the Eden Bann Weir, near Byfield National Park. This species occurs high in the canopy of rainforests, including subtropical rainforests, dry rainforests, littoral and developing littoral rainforests, and vine forests with figs and soft fruiting trees.
- Capricorn yellow-chat—is highly unlikely to occur in the project area. The distribution of this species is restricted to the areas of Curtis Island and to the Fitzroy River Delta, Torilla Plain and downstream of the weirs. This species is also listed as 'critically endangered' under the EPBC Act and the project's potential impacts are discussed in Section 6 (MNES). In that section, I concluded that the project is unlikely to have an unacceptable impact on this species, provided the proposed mitigation measures are undertaken by the proponents. Relevant mitigation measures include the management of water quality impacts during construction and the operation of the weirs. In addition, the project is not expected to significantly alter flow regimes downstream of the Fitzroy Barrage as the proponents would be obligated to ensure water releases from the weirs meet the relevant EFOs for this part of the system.

The listed species considered to have a high likelihood of occurring in the project area, based on existing records and/or suitable habitat, are the powerful owl, red goshawk and the squatter pigeon.

Powerful owl

Background

The powerful owl (*Ninox strenua*) is listed as 'vulnerable' under the NC Act. The species is endemic to eastern and south-eastern Australia, and is mainly found on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. There are a number of powerful owl records from the project area, including three records along the Dawson River near the proposed Rookwood Weir.

The species is known to inhabit a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforests. The powerful owl is a specialist predator, with a diet mainly comprising arboreal (tree-dwelling) mammals such as possums and gliders and occasionally small birds and large insects. Mapping indicates that there is around 89,995 ha of potentially suitable foraging habitat for the owl within a 10 km radius of the project area.

The powerful owl nests in large mature eucalypt hollows (up to 1 m wide and 2 m deep) that are within 100 m of waterways and surrounded by canopy trees. Based on existing

mapping, the EIS indicated there is around 25,994 ha of potentially suitable nesting habitat within a 10 km radius of the project area.

The species is listed in the New South Wales *Recovery Plan for the Large Forest Owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae)*.¹⁶ The recovery plan states that extensive forest clearing and fragmentation for agriculture, mining and urban development has contributed to the permanent regional declines and local extinctions of this species across its range.

Impacts and mitigation

The EIS indicated that approximately 1,244 ha (454 ha Eden Bann Weir and 790 ha Rookwood Weir) of potential foraging and 512 ha (205 ha Eden Bann Weir and 307 ha Rookwood Weir) of nesting habitat is likely to be impacted by the project. Given the amount of potentially suitable foraging habitat within the immediate project area, the EIS stated that the project is unlikely to result in a significant residual impact on foraging habitat.

While a large area of potentially suitable nesting habitat would remain in the surrounding project area, EHP considers that the project would have a significant residual impact on nesting habitat due to the more specific requirements of this species for nesting. EHP has also recommended that the proponents provide an offset to compensate for this impact. The loss of existing and potential hollow-bearing trees and trees is considered likely to impact this species.

Significant residual impacts and offsets

The project is expected to have a significant residual impact on 512 ha (205 ha at Eden Bann Weir and 307 ha at Rookwood Weir) of existing or potential powerful owl nesting habitat. As these areas of habitat overlap with a number of other matters of state environmental significance (including regulated vegetation, watercourses vegetation and connectivity areas) and Commonwealth matters (red goshawk), I consider that the offsets required for these matters are likely to compensate for this loss. In addition, to the stated conditions for regulated vegetation offsets, I have imposed a condition requiring that offset areas include habitat features which support powerful owl nesting habitat (e.g. large hollows in mature eucalypts).

Coordinator-General's conclusion

I am satisfied that the EIS has adequately identified the potential impacts that the project could have on the powerful owl. I have imposed conditions under the SDPWO Act requiring that offset areas for regulated vegetation and connectivity areas include habitat features which support powerful owl nesting habitat (e.g. large hollows in mature eucalypts). On the basis of the proposed avoidance and mitigation measures and conditions in this report, I consider that the project is unlikely to have an adverse impact on the powerful owl.

¹⁶ Department of Environment and Conservation (NSW) (2006). *NSW Recovery Plan for the Large Forest Owls: Powerful Owl (Ninox strenua), Sooty Owl (Tyto tenebricosa) and Masked Owl (Tyto novaehollandiae)*, Department of Environment and Conservation, Sydney, viewed 14 July 2016, <http://www.environment.nsw.gov.au/resources/nature/TSRecoveryPlanForestOwls.pdf>

Red goshawk

The red goshawk (*Erythrotriorchis radiatus*) is listed as 'endangered' under the NC Act. This species is also listed as 'vulnerable' under the EPBC Act. Potential impacts on the red goshawk are discussed in Section 6 of this report (MNES). In that section, I concluded that the project is unlikely to have an unacceptable impact on this species, provided that the proposed avoidance and mitigation measures are undertaken by the proponents, in addition to the conditions I have recommended to the Commonwealth Environment Minister.

For the red goshawk, the conditions I have recommended to the Minister include conditions requiring the proponents to:

- avoid and limit disturbance to habitat
- provide offsets for significant residual impacts.

Squatter pigeon

The squatter pigeon (*Geophaps scripta scripta*) is listed as 'vulnerable' under the NC Act. This species is also listed as 'vulnerable' under the EPBC Act and is discussed in Section 6 of this report (MNES). In that section, I concluded that the project is unlikely to have an unacceptable impact on this species, provided that the proposed avoidance and mitigation measures are undertaken by the proponents. The proponents have proposed a range of measures, including weed and pest management, which would assist in managing impacts on the species. In addition, the condition I have stated requiring the proponents to provide offsets for loss of regulated vegetation and connectivity areas. These offsets would be expected to also benefit the squatter pigeon.

Mammals

Six threatened mammal species are identified as potentially occurring in the project area. These are listed in Table 5.5.

Table 5.5 NC Act listed mammal species potentially occurring in the project area

Common name <i>Species name</i>	NC (Wildlife) Regulation listing status	EPBC Act listing status
Koala <i>Phascolarctos cinereus</i>	Vulnerable	Vulnerable
Ghost bat <i>Macroderma gigas</i>	Vulnerable	Vulnerable
Large-eared pied bat <i>Chalinolobus dwyeri</i>	Vulnerable	Vulnerable
Eastern long-eared bat <i>Nyctophilus corbeni</i>	Vulnerable	Vulnerable
Echidna <i>Tachyglossus aculeatus</i>	Special least concern	Not listed

Common name <i>Species name</i>	NC (Wildlife) Regulation listing status	EPBC Act listing status
Water mouse/false water rat <i>Xeromys myoides</i>	Vulnerable	Vulnerable

Whilst a number of threatened mammal species have been identified as potentially occurring within the project area, desktop and field surveys indicate that the project area provides limited suitable habitat for a number of the mammal species identified in Table 5.5 including:

- Large-eared pied bat—there are no records of this species in the project area, with the closest record being approximately 40 km north-east of Eden Bann Weir. The EIS indicated that suitable roosting habitat is limited in the project area. However, the rocky hills upstream the Eden Bann Weir impoundment area may provide suitable roosting habitat. Consequently, I consider that this bat is unlikely to be using the project area.
- Water mouse—the EIS reported that this species is not likely to occur in the immediate project area as there is no suitable habitat. In central south Queensland, the water mouse has been identified only in high inter-tidal zones in tall, closed fringing mangrove forest containing yellow and/or orange mangrove species. Suitable habitat occurs in the Fitzroy River estuary. The nearest record is 140 km south-east, near Gladstone.

While there is potentially suitable habitat for the eastern long-eared bat in the project area associated with open ironbark or box woodland (including REs 11.3.3, 11.3.2, 11.11.9 and 11.11.1), the species has not previously been recorded and was not identified during surveys. The closest record is from Expedition National Park 265 km south-west of Eden Bann Weir.

The species considered to have a high likelihood of occurring based on existing records and/or suitable habitat include the koala, ghost bat and the echidna.

Koala

Phascolarctos cinereus (koala) is listed as 'vulnerable' under the NC Act. While no koalas were observed during the field surveys within the Eden Bann Weir project footprint, faecal pellets were found. The EIS stated that the open eucalypt woodland along the riparian fringe and adjacent floodplain at these sites is suitable koala habitat, however they are poor quality due to the areas of vegetation being fragmented.

Submissions on EIS and AEIS raised issues about the proponents' assessment of the project's impacts on the koala. Submissions highlighted that the project would result in the removal of 1,390 ha of potential koala habitat.

The EIS concluded that the project is not expected to have a significant residual impact on local koala populations due to the low density of koalas and the lack of suitable habitat within the project area.

The EIS also concluded that riparian vegetation would re-establish along the edge of the new impoundments and would provide future koala habitat. In addition I consider

that the offsets that I require for the project's impact on a number of State (regulated vegetation and connectivity areas) and Commonwealth matters (red goshawk) would also mitigate the project's impacts on koala habitat.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts the project could have on the koala. I am satisfied that the proponents' commitments and proposed measures to manage construction impacts would ensure the project does not result in adverse impacts on koalas. I consider that the project's impact on potential koala habitat would be addressed through the offsets I have required the proponents to provide for a number of State and Commonwealth matters.

Ghost bat

Background

The ghost bat is listed as 'vulnerable' under the NC Act. In Queensland, ghost bats are known to occur along the coast, from Rockhampton to Cape York. The species is known to occur in a wide range of habitats from rainforest, monsoon and vine scrub, to open woodlands in arid areas.

The distribution of this species is strongly influenced by the presence of suitable roosting habitat, including caves, rock crevices, cliff lines, boulder piles and disused mine entrances. The colonies aggregate during the summer breeding season (September to April), and disperse in small groups during the cooler non-breeding season (June to August).

The EIS reported that the closest known breeding site for the ghost bat to the project area is Mount Etna Caves National Park, which is located around 40 km south-east of the Eden Bann Weir.

Surveys of the Mount Etna National Park population in 2013 only identified 26 individuals over several months of surveys. This indicates that the population likely to be using the Eden Bann Weir area is very small, which would reduce the chances of identifying any individuals with limited survey effort.

While the ghost bat has previously been recorded in the vicinity of the Eden Bann Weir, it was not recorded during EIS surveys. The EIS indicated that suitable roosting habitat is limited in the project area. However, it is considered that the rocky hills above the Eden Bann Weir impoundment area may support small populations of this species during the non-breeding season. The EIS indicated that potential foraging habitat is widely distributed through the project area.

The fauna surveys undertaken for the project were either not done in suitable months or did not use suitable detectors. Therefore, the surveys at Eden Bann Weir were not consistent with the EHP survey guidelines.

Impacts and mitigation

While the project is unlikely to impact on any roosts, the project would remove the area of surrounding foraging habitat. Based on existing RE mapping for the Eden Bann Weir Stage 3 footprint, the impact area is 290 ha from the weir to a point 4 km upstream.

Potential foraging habitat for the species would overlap with nesting habitat for the red goshawk and powerful owl which include the areas of riparian vegetation along the Fitzroy River. The land-based offsets required to be provided for these species would also benefit the ghost bat.

Significant residual impacts and offsets

I consider that the project would not have a significant residual impact on this species. While the project would result in the removal of potential foraging habitat for the species, offset requirements for the red goshawk and matters of state environmental significance: regulated vegetation, connectivity and powerful owl habitat, is likely to mitigate impacts on foraging habitat for this species.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts of the project on the ghost bat. Subject to the mitigation measures and conditions stated in this report I consider that the project is unlikely to have an adverse residual impact on this species.

Echidna

Background

The echidna is listed as a 'special least concern' species under the NC Act. Those are species that are important in maintaining ecosystems and a source of information integral to the evolution of Australian fauna, as well as a genetic resource of potential benefit to society.

The EIS indicated that echidnas were identified within open woodland habitats with grass understorey at several sites throughout the Eden Bann project area and were also observed in the Rookwood Weir site. The echidna is considered to be a habitat generalist (having no specialised habitat requirements), occurring in most areas that support ants or termites. Therefore, the entire project footprint is potential echidna habitat.

Impacts and mitigation

The EIS stated that the weir impoundments and vegetation clearing for associated infrastructure is expected to result in the removal of over 2,000 ha of potential echidna habitat.

Significant residual impacts and offsets

While the project would result in the removal of potential foraging habitat for the species, it is expected that large areas of potential echidna habitat would remain in the surrounding areas. In addition, I consider the conditions I have stated requiring the proponents to provide offsets for the project's impacts on regulated vegetation and connectivity are likely to mitigate impacts on foraging habitat for this species. Subject to compliance with these conditions, the project is not expected to have a significant residual impact on this species.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the project could have on the echidna. Subject to the mitigation measures and conditions stated in this report I consider that the project is unlikely to have an adverse impact on this species.

Terrestrial reptiles

Four threatened terrestrial reptile species are identified as potentially occurring in the project area. These species are listed in Table 5.6.

Table 5.6 NC Act listed reptile species potentially occurring in the project area

Species name <i>Common name</i>	NC (Wildlife) Regulation listing status	EPBC Act listing status
Ornamental snake <i>Denisonia maculata</i>	Vulnerable	Vulnerable
Dunmall's snake <i>Furina dunmali</i>	Vulnerable	Vulnerable
Yakka skink <i>Egernia rugosa</i>	Vulnerable	Vulnerable
Collared delma <i>Delma torquata</i>	Vulnerable	Vulnerable

While the EIS indicated that the project area provides potentially suitable habitat for a number of species listed in Table 5.6, there are no existing records of those species within the project area and no individuals were identified during EIS field surveys.

- Ornamental snake—this snake is known to favour low-lying habitats adjacent to fresh water bodies. Freshwater margins, particularly along tributaries of the main channel of the Fitzroy River, may provide important foraging habitat for this species. Brigalow woodland communities (REs 11.3.1 and 11.4.9) which occur in small remnant patches throughout the study area may also support this species.
- Dunmall's snake—this snake may occur in small numbers in isolated, small remnant patches of brigalow woodland that occur within the project footprint.
- Yakka skink—this skink utilises log piles, burrows and rocky crevices. Such habitat and resources are present within the project footprint, particularly in less disturbed areas of remnant mature woodland.
- Collared delma—this species is known to inhabit eucalyptus-dominated woodland and open forests with suitable micro-habitats (i.e. exposed rocky outcrops). The woodland areas throughout the project area may provide suitable habitat for this species.

5.4.6 Protected wildlife habitat—protected animals (aquatic—freshwater)

The EIS identified three aquatic threatened animal species as potentially occurring in the project area. These species are identified in Table 5.7.

Table 5.7 NC Act listed aquatic freshwater species potentially occurring in the project area

Species name <i>Common name</i>	NC (Wildlife) Regulation listing status	EPBC Act listing status
Freshwater reptiles		
Fitzroy River turtle <i>Rheodytes leukops</i>	Vulnerable	Vulnerable
White-throated snapping turtle/southern snapping turtle <i>Elseya albugula</i>	Endangered	Critically endangered
Mammals		
Platypus <i>Ornithorhynchus anatinus</i>	Special least concern	Not listed

Freshwater reptiles

Fitzroy River turtle

The Fitzroy River turtle is listed as ‘vulnerable’ under both the NC and EPBC Acts. Potential impacts on the Fitzroy River turtle are discussed in Section 6 of this report. In that section, I concluded that the project is unlikely to have an unacceptable impact on this species, provided that the proposed avoidance and mitigation measures are undertaken by the proponents. I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- construct turtle passage infrastructure on both weirs to allow for safe passage around the weirs
- conduct a turtle movement study to determine baseline data on turtle movement patterns, home range and seasonal variations to assist in developing performance criteria for passage infrastructure
- regulate water levels within the Eden Bann where practicable, to minimise the risk of inundating nests within the weir footprint
- provide offsets for significant residual impacts on nesting and aquatic habitat.

In addition, I have also made general recommendations that the proponents regulate water releases where practicable, to minimise the risk of inundating nests downstream and to assist in maintaining suitable aquatic habitat.

White-throated snapping turtle

Background

The white-throated snapping turtle, also known as the southern snapping turtle was listed as ‘endangered’ under the NC Act on 27 August 2015. This species was listed as ‘critically endangered’ under the EPBC Act on 20 October 2014. As the listing under the EPBC Act occurred after the controlled action decision date for the project, no evaluation of this species is required in Section 6 of this report (MNES).

The species is endemic to south Queensland with a distribution that is restricted to the Mary, Burnett and Fitzroy River catchments. Similar to the Fitzroy River turtle, the

white-throated snapping turtle aggregates its nesting on the same banks revisited across the years. Nests of the white-throated snapping turtle also occupy a similar area to that of the Fitzroy River turtle, with nesting occurring at the top of steep slopes in sand and soil substrates which are up to 5 m from the water's edge and 3 m above the water level. The species nesting period is significantly longer than the Fitzroy River turtle, and extends from March to September. Hatching occurs around the same time as the Fitzroy River turtle, with hatching occurring in early summer (December and January).

Impacts and mitigation

The project is expected to have similar impacts on the white-throated snapping turtle as the Fitzroy River turtle. The project's potential impacts on Fitzroy River turtle are discussed in detail in Section 6 of this report.

The key potential impacts of the project on the Fitzroy River turtle include the creation of barriers to passage and the modification of aquatic habitat associated with constructing weir infrastructure, water quality impacts and nest inundation associated with water levels in the weirs and water releases downstream. The proposed avoidance and mitigation measures for the Fitzroy River turtle, which I have discussed in Section 6, are considered to be applicable to the white-throated snapping turtle. The only difference is that the white-throated snapping turtle incubation period is significantly longer than the Fitzroy River turtle.

I have considered the proposed mitigation measures, outlined in the proponents' draft species management program document, would be adequate for managing impacts on this species.

I have imposed a number of conditions requiring specific management actions for the white-throated snapping turtle nests including:

- implementation of an approved species management program
- managing water levels within the Eden Bann Weir impoundment
- avoiding the timing of construction activities outside of white-throated snapping turtle and nesting and hatching seasons.

I have also made general recommendations that the proponents regulate water releases, where practical, to minimise the inundation of nests downstream.

Other conditions I have imposed for the white-throated snapping turtle include:

- constructing turtle passage infrastructure on both weirs to allow for safe passage around the weirs
- conducting a turtle movement study to determine baseline data on turtle movement patterns, home range and seasonal variations to assist in developing performance criteria for passage infrastructure.

I concluded in Section 6 that up to 80 per cent of turtle nests could be inundated within the impoundment and that the project would be expected to result in the modification of 942 ha of aquatic habitat. I consider that these impacts would be significant. I have required that the proponents provide offsets to compensate for these impacts. The proponents have committed to undertake a nest protection program and provide a

financial settlement value to compensate for the impacts on aquatic habitat. I consider these measures to be adequate for compensating the project's significant residual impact on this species. The proponents draft offset strategy also includes for the protection of white-throated snapping turtle nests.

Coordinator-General's conclusion

I am satisfied that the proponents have adequately identified the potential impacts the project could have on the white-throated snapping turtle. To ensure no adverse impacts on this species, I require the proponents to manage impacts through conditions imposed in this report, including offsets for impacts on nesting and foraging habitat.

I have imposed a condition requiring the proponents to design and construct a turtleway that is informed by a turtle movement study, which provides for the safe passage and maintains movement. Furthermore, I would expect the proponents to manage impacts on turtle nests downstream and to maintain suitable aquatic habitat between and downstream of the impoundments.

On the basis of the proposed avoidance and mitigation measures, and conditions in this report, I consider that the project would not have an adverse impact on the white-throated snapping turtle.

Aquatic mammals

Platypus

Background

The platypus is listed as a 'special least concern' species under the NC Act. No targeted surveys were undertaken for this species as part of the EIS. However, a single record exists within the project footprint at the upstream extent of the Rookwood Weir (Stage 2) inundation area on the Dawson River. The EIS indicated that potentially suitable habitat would occur throughout the Eden Bann Weir impoundment, both within the margins of the impounded pool habitat and in the upstream pool habitats.

However the use of habitat by this species is expected to be limited to the reaches of the river which support burrowing (i.e. earth banks, with overhanging vegetation and undercut banks where water has cut away soil from the bank). In addition, the areas of riparian vegetation that have been degraded by grazing cattle are considered to limit use of the area by platypus due to the lack of or sparse overhanging vegetation.

Impacts and mitigation

Submissions on the EIS and AEIS raised concerns about the proponents' assessment of the project's impacts on the platypus. I consider that the project would involve a number of elements and activities that have the potential to impact on platypus, including the construction of weir infrastructure, which would create a barrier to passage; and construction and operational activities that have the potential to impact on water quality or stability of potential nesting banks.

While no specific measures or design elements have been incorporated to cater for platypus, the proposed fishway infrastructure is likely to also provide passage for other

aquatic fauna such as platypus. In terms of potential water quality impacts during construction, the proponents have proposed a number of measures to manage potential water quality impacts including undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring the appropriate storage of hazardous chemicals and substances. These measures would be expected to reduce the potential for any adverse water quality impacts on platypus inhabiting these areas.

As discussed in Section 5.3, the retention of vegetation within the impoundments may result in a temporary increase in sediment and nutrients within these areas. Such water quality impacts may impact on platypus by altering the availability of prey resources (e.g. crayfish and other aquatic invertebrates), which are sensitive to these water quality changes. Such impacts would be expected to be temporary and normal water quality conditions would be expected to return overtime. The potential water quality impacts associated with decaying vegetation are discussed in more detail in sections 5.3 and 6 of this report.

In addition, the proponents have committed to a number of other measures that would assist in maintaining water quality during operation including the use of multi-level offtakes in the weir design; selective withdrawal outlets and manipulating flows to prevent the build-up of blue-green algae. These measures would be expected to assist in preventing a build-up of nutrients within the impoundments. The proponents have also committed to undertake water quality monitoring and to take corrective actions in the event that any adverse water quality impacts are identified.

Significant residual impacts and offsets

I consider that the project would not have a significant residual impact on platypus. In addition, the offset requirements for the project's impacts on aquatic habitat for turtles and the waterway barriers for fish would mitigate potential impacts on this species.

Coordinator-General's conclusion

I am satisfied that the proponents have adequately identified the potential impacts that the project could have on the platypus. Subject to the mitigation measures and conditions stated in this report I consider that the project is unlikely to have an adverse impact on this species.

5.4.7 Protected wildlife habitat—protected animals (aquatic—marine)

Section 6 indicates that 20 listed migratory marine species of fauna including seven marine mammals, six turtles, six sharks and the estuarine crocodile have the potential to occur in the project area. I concluded that the estuarine crocodile (referred to as the saltwater crocodile in Section 6), is the only species known to occur in the project area.

Estuarine crocodile

The estuarine crocodile (*Crocodylus porosus*) is listed as vulnerable under both the NC and EPBC Acts. Potential impacts on this species are discussed in Section 6 of this report (MNES). I concluded that the project is unlikely to have an unacceptable impact

on this species, provided that the proposed avoidance and mitigation measures are undertaken by the proponents. The proponents have proposed a number measures to manage potential water quality impacts, including undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring appropriate storage of hazardous chemicals and substances. These measures would be expected to reduce the potential for any adverse water quality impacts in the project area and consequential impacts on crocodiles inhabiting these areas. The proponents have also committed to undertake water quality monitoring and to take corrective actions in the event that any adverse water quality impacts are identified.

Marine and shorebird species

Potential impacts on the marine and shorebird species are discussed in Section 6 of this report. This includes 18 migratory marine bird species (including two species which are also listed as threatened under the NC Act). As discussed in the previous section, under the NC Act, 'special least concern' includes least concern birds which are listed under international agreements: JAMBA, CAMBA, ROKAMBA and the Bonn Convention.

In Section 6, I concluded that most of the migratory marine bird species are not expected to use the project area and are more likely to use the wetland and estuarine habitats downstream of the weirs. I also concluded that the project is not expected to have any direct water quality or flow regime impacts on the estuarine/marine waters downstream of the Fitzroy Barrage and therefore no impacts on potential marine bird habitat.

5.4.8 Protected areas

Great Barrier Reef Coast Marine Park

Background

The Great Barrier Reef Coast Marine Park (GBR Coast MP) is a State marine park that runs the full length of the Commonwealth GBRMP from just north of Baffle Creek (north of Bundaberg) to Cape York. It provides protection for Queensland tidal lands and tidal waters.

The GBR Coast MP complements the Commonwealth GBRMP as it adopts similar zone objectives, entry and land use provisions. While the activities that can be carried out within the GBR Coast MP and GBRMP are generally the same, there are some Queensland specific provisions that may apply. The GBR Coast MP forms part of the GBRWHA.

Impacts and mitigation

I concluded in Section 5.3 of this report (water quality) that, if not properly managed:

- short-term, direct, negative, water quality impacts may result from nutrients generated from decaying vegetation within the impoundments
- long-term, indirect, consequential, impacts may arise from irrigated cropping facilitated by the project.

Decaying vegetation impacts

There is some potential that nutrient concentrations (but not nutrient loads) from decaying vegetation could be managed to some extent by dilution and flushing of each impoundment. However, given the dependence of this management strategy on high rainfall events, I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to undertake a nutrient monitoring program and provide water quality offsets informed by the outcomes of the monitoring program.

Facilitated agricultural development impacts

There are considerable uncertainties about the timing, nature, duration, location and entities responsible for the potential impacts of FAD on the GBR Coast MP and the tools for calculating offset requirements for those impacts are not yet sufficiently developed.

Consequently, I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- develop and implement a land management code of practice that is to be attached as a condition of sale of water for irrigated agriculture aimed at achieving the WQOs of the Reef 2050 Plan
- implement a water quality monitoring program that would inform a future water quality offsets program, if required by the Commonwealth Environment Minister, to address any impacts of FAD on water quality entering the Fitzroy River.

Coordinator-General's conclusion

I am satisfied that, with the implementation of the proponents' commitments and the conditions recommended to the Minister, the potential impacts of the project on water quality in the Fitzroy River and the GBR Coast MP would be managed.

5.4.9 Fish habitat areas

Background

Fish Habitat Areas (FHAs) are declared under the Fisheries Act for the protection and management of high-value fish habitat along the Queensland coast. All FHAs are defined as a prescribed environmental matter under the Queensland Offsets Act.

The Fitzroy River FHA is 141 km downstream of Fitzroy weir. This FHA includes the Fitzroy River estuary, Raglan Creek and the wetland systems surrounding North Curtis Island and within the Fitzroy delta south-east of Rockhampton. This area also includes the waters of the GBRWHA.

Impacts and mitigation

As discussed in Section 6.4 of this report, I consider that the project would not have any direct water quality or flow regime impacts on the estuarine/marine waters downstream of the Fitzroy Barrage. The proponents have proposed a number of measures to manage water quality impacts during the construction and operation of the

project. As discussed in the previous section, I have recommended conditions to the Commonwealth Environment Minister, requiring the proponents to:

- develop and implement a land management code of practice that is to be attached to future water licences as a condition of sale to prospective agricultural users
- undertake a water quality monitoring program that would inform water quality offset strategy.

Coordinator-General's conclusion

I am satisfied that the proponents have adequately identified the potential impacts that the project could have on FHAs. On the basis of the proposed avoidance and mitigation measures and conditions in this report for the management of flow regimes and water quality, I consider that the project is unlikely to have an adverse impact on the Fitzroy River FHA.

5.4.10 Waterway providing for fish passage

Background

Movement along waterways is considered to be vital for native fish, including important recreational and commercial fishing species.

Waterway barrier works such as the construction or raising of, or maintenance on weirs and dams, culvert and road crossings can create barriers to fish passage and therefore have the potential to impact on fish life cycles.

It is a requirement under the Fisheries Act (section 76G) that such works include provisions (such as fish passage infrastructure) which adequately provide for fish passage.

Impacts and mitigation

The proposed raising of the existing Eden Bann Weir and the construction of the Rookwood Weir constitute waterway barrier works and would reduce the ability for fish to move into waters upstream and downstream of the barriers. As such, there is a requirement that both structures incorporate design features that allow for fish passage.

Under the Queensland *Environmental Offsets Policy Significant Residual Impact Guideline*, an action is likely to have a significant impact on a waterway providing for fish passage if there is a real possibility that it would:

- result in the mortality or injury of fish
- result in conditions that substantially increase risks to the health, wellbeing and productivity of fish seeking passage such as through the depletion of fishes' energy reserves, stranding, increased predation risks, entrapment or confined schooling behaviour in fish
- reduce the extent, frequency or duration of fish passage previously found at a site
- substantially modify, destroy or fragment areas of fish habitat necessary for the breeding and/or survival of fish

- result in a substantial and measurable change in the hydrological regime of the waterway, for example, a substantial change to the volume, depth, timing, duration and frequency of flows
- lead to significant changes in water quality parameters such as temperature, DO, Ph and conductivity that provide cues for movement in local fish species.

The following sub-sections outline the expected project impacts in the context of the relevant criteria from the significant residual impact guideline.

Reduction in the extent, frequency or duration of fish passage

Eden Bann Weir

The existing Eden Bann Weir currently provides fish passage through an existing fish lock. The raising of the weir would be expected to affect the operation of this existing lock and as such the proponents have proposed to include new infrastructure to maintain fish passage. At a preliminary level, the new infrastructure would include:

- an upgraded fish lock on the left bank
- a new fish lock located on the right bank for high and low reservoir levels to accommodate flows from 500 cubic metres per second (m^3/s) to $2,700 \text{ m}^3/\text{s}$. This would provide for normal operating conditions and low spillway flow conditions. The addition of the right bank fish lock is expected to improve on current passage efficiency above spilling flows.

Based on modelling for the EIS, passage would be provided for approximately 71 per cent of flood events and ongoing normal flows at Eden Bann Weir. I note that this may be further improved through detailed design.

Rookwood Weir

Preliminary designs for the proposed infrastructure at the Rookwood Weir include a right bank fish lock to cover low and high reservoir levels to cater for flows from a minimum operating level up to $500 \text{ m}^3/\text{s}$.

Based on modelling for the EIS, fish passage would be provided for ongoing 'normal flows' between 89.4 per cent and 99.8 per cent of the time. I note that this may be further improved through detailed design. The proponents have committed to monitor the effectiveness of the fishways during the construction and operation of the project.

The EIS indicated that fish passage would not be restricted during construction as flows would be maintained in-stream and the existing fish lock at Eden Ban Weir would remain operational during construction. In addition, the proponents have committed to undertake downstream works only during the dry season when flows have ceased.

I have stated a condition requiring the proponents to maintain fish passage during the construction and operation of the project and to design the fish passage infrastructure in consultation with DAF.

Road upgrades

In Section 5.8 of this report, I addressed the road crossing upgrades that would be undertaken for each weir. Those upgrades would be subject to water barrier approvals.

The proponents have committed in the draft EMP to design and construct all crossings to protect or enhance fish passage. I am satisfied that the consultation that will occur between the proponents and DAF, combined with statutory requirements under the Water Act, will be sufficient to protect fish passage at each river crossing upgrade.

Modification, destruction or fragmentation of fish habitat

The weir impoundment would result in the permanent modification and fragmentation of fish habitat. The EIS reported that the project would impact 942 ha (282 ha Eden Bann Weir and 660 ha Rookwood Weir) of aquatic fish habitat.

DAF does not consider the provision of fish passage infrastructure to be an adequate measure for mitigating the new inundation area and the modification of habitat. The provision of fish passage by the proposed fish passage structures would only mitigate the construction of the barrier and not permanent modification of habitat. As such, the project would require an offset to compensate for the permanent modification of this habitat.

Changes in water quality

Construction

Construction activities involving ground disturbance and the removal of vegetation may result in temporary and localised impacts on water quality. As discussed in the previous sections for other aquatic species, the proponents have proposed a number of measures to manage potential water quality impacts. These include undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring hazardous chemicals and substances are stored appropriately. These measures are discussed in further detail in Section 5.3 of this report. I consider that these measures would reduce the potential for any adverse water quality impacts in the project area and consequential impacts on fish inhabiting these areas.

Operation

Water releases from the weir would need to comply with the required WQOs for the Fitzroy Basin Plan and relevant operating plans.

The EIS indicated that the majority of the water quality impacts would be associated with the retention of vegetation within the impoundments. Decaying vegetation is expected to result in increased nutrient and sediment concentrations. Fish may be affected by these elevated nutrient and sediment concentrations, which may result in algal blooms and a reduction in DO levels.

The potential water quality impacts associated with decaying vegetation are discussed in further detail in sections 5.3 and 6 of this report. I concluded that water quality impacts would be temporary and depend on construction timing for each stage of the weirs and environmental factors (e.g. rainfall conditions).

Consequently I have recommended a condition to the Commonwealth Environment Minister requiring the proponents to monitor nutrient levels to determine nutrient increases and to report these to EHP and DEE. I have also recommended a condition that the results of the monitoring are used to inform an offset strategy to address these

water quality impacts. In addition, any significant fish-kill events would have to be reported to EHP, and subsequently steps would need to be undertaken to identify the cause and appropriate measures undertaken to prevent further fish kills.

Submissions on the EIS raised concern about the potential for the weirs to cause 'black water' (water devoid of oxygen) conditions, particularly during periods of drought, resulting in algal blooms.

The proponents have committed to a number of measures which would assist in maintaining water quality during operation, including the use of multi-level offtakes in the weir design; selective withdrawal outlets; and manipulating flows to prevent the build-up of blue-green algae. I consider that these measures would reduce, but not eliminate build-up of nutrients within the impoundments. The proponents have also committed to undertake water quality monitoring and would take corrective actions in the event that any adverse water quality impacts are identified.

Significant residual impacts and offsets

The project would result in a significant residual impact of 942 ha (282 ha Eden Bann and 660 ha Rookwood) on fish habitat. The condition I have recommended to the Commonwealth Environment Minister, requiring the proponents to provide an offset to compensate for the modification and fragmentation of aquatic habitat resulting from the project, would also partly compensate fisheries impacts. The proponents may provide either a financial offset settlement to DAF or provide a proponent-driven direct offset which may include works on existing waterway barriers within the Fitzroy catchment.

Coordinator-General's conclusion

I am satisfied that the proponents have adequately identified the potential impacts of the project on fish passage. I have made recommendations that the proponents maintain fish passage during the construction and operation of each weir and river crossing and to design all fish passage infrastructure in consultation with DAF.

The project would have a significant residual on 942 ha (282 ha Eden Bann and 660 ha Rookwood) of fish habitat. The condition I have recommended to the Commonwealth Environment Minister would require the proponents to provide offsets to compensate for the project's impacts on aquatic habitat would also partly compensate fisheries impacts. I consider that this may be provided as either a financial or land-based offset.

5.5 Social impacts

The SIA was conducted for the project in accordance with the principles of the Coordinator-General's *Social impact assessment guideline: July 2013*. The SIA addressed the potential social impacts of the project in relation to the local region, which incorporates Rockhampton and Central Highlands LGAs and the Livingstone and Woorabinda LGAs. The SIA also documents commitments made by the proponents to implement mitigation and management measures to address those impacts.

5.5.1 Submissions received

Submissions were made by 24 of the 54 directly impacted landowners on the EIS or AEIS. A summary of the key social issues raised during consultation and the potential social impacts identified in the SIA are summarised below:

- traffic management planning and traffic safety
- outcomes of environmental monitoring process and subsequent actions
- loss of land and associated land compensation/acquisition issues, including consultation, collaboration and negotiation as a result of change or loss
- access to land, whether reduced, removed or changed
- loss of viability of property for agricultural operation
- impacts of the new inundation areas on farm productivity, including stock routes and water entitlements, ability to graze stock and stock disturbance
- need for land access protocols during field surveys and site investigations
- reinstatement and rehabilitation of existing infrastructure—river crossings associated with property access
- impacts on agriculture infrastructure—pumps and fencing
- potential loss of local workers to project construction and particular concern about the ability to attract replacement agricultural workers
- potential increased noise and dust impacts for local residents
- better understanding of timing, format and processes in relation to community consultation, engagement and collaboration.

I have considered the submissions and the responses provided by the proponents in my evaluation of the project and my assessment is provided in relevant sections below.

5.5.2 Community and stakeholder consultation

I consider that the proponents have undertaken well-planned and extensive stakeholder consultation and community engagement for the project to date. The SIA has involved targeted stakeholder and community consultation to inform the social baseline study, the identification of social impacts and the development of mitigation and management strategies.

The SIA found that the stakeholder consultation to date will need to be supplemented by consultation, collaboration and engagement with impacted stakeholders during the pre-construction development stage through to the construction and operation stages, with a particular focus on impacted landowners.

Management and mitigation strategies

The proponents are committed to implementing a consultation, engagement and negotiation process with stakeholders during the pre-construction development stage through to the construction and operation stages.

To ensure that community and stakeholder consultation is appropriately managed, and to maintain open and transparent communication, the proponents have committed to prepare stakeholder and community engagement plans during the pre-construction

phase, following the final Commonwealth approval, and one month prior to the commencement of the construction and operation phases for the project. These would focus on maintaining and building relationships established during the EIS consultation phase. The proponents have committed to providing the plans to the Coordinator-General and making them publicly available.

All stakeholder and engagement plans would include information relating to project schedules and programs, project contacts and communication procedures including notification processes, grievance mechanisms, complaints reporting and monitoring protocols.

In addition, for the 58 directly impacted landowners, the proponents have committed to develop a near-neighbour program. This program would provide landowners with the following:

- proponent contact details to monitor any changes on their properties
- a process to provide accurate and timely information
- an ability to identify decisions that need the participation and collaboration of the proponents and landholders
- an agreed process for dispute resolution between proponents and landholders.

The near-neighbour program would include the appointment of dedicated land liaison officers to provide a direct, single point of contact for individual negotiation with all directly impacted landholders.

The proponents have also committed to develop and implement a detailed project land access, acquisition and compensation strategy specifically for land impacts raised by landholders. The strategy would include the following:

- mitigation and management of identified individual and specific landholder property impacts
- implications for securing land and rights to land
- preference for acquisition of land by agreement
- timing of land acquisition and payment of compensation
- provision of financial assistance to landholders for the purposes of land valuations and legal representation
- the process for acquiring land including the use of private land for project construction and quarrying
- grievance and dispute mechanisms, including mediation
- productivity impacts, including loss of business viability, loss of agricultural infrastructure and alterations to water allocation
- loss of opportunistic river crossings
- improved road access and flood immunity of identified river crossings
- opportunities for improved water security.

In addition, as further evaluated in other sections of this report, the proponents would also incorporate consultation into their draft construction and operations EMPs and implement the commitments they have made with respect to:

- noise (refer to Section 5.11)
- dust (refer to Section 5.9)
- traffic and road conditions (refer to Section 5.8)
- weed and pest management (refer to Section 5.1).

I consider that the information presented in the EIS and AEIS sufficiently demonstrates the proponents' commitment to implement an ongoing consultation, engagement and negotiation process with stakeholders during the pre-construction, construction and operational stages of each weir.

5.5.3 Workforce and housing

The project would require a construction workforce of approximately 150 people across both weir sites over a two-year construction period. In the likely event that each weir would be constructed at different times and potentially in stages, the potential impact of the construction workforce on local housing would be substantially reduced.

The proponents do not intend to develop a construction camp for the project. Other than for a small number of short-term technical specialists, no fly-in, fly-out arrangement is proposed.

The project would require an operational workforce of approximately five people. The project would create both direct and indirect employment opportunities.

Management and mitigation strategies

The proponents are committed to sourcing the majority of employees locally from within the regional study area, with a small proportion of highly specialised workers being sourced from elsewhere in Queensland. The proponents have committed to develop and implement a recruitment plan as a mitigation and management strategy prior to construction that would detail:

- workforce participation strategies providing employment opportunities and programs for indigenous and minority groups
- recruitment planning—the use of local recruiting agencies and strategies giving preference to maximising opportunities for local employment
- provision of appropriate contractual arrangements with contractors to facilitate local employment opportunities.

Maximising local and regional employment opportunities for the relatively small construction workforce is not expected to have a net negative impact on the existing labour workforce in relation to causing skills shortages or a loss of local workers to the project. In the context of the regional economy and unemployment, it is anticipated the project would have positive impacts.

With a management strategy focusing on the majority of construction workers being recruited from the local and regional area, it is anticipated that the construction workers would already reside in the region and there would be no additional impact on the housing market.

The management strategy to be implemented in relation to the limited numbers of specialised workers sourced from outside the region is to house them in short-term temporary commercial accommodation. Suitable accommodation for these construction personnel is available in Rockhampton, Duaringa, Mount Morgan, Stanwell, Gracemere, Mount Hay and Yaamba.

Notwithstanding that the timing of construction of each stage of each weir is uncertain, any construction commencing within the next two years has the potential to take advantage of the increased supply and decreased demand for housing as a result of the recent downturn in the resources sector. Therefore the impact of the project on the housing and accommodation sector is expected to be generally positive.

The proponents intend that all construction workers would be transported daily by bus to each construction site and back to their accommodation.

5.5.4 Community health, safety and wellbeing

During the consultation processes undertaken for the EIS and AEIS, the community and stakeholders raised community health and safety concerns with regard to:

- the need for traffic management planning and traffic safety arrangements
- increased traffic volumes and increased road safety concerns
- the need for environmental monitoring processes
- potential increases in noise and dust impacts for local residents
- emergency planning processes and protocols
- water flow, flooding and inundation.

Management and mitigation strategies

In response to community concerns about project impacts, the proponents have committed to develop and implement a range of mitigation and management strategies including:

- an emergency response plan in consultation with Emergency Services, Queensland Fire and Rescue Service, Queensland Police Service and Queensland Ambulance Service
- air quality, noise and vibration, and water management programs to be implemented at the commencement of construction, including processes for managing and monitoring noise and dust impacts, bore and water flow issues for local residents
- managing potential nuisance activities, including notifying residents and stakeholders of noise-generating activities, time restrictions on activities, dust suppression and maintaining and operating equipment, plant and machinery in accordance with manufacturers' guidelines
- an alert system for landholders to inform them of water release activities
- a project complaints and grievance procedure as part of the stakeholder and community engagement strategy, near-neighbour policy and the land access, acquisition and compensation strategy

- a weed management plan to prevent the introduction of new weeds species and the spread of declared weeds
- a designated community consultation officer with responsibility for complaint management processes and procedures
- a social impact monitoring program in order to identify and respond to any unexpected impacts.

In addition to the above committed mitigation and management strategies, the following community concerns, which are further evaluated in other sections of this report, would form part of the proponents' consultation, collaboration and engagement commitments for the monitoring of potential impacts:

- weed management (Section 5.1)
- water flow and flooding (sections 5.2 and 5.12)
- water management program (Section 5.3)
- traffic and road conditions (Section 5.8)
- dust (Section 5.9)
- noise (Section 5.11).

As a consequence of the above measures and the information presented in the EIS and AEIS, it has been demonstrated that the proponents are committed to managing community health, safety and wellbeing impacts during the construction and operational stages for each weir.

5.5.5 Local business and industry content

The project would benefit the local and regional economies by employing local workers and by offering opportunities for local suppliers to provide resources for the construction phase of the project.

Management and mitigation strategies

The proponents have committed to develop and implement a procurement plan in line with the Australian Industry Participation Policy (AIPP). The proponents would consider advertising work packages on the Industry Capability Network (ICN) Gateway. The services, equipment and materials required for the project are typical for construction projects in the region and it is anticipated that they would be locally available.

I note that the ICN Gateway provides opportunities to engage with and maximise local supplier content, as well as second and third-tier supply chain opportunities. I consider that this network would benefit companies involved in tendering for work on the project.

5.5.6 Coordinator-General's conclusion

Overall, I consider the project would generate net social benefits for the region and that commitments made by the proponents would ensure that identified social impacts would be appropriately mitigated or managed.

I have imposed a condition for the proponents to produce an annual Social Impact Management Report (SIMR) on the implementation of the commitments and the

outcomes achieved to mitigate and manage social impacts. The annual SIMRs must be produced for a period of five years from the commencement of construction of each weir. Each SIMR must be made publicly available on the proponents' website during each year of reporting.

In addition I have imposed a condition for the proponents to review the social impact assessment for the project to ensure it reflects the current social and economic context if construction does not commence within two years of the notification of my Coordinator-General's report.

Community and stakeholder consultation

I note the proponents' commitment for a structured and integrated approach to ensure that directly impacted landholders have access to information, processes and protocols that provide them with opportunities to participate, collaborate and negotiate on developing mitigation and management strategies for specific landholder issues and broader community social impacts. Therefore, I am satisfied that the consultation, engagement, collaboration and negotiation processes proposed for the life of the project are comprehensive and well targeted to identify community and stakeholder issues.

Workforce and housing

I acknowledge that the proponents have committed to mitigation and management strategies in relation to potential construction workforce and housing impacts.

I consider that the information presented in the EIS and AEIS sufficiently demonstrates minimal impacts of construction workers on the local and regional labour and housing markets are expected. These impacts would be reduced by the anticipated separate timing of construction for each weir, the proposed staged nature of construction of each weir, the relatively small construction workforce and the commitment by the proponents to maximise local employment.

Community health, safety and wellbeing

I am satisfied the committed mitigation and management strategies in relation to potential community health, safety and wellbeing impacts, including for potential emergency, nuisance and weed impacts, are appropriate.

Local business and industry content

I am satisfied that the proponents' commitment to develop a procurement plan in line with the AIPP would provide fair and reasonable tender opportunities for local business and industry to participate as suppliers for all stages of the project. I expect the proponents to comply with AIPP reporting requirements.

5.6 Cultural heritage

The EIS assessed the potential impacts of the project on the Indigenous cultural heritage (ICH) and non-Indigenous cultural heritage (NICH) values of the project area

and found that construction works at the weir sites and inundation of land adjacent to the Fitzroy River have the potential to impact sites of ICH only.

No issues regarding cultural heritage impacts were raised in submissions on the EIS and AEIS.

5.6.1 Indigenous cultural heritage

ICH values were identified through a review of relevant registers, literature and field surveys previously undertaken across the project area. In particular, the EIS relied on the 2007 assessment of ICH values undertaken by Central Queensland Cultural Heritage Management (CQCHM) as part of a suite of pre-feasibility studies commissioned by the Queensland Government Department of Infrastructure.

The assessment identified 28 registered ICH places across the project area. These places are dominated by stone artefacts (80%), and also include scarred trees, shell middens, a source of yellow and red ochre, a landscape feature and a stone arrangement. These places are listed in the Queensland Cultural Heritage Database and Register and are located within the buffer area for the Eden Bann Weir. No places were recorded on the Queensland Cultural Heritage database or register within the buffered area for the Rookwood Weir. There are no national or Commonwealth heritage places located within a 2 km buffer of the project development footprints and inundation area.

Impacts and mitigation

The EIS reported that field surveys identified 143 cultural heritage areas and/or objects, including the Fitzroy River itself as a place of traditional significance. The places identified during field investigations broadly included stone artefacts either as scatters or as isolated find sites, scarred trees and shell middens.

To protect these areas or objects and comply with the ACH Act, cultural heritage management plans (CHMPs) were prepared. These CHMPs were approved and registered in 2011. These plans include management and mitigation measures proposed to be implemented to protect ICH values and were developed with five relevant endorsed Aboriginal parties—the Darumbal, Gangulu, Kangoulu, Ghungalu and Jetimarala People. The CHMP for the Darumbal People was subsequently updated and registered in 2014. The CHMPs were registered by the relevant state government agencies responsible for the implementation of the ACH Act¹⁷.

The proponents have committed to undertake measures in the draft EMP to manage the impacts of the project on ICH including:

- undertaking a cultural heritage survey and implementing management measures in accordance with the CHMPs
- implementing the relevant CHMPs developed or any documentation that supersedes them with the Darumbal Endorsed Parties for the Eden Bann Weir and the

¹⁷ The relevant state agencies responsible for the implementation of the ACH Act were the Department of Environment and Resource Management in 2011 and the Department of Aboriginal and Torres Strait Islander and Multicultural Affairs in 2014.

Darumbal Endorsed Parties, Gangulu Endorsed Parties, Kangoulu and Ghungalu Endorsed Parties and Jetimarala Endorsed Parties for the Rookwood Weir

- avoiding impacts to sites of heritage significance, particularly with regard to temporary installations
- implementing a stop work procedure and notification to an appropriately qualified cultural heritage advisor for cultural heritage 'finds'
- preventing the destruction, damage, movement, excavation or disturbance of items of cultural heritage significance unless documented regulatory approval has first been granted
- including cultural heritage information in inductions to create awareness and training employees in the identification of archaeological material and actions to take in the case of a cultural heritage find
- avoiding work on private roads and burrow areas located on non-freehold land where Native Title has not been previously extinguished.

I am satisfied that the implementation of these mitigation and management measures would enable the proponents to adequately recognise, protect and preserve ICH places.

5.6.2 Non-Indigenous cultural heritage

The EIS reported that there are few structures of NICH value located on or near the development footprint or inundation areas of the project as the Fitzroy River is subject to regular flooding and landholders have historically avoided building on the lower Fitzroy River floodplain. Apart from three river crossings, the only structure identified within or close to the project footprint was the Riverslea Hut at Riverslea crossing.

The NICH values of the project area were identified through desktop reviews of statutory and non-statutory registers and field surveys. NICH values were assessed against the standard criteria under the *Queensland Heritage Act 1992* (QH Act) and Queensland Heritage Council Guidelines and the field investigations comprised:

- an analysis of topographic maps and aerial photographs to determine the location of structures and other features along the river and within the potential inundation areas
- consultation with local community and stakeholders to determine potential places of significance within the development footprints and inundation areas
- an aerial survey undertaken by helicopter along the lower Fitzroy River, flown at approximately 200m above ground level.

Although no terrestrial survey was undertaken due to the large distance required to be assessed and the nature of the location being in a floodplain, I am satisfied with the approach undertaken by the proponents. The EIS reported that the project would not impact any place listed on the National Heritage List or the Commonwealth Heritage List established under the EPBC Act for cultural values. No NICH values were determined to be of state significance.

Areas of local significance were determined based on a 2010 study commissioned by the RRC to identify, document and assess NICH values for the creation of a local

heritage register. The assessment of sites and structures with potential NICH values identified Riverslea Hut as the only structure of cultural heritage significance within proximity to the project development footprints and inundation areas. Riverslea Hut is considered a well-known local landmark warranting conservation and demonstrates the evolution of an isolated building from its original use of a vehicle shed to a stockman's hut. Character sites and NICH values identified by this process are protected by provisions in the Rockhampton Region Planning Scheme 2015.

Impacts and mitigation

Riverslea Hut

The EIS reported that the Riverslea Hut is not threatened by the proposed inundation as it is located approximately 140 m above the impoundment of the proposed Rookwood Weir. In addition, no construction or operation activities are proposed near Riverslea Hut and therefore no impacts are predicted.

The project's draft EMP includes a Cultural Heritage Management Program which aims to recognise, protect and preserve potential NICH places and avoid disturbance to cultural heritage items of places.

Great Barrier Reef World Heritage Area

The EIS reported that the project would not have any direct impacts on the GBRWHA cultural values as it is located over 140 km away. Indirect impacts that may result from changes in flow and water quality indicated that there would be a negligible change in nutrient levels flowing to the reef as a result of the project and therefore were assessed not to have any measurable impact on cultural heritage values.

I am satisfied that the project would not have any impacts on matters of NICH.

5.6.3 Coordinator-General's conclusion

I am satisfied with the EIS assessment of the impacts of the project on ICH and NICH. I conclude that the proponents' commitment to comply with the approved CHMPs and to recognise, protect and preserve ICH and NICH places and objects in the draft EMP are sufficient to meet the legislative requirements of the ACH Act and the QH Act and ensure potential impacts can be adequately managed.

5.7 Economic impacts

5.7.1 Background

The EIS reported that the project would benefit the local and regional economy through increased employment, expenditure in the region and the provision of a secure water supply for industrial and urban/residential uses. It could also support new agricultural development.

The economic impact assessment (EIA) evaluated the impacts of the project on the local region which incorporates the LGAs of the Rockhampton Regional, Livingstone Shire, Central Highlands and Woorabinda Aboriginal Shire Councils.

The EIS reported that the population of the study area was approximately 143,000 in 2011 and its largest industries, by employment numbers, are health care and social assistance, mining, retail trade and construction. The gross regional product of the Fitzroy Statistical Division was estimated to be over \$22 billion in 2012–13, which is 7.7 per cent of Queensland's gross state product. The unemployment rate of the RRC was 5.7 per cent in 2012–13, which was in line with the average Queensland unemployment rate of 5.6 per cent.

The EIS reported that, without the project's two water infrastructure developments, the region would be expected to experience water shortages during drought periods due to increased water demands over time. Those water shortages would need to be managed through urban water use restrictions, cartage of water, installation of water tanks and/or the development of alternative water supply infrastructure.

5.7.2 Submissions received

Key issues regarding the economic impacts of the project raised in submissions on the EIS and AEIS included the following:

- the benefit-cost analysis (BCA) does not put a value on the cost of altering a naturally flowing river system and the impacts of this change on riverine and riparian habitats
- the proposed project is a priority economic and regional development project that would aid in diversifying the regional economy and indirectly address unemployment and socioeconomic disadvantage in the region and that these benefits should be quantified as part of the EIS.

I have considered each submission and the responses provided by the proponents in my evaluation of the project and my assessment is provided below.

5.7.3 Economic analysis

The EIA described the local and regional economies the project would impact on and included a BCA. Key regional economic benefits are expected to include capital expenditure of \$495 M, the employment of local labour resources during construction and the use of local suppliers. The EIA reported that the project is expected to generate approximately 150 direct jobs during the two-year construction period, with the majority of employees to be sourced from within the region. After construction, the project is expected to employ between one and five direct full-time equivalents in operation and maintenance capacities.

Methodology

The analysis of local and regional economic effects included:

- a statistical analysis of demographics and regional economies
- a quantitative and qualitative discussion of market trends, regional competitive advantage and other factors relevant to the project
- a review of data from the Australian Bureau of Statistics (ABS).

The EIA also provided a summary of the key findings undertaken in a (commercial-in-confidence) BCA. The BCA quantified:

- construction capital costs for weir infrastructure, including aquatic fauna passageways, road and river crossings, power infrastructure and critical infrastructure protection measures
- costs associated with approvals, land acquisition and compensation, and water regulation
- environmental mitigation, management and offset (compensation) costs
- owners' costs associated with non-capital components such as approvals, land, water regulation, environmental management and offsets
- operations and maintenance costs
- benefits associated with the availability of high priority water
- benefits associated with the avoidance of demand management strategies
- benefits within the regional economy associated with the employment of local labour resources and the use of local suppliers.

Response to submissions

Submissions on the EIS identified additional benefits and costs that could be quantified as part of the BCA such as the diversification of the regional economy, indirect improvements in unemployment and socioeconomic disadvantage in the region and the impacts to the riverine system and riparian habitat. I am satisfied that the matters included in the BCA are adequate to evaluate the net benefits of the project. I consider that impacts on the ecology and environment of the area or social impacts beyond those impacts included in the BCA have been adequately avoided, mitigated, managed and/or offset, as detailed in other parts of the EIS.

Results

The BCA found that for all development scenarios for Eden Bann Weir and Rookwood Weir, the project would provide a net gain to the region and State, as demonstrated by positive net present values (NPV) and benefit-cost ratios (BCRs) greater than 1 (where the BCR represents the relationship between the discounted benefits and the costs of a project).

More specifically, for the provision of unallocated water held as strategic water infrastructure reserve (i.e. a capped yield of 76,000 ML/a), the construction of the Rookwood Weir Stage 2 (with no further development at the Eden Bann Weir), the raising of the Eden Bann Weir Stage 3 (without construction of Rookwood), or the full project development scenario (Rookwood Stage 2 plus Eden Bann Stage 3) would each result in BCRs of approximately 2.9 (but with wide ranging NPVs).

The EIA included a sensitivity analysis which demonstrated the impact of changes in the discount rate, capital costs and water prices for all development scenarios. The analysis found that the BCR was similarly influenced by changes to each of these variables. In all cases, the project would deliver a net benefit to the community.

5.7.4 Coordinator-General's conclusion

I am satisfied that the EIS has appropriately evaluated the economic impacts of the project and that the matters included in the BCA are sufficient to evaluate the net benefits of the project.

5.8 Traffic and transport

5.8.1 Background

The existing roads in the vicinity of the project are mostly bitumen sealed roads, local unsealed gravel roads and private access roads. The flood immunity of the roads is generally poor and culverts and bridges are subject to frequent flooding.

The EIS described the results of a traffic impact assessment (TIA) which assessed the potential impacts of construction traffic on the existing road network. This assessment was undertaken in accordance with DTMR's *Guidelines for Assessment of Road Impacts of Development* (2006) (GARID). The TIA was based on the maximum traffic impact scenario at the Eden Bann Weir raising and Rookwood Weir construction occurring simultaneously and to the full supply level.

The EIS predicted traffic numbers for each weir during the various construction phases of mobilisation and site preparation, weir construction, installation of the flap gates and equipment and demobilisation. During these phases the project is expected to generate the types and numbers of traffic detailed in tables 5.8 and 5.9.

Table 5.8 Construction traffic generation for Eden Bann Weir

Vehicle type	Mobilisation and site preparation	Construction	Flap gates and equipment installation	Demobilisation
Vehicle transporter	4 single trips	2 single trips		4 single trips
Oversized vehicles	10 single trips		18 single trips	10 single trips
Trucks	30 trips daily	5 trips daily	5 trips daily	30 trips daily
Bulk tankers (for delivery of cement and fly ash)		1 trip daily		
Fuel truck	1 weekly	1 weekly	1 weekly	1 weekly
Workers bus	1 daily	1 daily	1 daily	1 daily
Light vehicles	10 daily	20 daily	10 daily	10 daily

Table 5.9 Construction traffic generation for Rookwood Weir

Vehicle type	Mobilisation and site preparation	Construction	Flap gates and equipment installation	Demobilisation
Vehicle transporter	4 single trips	2 single trips		2 single trips
Oversized vehicles	10 single trips		14 single trips	10 single trips
Trucks	30 trips daily	5 trips daily	5 trips daily	30 trips daily
Bulk tankers (for delivery of cement and fly ash)		1 trip daily		
Fuel truck	1 weekly	1 weekly	1 weekly	1 weekly
Workers bus	1 daily	1 daily	1 daily	1 daily
Light vehicles	15 daily	30 daily	15 daily	15 daily

It is anticipated that construction would be a six-day per week operation with one construction shift limited to daylight hours (operating from 6.00 am to 6.00 pm). Night-time haulage of materials and plant on public roads is not anticipated.

5.8.2 Submissions received

Key issues regarding traffic and transport raised in submissions on the EIS and AEIS include:

- that the location and design of the Capricorn Highway/Third Street intersection at the township of Gogango may require changes due to the close proximity of the Gogango Creek Bridge and Young Street
- concerns relating to the flood immunity of the Foleyvale crossing during the operation of Rookwood Weir Stage 1.

In my evaluation of the project, I have considered each submission and the responses provided by the proponents and my assessment is provided below.

5.8.3 Impacts and mitigation

The EIS identified potential impacts on the road network resulting from the generation of construction and operation traffic and the impacts on river crossings resulting from inundation during operation.

For Eden Bann Weir, impacted roads would include:

- the Bruce Highway and Rockhampton–Ridgeland Road (state-controlled roads)
- Atkinson Road, Mona Vale Road and Eden Bann Road (local roads managed by LSC)
- Ridgeland Road and Glenroy Road (local roads managed by LSC)

For Rookwood Weir, impacted roads would include:

- the Capricorn Highway (state-controlled road)
- Third Street, Riverslea Road, Thirsty Creek Road and Duaringa-Apis Creek Road (local roads managed by RRC).

The EIS also assessed the potential impacts of the project on river crossings resulting from inundation upstream of the Rookwood and Eden Bann Weirs and impacts downstream of the weirs resulting from operational releases. The assessment identified three crossings that would be affected by inundation that would require upgrading to maintain the connectivity and function of the existing road network—the Glenroy, Riverslea and Foleyvale Crossings. In addition, the Hanrahan Crossing would require an upgrade to facilitate water releases downstream of the Rookwood Weir.

Each crossing upgrade would be undertaken at the following project stages—when the project is expected to have a significant negative impact on the flood immunity of each crossing:

- Glenroy Crossing low level bridge—Eden Bann Stage 2
- Riverslea Crossing low level bridge—Rookwood Stage 1
- Hanrahan Crossing pipe and culvert upgrade—Rookwood Stage 2
- Foleyvale Crossing low level bridge—Rookwood Stage 2.

Eden Bann Weir

Construction traffic

The TIA found that for the Eden Bann Weir raising, construction traffic and heavy vehicle movements would significantly increase¹⁸ traffic on Atkinson Road necessitating a pavement impact assessment and road safety audit during the detailed design phase.

The TIA found that construction traffic would not have a significant impact on traffic operation or pavements on the Bruce Highway approaches to the project access roads.

Weir access roads

The existing access to the northern bank of the Eden Bann Weir is via Eden Bann Road. The proponents have committed to upgrade sections of Eden Bann Road to improve the level of service of the road during flood events as well as provide a flood channel to facilitate flow to waterholes and lake areas as per existing conditions. Upgrading would comprise a raised earth embankment with pipe culverts.

The proponents have also committed to construct a new 12 km private access road from Ridgeland Road to facilitate access to the southern bank of the Eden Bann Weir prior to Stage 2 raising.

¹⁸ A significant increase in traffic, according to the DTMR Guidelines for the Assessment of Road Impacts of Development, is an increase in project traffic equal to or greater than five per cent in either traffic numbers (expressed as average annual daily traffic AADT) or axle loadings (expressed as ESAs).

Upgrades to local roads and river crossings

The EIS identified that Glenroy Road would require upgrading during the construction of Eden Bann Weir Stage 2. Specifically, the proponents have committed to the construction of a new low level bridge at Glenroy Crossing in conjunction with upgrades to the approaches to the crossing on Glenroy Road. The eastern approach would require 150 m of new road and the western approach would require 520 m of new road.

Upgrades to state-controlled roads

The TIA identified that the intersection of the Bruce Highway and Atkinson Road at Canoona would require upgrading to facilitate project traffic prior to the construction of Eden Bann Weir Stage 2. The proponents have committed to augment the intersection by increasing the width and length of the basic right/auxiliary left-turn treatment.

Rookwood Weir

Construction traffic

The TIA found that, for the construction of Rookwood Weir, construction traffic and heavy vehicle movements would increase annual average daily traffic and equivalent standard axles (ESAs) by more than 5 per cent on Third Street and require:

- a pavement impact assessment and road safety audit during detailed design
- the implementation of traffic management measures such as improved visibility of warning signage and reduced traffic speeds.

The TIA found that construction traffic would not have a significant impact on traffic operation or pavements on the Capricorn Highway approaches to the project access roads.

Weir access road

To facilitate access to Rookwood Weir, the proponents have committed to augment Thirsty Creek Road to facilitate construction access and maintain operational access. The Thirsty Creek Road upgrade would include road surface regrading, upgrading and new culverts and potential road widening, curve realignment and other works to be assessed during the detailed design phase.

Upgrades to local roads and river crossings

The EIS identified that Stage 1 of the Rookwood Weir construction would trigger the need for upgrades on Riverslea and Hanrahan Roads.

Specifically, Riverslea Road would require a new low level bridge at Riverslea Crossing and approximately 500 m of new road to accommodate the realignment of approaches.

The existing Hanrahan Crossing on Hanrahan Road would be inundated by operational releases from Rookwood Weir of up to 50 m³/s. The proponents have committed to install a bank of new culverts and a causeway to mitigate this impact and maintain connectivity along Hanrahan Road across the Fitzroy River during water releases from Rookwood Weir.

Upgrades to state-controlled roads

The TIA identified two state-controlled roads in the vicinity of Rookwood Weir that would require upgrades as a result of construction traffic impacts. Proposed works include:

- upgrading the Capricorn Highway and Third Street intersection at Gogango—including improving the acceleration lane heading east from Third Street onto the Capricorn Highway and constructing a channelised right-turn treatment with a short-turn slot treatment to provide safer access and egress conditions prior to the construction of Rookwood Weir Stage 1
- constructing a new low level bridge at the Foleyvale Crossing on Duaringa-Apis Creek Road during Stage 2 to accommodate impoundment impacts and approximately 400 m of new road either side of the river to accommodate realignment of approaches to the bridge.

The AEIS acknowledged that further assessment, in consultation with DTMR and RRC, would be required during detailed design of the Capricorn Highway/Third Street intersection to take account of the proximity of the Gogango Creek Bridge and Young Street.

Road-use management and traffic management plans

Prior to the commencement of construction, the proponents have committed to develop road-use management plans (RMPs) for both weirs in consultation with DTMR and RRC and in accordance with state and local government policies and guidelines. The RMPs would enable a more detailed update of traffic generation and road-use data and govern the need for road upgrades, maintenance, restoration, and road-use management strategies for impacted roads.

For the detailed design phase, the proponents have also committed to:

- develop traffic management plans (TMPs) in consultation with DTMR, the Queensland Police Service and regional school bus operators
- update traffic counts and undertake pavement impact assessments and a road safety audit
- for Eden Bann Weir raising, undertake a dilapidation survey of the Atkinson Road/Bruce Highway intersection
- for Rookwood Weir, undertake a dilapidation survey of the Capricorn Highway/Third Street intersection to provide information necessary to restore this intersection to its original condition post-construction.

Operation

Traffic impacts

During the operational phase of the project, the volume of traffic generated would be generally limited to maintenance personnel accessing the weir site which is expected to be minimal. Accordingly, I am satisfied that operational traffic would not have any adverse impacts on the road network.

Impacts on river crossings

The EIS and AEIS presented the findings of hydraulic modelling that showed that the current annual average time of closure (AATOC) for the upgraded river crossings during flood events would be reduced after the construction of the proposed weirs and new river crossings. The modelling also indicated that the flood immunity of the upgraded river crossings would be improved during a range of flood events ranging from a two-year average recurrence interval (ARI) event to a 100-year ARI event and that the proposed upgrades would reduce the duration of flooding at each crossing.

The new crossings at Riverslea and Foleyvale would be designed to withstand a two-year ARI flood event, in contrast to the current AATOC of 23 days or more for the existing crossings. The design of the new Glenroy Crossing would reduce the AATOC during a two-year ARI flood event from 23.5 days to 2.2 days. The Hanrahan Crossing would be built to fully mitigate the impacts of the project and facilitate access during operational releases.

Foleyvale Crossing hydraulic assessment

DTMR raised concerns during the public consultation period on the AEIS that the hydraulic assessment did not assess the potential impacts of the Rookwood Weir Stage 1 inundation on the flood immunity of the Foleyvale Crossing on the state-controlled Duaringa-Apis Creek Road during smaller flood events (i.e. more frequent events than a 2-year ARI event). Accordingly, DTMR require the proponents to establish the estimated time of closure during smaller flood events prior to the commencement of Rookwood Weir Stage 1 and take these impacts into consideration as part of the detailed bridge design and timeframe for upgrading the Foleyvale Crossing. Accordingly, I have recommended a condition requiring the proponents to complete an additional hydraulic assessment prior to the construction of Rookwood Weir to determine if any additional flood mitigation is required.

5.8.4 Coordinator-General's conclusion

I am satisfied that the EIS adequately evaluated the impacts of the project on traffic, transport and road infrastructure. I have recommended in appendices 6 and 7 that the proponents submit a road impact assessment, a TIA and a RMP to DTMR, RRC and LSC. These assessments and plans would identify works and measures to maintain the safety, condition and efficiency of state-controlled and local roads for each stage of the Rookwood Weir construction and Eden Bann Weir raising.

I have recommended that the road condition surveys, RMPs and TMPs for each weir be completed at least six months prior to the commencement of construction. I further recommend that construction of the Rookwood Weir and works to raise Eden Bann Weir do not commence until the RMP and TMP are approved by DTMR, RRC and LSC.

Where roadworks are required, I have recommended these be completed and approved by DTMR, RRC and LSC before the commencement of significant construction works on either weir.

Furthermore, I recommend that the proponents enter into an infrastructure agreement with the LSC, RRC and/or DTMR to formalise arrangements about:

- works and contributions required to upgrade impacted road infrastructure and provide vehicular access
- contributions to the cost of maintenance and rehabilitation of road or pavement impacts
- criteria for updating traffic assessments and impact mitigation measures based on actual traffic volume and impacts, should the predicted project details, traffic volumes and/or impacts change.

I am satisfied with the proponents' commitments to mitigate the impacts of the project on road crossings with the construction of new bridges at Glenroy Crossing, Riverslea Crossing and Foleyvale Crossing including the new culverts and causeway to be installed at Hanrahan Crossing.

To address concerns about the flood immunity of the Foleyvale crossing, I have recommended that the proponents complete an additional hydraulic assessment at least six months prior to the commencement of construction of the Rookwood Weir. I further recommend that, subsequent to that assessment, DTMR would determine whether any additional flood protection mitigation is required.

I note that the proponents have made a number of specific project commitments (Appendix 8) and identified measures in the draft EMP relating to the management of project impacts on state-controlled and local roads and road users. These commitments, supplemented by the recommendations in appendices 6 and 7, should be adequate to avoid or mitigate project impacts on roads and address the concerns of submitters on the EIS.

5.9 Air quality

5.9.1 Background

The EIS reported that construction activities would generate localised dust impacts at the Rookwood and Eden Bann Weir sites, the Foleyvale, Riverslea and Hanrahan crossings and along access roads. Dust emissions would be generated by activities such as:

- mechanical ground disturbances, excavation activities, crushing and screening of aggregate and concrete batching within the construction area
- construction vehicles travelling over unsealed sections of access roads
- exposed disturbed soil surfaces under elevated wind speeds
- disposal of blast material and dust releases during blasting.

Other sources of air emissions include equipment and motor vehicles and stationary plant diesel engine exhausts.

Due to the project's rural and remote location, no publicly accessible air quality monitoring is available in proximity to the project. DEHP does not conduct air quality monitoring within the Rockhampton areas. Accordingly, baseline air quality values have

been adopted based on a review of baseline monitoring undertaken for projects in the Bowen Basin which are considered representative of air quality values in the project area. This data indicates that the existing environment is expected to have low levels of existing pollutants, particulate matter, total suspended particles and dust deposition.

Sensitive receptors

The project is rural in nature and relatively isolated and, as a result, there are few sensitive receptors in close proximity to the project. The EIS identified four sensitive receptors with the potential to be impacted by dust or particulate matter generated by construction activities, including three homesteads and the town of Gogango which has a population of 310 (as at 2011¹⁹). The four sensitive receptors are listed in Table 5.10.

There are no air quality sensitive receptors in close proximity to:

- the proposed Rookwood Weir—the nearest homestead is 3.5 km west of the construction area
- the Hanrahan or Foleyvale Crossings
- the new Eden Bann access road—the closest homestead is approximately 2 km west of the proposed alignment.

Table 5.10 Air quality sensitive receptors

Receptor number	Receptor type	Nearest construction area/activity	Distance from construction area/activity
1	Homestead	Eden Bann Weir and access road	750 m from the existing Eden Bann Weir; 450 m from the existing (and proposed construction) left bank access road
2	Homestead	Glenroy Crossing (bridge)	700 m
3	Homestead/outbuildings	Riverslea Crossing (bridge)	700 m
4	Gogango town	Road and intersection upgrade	<50 m

5.9.1 Submissions received

One issue was raised in the submissions on the EIS which identified that the dust deposition reporting period should be on a monthly rather than annual basis. The proponents have subsequently updated this criteria in the draft EMP (120 milligrams per square metres per day ($\text{mg}/\text{m}^2/\text{day}$) monthly average).

5.9.2 Impacts and mitigation

The EIS reported that air quality impacts are not expected to affect any sensitive receptors during construction activities and that impacts associated with operations are likely to be negligible. During construction, localised dust impacts are anticipated at each of the weir sites, river crossings, intersection upgrades and along access roads.

¹⁹ 2011 Census

However, it is not expected that dust generated as a result of construction of the project would exceed the following air quality objectives adopted for the project at offsite sensitive receptors:

- 50 $\mu\text{g}/\text{m}^3$ (micrograms per cubic metre) of airborne particulates of 10 microns diameter (PM_{10}) or less, averaged over a 24-hour period (5 days per year exceedance)
- 90 $\mu\text{g}/\text{m}^3$ total suspended particles, averaged annually
- dust deposition of 120 $\text{mg}/\text{m}^2/\text{day}$, averaged monthly.

The most intensive dust-generating activities during construction would occur at the Rookwood Weir site. The EIS predicted that weir construction, combined with typical background dust levels, would result in the maximum concentration of PM_{10} being in the order of 40 $\mu\text{g}/\text{m}^3$ which would be below the air quality objectives stated in the Environmental Protection (Air) Policy 2008 (EPP [Air]) of 50 $\mu\text{g}/\text{m}^3$. Similarly, the maximum dust deposition rate was estimated at 60 $\text{mg}/\text{m}^2/\text{day}$, which is also below the stated objective 120 $\text{mg}/\text{m}^2/\text{day}$. Therefore, I am satisfied that the air quality mitigation measures described in the draft EMP for the project would ensure that the impacts of project activities would be acceptable.

The EIS did not present data relating to the air quality impacts of road construction activities on the town of Gogango, located less than 50 m from where the intersection of Third Street and the Capricorn Highway would be upgraded, as described in Section 5.8. Due to the close proximity of the roadworks to residences, I consider that it is necessary that the proponents implement dust mitigation and management measures to ensure the project complies with the EPP (Air). Therefore, I have included in my recommendations a requirement that DTMR approve the dust management control measures for those intersection upgrade works.

Measures to manage and mitigate the generation of dust emissions and achieve air quality objectives are proposed in the draft EMP. The draft EMP states three air quality performance criteria which correspond to the requirements of the EPP (Air):

- (1) negligible air and dust impacts to sensitive receptors
- (2) comply with approval conditions and air quality objectives
- (3) to have complaints responded to in a timely and considerate manner with an initial response within 24 hours.

To manage air quality impacts, the draft EMP states that the proponents would:

- consider climatic conditions during construction
- minimise areas of cleared and exposed soil
- stabilise/rehabilitate exposed soils as soon as possible
- cover/dampen stockpiles
- minimise traffic on unsealed roads
- control dust on access roads with water spray where required
- cover/dampen loads during haulage
- enforce low speed limits during construction and limit vehicle access to essential construction vehicles only

- regularly maintain all construction equipment and machinery to ensure efficient operation
- where appropriate, turn off or throttle down all construction equipment and machinery when not in use
- use blasting mats to prevent excessive dispersal of blast material and to reduce dust releases
- store paints, thinners, solvents and other volatile organic substances in sealed containers.

The draft EMP describes the monitoring and corrective actions that would be implemented in the event of any air quality complaints and I am satisfied these measures would be adequate to manage potential impacts on sensitive receptors.

5.9.3 Coordinator-General's conclusion

While the EIS has evaluated the impacts of the project on air quality sensitive receptors, I note that the duration and magnitude of impacts of roadworks at the intersection of the Capricorn Highway and Third Street at Gogango require further detailed assessment. Accordingly, I have made a recommendation (Appendix 7) that the proponents' dust management measures be approved by DTMR prior to the commencement of construction of that intersection upgrade.

For all other matters, I accept that the proponents' commitments to implement the air quality measures set out in the draft EMP are sufficient to manage impacts.

5.10 Waste management

The EIS identified potential impacts and mitigation measures associated with the type, quantity and nature of waste that may be generated by the project during both construction and operation. The EIS also identified the relevant legislative and regulatory framework for waste management, which includes the *Waste Reduction and Recycling Act 2011* (Qld) (WRR Act), the *National Waste Policy 2009* (Cwlth) and the *National Environment Protection Council Act 1994* (Cwlth).

Throughout the project's lifecycle, a variety of solid and liquid waste streams would be generated. The EIS identified the estimated quantity of waste types and potential impacts that are likely to be generated during the construction phase which would be produced during different phases of the project's preparation, construction, operation and decommissioning.

There were no issues regarding waste management impacts of the project raised in submissions on the EIS.

5.10.1 Impacts and mitigation

The EIS reported that potential waste types generated by the project during construction would include:

- construction building waste (timber, scrap metal, concrete, building material and wastewater run-off)

- excavated waste/spoil from earthworks and road construction
- vegetated waste associated with land clearing
- regulated wastes (lubricants, waste oil, tyres and batteries)
- general waste from construction workers.

The EIS stated that, prior to commencement of construction, a waste management plan (WMP) would be developed as part of the draft EMP and implemented over the life of the project. The WMP would involve the identification of waste streams, appropriate transport, storage and disposal and review of management practices. A strategy for managing wastes generated during all project phases has been developed in accordance with best practices, legislation, policies and strategies relevant to waste management.

The project would incorporate waste management measures such as waste avoidance, waste reduction, waste re-use, waste recycling and waste disposal. The EIS described the implementation of management measures which includes the following:

- waste would not be stored on land outside of the construction area
- licensed waste contractors would remove, track and record any regulated waste
- recycled materials with the potential to be re-used on site or transported off site by a licensed contractor to a licensed recycling plant
- spill clean-up material (used for fuel and/or chemical spills) and contaminated soil is to be stored and disposed of appropriately through a licensed contractor
- waste that cannot be recycled or re-used would be disposed of by a licensed waste contractor at an appropriate waste and recycling facility.

The proponents would be required to obtain approval for the management and disposal of waste generation. Such assessment of waste management would require separate approvals under the WRR Act.

I consider that the WMP contains sufficient technical details to demonstrate that it meets the relevant waste management and reporting requirements.

5.10.2 Coordinator-General's conclusion

I am satisfied that the potential impacts of project waste can be adequately managed through the proponents' commitments and the development and implementation of a WMP to improve waste management practices and reduce the project's potential waste management risks.

I consider that the EIS assessment adequately demonstrates waste impacts would be effectively managed to avoid adverse impacts on environmental values and associated ecosystems surrounding the project area.

5.11 Noise and vibration

The EIS reported that, during construction, noise and vibration could be generated by activities such as earthworks, blasting at the Rookwood Weir site, concrete batching

and aggregate screening, pile driving at river crossings and the operation of excavators, trucks, generators and dewatering pumps.

During operation the only source of noise would be from water running over the weir crest during high flow conditions.

Due to the project's rural location, and the separation distance to sensitive receptors, noise and vibration monitoring was not considered necessary as part of the EIS. Instead background noise values from Australian Standard 1055.3-1997 (Acoustics—Description and measurement of environmental noise) were used to estimate background noise levels. The standards identified that the project location would be typical of a rural area with low background noise levels and no perceptible ground vibration.

5.11.1 Submissions received

One submission was received on the EIS which requested further information demonstrating how the project would comply with the Environmental Protection (Noise) Policy 2008 (EPP [Noise]). I have considered the proponents' response to the submission in my evaluation of the project and my assessment is provided in relevant sections below.

5.11.2 Impacts and mitigation

The EIS reported that construction noise and vibration impacts are expected to be localised, intermittent, occur over short durations, are likely to move within the construction areas and would be mostly confined to daytime hours.

Sensitive receptors

The EIS identified eight sensitive receptors (listed in Table 5.11) with the potential to be impacted by noise and vibration generated by construction activities, including seven homesteads and the community of Gogango. The sensitive receptors are located within the vicinity of different construction areas—the Eden Bann and Rookwood Weirs, the Glenroy, Riverslea, Hanrahan and Foleyvale crossings, access roads and intersection upgrades. The sensitive receptors are listed in Table 5.11.

Table 5.11 Noise and vibration sensitive receptors

Receptor number	Receptor type	Nearest construction area/activity	Distance from construction area/activity
1	Homestead	Eden Bann Weir and access road	750 m from the existing Eden Bann Weir; 450 m from the existing (and proposed construction) left bank access road
2	Homestead	Glenroy Crossing (bridge)	700 m
3	Homestead/ outbuildings	Riverslea Crossing (bridge)	700 m
4	Gogango town	Road and intersection upgrade	<50 m
5	Homestead	Rookwood Weir	3,500 m

Receptor number	Receptor type	Nearest construction area/activity	Distance from construction area/activity
6	Homestead	Foleyvale Crossing (bridge)	2,200 m
7	Homestead	Hanrahan Crossing (culverts)	3,100 m
8	Homestead	Eden Bann Weir access road (right bank)	2,000 m

Noise impacts

The EIS predicted that construction noise levels would be audible for receptors 1, 2 and 3 identified in Table 5.11 and could exceed the 50 A-weighted decibel (Db(A)) limit required by the EPP (Noise). However, these predicted impacts were based on conservative assumptions, including that all equipment would be operating concurrently; that there would be no shielding or ground attenuation; and that the equipment would be operating in the worst-case position on the site.

While the EIS identified potential impacts of traffic on the town of Gogango, I consider that the impacts of the upgrade of the Capricorn Highway/ Third Street intersection at Gogango requires management to ensure residents in Gogango are not impacted by noise and vibration associated with the intersection upgrade construction activities. Therefore, I have included in my recommendations a requirement that DTMR approve the noise management control measures for those intersection upgrade works.

Vibration impacts

The EIS reported that the use of construction plant and equipment and activities such as piling for bridge construction at river crossings has the potential to cause vibration impacts. However, predicted ground vibration levels dissipate rapidly with distance from the source and are generally expected to be below accepted criteria within 100 m of the source. As all vibration specific sensitive receptors are located at distances of 700 m or more from piling activities occurring during the construction of the bridges at the Glenroy, Riverslea and Foleyvale crossings, they are not expected to be adversely affected as a result of vibration activities.

Mitigation

A construction noise and vibration management plan is incorporated into the draft EMP which includes a detailed list of measures that could be implemented to avoid or minimise impacts on sensitive receptors and amenity. The draft EMP:

- proposes that noisy construction activities are to be conducted during daytime working hours and that night works are to be restricted as far as practicable
- describes the communication that would take place between the proponents and local residents about construction works that may be particularly noisy or generate vibration that may affect them
- describes noise reduction measures, a complaints management procedure, monitoring methods and corrective actions to be undertaken if required.

The AEIS identified specific measures to manage noise impacts in response to submitter concerns about impacts on sensitive receptors to prevent noise levels exceeding 50 Db(A) including:

- using shielding or portable noise barriers around jackhammers and rock breakers as far as is practicable
- situating the concrete batching plant at the farthest distance possible from the receptors
- using screening or barriers to reduce noise levels
- implementing a noise management plan that would include specific actions for piling such as respite periods, where periodic breaks occur or activities are restricted to certain hours.

5.11.3 Coordinator-General's conclusion

While the EIS has evaluated the impacts of the project on noise and vibration sensitive receptors, I note that the duration and magnitude of impacts of roadworks at the intersection of the Capricorn Highway and Third Street at Gogango may result in noise and vibration impacts on sensitive receptors. Accordingly, I have made recommendations (Appendix 6 and Appendix 7) that the proponents' noise and vibration management measures be approved by DTMR prior to the commencement of construction of that intersection upgrade.

For all other matters, I accept that the proponents' commitments to implement noise and vibration management measures set out in the draft EMP are sufficient to avoid unacceptable impacts.

5.12 Hazard and risk

The EIS presented an analysis of hazard and risk impacts that may arise from construction or operation of the project. The proponents conducted a preliminary assessment of hazard and risk for all components and phases of the project to determine potential impacts on the health and safety of people and property. The assessment, undertaken in accordance with the requirements of the *AS/NZS ISO 31000: 2009 Risk management – Principles and guidelines*, also proposed mitigation measures to address potential hazards and risks.

The WSSR Act sets the legislative framework for dam safety in Queensland. SPA establishes a framework for development assessment, which includes the WSSR Act which deals with particular dams that must be failure impact assessed.

5.12.1 Submissions received

Key issues regarding the hazards and risks of the project raised in submissions on the EIS and AEIS related to the following:

- requirement for a bushfire site assessment to be conducted
- compliance with relevant legislation and implementation of appropriate management systems to mitigate hazards and risks

- the process for referable dam assessment, including the assessment for weir design and safety.

I have considered each submission and the responses provided by the proponents in my evaluation of the project and my assessment is provided in relevant sections below.

5.12.2 Impacts and mitigation

The potential hazards and risks of the project were assessed to rate their potential consequence, likelihood and outcome. The proponents intend to avoid, manage, minimise or mitigate each identified risk that may arise during construction and operation, using both preventative and responsive measures, as outlined in the draft EMP. There would be an ongoing hazard and risk assessment throughout the life of the project.

Construction risks

The EIS identified the potential impacts and relevant preventative and responsive measures to be adopted. The analysis included an assessment of potential hazards as having a residual high risk level, which included:

- project-related traffic accidents
- interaction with external factors and or third parties
- spill or leak of hazardous materials
- natural hazards such as tropical cyclones, bushfires and severe storms
- wildlife hazards such as bites and stings.

The project would potentially use a number of environmentally hazardous substances which would be stored and handled in accordance with appropriate legislation and Australian standards. Trucks used to transport diesel would comply with all aspects of the Australian Code for Transport of Dangerous Goods by Road and Rail.

The proponents propose to develop incident response plans for oil spill, traffic-related incidents, fire and explosion with appropriate preventative measures, to minimise the risk of accidental spills and leaks of hazardous substances, responding to vehicular accidents and any potential firefighting during the construction phase.

Any potential emergency situations at the project site would require effective planning and management to reduce potential impacts. The proponents have committed to develop an emergency response plan which has linkages to an incident response management system. Furthermore, in response to a submission, the proponents have committed to undertake a bushfire site assessment and incorporate the outcomes into emergency response plans for the construction and operational phases.

Operational risks

The operational risk assessment included a description of potential risk events such as disruption to water supplies, road accidents, weather events, wildlife hazards and weir failure.

The assessment identified 14 potential hazards during operation which resulted in five high risks and nine medium risks in the absence of management and mitigation. After

mitigation measures are implemented, the residual risks comprise three medium risks and 11 low risks. The findings from the operational risk assessment would inform the development and implementation of a detailed draft EMP.

The draft EMP includes management plans to protect environmental values. All potential operational hazard event incidents would be addressed through incident response plans. The proponents have committed to prepare incident response plans that would incorporate both workplace health and safety requirements and community and environmental hazard management. These plans would document the response systems that would be implemented in the event of an incident at the site.

Emergency response plans including emergency management for identified scenarios such as spills and leakages, weir failure, vehicle collisions and fire prevention and detection would be developed for the construction and operation phases of the project in consultation with relevant state emergency providers. The proponents have also committed to ongoing consultation with relevant emergency service agencies on hazard and risk issues.

I note that in the draft EMP, response measures to facilitate communication and liaison with all relevant and representative agencies have been appropriately addressed.

Weir design

In response to a submission, the proponents have clarified the regulatory process for referable dams and the associated development assessment framework for weir design and safety.

Weir failure could place the population downstream at risk and cause significant damage to downstream watercourses, such as scouring and vegetation removal. The EIS reported that the primary cause of failures could be inadequate site analysis, design and construction.

The provisions of the WSSR Act apply only to the project for the raising of Eden Bann Weir to Stage 3 and constructing Rookwood Weir to Stage 2, as gates proposed for these stages would be greater than 10 m in height, with a storage capacity of more than 1,500 ML.

The proponents undertook a failure impact assessment (FIA) for the proposed Eden Bann Weir Stage 3. The FIA estimated the incremental population at risk due to a breach is greater than two people for all considered scenarios and, therefore identified Eden Bann Weir Stage 3 as a referable dam under the WSSR Act requiring it to be assessed against the following dam safety guidelines:

- Guidelines on Acceptable Flood Capacity for Water Dams²⁰
- Guidelines for Failure Impact Assessment of Water Dams²¹
- Queensland Dam Safety Management Guidelines.²²

²⁰ Guidelines on Acceptable Flood Capacity for Water Dams, DEWS (Qld) August 2016. Viewed on 15 November 2016.

²¹ Guidelines for Failure Impact Assessment of Water Dams, DEWS (Qld) 2012. Viewed on 15 November 2016.

²² Queensland Dam Safety Management Guidelines, DNRm (Qld) February 2002. Viewed on 15 November 2016.

I note that the FIA has not been assessed by the Chief Executive of DEWS. The FIA must be accepted by the Chief Executive of DEWS prior to lodgement of a development application under SPA for a particular dam. I note that an assessment of a particular dam would be undertaken through a separate approval process which is not addressed as part of this report.

The results of the FIA for the proposed Rookwood Weir Stage 2 revealed that none of the properties identified in the EIS are potentially at risk with a present estimate of incremental population at risk being less than two people. Therefore, the EIS noted that the proposed Rookwood Weir is not expected to be a referable dam. Both weirs would be assessed at five yearly intervals to determine populations at risk.

The proponents outlined preventative measures to reduce the likelihood of weir failure which includes ensuring the weir design complies with the Queensland Dam and Australian National Committee on Large Dams guidelines, and peer review of design and construction of the weir.

5.12.3 Coordinator-General's conclusion

The proponents have committed to safely manage and minimise risks to the workforce, public and surrounding land uses throughout all stages of the project. These commitments include developing emergency response plans, defining roles and responsibilities and ongoing liaison with local emergency services once development of the project has commenced.

After evaluating the mitigation measures contained within the draft EMP, and legislative requirements which establish minimum health and safety standards, I am satisfied the construction and operation of the project would provide the appropriate management of hazards and risks.

Based on the information provided in the EIS and AEIS, I conclude that the proponents have conducted a thorough hazard and risk assessment for the proposed project. I consider the strategies proposed to manage the hazards and risks of the project during construction and operation to be consistent with accepted standards that focus on minimising risks to people, property and the environment.

I consider the EIS included satisfactory information to demonstrate that the weirs would be designed, constructed and operated to Australian guidelines and safety standards.

I note that the proponents have made a number of specific commitments (Appendix 8) and in the draft EMP relating to the implementation of incident response and reporting management systems and I consider that the measures in the recommendations, proponents' commitments and the draft EMP would suitably avoid, manage or mitigate project impacts and address the concerns of submitters on the EIS.

6. Matters of national environmental significance

6.1 Introduction

This section addresses the potential impacts of the Lower Fitzroy River Infrastructure project (the project) on matters of national environmental significance (MNES) protected under the EPBC Act.

On 22 October 2009, the project was referred to the then Department of Sustainability, Environment, Water, Population and Communities (now DEE) for consideration under the EPBC Act. On 7 January 2010, the Commonwealth Environment Minister determined that the project was a controlled action under the EPBC Act (reference number EPBC 2009/5173) for the following controlling provisions:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- listed threatened species and communities (sections 18 and 18A)
- listed migratory species (sections 20 and 20A).

The EIS process has been undertaken in accordance with the requirements of the bilateral agreement between the Queensland and Australian Governments.

6.2 Project description

Sunwater and the GAWB (the proponents) propose to raise the existing Eden Bann Weir and construct and operate a new weir near the Rookwood Crossing on the Fitzroy River. The purpose of the project is to improve current water security and meet future demand for water supply for Rockhampton, Gladstone and the Capricorn Coast.

At full development, the weirs would store sufficient water to reliably supply 76,000 ML per annum (ML/a) of unallocated, high priority water. This would include a:

- reservation of up to 30,000 ML/a of reliable water for urban and industrial use for Gladstone (through GAWB)
- reservation of 4,000 ML/a of reliable water for urban needs on the Capricorn Coast
- reservation of the balance (42,000 ML/a) for other urban, industrial and agricultural purposes.

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

The proposed stages for raising Eden Bann Weir are:

- raising the weir to a FSL of 18.2 m Australian Height Datum (AHD) (from existing Stage 1 FSL of 14.5 m AHD) and associated impoundment of the Fitzroy River—Stage 2

- the addition of 2 m high flap gates to raise the weir structure to a FSL of 20.2 m AHD and associated impoundment of the Fitzroy River—Stage 3.

The proposed stages for the construction of the Rookwood Weir are:

- construction of a roller-compacted concrete gravity weir with a FSL of 45.5 m AHD, saddle dams, and associated impoundment of the Fitzroy, Mackenzie and Dawson Rivers—Stage 1
- the addition of 3.5 m high flap gates to raise the structure to a FSL of 49 m AHD and associated impoundment of the Fitzroy, Mackenzie and Dawson Rivers—Stage 2.

While construction of the Rookwood and Eden Bann Weirs may be undertaken simultaneously, it is more likely that the weirs would be developed at different times. Similarly, construction at each weir may be to maximum capacity without the interim stages described above. For the purpose of this assessment, it is assumed that both weirs would be developed to full capacity at both sites at the same time (i.e. the maximum impact scenario).

To accommodate raised water levels, three existing river crossings (low-level causeways) would be removed and replaced with low-level bridges. These works are proposed to be undertaken upstream of Eden Bann Weir (Glenroy Crossing) and upstream of the proposed Rookwood Weir site (Riverslea Crossing and Foleyvale Crossing). The existing low-level crossing downstream of the proposed Rookwood Weir site (Hanrahan Crossing) is also proposed to be augmented to accommodate operational releases made from Rookwood Weir.

The project would also involve upgrades to Thirsty Creek Road to provide construction traffic access to the Rookwood Weir site and the construction of access roads to and from the weir sites including a new 12 kilometre (km) access road to the right (southern) bank of the Eden Bann Weir.

Both weirs would be designed to include turtle passage infrastructure (turtleway) to facilitate turtle movement upstream and downstream of the weirs.

Both weirs would also be designed to incorporate fish passage infrastructure to allow for the safe passage of fish. At Eden Bann Weir this would include an upgraded fish lock on the left bank and a new fish lock on the right bank. Fish passage infrastructure at Rookwood Weir would include a right bank fish lock.

6.3 Project location

The project is located in the Fitzroy Basin catchment on the Fitzroy River, central Queensland. The Fitzroy Basin catchment covers an area of 142,000 km² and consists of six major sub-catchments, namely: Isaac; Connors; Nogoia; Comet; Mackenzie; Dawson and the Fitzroy. The proposed water storage infrastructure would be located within the lower Dawson, lower Mackenzie and Fitzroy River sub-catchments.

The existing Eden Bann Weir is located on the Fitzroy River, 62 km north-west of Rockhampton. The proposed Rookwood Weir would also be on the Fitzroy River approximately 10 km downstream from the Riverslea Road Crossing.

The rivers within the catchment are heavily regulated, with 5 dams, 11 weirs and a large tidal barrage (Fitzroy Barrage) currently operating within the Basin. This has resulted in approximately 36 per cent of the Fitzroy, Dawson and Mackenzie sub-catchments being impounded.

Two other dams have also been proposed within the catchment: including Nathan Dam on the Dawson River and Connors River Dam on the Connors River. The Connors River Dam and Pipelines project has State and EPBC Act (reference number 2008/4429) environmental approvals. The Nathan Dam is currently undergoing environmental impact assessment under the bilateral agreement (EPBC reference number 2008/4313).

6.4 World Heritage properties

6.4.1 Background

The World Heritage property relevant to the project site is the GBRWHA, which is located approximately 141 km downstream from the project site and includes the waters of the Fitzroy River estuary and Keppel Bay.

The GBRWHA is one of the world's largest World Heritage properties, extending 2000 km along the Queensland coastline and covering an area of approximately 348,000 km². The GBR was listed as a World Heritage Area in 1981 and meets all four natural World Heritage criteria which are detailed in the statement of outstanding universal values (OUVs) (see Appendix 10 of this report).

The four natural criteria relevant to the GBRWHA are:

- Criterion VII—contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
- Criterion VIII—be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
- Criterion IX—be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals
- Criterion X—contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

For each criterion, there are a number of attributes for which the property was listed. The EPBC Act *Referral Guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area* (2014) details the attributes which underpin each criterion. These attributes may not be expressed equally over the whole GBRWHA, and as such only attributes that are relevant to the project have been assessed in this report.

Criterion VII and VIII are not considered to be relevant to the project. Due to the considerable distance from the GBRWHA, the project would not have an impact on the aesthetics of the GBR coastal zone or impact on coastal geological processes.

As the project has the potential to impact on water quality and flow regimes of the Fitzroy River, which discharges into the GBRWHA, Criterion IX and X are relevant to the project. The Fitzroy River estuary and the adjacent marine waters provide habitat for a range of marine fauna which are considered to be OUVs of the GBRWHA. The coastal areas surrounding the Fitzroy River estuary provide important habitat for a number of migratory shore bird species and threatened species of bird, including the Capricorn Yellow-chat. These bird species inhabit and/or use areas which are subject to varying degrees of fresh and saltwater (tidal) influence. The marine waters surrounding these areas are known to support a number of threatened turtle species and inshore dolphins. The presence of these marine species is influenced by factors including water quality and hydrological processes, which influence the distribution of suitable foraging resources.

The Fitzroy Basin catchment where the project is located covers approximately 37 per cent of the total GBR catchment area. The Fitzroy Basin contributes substantial amounts of contaminants to the GBR lagoon, particularly during large-scale flood events. For example, the 2014 GBR Report Card²³ indicated that water quality guidelines for TSS were exceeded in over 50 per cent of the waters in the inshore GBR lagoon in the Fitzroy region during 2013/2014. That followed repeated flood events during this period.

In addition to flooding events, land uses within the catchment also contribute a large source of contaminants. Agriculture accounts for almost 90 per cent of land use in the Fitzroy Basin. The dominant land use is grazing. Intensive agriculture, such as cotton and grain cropping, is also prominent. In the 2013 *Reef Water Quality Protection Plan*²⁴ (2013 Reef Plan) the Fitzroy region was ranked as a medium-high risk to the health of the GBR for fine sediment, herbicides, pesticides and dissolved inorganic nitrogen (DIN).

Reef Rescue Water Quality Grants²⁵ projects and a range of other Government Reef investment programs have facilitated the adoption of improved land management practices by the agriculture industry within the catchment. As a result of these programs, there has been some reduction in the pollutant loads entering the GBR.

The Reef 2050 Long-Term Sustainability Plan

The Reef 2050 Plan is the overarching framework for the future protection and management of the GBR. It includes targets for water quality improvements, an implementation plan and an outline of an integrated monitoring and reporting program.

²³ The State of Queensland, *Great Barrier Reef Report Card 2014, Reef Water Quality Protection Plan*, pp. 132-133, viewed 28 October 2016, <http://www.reefplan.qld.gov.au/measuring-success/report-cards/2014/>

²⁴ The State of Queensland, *Reef Water Quality Protection Plan 2013: Securing the health and resilience of the Great Barrier Reef World Heritage Area and adjacent catchments*, Reef Water Quality Protection Plan Secretariat, 2013, viewed 20 August 2016, <http://www.reefplan.qld.gov.au/resources/assets/reef-plan-2013.pdf>

²⁵ National Landcare Program, The Australian Government Reef Programme, Australian Government, viewed 3 November 2016, <http://www.nrm.gov.au/national/continuing-investment/reef-programme>

2018 targets for anthropogenic, end-of-catchment water quality flow from priority areas to the GBR include at least a:

- 50 per cent reduction in DIN, on the way to achieving up to an 80 per cent reduction by 2025
- 20 per cent reduction in sediment, on the way to achieving up to a 50 per cent reduction by 2025
- 20 per cent reduction in particulate nutrients
- 60 per cent reduction in pesticide loads.

The Queensland and Australian Governments have also developed the 2013 Reef Plan to protect the GBR from land-based sources of dispersed pollution. The 2013 Reef Plan informs the Reef 2050 Plan.

While both the Reef 2050 Plan and the 2013 Reef Plan refer to government and other programs aimed at achieving water quality improvements, neither stipulate whether individual projects subject to government development approvals must deliver net water quality improvements in their own right. Consequently, I consider that for the purpose of this evaluation report:

- it is necessary to consider the impacts of the consequential use of water from the project on the quality of water flowing to the GBR lagoon
- these impacts cannot be accurately quantified due to the unspecified agricultural development by third parties at unidentified locations it is reasonable for me to require the proponents to put in place achievable measures to both monitor the impacts of such future development and increase the probability that water quality improvements occur in line with the Reef 2050 Plan.

6.4.2 Impacts and mitigation

Water quality impacts—construction

Given its considerable distance from the GBR, construction of the project has limited potential to have any direct impacts on the water quality of the GBRWHA.

The proponents have committed in the draft environmental management plan (EMP) to a number of measures to ensure that water quality impacts are adequately managed during construction, including:

- ensuring that hazardous chemicals and substances, including hydrocarbons and oils, are only stored and handled within bunded areas that have been designed and constructed in accordance with Australian standards
- implementing erosion and sediment control consistent with the practices described in accepted guidelines²⁶
- stabilisation of existing slopes

²⁶ e.g. the IECA (2008) *Best Practice Erosion and Sediment Control Guideline*; and the Queensland Division of the Australian Institute of Engineers' (1996) *Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites*.

- undertaking the more significant ground-disturbing activities, such as embankment excavations and construction of coffer dams, during drier periods
- minimising clearing of vegetation for access and site facilities
- diverting flows around disturbed areas and treating site-affected water
- installing and maintaining floating booms downstream of the works supporting silt curtains weighted to the river
- reinstating disturbed areas as soon as possible after work is complete.

No on-site treatment of sewage is proposed and on-site treatment of wastewater would be limited to greywater sources, stormwater run-off, wash-down water and dewatering activities. All wastewater would be stored, treated and tested prior to being released to the receiving environment. Any releases would need to comply with the required WQOs for the receiving environment.

I am satisfied that the EIS has adequately evaluated the impacts of the construction of the project on water quality in the Fitzroy River.

I am also satisfied that implementation of the measures committed to by the proponents in the draft EMP would be adequate to avoid or sufficiently limit pollution of the Fitzroy River due to construction activities. Furthermore, I am satisfied that the permits or approvals required for the construction works for the weirs would ensure compliance with the commitments in the draft EMP.

Water quality impacts—mobilisation of nutrients following filling of weirs

Vegetation would not be cleared within the watercourse prior to the filling of each weir. Accordingly, there would be slow decomposition of plant and other organic material and subsequent release of nutrients (principally nitrates and phosphates) within the impoundment.

The 'Full Carbon Accounting Model' was used for the EIS to model rates of decay of organic matter and the subsequent release of nutrients. The predictions of model were that approximately half the TN and TP would be released during the first year of impoundment. This is predicted to be 458 t for TN and 90 t for TP from Eden Bann Weir; and 645 t for TN and 127 t for TP from Rookwood Weir. Decaying vegetation would also increase water turbidity and reduce DO. These predicted water quality changes have the potential to impact the immediate and downstream environments.

New water storages generally have organic matter decay rates that are high during the first year after inundation and then decline to background levels over about six years. The background loads of TN and TP in the lower Fitzroy River are approximately 13,000 t/a and 3,500 t/a respectively.

Modelling undertaken for the EIS demonstrates that, in the first year after filling, TN levels at the Fitzroy Barrage would be increased by approximately 8.5 per cent if both Eden Bann and Rookwood Weirs are fully developed at the same time and by approximately 2.6 per cent over the whole six-year period.

As approximately half of the nutrient increase from decaying vegetation is attributable to each weir, the peak nutrient loads would be halved if construction of the two weirs were to be separated by more than two years. Furthermore, nutrient peaks from

decaying vegetation at each weir would be halved if the two stages of weir development were to be separated by more than two years.

While the proponents have advised that market-driven factors are most likely to favour several years of separation of construction at the two weirs, I cannot rely on this outcome. Nonetheless, this likelihood leads me to conclude that the application of measures to mitigate and/or offset nutrient increases from decaying vegetation should be guided by measured nutrient concentrations of water released from each weir, not by predictions of nutrient concentrations.

Management of nutrients levels by water release strategies

Impacts from increased nutrient levels are expected to occur mostly as short duration events with each water release. Under normal operating conditions, wet season inflows would allow nutrient concentrations to be diluted by flushing. Conversely, prolonged dry weather would be more difficult to manage.

The proponents have committed to the development of operational strategies for both weirs during the detailed design phase to manage the quality of water released and to respond to the results of water quality monitoring programs. The operating rules for each weir would be subject to the approval of the chief executive under the Queensland *Water Act 2000* (Water Act) and must be implemented.

While the Water Act provides statutory control over water releases, I consider that water release management would be insufficient to adequately mitigate the overall increase in nutrients caused by the decay of organic matter in the impoundment areas, especially during the first few years of operation of each weir. Therefore, I consider that the further management measures described below are required.

Existing models and offset calculators

Only TN and TP levels were predicted and reported in the AEIS. Much of the TN and TP are not immediately bioavailable (i.e. able to be taken up by biota in the water). For example, TN is made up of particulate nitrogen (PN) and dissolved nitrogen. The dissolved nitrogen is conventionally categorised into dissolved inorganic nitrogen (DIN) and dissolved organic nitrogen (DON). Almost all DIN is considered to be immediately bioavailable. Over time, PN and DON are transformed to DIN.

As the rates of conversion of species of nitrogen vary widely with a range of water conditions, there are currently no reliable equations to simply convert TN and TP to bioavailable nutrients in any of the river systems flowing to the GBR.

Based on information recently commissioned from JCU by the Commonwealth DEE²⁷ and other source catchment work undertaken for DEE Reef Trust, approximately one third of the TN may be present as DIN and a further 20 percent of PN and DON may become bioavailable during one flushing cycle of the GBR lagoon.

²⁷ Brodie, J., Burford, M., Davis, A., da Silva, E., Devlin, M., Furnas, M., Kroon, F., Lewis, S., Lønborg, C., O'Brien, D., Schaffelke, B., Bainbridge, Z. 2016. The relative risks to water quality from particulate nitrogen discharged from rivers to the Great Barrier Reef in comparison to other forms of nitrogen. *TropWATER Report 14/31* (unpublished).

However, I am advised that these broad general estimates are not sufficiently reliable to calculate the offset requirements for decaying vegetation from the project. I therefore consider that the current level of certainty about the predicted scale of the impact of decaying vegetation is too low to reliably quantify the offset requirements now. I further consider that it would be more appropriate to base future offset requirements on measured actual changes in nutrient levels upstream and downstream of each weir at each stage of development.

The University of Queensland and JCU are currently developing a prototype 'Reef Trust Offsets Calculator'²⁸ for determining financial liability for marine biodiversity offsets voluntarily delivered through DEE Reef Trust. I note general communications between a range of parties about the proposed wider use of this calculator.

Discussions with DEE, the GBR Marine Park Authority (GBRMPA) and the Queensland Departments of Environment and Heritage Protection (EHP) and Natural Resources and Mines (NRM) during the EIS process also considered application of this calculator to determine an offset for the increase in nutrients arising from decaying vegetation in the impoundments. However, I consider that the calculator is not yet sufficiently developed for this purpose.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponents to monitor nutrient levels immediately upstream of the FSL and immediately downstream of the water release point of each weir to measure any actual nutrient increases caused by each impoundment. I have also recommended a condition requiring that the results of monitoring program inform future offsets requirements for water quality impacts on the GBRWHA, should it be determined by the Minister that offsets are required.

Consequential impacts—FAD

Background

The Fitzroy Basin contributes substantial amounts of contaminants to the GBR lagoon, particularly during large-scale flood events. Agriculture accounts for almost 90 per cent of land use in the Fitzroy Basin.

The EIS reported that the Fitzroy Basin is one of the major contributors of TSS load to the GBR lagoon, caused by human activity, with grazing lands, hillslope erosion and streambank erosion the main sources. The EIS also identified that land degradation, habitat disturbance and alteration and impacts to water quality resulting primarily from agricultural and mining activities are the current pressures on the Fitzroy Basin catchment. High TSS loads in the GBR lagoon are known to have an adverse on marine ecosystems including seagrass and coral reefs. These ecosystems are dependent on light availability and can be adversely affected by high TSS loads in the water column which reduce light availability.

The marine waters fed by the Fitzroy River support a variety of habitats, including seagrass, that supports a range of fauna contributing to the OUVs of the GBRWHA

²⁸ <http://nesptropical.edu.au/wp-content/uploads/2016/07/NESP-TWQ-3.12-FINAL-REPORTa.pdf> viewed 20 November 2016.

(e.g. dugong and marine turtles). As the project is expected to result in an increase in agricultural development, it has the potential to impact on the marine ecosystems and species in the GBRWHA. This section provides an analysis of the potential impacts of the development facilitated by the provision of water from the project.

Consequential impacts and the Queensland regulatory regime

At full development, the project would store sufficient water to reliably supply 76,000 ML/a of unallocated water, including a reservation of up to 42,000 ML/a for agricultural development or other urban and industrial purposes.

A regulatory regime exists for the utilisation of water for industrial projects, residential development and animal feedlots. Consequently, assessment of the potential impacts of the use of water for those purposes would be undertaken separately under that regime.

For example, intensive animal husbandry, such as piggeries or cattle feedlots are regulated under the Queensland *Environmental Protection Act 1994* (EP Act), and are subject to an EA and an enforcement regime for unauthorised water releases.

The 2012 National Beef Cattle Feedlot Environmental Code of Practice²⁹ provides nationally consistent requirements, which are enforced through regulation in Queensland.

The 2011 National *Guidelines for Beef Cattle Feedlots in Australia*³⁰ complement the Code of Practice and specify that:

- feedlots not be located in a flood prone areas unless adequate safeguards are incorporated
- feedlots be enclosed within a controlled drainage area, which is designed to hydrological standards to prevent runoff discharge
- leachate or percolate from a feedlot and associated infrastructure does not contaminate groundwater
- associated water utilisation areas not be located above groundwater resources unless suitable measures can be put in place to protect those resources.

While intensive animal husbandry is subject to regulatory requirements under the EP Act, there is no guarantee that feedlots could not make a minor contribution to a net increase in nutrients flowing to the GBR (e.g. during storm events). Consequently, I consider that any future water quality monitoring program implemented by the proponents to identify any changes in water quality of the Fitzroy River due to the use of water from the project for irrigated agriculture should also monitor areas used for intensive animal husbandry.

As the use of water for irrigated agriculture is not currently regulated, the assessment of consequential impacts for that land use is more problematic. There are statutory reef protection regulations for sugarcane and grazing in the high priority GBR catchments of

²⁹ Meat and Livestock Australia, National Beef Cattle Feedlot Environmental Code of Practice, June 2012, 2nd edition, viewed on 14 November 2016: <http://www.mla.com.au/news-and-events/publications/>

³⁰ Meat and Livestock Australia, National Guidelines for Beef Cattle Feedlots in Australia, June 2012, 3rd edition, viewed on 14 November 2016: <http://www.mla.com.au/news-and-events/publications/>

the Wet Tropics, Burdekin and Mackay Whitsundays³¹. I note that the Queensland Government is currently exploring options for further application of these or similar regulatory requirements for new agricultural development of land within the GBR catchment.

The future growth of agriculture in the Fitzroy area is dependent on the suitability of land, water availability and cost, provision of supporting infrastructure and market demand for agricultural products. Investigations such as the 2010 *Fitzroy Industry and Infrastructure Study*³² identified land within the Fitzroy region as potentially suitable for irrigated agricultural and intensive animal husbandry development facilitated through the provision of water supply.

Water provided by the project for irrigated cropping has the potential to exit farm properties carrying sediment, nutrients and farm chemicals in overland flow and leaching nutrients and chemicals into shallow aquifers. However, I note that, with higher water prices and increasing pressure from the broader community to improve agricultural practices, application technologies and water capture and re-use practices are becoming commonplace.

A study based on historical data for the Fitzroy Basin has indicated that, although grazing lands contribute the majority of pollutants exported by the Fitzroy River, the maximum pollutant concentrations are closely related at the sub-catchment level to the percentage area of croplands receiving heavy rain³³. I consider the findings of that study are relevant to my evaluation of the project's consequential impacts of FAD on water quality. However, I also note that the data collected for that study is now 8–22 years old and reflects historical land use practices over the years prior to the collection of that data.

I am advised by the Queensland Department of Agriculture and Fisheries (DAF) that the standards of sediment, irrigation and fertilizer management currently practiced are higher than in previous decades. More importantly, I consider that the study cannot be used to predict the outcomes of a future irrigated broadacre and tree cropping scheme that might be established under 'greenfield' 'best-practice' management.

This view is reinforced by information in the 2015 Reef Report Card³⁴. That report states that "...management improvements that are relatively simple to implement and present little perceived production risk, can be fostered through awareness activities and modest extension efforts". It describes a range of Queensland and Australian Government programs that are being implemented to drive such improvements. For the farming activity of relevance to the project—grain production in the Fitzroy basin—the report card describes progress towards implementation of best management practices of approximately 70 per cent for pesticides, 54 per cent for nutrients and 43 per cent for sediment control. The Report Card also notes that less than 5 per cent of grain production lands in the Fitzroy catchment are at 'high risk' from current soil, nutrient

³¹ <https://www.qld.gov.au/environment/agriculture/sustainable-farming/reef-initiatives/> viewed 1 December 2016.

³² www.rdafcw.com.au/growing_central_queensland/fitzroy-infrastructure-industry-study-2010

³³ Packett, R, et al. (2009). Agricultural lands are hot-spots for annual runoff polluting southern Great Barrier Reef lagoon. *Marine Pollution Bulletin* 58 (pp976-986):

<http://www.sciencedirect.com/science/article/pii/S0025326X09000897>, viewed 18 November 2016.

³⁴ State of Queensland 2016, Great Barrier Reef Report Card 2015: Results, viewed 22 November 2016, <http://www.reefplan.qld.gov.au/measuring-success/report-cards/2015/assets/gbr-2015report-card-detailed-results.pdf>

and pesticide management practices. This compares to 25-40 per cent at high risk on the Fitzroy grazing lands.

However, the Report Card also notes that:

- very poor progress has been made to improve the water quality entering the GBR from the Fitzroy Catchment (e.g. less than ten per cent reduction in nutrients)
- marine conditions adjacent to the Fitzroy remains poor.

Therefore, although I consider that the combination of likely high cost of irrigation water from the two weirs and the opportunity for greenfield farm design are likely to drive the adoption of best of water management, the potential impacts of FAD must be subject to water quality sampling, mitigation measures and, if necessary, offsets.

Analysis in the AEIS

The EIS and AEIS provided an assessment of potential consequential impacts of FAD on water quality flowing into the Fitzroy River. The modelling considered different land use types and the potential changes in run-off of sediment, nitrogen and phosphorus (measured as TSS, TN and TP). No assessment of potential increase in herbicides and pesticide discharge was undertaken in the AEIS.

The modelling concluded FAD from the project has the potential to increase loads of TSS in the lower Fitzroy River by 0.02 per cent, of TN by 0.46 percent and TP by 0.10 per cent. The AEIS concluded that the predicted proportional increases in the generated loads and the consequential downstream impact on water quality in the GBR into the system from potential FAD to be very low.

However, to consider the incremental impacts to water quality, relevant state and Commonwealth agencies agreed that a more rigorous investigation was required:

- applying modelling tools used by government for GBR water quality planning
- using an agricultural development scenario considered most probable by regional agricultural experts
- adopting assumptions for each model parameter considered by relevant experts as most appropriate analysis
- ensuring review by relevant government agencies of both the modelling methodology and the model outputs.

Analysis subsequent to the AEIS

Following analysis of submissions received on the AEIS, the proponents agreed to undertake an additional modelling study subject to the four requirements outlined above. This study is detailed in the technical note presented as Appendix 11 to this report.

An expert government panel was assembled to advise, monitor and review the modelling. The panel consisted of representatives from the Office of Coordinator-General, DAF, DNRM, EHP and DEE. The panel also received advice from DSITI.

The panel agreed that it would be reasonable for the modelling to assume:

- all 42,000 ML/a of unallocated water is used for agriculture (i.e. the most precautionary volume from the impact assessment perspective)
- cattle feedlot development to a total of 40,000 head
- 1,600 ha of irrigated broadacre cropping for fodder and grain crops on the alluvial flats
- 1,400 ha of irrigated tree crops (e.g. macadamia and avocado) on the better quality adjacent lower hills.

The water balance modelling tool applied by the proponents was 'HowLeaky[®]', a key tool used regularly by State and Australian government agencies for policy, planning and program work for the GBRWHA. The model compared new FAD land uses against the dominant existing land use (cattle grazing) at three different levels of pasture cover.

A selective summary of the modelling results are presented in Table 6.1. The calculations based on the model outputs refer only to the higher-rainfall Yaamba climate data (which predict higher rates of pollutant run-off than the Westwood Store data). Total annual pollutant loads were calculated by multiplying the total land area in the modelled scenario for each cropping practice by the difference between the pollutant loads for each cropping practice. The consequential interpretation of the model output shows the total differences in pollutant loads per year for the conversion of land use from:

- the highest level of pasture cover (i.e. representing the lowest level of erosion from grazing of the three options modelled) to broadacre sprinkler irrigation over 1,600 ha of land
- the middle level of pasture cover to non-contoured, irrigated tree cropping (higher erosion option) on 1,400 ha of land.

Table 6.1 Estimated changes in pollutants resulting from conversion of land use from grazing to irrigated broadacre and irrigated tree cropping

Agricultural practice	Sediment (Tonne/year)	TN	TP (kg/year)	Herbicides
Broadacre cropping	-176	-352	-160	1.4
Tree cropping	-2,408	-4,816	-4,480	2.0

I consider that the precision of each of these modelled estimates is low and the scenario assumptions are speculative. However, as a method of comparative analysis, I am satisfied that, in broad terms, the model output indicates that establishment of an irrigated agriculture scheme would marginally increase herbicide and pesticide loads, but may not necessarily result in a net decrease in water quality entering the lower Fitzroy River.

Amongst the assumptions applied to the modelling were adoption of common contemporary good farming practices (e.g. grass inter-rows between tree-crop rows, or engineered structures to capture and re-use overland flow on broadacre crops). There appears to be no barrier to such practices being required as a condition of the sale of water from the weirs to new FAD.

In light of the uncertainties associated with analysis of the potential impacts of FAD on the GBRWHA, I consider that precise prediction of pollutant outcomes cannot be made at this stage. Therefore, I consider that it would be unreasonable to identify at this stage specific offsets that the proponents must provide to counter the potential impacts of FAD. Consequently, I have recommended conditions to the Commonwealth Environment Minister that apply to both weirs requiring the proponents to:

- undertake a long-term monitoring program of water quality in the lower Fitzroy River and key sub-catchments affected by land use change to irrigated cropping
- any future water quality offset requirement be determined by the Minister
- make the sale of water from the two weirs for irrigated agriculture conditional on the use of best practicable farm management as described within a 'land use code of practice'.

Sections 6.6 and 5.4 of this report, document the extensive requirements for environmental offsets for impacts on listed threatened species, regional ecosystems, and vegetation connectivity. A considerable part of these offsets would require the re-establishment and protection of riparian and adjacent vegetation. These offsets would provide large water quality improvements by reducing gully erosion and filtering sediment and nutrients. Consequently, I consider that these offsets should be taken into account when determining any water quality offset measures.

Therefore, the level and type of water quality offset required by the Minister should be:

- contingent upon the results of the water quality monitoring required by that condition
- net of any water quality benefits arising from offsets provided by the proponents for other environmental values

Also, I consider that the offset requirement attributable to each weir should be proportional to the volume of water allocated to irrigated agriculture from that weir.

Based on my evaluation of the potential water quality impacts associated with the agricultural development facilitated by the project, and the conditions I have recommended to the Commonwealth Environment Minister in this report, I consider that the project is unlikely to have an unacceptable impact on values (i.e. marine ecosystems and the fauna which these systems support) which contribute to the OUV of the GBRWHA.

Impacts on flow regimes

Construction

The EIS indicated that downstream flows would be adequately maintained throughout the construction period by restricting works to the dry season and implementing temporary flow diversions. Eden Bann Weir would also remain operational during construction. Consequently, flows downstream of the Fitzroy Barrage to the GBRWHA appear unlikely to be adversely affected by the construction of the weirs.

Operation

The raising of Eden Bann Weir and the construction of Rookwood Weir is expected to affect flow regimes in a number of ways, including:

- a reduction in the magnitude of flood events and delayed flows
- a reduction in the frequency and magnitude of small to medium downstream flood flows
- an increase in water flows downstream during the dry season
- decreased frequency and duration of no-flow periods.

The integrated water quality and quantity analysis presented in the EIS indicated that full development of the project would not have a significant net impact on the flow regimes at the end of the Fitzroy River system in the marine estuarine environment and the GBRWHA. In addition the proponents have committed to release water as required to satisfy the EFOs as defined in the Fitzroy Basin WRP which would be expected to assist in maintaining flow regimes which are appropriate for downstream coastal habitats. Based on the modelling and this commitment I consider that the project is not expected to have an unacceptable impact on values of the GBRWHA which contribute to its OUV including migratory shorebirds which rely on flow regimes that influence the availability of foraging habitat (e.g. mud flats).

Removal of riparian vegetation

A riparian area is defined as an area within 100 m of a mapped stream or riverine wetland³⁵. Retaining riparian vegetation along the banks of waterways is important for maintaining good water quality. Riparian vegetation provides stability to stream banks which reduces sediment losses and also acts as a filter by removing water-borne pollutants. Riparian vegetation is also important for shading in-stream habitat, which helps maintain water temperatures and provides cover for fish and other aquatic organisms. Riparian areas also provide important habitat for a range of terrestrial fauna.

The GBR regions with the largest amount of riparian areas are the Burdekin (2.42 million ha) and the Fitzroy (2.2 million ha). Since European settlement, approximately 37 per cent of forested riparian areas have been lost in the Dawson River catchment and 36 per cent in the Mackenzie River catchment. Between 2009 and 2013, the Fitzroy region had the largest increase in the loss of riparian vegetation with an increase of 0.7 per cent (approximately 14,800 ha) compared with loss between 2005 and 2009.³⁶

In the Reef 2050 Plan, the Queensland Government has committed to ensuring that development in the GBR coastal zone occurs in an ecologically sustainable manner. One of the key actions in the plan for maintaining and enhancing the ecological health of the reef includes: strengthening vegetation management laws to protect remnant and high-value regrowth native vegetation (including riparian zones). In addition, one of the targets in the plan is to increase the extent of riparian vegetation by 2018.

³⁵ Australian Government 2014, Riparian methods: Great Barrier Reef Report Card 2014, Australian Government, Canberra, viewed 15 November 2016, <http://www.reefplan.qld.gov.au/about/assets/gbr-report-card-2014-riparian-methods.pdf>

³⁶ Commonwealth of Australia, *Reef Water Quality Protection Plan Great Barrier Reef Report Card 2014: Riparian results*, Australian Government, Canberra, 2015, viewed 7 November 2016, <http://www.reefplan.qld.gov.au/about/assets/gbr-report-card-2014-riparian-results.pdf>

Much of the landscape surrounding the project area has been cleared, predominantly for cattle grazing. As a result, vegetated areas tend to be concentrated along the riparian fringes of the Fitzroy, Dawson and Makenzie Rivers and adjoining creeks. The project is expected to result in the removal of 1,947 ha of remnant vegetation as a result of clearing for construction and inundation of riparian vegetation. In addition, 558 ha of high-value regrowth would also be impacted as a result of the project.

The loss of this vegetation is likely to disrupt connectivity between habitats and potentially impact on the breeding habitat of a number of threatened bird species (refer to Section 6.6), including the red goshawk (listed as vulnerable under the EPBC Act and endangered under the Queensland *Nature Conservation Act 1992* [NC Act]). Therefore, I have stated a condition under Queensland legislation, and I recommend the Commonwealth Environment Minister set a condition requiring the proponents to provide offsets for the loss of this vegetation. Offsets are likely to involve protection and rehabilitation of riparian vegetation within the Fitzroy Basin catchment. The proponents would need to determine whether they would provide a financial contribution or a land-based offset to compensate for this loss.

6.4.3 Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the OUVs of the GBRWHA. The proponents would be required by the Fitzroy Basin ROP to ensure that water releases are made to meet the EFOs at the Fitzroy Barrage to the extent possible and therefore have no impact on flow regimes downstream of the barrage and the waters of the GBRWHA. As such, I consider that the project would not have an unacceptable impact on the values which contribute to the OUV of the GBRWHA including migratory shorebirds and the Capricorn yellow-chat.

To manage the potential water quality impacts associated with decaying vegetation, I have recommended a condition to the Commonwealth Environment Minister requiring the proponents to undertake water quality monitoring to determine the actual nutrient concentrations and to report the findings to the EHP and DEE. In addition, due to the uncertainty of the timing of construction of each stage of the weirs, and the difficulties in determining the quantities of bioavailable nutrients associated with the decay of vegetation, I have recommended a condition to the Minister requiring that the results of the monitoring be used to inform any offset requirements for potential water quality impacts on the GBRWHA.

I conclude that Queensland and Commonwealth government policies require that an approval decision for this project:

- must have regard for the impacts of FAD on the quality of water flowing to the GBR
- may require the proponents to put in place achievable measures to both monitor the impacts of FAD and reduce the likelihood that water quality flowing to the GBR would be reduced.

Consequently I have recommended to the Minister conditions requiring the proponents to:

- develop and implement a land management code of practice that is to be attached to future water licences as a condition of sale to prospective agricultural users
- implement a water quality monitoring program that would inform measures and programs to improve water quality flowing to the GBR and determine potential offset requirements for consequential water quality impacts on the GBRWHA.

In light of the proposed avoidance, mitigation and offset measures and conditions in this report, I consider that the project would not have unacceptable impact on the OUVs of the GBRWHA.

6.5 National Heritage places

The GBR was placed on the National Heritage list in May 2007. The criteria for a National Heritage place are that it has outstanding heritage value to the nation due to its:

- importance in the course and pattern of Australia's natural or cultural history
- possession of uncommon, rare and endangered aspects of Australia's natural or cultural history
- potential to yield information that would contribute to an understanding of Australia's natural or cultural history
- importance in demonstrating the principal characteristics of Australia's natural or cultural places or cultural environments
- importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.

A management plan for the GBR National Heritage place has not been prepared under section 324S of the EPBC Act.

I consider that the matters discussed in this section for World Heritage properties (refer Section 6.4) apply equally to National Heritage places.

6.5.1 Coordinator-General's conclusion

I have imposed a condition under the SDPWO Act, and I recommend to the Commonwealth Environment Minister a condition requiring the proponents to ensure the protection of the GBR National Heritage values including conditions requiring the proponents to implement various measures to manage water quality impacts associated with FAD on the GBR National Heritage place.

Consistent with the discussion on World Heritage properties, I consider that the project is not expected to have any unacceptable impacts on the GBR National Heritage place.

6.6 Listed threatened species and communities

6.6.1 Threatened ecological communities

The EIS indicated that there are four threatened ecological communities (TECs) listed under the EPBC Act which have the potential to occur in the project area, including:

- brigalow (*Acacia harpophylla* dominant and co-dominant) (brigalow EC)
- natural grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
- semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions
- Weeping Myall Woodlands.

A search of the EPBC Act protected matters search tool (PMST) database indicates that the Coolibah—Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South Bioregions threatened ecological community (TEC) also has the potential to occur in the project area. However this TEC was listed under the EPBC Act after the controlled action decision and therefore, in accordance with section 158A(4) of the EPBC Act, is not considered in this assessment.

Based on likelihood of occurrence assessments undertaken for the EIS, the brigalow EC is the only TEC that is likely to occur within the project footprint.

Brigalow (*Acacia harpophylla* dominant and co-dominant) EC

Background

The brigalow EC is listed as ‘endangered’ under the EPBC Act. In Queensland, areas of brigalow EC include vegetation that meet the description of 16 regional ecosystems (REs), all of which are listed as ‘endangered’ under the Queensland *Vegetation Management Act 1999*. The RE associated with the brigalow EC that occurs in the project area is RE 11.3.1 ‘*Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains’. The EIS indicated that 35,153 ha of vegetation is mapped as RE 11.3.1 within the catchment.

Impacts and mitigation

In Queensland, the brigalow EC has been extensively cleared for cropping and grazing, and is now highly fragmented across most of its range. The brigalow EC has also been impacted by altered fire regimes and the introduction of weeds and feral animals. The EIS demonstrated that areas of brigalow EC within the project footprint are fragmented as a result of historic and current land use practices.

There is no ‘recovery plan’ under the EPBC Act relevant to this EC. There is an approved ‘conservation advice’ for brigalow EC: *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community*.³⁷ Relevant priority recovery and threat abatement actions in the conservation advice include:

- protecting and conserving remnant and regrowth areas of the EC

³⁷ Commonwealth of Australia, *Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant)*, Department of the Environment, Canberra, 2013, viewed 11 July 2016, <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservation-advice.pdf>

- mitigating the severity of impacts where further clearance is unavoidable and providing offsets which consider the location and emulate qualities of affected patches
- managing areas of the EC to reduce threats, including fire management, targeted weed and feral animal control with a particular focus on exotic grasses and feral pigs.

There is one 'threat abatement plan' relevant to the brigalow EC: *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads*.³⁸ While the current geographic range of the cane toad falls within the brigalow community, the conservation advice indicates that the cane toad is not a threat to the community.

Clearing and inundation impacts

The project is expected to impact a total of 20.1 ha of brigalow EC. For Rookwood Weir, approximately 1.6 ha would be cleared during construction and around 17.8 ha would be inundated at FSL. For the raising of Eden Bann Weir, no brigalow would be impacted by construction activities and around 0.7 ha would be inundated at FSL. It is also considered that 6.3 ha of unverified brigalow may also occur along Gogango Creek with the Rookwood Weir impoundment. These areas are relatively small in the context of the remaining extent of brigalow EC in the surrounding catchment.

The EIS stated that the project is not expected to result in further fragmentation of brigalow as impacts would be limited to a number of small areas along the boundaries of the water's edge. However, some of these brigalow patches may be important to the survival of this EC because they meet key diagnostic characteristics and condition thresholds³⁹ defined in the recovery plan.

Fire regimes and weed/pests

Under the Queensland *Biosecurity Act 2014* landowners have a general obligation to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals on a person's land. The proponents have committed to keep the project site free of invasive weeds in accordance with a weed management plan.

Fire poses a serious threat to areas of brigalow EC, which are more infested with exotic grass species. The conservation advice indicates that the most appropriate fire regime for the brigalow EC is fire-exclusion. The proponents have not proposed any specific measures to manage fire impacts on the brigalow EC. However, I would expect any remaining areas of brigalow EC would be protected some degree by fire breaks and other relevant measures required for excluding fires from the weir areas.

³⁸ Commonwealth of Australia, *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads*, Department of the Environment and Energy, Canberra, 2011, viewed 31 October 2016, <http://www.environment.gov.au/system/files/resources/2dab3eb9-8b44-45e5-b249-651096ce31f4/files/tap-cane-toads.pdf>

³⁹ To meet condition thresholds a patch must be 0.5 ha or more in size and exotic plants comprise less than 50 per cent of the total vegetation cover, assessed over a minimum sample area of 0.5 ha.

Significant residual impacts and offsets

The EIS indicated that the project is expected to have a residual impact of 20.1 ha of brigalow EC, which is considered to be significant. The proponents have investigated offset availability within 20 km surrounding the project area and have identified a total of 51,000 ha of potentially suitable areas for offsets.

It is considered that the requirement to provide offsets for the brigalow EC would be staged in line with the following project development stages:

- Eden Bann Weir Stage 2—up to 0.3 ha (impacted within the impoundment)
- Eden Bann Weir Stage 3—up to 0.4 ha (impacted within the impoundment)
- Rookwood Weir Stage 1—up to 1.4 ha (impacted by construction activities) and 2.3 ha (impacted within the impoundment)
- Rookwood Weir Stage 2—up to 0.2 ha (impacted by construction activities) and 15.5 ha (impacted within the impoundment).

I have recommended conditions to the Commonwealth Environment Minister which require the proponents to provide offsets for the brigalow EC for each stage of development and for each weir in accordance with approved offset management plans.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the brigalow EC. I am satisfied that the proponents' commitments to implement weed and pest management measures (as specified in the draft EMP) are appropriate for maintaining brigalow EC.

In addition, I have recommended conditions to the Commonwealth Environment Minister requiring the proponents to:

- avoid and limit disturbance to habitat
- undertake pre-clearance survey to determine the amount of brigalow EC that would be impacted by the project
- provide offsets for the significant residual impacts on the brigalow EC.

In light of the proposed mitigation and offset measures and conditions recommended in this report, I conclude that the approved conservation advice for this species has been considered; the proposed management actions are not inconsistent with the relevant threat abatement plans; and the impacts on the brigalow EC are not unacceptable.

6.6.2 Threatened terrestrial flora

The PMST search identified four species of EPBC listed threatened flora as potentially occurring within 5 km of the project area (refer Table 6.2).

Table 6.2 EPBC Act listed threatened flora species potentially occurring in the project area

Common name	EPBC Act listing status
<i>Species name</i>	

Black ironbox <i>Eucalyptus raveretiana</i>	Vulnerable
Shrubby bush pear <i>Marsdenia brevifolia</i>	Vulnerable
Marlborough blue cycad <i>Cycas ophiolitica</i>	Endangered
<i>Cycas megacarpa</i>	Endangered

While these threatened flora species have been identified as potentially occurring in the project area, desktop and field surveys indicate the project area provides limited suitable habitat for three of these species:

- The shrubby bush pear is known to grow on serpentine rock outcrops or crumbly black soils in eucalypt woodlands. Assessments undertaken for the EIS indicate serpentine soils are not found in the proposed inundation zones and on this basis the species is considered unlikely to be impacted by the raised water levels associated with the impoundments.
- *Cycas ophiolitica* grows on hills and slopes in sparse, grassy open forest and is more frequently found on shallow, stony, infertile soils, which are developed on sandstone and serpentinite. While it is sometimes found on alluvial loams, it was not identified in field surveys undertaken for the EIS.
- *Cycas megacarpa* is found in woodland and open forests. This species often grows on undulating to hilly terrain on rocky substrates, derived from acid volcanics, ironstone or mudstone, but rarely from alluvium.

Only black ironbox was recorded in the proposed inundation zones.

Targeted surveys were also undertaken for a number of other listed threatened flora species based on the presence of potentially suitable habitat including:

- *Corymbia xanthope* (Glen Geddes bloodwood)
- *Hakea trineura* (three-veined hakea)
- *Neoroepera buxifolia*
- *Pultenaea setulosa*
- *Samadera bidwillii* (quassia)
- *Capparis thozetiana*
- *Pimelea leptospermoides*
- *Cadellia pentastylis* (ooline).

All of these species with the exception of ooline are 'serpentine endemics' and therefore typically have a greater preference for serpentine soils which are not found in the inundation zones. While incidental plants may occur in the inundation zones, more sustainable populations would be expected to occur in the surrounding hills above the inundation zones. Based on these observations it is considered that these populations are not expected to be impacted by the raised water levels associated with the impoundments.

The ooline is known to occur in the brigalow community to the north of the proposed Rookwood Weir pool and a small population was recorded along the banks of the Mackenzie River in the upper reaches of the proposed weir pool at FSL 49. The EIS stated that this population is unlikely to be affected by raised water levels as the water would remain in the bed of the river.

Black ironbox

Background

The black ironbox is listed as 'vulnerable' under the EPBC Act. The species has a wide distribution in coastal and sub-coastal areas of Queensland, from south of Townsville to Nebo, around Rockhampton and areas 100 km west of the city. The species usually grows along watercourses, and sometimes on river flats or open woodland and its distribution is known to overlap with the brigalow EC.

There are no threat abatement plans relevant to this species. The species has an approved conservation advice: *Approved Conservation Advice for Eucalyptus raveretiana (Black Ironbox)*.⁴⁰

Priority recovery and threat abatement actions for the black ironbox in the conservation advice that are relevant to the project include:

- minimising adverse impacts from land use at known sites
- identifying and removing weeds (especially rubber vine [*Cryptostegia grandiflora*]) and managing sites to prevent introduction of invasive weeds
- developing and implementing a suitable fire management strategy
- undertaking appropriate seed collection and storage
- linking, enhancing or establishing additional populations
- implementing national translocation protocols where establishing additional populations is considered necessary and feasible.

Eden Bann Weir

Two populations of black ironbox were recorded during EIS surveys. This included a single specimen at Glenroy Creek and 48 and 40 trees per kilometre, respectively at Ten Mile Creek and an unnamed branch of Green Creek (upstream of Eden Bann Weir).

Rookwood Weir

Approximately 200 individuals were identified along Melaleuca Creek within or adjacent to the proposed Rookwood Weir inundation area (FSL 49 m AHD).

⁴⁰ Commonwealth of Australia, *Approved Conservation Advice for Eucalyptus raveretiana (Black Ironbox)*, Threatened Species Scientific Committee, Department of the Environment, Water, Heritage and the Arts, Canberra, 2008, viewed 20 August 2016, <http://www.environment.gov.au/biodiversity/threatened/species/pubs/16344-conservation-advice.pdf>

Impacts and mitigation

Clearing and inundation impacts

The EIS indicated that up to 100 black ironbox trees would be directly impacted at the upper limit of development by the impoundment associated with Stage 2 of Rookwood Weir along Melaleuca Creek.

The loss of these individuals would be a significant residual impact on this species as it is likely to result in a long-term reduction in the size of the population along the Fitzroy River and its immediate tributaries.

Weeds/pests

As discussed above, the Conservation Advice identifies invasive weeds, particularly rubbervine as a key threat to the black ironbox. Field surveys undertaken for the EIS indicate a number of areas in the project area that are under threat from rubber vine infestation. The rubber vine is a Category 3 restricted matter under the Queensland *Biosecurity Act 2014* and landowners have a 'general biosecurity obligation' to take all reasonable and practical steps to minimise the risks associated with invasive plants on a person's land. The proponents have committed to keeping the project site free of invasive weeds in accordance with a weed management plan.

Significant residual impacts and offsets

Based on information provided in the EIS, the project would be expected to impact on at least 100 individuals. As the exact number of individuals that would be impacted is unknown I have recommended a condition to the Commonwealth Environment Minister requiring that proponents to undertake pre-clearance surveys to determine the actual number impacted. The proponents have proposed a draft offset strategy. The strategy indicates, prior to inundation, black ironbox seeds would be collected from a number of mature trees along Melaleuca Creek and other suitable locations along the Fitzroy River in the vicinity of the impoundments. The resultant seedlings would be planted at a suitable location within proximity to the impacted population at Melaleuca Creek under the guidance of a suitably qualified specialist. The amount to be planted would be dependent on the results of the pre-clearance surveys.

Offsets would be staged in accordance with the staged development of each weir, with the full offset to be implemented to coincide with Stage 1 of Rookwood Weir. The revegetated area would be fenced to keep out grazing livestock; and weed management would be undertaken and monitored on an ongoing basis. The proponents have ambitiously anticipated a 90 per cent probability of successful long-term survival of the ironbox revegetation.

Coordinator-General's conclusion

I am satisfied the EIS has identified the potential impacts that the proposed action would have on listed flora under the EPBC Act.

I am satisfied that the proponents' commitments to implement fire regimes, weed and pest management measures, fencing and monitoring are appropriate for maintaining black ironbox as part of an ongoing management plan. I have stated a condition under

Queensland legislation, and I recommend to the Commonwealth Environment Minister, a condition requiring the proponents to ensure there are no unacceptable impacts on black ironbox, including:

- limiting disturbance
- undertake pre-clearance survey to determine the amount of brigalow EC that would be impacted by the project
- providing offsets for the significant residual impacts.

6.6.3 Threatened terrestrial fauna

Survey effort and methodologies

Eden Bann Weir

Wet season habitat assessments were undertaken within the Eden Bann Weir footprint between 28 January and 2 February 2009 and dry season field surveys were conducted between 6 August and 11 August 2009. This included six fauna trapping sites. Bat detectors were deployed for five nights to remotely detect microchiropteran bat echolocation calls and harp traps were used for eight nights.

Rookwood Weir

Wet season field surveys of the Rookwood Weir footprint were conducted between 29 April and 1 May 2009 and dry season surveys were undertaken between 25 and 30 July 2009. Bat detectors and harp traps were deployed for 12 nights.

Downstream of the weirs

Fauna values of downstream habitats between the proposed Rookwood Weir site and Eden Bann Weir and downstream of Eden Bann Weir were primarily assessed through desktop analysis.

Mammals

A search of the PMST database identified eight threatened mammal species, listed under the EPBC Act, as potentially occurring within 5 km of the project site. These species are listed in Table 6.3.

Table 6.3 EPBC Act listed threatened mammals potentially occurring in the project area

Common name <i>Species name</i>	EPBC Act listing status
Large-eared pied bat <i>Chalinolobus dwyeri</i>	Vulnerable
Northern quoll <i>Dasyurus hallucatus</i>	Endangered
Ghost bat <i>Macroderma gigas</i>	Vulnerable

Common name <i>Species name</i>	EPBC Act listing status
Corben's long-eared bat <i>Nyctophilus corbeni</i>	Vulnerable
Greater glider <i>Petauroides Volans</i>	Vulnerable
Koala <i>Phascolarctos cinereus</i>	Vulnerable
Grey-headed flying fox <i>Pteropus poliocephalus</i>	Vulnerable
Water mouse <i>Xeromys myoides</i>	Vulnerable

The koala, greater glider and ghost bat were listed as a 'threatened species' under the EPBC Act after the controlled action decision and therefore, in accordance with section 158A(4) of the EPBC Act, are not considered in this assessment.

Whilst a number of threatened mammal species have been identified as potentially occurring within the project area, desktop and field surveys indicate that the area provides limited suitable habitat for a number of the mammal species identified in Table 6.3, including:

- Large-eared pied bat—there are no records of this species in the project area, with the closest record being approximately 40 km north-east of Eden Bann Weir. The EIS indicated that suitable roosting habitat is limited in the project area. The rocky hills upstream of the Eden Bann Weir impoundment area may provide suitable roosting habitat. Due to limited suitable roosting habitat and no records of this species in the project area it is considered unlikely to be using the project area.
- Water mouse—the water mouse is considered unlikely to occur in the immediate project area as there is no suitable habitat. In central south Queensland, the water mouse has only been identified in high inter-tidal zones in tall, closed, fringing mangrove forest containing only yellow and/or orange mangrove species. Suitable habitat occurs downstream of Eden Bann Weir between the Fitzroy Barrage and the Fitzroy River estuary. The nearest record is 140 km south-east of the project, near Gladstone.
- Grey-headed flying fox—there are no records of grey-headed flying fox from the project area with the closest record being approximately 40 km south-east of Eden Bann Weir, near Rockhampton. This species is typically found in coastal areas and is considered unlikely to be using the project area.

The EIS identified a number of species that have a moderate likelihood of occurring based on the presence of potentially suitable habitat:

- Northern quoll—potential suitable habitat for this species associated with the open woodland on rocky hillside occurs within the Eden Bann and Rookwood Weir footprints and brigalow EC within the Eden Bann Weir impoundments. The species

was not recorded during EIS surveys, and has not been previously recorded in the project area.

- Corben's long-eared bat—while there is potentially suitable habitat for this species in the project area associated with open ironbark or box woodland including REs 11.3.3, 11.3.2, 11.11.9 and 11.11.1, the species has not previously been recorded and was not recorded during surveys. The closest record is from Expedition National Park 265 km south-west of Eden Bann Weir.

Reptiles

A search of the PMST database identified four threatened reptile species listed under the EPBC Act as potentially occurring within 5 km of the project site. These species are listed in Table 6.4.

Table 6.4 EPBC Act listed threatened reptiles potentially occurring in the project area

Common name <i>Species name</i>	EPBC Act listing status
Ornamental snake <i>Denisonia maculata</i>	Vulnerable
Dunmall's snake <i>Furina dunmalli</i>	Vulnerable
Yakka skink <i>Egernia rugosa</i>	Vulnerable
Collared delma <i>Delma torquata</i>	Vulnerable

While the EIS indicated that the project area provides potentially suitable habitat for a number of these species, the following seem unlikely to occur in the project area because there are no existing records and field surveys failed to identify individuals:

- Ornamental snake—this species is known to favour low-lying habitats adjacent to fresh water bodies. Freshwater margins, particularly along tributaries of the main channel of the Fitzroy River, may provide important foraging habitat for this species. Brigalow woodland communities (REs 11.3.1 and 11.4.9), which occur in small remnant patches throughout the study area, may also support this species.
- Dunmall's snake—this species may occur in small numbers in isolated, small remnant patches of brigalow woodland that occur within the project footprint.
- Yakka skink—log piles, burrows and rocky crevices are utilised by this species as communal refugia. Such habitat and resources are present within the project footprint, particularly in less disturbed areas of remnant mature woodland.
- Collared delma—this species is known to inhabit eucalyptus dominated woodland and open forests with suitable micro-habitats (i.e. exposed rocky outcrops). The woodland areas throughout the project area may provide suitable habitat for this species.

Birds

A search of the PMST database identified 18 threatened bird species, listed under the EPBC Act, as potentially occurring within 5 km of the project site. These species are listed in Table 6.5.

Table 6.5 EPBC Act listed threatened birds potentially occurring in the project area

Common name Species name	EPBC Act listing status
Terrestrial species	
Australasian bittern <i>Botaurus poiciloptilus</i>	Endangered
Red goshawk <i>Erythrorchis radiatus</i>	Vulnerable
Capricorn yellow-chat <i>Epthianura crocea macgregori</i>	Critically endangered
Coxen's fig parrot <i>Cyclopsitta diophthalma coxeni</i>	Endangered
Squatter pigeon <i>Geophaps scripta scripta</i>	Vulnerable
Star finch <i>Neochmia ruficauda ruficauda</i>	Endangered
Southern black-throated finch <i>Poephila cincta cincta</i>	Endangered
Australian painted snipe <i>Rostratula australis</i>	Endangered
Black-breasted button quail <i>Turnix melanogaster</i>	Vulnerable
Marine and shorebird species	
Eastern curlew <i>Numenius madagascariensis</i>	Critically endangered
Kermadec petrel <i>Pterodroma neglecta neglecta</i>	Vulnerable
Greater sand plover <i>Charadrius leschenaultii</i>	Vulnerable
White-bellied storm-petrel <i>Fregetta grallaria grallaria</i>	Vulnerable
Bar-tailed godwit <i>Limosa lapponica baueri</i>	Vulnerable
Campbell albatross <i>Thalassarche impavida</i>	Vulnerable
Southern giant petrel <i>Macronectes giganteus</i>	Endangered

Common name Species name	EPBC Act listing status
Northern Siberian bar-tailed godwit <i>Limosa lapponica menzbieri</i>	Critically endangered
Fairy prion (southern) <i>Pachyptila turtur subantarctica</i>	Vulnerable

As the project is not proximate to marine areas (140 km) it is not expected to have a direct impact on any of the marine and shorebird species listed in Table 6.5.

While the EIS indicated that the project area provides potentially suitable habitat for the following four species listed in Table 6.5, field surveys failed to identify individuals:

- Australian bittern—not assessed in the EIS. The closest record is from the Fitzroy River delta, approximately 75 km south-east of Eden Bann Weir.
- Star finch—there are a number of existing records of this species in the vicinity of the Fitzroy River near Rockhampton approximately 50 km south-east of Eden Bann Weir. The EIS indicated that there is potentially suitable habitat in the project area associated with reed beds and tall grasses along the river edge and within the side tributaries.
- Southern black-throated finch—there are a number of existing records of this species in the vicinity of the Fitzroy River near Rockhampton approximately 50 km south-east of Eden Bann Weir. The EIS indicated that there is potentially suitable habitat in the project area associated with grassy woodland and riverine vegetation.
- Australian painted snipe—there are a number of existing records of this species in the vicinity of the Fitzroy River near Rockhampton approximately 50 km south-east of Eden Bann Weir. The EIS indicated there is potentially suitable habitat in the project area associated with regional ecosystems 11.3.3 and 11.3.25 and that the species may occur among the reeds in shallow water along the edge of the river and adjacent billabongs.

The EIS indicated that there are no existing records and that the project area is considered to provide limited habitat for the following species:

- Black-breasted button-quail—this species is more commonly associated with vine forest and thicket vegetation communities which are not found within the project footprints. There are a number of existing records of this species in the vicinity of the Fitzroy River near Rockhampton approximately 50 km south-east of Eden Bann Weir.
- Coxen's fig-parrot—not assessed in the EIS. The closest record of this species is approximately 60 km north-east of Eden Bann Weir, near Byfield National Park. This species occurs high in the canopy of rainforests, including subtropical rainforests, dry rainforests, littoral and developing littoral rainforests, and vine forests with figs and soft fruiting trees.

While the Capricorn yellow-chat is highly unlikely to occur in the project area, this species occurs downstream and has the potential to be impacted as resulted of altered flow regimes in the Fitzroy River associated with the project.

Capricorn yellow-chat

Background

This species is listed as 'critically endangered' under the EPBC Act. It is restricted to coastal areas of central Queensland, with three known breeding populations on the Fitzroy River Delta, Torilla Plain and Curtis Island.

The Capricorn yellow-chat inhabits marine plain wetlands that are subject to extensive seasonal inundation and varying degrees of fresh and saltwater (tidal) influence. The species uses habitats that have shallow drainage channels and depressions which support a mosaic of vegetation consisting of saltmarsh grassland, dense beds of rushes or sedges, patches of samphire and areas of bare or sparsely-vegetated mud and/or shallow water. The species relies on rush/sedge and grassland vegetation along drainage lines and depressions for shelter and nesting and more sparse grasslands and samphire for foraging. These habitats are reliant on surface flows and tidal influence.

There is no approved conservation advice for this species. There are two threat abatement plans relevant to this species:

- threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses⁴¹
- threat abatement plan for predation by feral cats.⁴²

There is a recovery plan for this species: *Yellow chat (Capricorn subspecies) Epthianura crocea macgregori*⁴³.

Key threats identified in the recovery plan include land management activities that:

- interfere with surface flows upon which productivity of marine plain wetlands are dependent
- reduce habitat and hydrological complexity
- damage sedges and grasses that provide shelter and nesting habitat
- cause habitat losses.

Other key threats include replacement of native sedges and grasses by introduced pasture grasses, trampling of habitat by grazing cattle, increased groundwater salination, siltation, prolonged floods and predation by feral cats.

The recovery plan also highlights that any reduction or alteration of surface flows into catchments supporting Capricorn yellow-chat sub-populations may adversely affect the timing and extent of inundation of habitat required to promote breeding and subsequent

⁴¹ Commonwealth of Australia, *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses*, Department of Sustainability, Environment, Water, Population and Communities, Canberra, 2012, viewed 2 November 2016, <https://www.environment.gov.au/system/files/resources/ff24e078-fbb9-4ebd-855d-db09cb4db1f8/files/five-listed-grasses-tap.pdf>

⁴² Commonwealth of Australia, *Threat abatement plan for predation by feral cats*, Department of the Environment, Canberra, 2015, viewed 8 November 2016, <https://www.environment.gov.au/system/files/resources/78f3dea5-c278-4273-8923-fa0de27aacfb/files/tap-predation-feral-cats-2015.pdf>

⁴³ W Houston and A Melzer, *Yellow chat (Capricorn subspecies) Epthianura crocea macgregori recovery plan: Report to Department of the Environment, Water, Heritage and the Arts, Canberra*, Queensland Environmental Protection Agency, Brisbane, 2008, viewed 12 September 2016, <https://www.environment.gov.au/system/files/resources/ecd1aa78-2135-49d0-8b0b-dce3325b3f98/files/e-c-macgregori.pdf>

survival during the dry season. It is therefore considered that any future stream diversions due to construction of weirs, road infrastructure, water-harvesting or ponded pasture proposals in significant Capricorn yellow-chat catchments be assessed for potential adverse effect on habitat.

Impacts and mitigation

As discussed in Section 6.4 of this report, the project is not expected to significantly alter flows downstream of the Fitzroy Barrage. As Capricorn yellow-chat sub-populations are found in the areas beyond the Fitzroy Barrage, its habitat is not expected to be affected by any altered flow regimes. The proponents would be required to ensure that water releases comply with the EFOs at the barrage. The project would not be expected to have water quality impacts on Capricorn yellow-chat habitat downstream. As discussed in previous section the proponents have proposed a number measures to manage potential water quality impacts including undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring the appropriate storage of hazardous chemicals and substances. These measures would be expected to reduce the potential for any adverse water quality impacts in the project area and consequently impacts on Capricorn yellow-chat habitat downstream.

Coordinator-General's conclusion

I am satisfied that the EIS has adequately identified the potential impacts that the proposed action could have on the Capricorn yellow-chat. The proponents would be under a statutory obligation to ensure that water releases are made to meet the EFOs at the Fitzroy Barrage and downstream of the barrage.

In light of the proposed avoidance and mitigation measures and conditions in this report for the management of flow regimes and water quality, I consider the impacts on the Capricorn yellow-chat are not unacceptable and the proposed management actions are not inconsistent with the recovery plan for the species and relevant threat abatement plans.

Red goshawk

Background

Erythrorchis radiatus (red goshawk) is listed as 'vulnerable' under the EPBC Act. It occurs in coastal and sub-coastal areas in the tropical and warm-temperate areas of Australia within tall open forests and woodlands, rainforest margins and tropical savannas traversed by wooded or forested rivers.

Historically, the species occurred from the north-east tip of New South Wales (NSW), across Queensland and the Northern Territory, to the north of Western Australia. However it is now considered to be virtually extinct in NSW and Western Australia. Significant declines in the Queensland population have also been observed in more recent years.

The red goshawk is largely a sedentary species (occupying the same territory throughout the year), with large home ranges of up to 200 km². The species prefers a mosaic of vegetation types, large prey populations (birds), and permanent water

sources. Nesting is typically restricted to tall trees (more than 20 m tall) which are located within 1 km of a watercourse or wetlands.

It is considered that the red goshawk has the potential to use the project area based on the existing records and the presence of suitable habitat to support foraging and nesting. The closest record of this species is near the proposed Rookwood Weir impoundment, approximately 10 km from the confluence of the Dawson and the Mackenzie Rivers.

The proponents have undertaken surveys generally in accordance with the survey guidelines for the red goshawk. Approximately 196 person hours were spent searching for suitable nesting habitat over both the wet and dry seasons and no nests or red goshawk were identified during these surveys. However, the surveys were only undertaken for one year and no consecutive surveys have been undertaken since 2007.

There is a national recovery plan for the Red Goshawk: *National Recovery Plan for the Red Goshawk Erythrotriorchis radiatus*.⁴⁴ The recovery plan states that the main cause of decline of the red goshawk in north-east NSW and eastern Queensland is the widespread clearance of native forests and woodlands for agriculture. Other threats identified in the recovery plan are fragmentation and degradation of habitat, direct disturbance and/or loss of nesting sites and changes to prey availability.

An action identified in the recovery plan that is relevant to the project is reducing the effects of habitat fragmentation and degradation by encouraging landholders to protect and manage threatened red goshawk territories.

There is an approved conservation advice for the red goshawk: *Conservation Advice for Erythrotriorchis radiatus (red goshawk)*.⁴⁵ The conservation advice identifies a number of key threats to this species, including vegetation clearing for agriculture and timber, loss and/or degradation of freshwater wetlands, loss of hollow-bearing trees and inappropriate fire regimes. The key conservation and management action in this conservation advice which is relevant to the project is encouraging landholders to protect and manage red goshawk territories.

There are no threat abatement plans relevant to this species.

Impacts and mitigation

The project is expected to result in the loss of 1,243 ha of potential foraging habitat and 972 ha of potential nesting habitat. The EIS indicated that, subject to detailed design, vegetation clearing for the creek crossings and weir infrastructure has been avoided and minimised as far as practicable. The loss of vegetation within the impoundment areas is considered to be an unavoidable impact.

⁴⁴ Department of Environment and Resource Management, *National recovery plan for the red goshawk Erythrotriorchis radiatus*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra. Queensland Department of Environment and Resource Management, Brisbane, 2012, viewed 30 June 2016, <https://www.environment.gov.au/system/files/resources/115185bc-74f7-40e4-a0af-f46aaa482dc7/files/erythrotriorchis-radiatus.pdf>

⁴⁵ Commonwealth of Australia, *Approved Conservation Advice for Erythrotriorchis radiatus (red goshawk)*, Threatened Species Scientific Committee, Department of the Environment, Canberra, 2015, viewed 30 June 2016, <http://www.environment.gov.au/biodiversity/threatened/species/pubs/942-conservation-advice-31102015.pdf>

In total, the project would have a negative impact on 44 per cent of potential nesting habitat within a 1 km buffer area of the weirs (17 per cent for Rookwood and 27 per cent for Eden Bann). The recovery plan considers that the removal of more than 25 per cent of forest and woodland within 4 km of a red goshawk's nest site, or the centre of its territory is likely to hamper the viability and recovery of red goshawk populations. The localised loss of this habitat would be expected to reduce the capacity for the species to establish new breeding territories in the future and subsequently disrupt the breeding cycle of an important population.

Red goshawk populations within the Fitzroy Basin are likely to be important given the significant contraction of south eastern populations. This species is ranked as a high priority species under the EHP 'Back on Track' species prioritisation framework for the Fitzroy Natural Resource Management region.⁴⁶ The conservation of habitat is therefore important to the remaining population within the Fitzroy region.

Significant residual impacts and offsets

The project is expected to have a significant residual impact of 972 ha of potential red goshawk nesting habitat. I have recommended to the Commonwealth Environment Minister a condition requiring the proponents to provide offsets for this impact. I consider that offsets for red goshawk could be co-located with offsets for a number of State matters including regulated vegetation, and connectivity areas.

Coordinator-General's conclusion

I am satisfied that the EIS has adequately identified the potential impacts that the proposed action could have on the red goshawk. I have recommended conditions to the Minister requiring the proponents to ensure that there are no unacceptable impacts on the red goshawk, including:

- avoiding and limiting disturbance to habitat
- providing offsets for significant residual impacts.

In light of such proposed avoidance and mitigation measures and conditions in this report, I consider the impacts on the red goshawk are not unacceptable and the proposed management actions are not inconsistent with the recovery plan for the species and relevant threat abatement plans.

Squatter pigeon

Background

Geophaps scripta scripta (squatter pigeon) is listed as 'vulnerable' under the EPBC Act. Suitable nesting and foraging habitat for this species occurs in open riparian woodland habitats, open woodlands on alluvial floodplains and grasslands within the fragmented agricultural landscape.

⁴⁶ DEHP, *Back on track actions for biodiversity: Taking action to conserve species in the Fitzroy Natural Resource Management Region*, 2010, viewed 3 November 2016, <https://www.ehp.qld.gov.au/wildlife/prioritisation-framework/bot-biodiversity-documents.html> viewed 1 November 2016.

The squatter pigeon was recorded on several occasions in open woodland and grassland habitats near the proposed Eden Bann Weir and Rookwood Weir impoundments during EIS surveys. The EIS stated that the species is relatively common in the project area. Suitable habitat in the project area includes REs 11.12.2 and 11.3.2.

There is an approved conservation advice for this species: *Approved Conservation Advice for Geophaps scripta scripta (Squatter Pigeon (southern))*.⁴⁷ Key threats to this species identified in the conservation advice are:

- ongoing clearance of habitat for farming or development
- grazing of habitat by livestock and feral herbivores
- predation from feral cats and foxes.

Key priority recovery and threat abatement actions which are relevant to the project include:

- managing threats to areas of vegetation that support important populations
- developing and implementing management plans for the control and eradication of feral herbivores
- implementing appropriate recommendations outlined the threat abatement plans for feral cats and the European red fox.

Threat abatement

The squatter pigeon is listed as a species that may be adversely affected by pest animal species in the following threat abatement plans:

- *Threat abatement plan for predation by feral cats*⁴⁸
- *Threat abatement plan for predation by the European red fox*⁴⁹
- *Threat abatement plan for competition and land degradation by rabbits*.⁵⁰

The European red fox and the rabbit are Category 3, 4, 5 and 6 restricted matters and the feral cat is a Category 3, 4, and 6 restricted matter under the Queensland *Biosecurity Act 2014*. Under this Act, landowners have a 'general biosecurity obligation' to take all reasonable and practical steps to minimise the risks associated with invasive plants and animals on a person's land. The proponents have committed to keep the weir project sites free of invasive animals in accordance with a feral animal management plan.

⁴⁷ Commonwealth of Australia, *Approved Conservation Advice for Geophaps scripta scripta (Squatter Pigeon (southern))*, Threatened Species Scientific Committee (TSSC), Department of the Environment, Canberra, 2015, viewed 1 November 2016, http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440

⁴⁸ Commonwealth of Australia, *Threat abatement plan for predation by feral cats*, Department of the Environment, Canberra, 2015, viewed 2 November 2016, <https://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats>

⁴⁹ Commonwealth of Australia, *Threat abatement plan for predation by the European red fox*, Department of the Environment, Water, Heritage and the Arts, Canberra, 2008, viewed 2 November 2016 <http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox>

⁵⁰ Commonwealth of Australia, *Threat abatement plan for competition and land degradation by rabbits*, Department of the Environment, Water, Heritage and the Arts, Canberra, 2008, viewed 2 November 2016, <http://www.environment.gov.au/system/files/resources/7097f100-4a22-4651-b0e1-df26e17c622c/files/tap-rabbit-report.pdf>

Impacts and mitigation

The project is expected to result in a loss of riparian woodland habitat available to this species in the short term. The EIS indicated that suitable habitat for this species would persist in large fragments on low rocky hills and uncleared alluvial plains.

It is considered that the regional viability of this species is unlikely to be adversely affected and the creation of new permanent water bodies would provide some benefit to this species. The project is expected to result in the loss of 15 ha of RE 11.12.2 and 6.3 ha of RE 11.3.2.

I have recommended conditions of approval requiring the proponents to provide offsets to compensate for loss of vegetation associated with impoundments and the construction of the creek crossing and access road to Eden Bann Weir. These offsets would be expected to benefit the squatter pigeon.

Significant residual impacts and offsets

The project would have a significant residual impact of 21.3 ha on the squatter pigeon. However the loss of 21.3 ha of potential habitat is expected to be temporary. Offsets that are required for the loss of vegetation within the impoundments, creek crossings and access roads for brigalow EC would address the requirements of an offset for squatter pigeon.

Coordinator-General's conclusion

I am satisfied that the proponents have adequately identified the potential impacts that the project could have on the squatter pigeon. I consider the impacts on the squatter pigeon are not unacceptable and would be addressed in my recommended conditions. I also consider that the proposed mitigation measures including weed and pest management are not inconsistent with the relevant threat abatement plans.

6.6.4 Threatened aquatic fauna

Habitat assessment

Habitat assessments were undertaken at sites representing aquatic habitats throughout the project area and in the downstream reaches to the Fitzroy Barrage. Subsequent surveys for aquatic fauna were undertaken for the Eden Bann project area on 13 and 14 February 2009 (wet season) and 12 and 14 July 2009 (dry season). Nesting bank surveys were conducted at the Eden Bann Weir project area between 15 and 18 December 2008.

Surveys for aquatic fauna were undertaken for the Rookwood Weir project area between 29 April and 1 May 2009 (wet season) and 25 and 30 July 2008 (dry season). Turtle nesting bank surveys were undertaken in the Rookwood Weir project areas between 9 and 12 December 2008 and 25 and 30 July to coincide with turtle nesting/hatching seasons.

Fitzroy River turtle

Background

The Fitzroy River turtle, also known as the Fitzroy Tortoise, is listed as 'vulnerable' under the EPBC Act. The species is endemic to the Fitzroy Basin catchment and is known to occur within the project footprint. The Fitzroy River turtle is listed as a high priority species under EHP's 'Back on Track' prioritisation framework for the Fitzroy Basin catchment.

The Fitzroy River turtle inhabits flowing riverine habitats. The species can respire aquatically (extract oxygen from water), which allows it to remain submerged underwater for longer periods (days or weeks at a time). This ability allows the species to use fast-flowing riffle zones from which air-breathing turtle species are primarily excluded, allowing access to a higher abundance and diversity of food resources.

The species is considered to have a relatively small home range (up to 4 ha). However, it is known to travel much greater distances (in the order of tens of kilometres) for the purposes of dispersal, courtship and repositioning after floods. Upstream and downstream migrations may also occur during the nesting season.

The Fitzroy River turtle nests in spring (between September and October) with hatchlings emerging in the summer months (between December and January). Nesting is typically restricted to alluvial sand/loam banks (approximately 5 m from the water's edge) that have a relatively steep slope, a low density of the ground/understorey vegetation and partial shade cover. Female turtles tend to nest in aggregations, nesting in the same general area. The EIS indicated that within the project area there is important nesting habitat at the Glenroy, Redbank and Boolburra Rail crossings and Marlborough Creek.

During the EIS surveys, nesting activity was recorded at six nesting banks within the Rookwood Weir project area with five of these sites confirmed to have contained eggs. Another two nesting banks, one within the Rookwood Weir project footprint and one within the Eden Bann Weir project footprint, were identified as being highly suitable for Fitzroy River turtle nesting.

Important nesting habitat is also known to occur at Alligator Creek which is located 40 km downstream of the project footprint, within the upper reaches of the Fitzroy Barrage impoundment. This area supports the largest known nesting aggregation of Fitzroy River turtles. Nesting aggregations have also been recorded within the upper reaches of the Tarrus Weir impoundment on the Isaac River and immediately downstream of the Tarrus Weir on the Mackenzie River.

There is an approved conservation advice currently in place for this species: *Approved Conservation Advice for Rheodytes leukops (Fitzroy Tortoise)*.⁵¹ The conservation advice identifies a number of key threats to the species, including loss and disturbance of habitat from agriculture, mining, damming of rivers, and pollution and siltation of

⁵¹ Commonwealth of Australia, *Approved Conservation Advice for Rheodytes leukops (Fitzroy Tortoise)*, Department of the Environment, Canberra, 2008, viewed 2 September 2016, <http://www.environment.gov.au/biodiversity/threatened/species/pubs/1761-conservation-advice.pdf>

rivers and creeks. The most significant threat to this species is the loss of nests to predation. The species is threatened by very high rates of nest predation by feral animals (pigs and foxes), goannas and water rats, with nearly 100 per cent of nest clutches being predated each season. Nests are also trampled by cattle. With lack of hatchling recruitment into the population, the species is considered to be at a high risk of extinction.

The regional and local priority recovery and threat abatement actions in the conservation advice which are relevant to the project include:

- protecting areas of riparian habitat where populations are known or have the potential to occur
- ensuring infrastructure or development activities do not impact on known populations
- managing changes in hydrology that may result in changes to water table levels increased runoff, sedimentation or pollution
- controlling or eradicating feral animals around breeding colonies
- improving recruitment of hatchlings into the population
- maintaining stream flow and the continuity of turtle populations between impoundments
- controlling and managing access to nest sites and managing known threats on private land
- considering the requirements and protection of this species in all proposals for impoundment developments
- minimising adverse impacts from land use at known sites
- maintaining nesting banks and protecting turtle nests from predation and disturbance
- improving water quality in the lower Fitzroy River catchment.

The threat abatement plans for feral cats and the European red fox are relevant to the Fitzroy River turtle.

Impacts and mitigation

Loss of nesting areas—construction

Water flows downstream of the construction footprint are to be maintained during the construction period and a diversion strategy would be implemented at the Rookwood Weir site. The existing fish lock at Eden Bann would remain in operation during construction of the right bank to maintain flows. During the raising of Eden Bann Weir, a turtle passage facility would be provided to allow for safe passage of turtles past the construction footprint when works move to the left bank.

Flows would be maintained within the natural river channel at all river crossing construction areas. Existing low level causeways at river crossings would remain in place during bridge construction to facilitate water flows and maintain turtle movement.

The EIS stated that no areas containing nesting habitat or areas that have a high potential for supporting nesting habitat are proposed to be disturbed for acquiring

materials during construction. The proponents propose to source extraction materials required for construction from the project excavation footprints and future inundation areas where possible, to avoid impacts on turtle nesting habitat.

Important areas of nesting habitat which have the potential to be affected by construction activities include the areas around Glenroy Crossing. To reduce the risk of potential nest disturbances, the proponents have committed to avoid construction works at Glenroy Crossing during peak nesting and hatching seasons (September to March). In addition, the proponents have also committed to ensure that all construction personnel are appropriately inducted to manage activities in a way that reduces disturbance to individual turtles and nesting habitat. Based on the information provided in the EIS and the proponents' commitments, I consider that construction activities associated with the project can be managed to prevent any adverse impacts on the Fitzroy River turtle.

Loss of nesting areas within the impoundments—operation

During operation, each weir has the potential to impact on turtle nesting habitat within the impoundments by inundating known existing and potential nests within the weir storage footprints.

The project would be expected to result in the inundation of 80 per cent of potential Fitzroy River turtle nest areas within the impoundment footprints including 2.5 ha of the known/potential nesting habitat within the Rookwood Weir impoundment (at Stage 2) and 3.2 ha of potential nest areas within the Eden Bann Weir impoundment (at Stage 3).

While the project would result in the inundation of potential nesting habitat, it is expected that turtle nesting is likely to re-establish within or adjacent to inundation areas over time. The proponents have proposed a number of measures to encourage re-establishment of turtle habitat within the impoundments including:

- avoiding rapid drawdown of the storages and controlling water levels to allow for the stabilisation of nesting habitat around the margins of the impoundment (where possible)
- rehabilitating and restoring areas impacted by scouring, erosion and slumping.

Submissions on the EIS indicated that the re-established nesting areas would be at risk of being inundated and requested the proponents to determine whether impacts on turtle nests could be mitigated by regulating water levels within the impoundments. This strategy has been used successfully in the Burnett catchment for managing impacts on white-throated-snapping-turtle nests within the Ben Anderson Barrage impoundment.

The EIS indicated that there would be limited capacity to regulate water levels within the proposed Rookwood Weir impoundment as there are no suitable structures upstream from which regulated releases could be made to maintain a nominated water level within the impoundment. The EIS indicated that while there is potential for the proposed Rookwood Weir to regulate flows to Eden Bann Weir to some degree, this would be limited and likely to be superseded by naturally occurring high river flows that overtop the spillway.

While the ability to regulate water levels within the impoundments would be limited, I have recommended a condition to regulate water levels in Eden Bann Weir during turtle nesting season, when it is practical to do so.

Loss of nesting habitat downstream of the impoundments—operation

During operation, the project has the potential to impact on turtle nesting habitat downstream of the weirs by:

- inundating nesting habitat downstream as a result of operational water releases which raise water levels
- altering the quality of nesting habitat downstream by reducing the frequency and magnitude of small to medium downstream flood flows.

Both weirs are in-river structures and are designed to be overtopped and they are not designed for flood mitigation. When a weir wall is breached during a flood event, the release of water downstream would be uncontrolled. This outcome would be similar for the no-project option.

Submissions on the EIS indicated that the turtle nests downstream would be at risk of being inundated by water releases from the impoundments and requested the proponents to determine whether impacts on nests could be mitigated by regulating the timing and volume of water releases.

The EIS indicated that while water releases through environmental and water supply outlets would be undertaken in accordance with the EFOs, there would be times when there would be uncontrolled releases (spill events). These spill events would be expected to raise water levels downstream above controlled releases and subsequently inundate turtle nests downstream. Based on this assumption the proponents consider that it would not be feasible to manage water releases all of the time to minimise impacts on turtle nests downstream.

I have made a general recommendation that the proponents manage water releases from each weir to minimise impacts on turtle nests downstream.

The project would also be expected to impact on turtle nests downstream by altering the frequency and magnitude of flood events. The EIS indicated that the operation of the weirs is likely to reduce the frequency and magnitude of small to medium downstream flood flows. This reduction in flood flows would have the potential to alter the availability of suitable turtle nesting habitat downstream by disrupting the natural replenishment of these banks and enhancing conditions for aquatic plant growth over potential nesting areas. The availability of nesting areas is largely dependent on the transport and deposition of sediment associated with large flooding events and would therefore be influenced by any changes to flood flows.

The EIS indicated that large flood flows (more than 9,000 m³/s) would not be affected by the proposed infrastructure and that sufficient sediment transport would be maintained downstream. These higher flows would also be expected to remove any aquatic plants that have established in these areas. This suggests that a reduction in the frequency and magnitude of small to medium downstream flood flows would not have a significant impact, as larger flood events would maintain these areas.

The proponents have committed to undertake monitoring to identify any signs of degradation as a result of changes in the downstream flow regime and have committed to investigate corrective actions and adaptive management measures where any adverse impacts are identified. This monitoring would be undertaken at sites where important nesting habitat is known to occur (e.g. Alligator Creek aggregated nesting area).

Barriers to passage

Impoundment infrastructure and road causeways can impede the upstream and downstream movement of turtles. This restricted movement in the river may disrupt reproductive behaviours and subsequently result in genetically isolated populations.

The turtle passage is already restricted by the existing Eden Bann Weir structure. The existing fishway on that weir is not conducive to the safe passage of turtles.

The section of the Fitzroy River where the Rookwood Weir is proposed is an undeveloped site that currently provides unimpeded passage for turtles. Construction of the Rookwood Weir would create a barrier to passage upstream and downstream.

To mitigate these barriers to passage, the proponents have committed to construct a specifically designed turtleway at each weir. The turtleway would include design features which provide:

- both upstream and downstream passage
- passage in all headwater/tailwater conditions from dead storage up to 'drown out' of the weirs
- passage on the bank adjacent to the main river channel
- entry and exit points sloped and located at the river margins where turtles can access them at low velocity conditions
- a roughened concrete-lined channel suitable for turtles to climb
- small attraction flows maintained by a pump.

The proponents have committed to consult with EHP during the detailed design phase to refine the design of the turtleway at each of the weirs.

The design of the passage would be influenced by data collected by turtle movement studies. These studies are intended to improve current knowledge of turtle movement patterns, home range and seasonal variations. The results of the study would inform the requirements for turtle passage and would facilitate quantifiable performance criteria to measure the effectiveness of the turtleways during operation. The EIS indicated that the study would be implemented through a university research program (or similar approach with qualified experts) in collaboration with EHP.

I have recommended a condition to ensure that the effectiveness of the turtleway is monitored until it can be demonstrated that turtle movement is not being restricted by either weir. In the event that monitoring shows that turtle passage is being restricted, the condition requires the proponents to adaptively manage the turtleway and/or supplement passage (if required) with a catch and release program until it can be demonstrated that passage is no longer being restricted. The condition also requires the proponents to maintain the operation of each turtleway for the life of the project.

The EIS found that the existing low-level causeways at Glenroy, Riverslea and Foleyvale crossings currently do not provide adequate passage for turtles. It is considered that the upgrades proposed for these crossings may improve turtle passage.

Loss of aquatic habitat—construction

Construction would involve a number of activities that have the potential to impact on aquatic habitat including the removal of vegetation, excavation of bed and banks and resource extraction within the weir construction footprints.

Construction activities associated with the raising of Eden Bann Weir are expected to have minimal impact on turtle habitat as construction works would be undertaken within the existing impoundment footprint and degraded habitat downstream. These areas are not known to support turtle nesting and are considered to provide limited foraging habitat for the Fitzroy River turtle.

Some activities associated with the construction of the Rookwood Weir are proposed within an un-impounded section of the Fitzroy River. The construction of the Rookwood Weir is expected to result in the permanent loss of 4 ha of aquatic turtle habitat. Additional losses in aquatic habitat are also expected to occur within the river crossing construction areas.

Loss of aquatic habitat within the impoundments—operation

The reduced availability of riffle zones, particularly during periods of drought is known to affect the availability of foraging resources for the Fitzroy River turtle and subsequently affect egg production.

At FSL, the project, in conjunction with existing impoundments, would result in approximately 65 per cent of the Fitzroy River (between the junction of the Dawson River and the Fitzroy Barrage) being converted from a natural state (natural creeks and pool-riffle-run habitats) to impounded waters. This would result in a significant residual impact of 942 ha of Fitzroy River turtle aquatic habitat (282 ha at Eden Bann Weir and 660 ha at Rookwood Weir) for the Fitzroy River turtle.

Impounded habitat is characterised by deep and wide slow or zero flowing river channels with a low density of in-stream debris and overhanging riparian vegetation. It is considered that beyond 5 m depth of water, the impounded habitat is largely uninhabitable to the species due to lower DO concentrations, limited light penetration, cooler temperatures and limited food resources. This has the potential to lead to a long-term decrease in the size of the Fitzroy River turtle population.

The EIS stated that the species can persist in impounded habitat and suitable habitat would occur within the shallow littoral zones along the perimeter of the storages and in the shallow upstream margins.

Loss of aquatic habitat downstream of the impoundments—operation

The EIS found that the construction of the weirs would result in increased flows during the dry season. Increased flows may improve the quality of Fitzroy River turtle habitat by reducing the duration and severity of the pool isolation downstream and prolong the

presence of flowing riffle zones and runs. The EIS concluded that this may provide additional resources for turtles during times when conditions are limiting.

I note that the proponents have committed to maintain environmental flows downstream of the impoundments. I have made a general recommendation that the proponents manage water releases from the impoundments to maintain aquatic habitat for this species. This recommendation is additional to the EFOs obligations under the Fitzroy WRP.

Water quality impacts—construction

Poor water quality may also threaten the Fitzroy River turtle. Reduction in DO levels has the potential to alter respiratory physiology and the diving behaviour of turtles. This may lead to reduced foraging and breeding rates and increased predation, particularly of hatchlings. A reduction in water quality also has the potential to alter the abundance and diversity of foraging resources (e.g. aquatic plants, macroinvertebrates and benthic invertebrates), particularly when associated with reduced flows.

The EIS indicated that construction activities involving ground disturbance and the removal of vegetation may result in temporary and localised impacts to water quality. As discussed in previous section the proponents have proposed a number measures to manage potential water quality impacts including undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring the appropriate storage of hazardous chemicals and substances. The proponents have committed to these measures, through its EMP. These measures would be expected to reduce the potential for any adverse water quality impacts in the project area and consequential impacts on Fitzroy River turtles using these areas.

Water quality impacts—operation

The project is not expected to have any significant impact on water quality within the Fitzroy system during operation. Water releases from the weir would need to comply with the required WQOs for the Fitzroy Basin ROP.

The majority of the water quality impacts would be associated with the retention of vegetation within the impoundments. During operation, the project would not be expected to significantly contribute to nutrients downstream other than from decaying vegetation within the impoundments. Modelling indicates that gradual decay of organic matter within the impoundments would result in a temporary reduction in water quality, particularly with regard to increased nitrogen and phosphorous over the first year of filling each impoundment. This impact would likely reduce gradually to background levels over the subsequent six years.

Elevated nutrient levels may affect the Fitzroy River turtle and may also cause algal blooms, and a subsequent reduction in DO levels and availability of prey resources. However, these impacts would be temporary under most conditions and wet season inflows, overtopping of the spillway, operational releases and releases through the fishways and outlet works would dilute and flush nutrients and materials from the impoundments over time. Potentially, if this decay period coincided with a drought and there are little to no inflows in the warmer months of the year, this may result in more severe or prolonged algal blooms.

The proponents have committed to a number of measures to assist in maintaining water quality during operation including the use of multi-level offtakes in the weir design; selective withdrawal outlets and manipulating flows to prevent the build-up of blue-green algae. These measures would be expected to assist in preventing a build-up of nutrients within the impoundments.

The proponents have committed to undertake water quality monitoring and would take corrective actions in the event that any adverse water quality impacts are identified.

Turtle injury and mortality—construction

The proponents have proposed a number of management actions to avoid and minimise the potential for turtle injury or mortalities during construction. The proponents have committed to these measures, through a species management program, which would need to be approved by EHP and the Commonwealth Environment Minister, prior to commencing the proposed action.

All river banks within the construction footprint would be surveyed prior to construction by a suitably qualified ecologist during peak nesting (September to November) and hatching seasons (November to March).

Prior to disturbing any aquatic habitat, the impact area would be surveyed by a suitably qualified fauna spotter and any turtles that are identified would be captured and relocated. These surveys would be undertaken immediately after rainfall to detect any evidence of turtle nesting or hatchlings and would be undertaken repeatedly throughout the nesting and hatching season.

If nesting is confirmed to be present in the construction footprints, the area is to be marked in the field and in construction maps. Nest protection mesh would also be placed over any identified nests to protect against predation.

Exclusion measures, including fencing/netting or bund walls would be used where required to prevent turtles entering construction areas. All construction personnel would be informed of their environmental responsibility with respect to minimising the risk of turtle injury or mortality.

Turtle injury and mortality—operation

Impoundment structures create a number of risks for turtles. Studies in the Fitzroy Catchment have reported large numbers of turtles killed annually as result of water supply infrastructure. Many of these deaths can be attributed to being trapped on trash screens and making contact with hard structures during over-topping events or high volume water releases.

The EIS indicated that the structural components of the proposed weirs and associated works would be designed to minimise the risk of turtle injury or mortality. Key design features typically associated with turtle injuries (i.e. stepped spillways, dissipater teeth, high turbulence, insufficient pool length and depth, high velocity trash screens) would be entirely avoided.

The proposed measures would be further refined during the detailed design phase in consultation with EHP. The proposed measures include design features that would

reduce the risk of turtles being projected against hard structures, being trapped and drowned, and features that would discourage turtles from moving into unsafe locations.

The provision of a properly functioning turtleway would also reduce injury and mortality. I have recommended a condition requiring the proponents to build a specifically designed turtle passage facility at each of the weirs and to ensure that the structural and operational design of the turtleway does not result in an increased risk of turtle injury or mortality.

In addition, the proponents have committed to ensure that the operating strategy for each weir would include actions that would avoid or minimise the risk of aquatic fauna injury and mortality including:

- controlling the flow of water through release valves to provide gradual increments in water release volumes
- increasing water releases during dawn and dusk period when turtles are more likely to be away from weir infrastructure
- operating the flood gates next to the fishway independently and initiating the gate-opening sequence with this gate to build tailwater in the stilling basin.

Threat abatement

The project has the potential to increase the abundance of predators within the weir impoundments as result of increasing permanent water resource availability. To mitigate impacts from feral predators, the proponents have committed to implement a feral animal control program. Control measures are likely to include culling, baiting and trapping pigs, foxes, wild dogs and feral cats.

The proponents have also committed to implement a weed management plan which would include the management of terrestrial and aquatic weeds to prevent weeds from blocking access to nesting habitat.

Significant residual impacts and offsets

Nesting habitat

Impacts on nesting habitat are considered to be mostly unavoidable. While the proponents have made a commitment to regulate water levels for some of the time (i.e. where practicable), up to 80 per cent of nests could be inundated within the impoundments. This is considered a significant residual impact and as such I require that the proponents provide offsets to compensate for this loss of nesting habitat. Offsets may also be required for impacts on nests downstream. The actual offset obligation for impacts on nesting habitat would be determined when the proponents finalise their offset management plan.

To compensate for the unavoidable loss of turtle nesting habitat within the impoundments, the proponents have committed to a nest protection program (i.e. from predation and trampling cattle) as part of their offset obligations. Similar nest protection programs for the Fitzroy River turtle have been undertaken within the upper reaches of the Fitzroy Barrage impoundment and the Fitzroy Basin Association has reported some success with this technique.

The proponents have prepared a draft offset proposal for the Fitzroy River turtle which includes a nest protection program.

The protection of nests would be expected to improve nest success and subsequent hatching rates. At this stage, the proponents have not confirmed which sites would be targeted for protection. There are three sites within the upper reaches of the proposed Rookwood Weir impoundment that are considered potentially suitable for nest protection. These areas would be unaffected by the impoundment.

The EIS indicated that there are a number of sites outside of the impoundments potentially suitable for offset actions, including:

- nine sites downstream between Eden Bann Weir and the Fitzroy Barrage
- ten sites identified between the upper extent of the raised Eden Bann Weir impoundment and the proposed Rookwood Weir impoundment
- twenty-seven sites 50 km upstream of the Rookwood Weir impoundment on the Dawson and Mackenzie Rivers.

Use of off-site locations for offsets would be subject to landholder negotiations to allow access to river banks and the exclusion of livestock during nesting seasons.

The offset proposal would need to be finalised and approved by the Commonwealth Environment Minister prior to commencing the proposed action. It is considered that current draft proposal does not include enough information to ensure the proposed offset is enforceable. As such I have recommended a condition to the Minister requiring that the final offset management plan include details of:

- how the offset would be secured and timeframes for when the offset would be secured
- the predation program including timelines and additional mitigation measures and the timelines to monitor and report on the effectiveness of the program
- any contingency measures.

Aquatic habitat

The project is expected to have a significant residual impact of 942 ha of Fitzroy River turtle habitat (282 ha at Eden Bann Weir and 660 ha at Rookwood Weir). The proponents have considered direct offsets (land-based) to be impractical and have a preference to undertake other compensatory measures (i.e. financial offset contribution). While the 2012 *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*⁵² generally requires that 90 per cent of the offset requirements for any given impact are met through direct offsets, the proportion of other compensatory measures can be increased if it can be demonstrated that there would be a greater benefit to the protected matter. Based on the current Queensland environmental offsets Financial Settlement Offset Calculator the proponents would be required to provide a financial contribution of approximately \$10,331,000. I have

⁵² Commonwealth of Australia, *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, Department of Sustainability, Environment, Water, Population and Communities, Canberra, 2012, viewed 29 July 2016, http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf

recommended a condition to the Commonwealth Environment Minister, requiring that if the proponents elect to provide a financial offset, that the financial settlement offset funds be paid into either an account or financial facility administered by EHP or the relevant Government entity. If the funds are paid into an account or financial facility administered by EHP the funding would be spent on activities or programs which deliver a conservation outcome for the Fitzroy River turtle. Information regarding the financial settlement offset would be made publically available on the EHP 'register of offsets' on the Queensland Government website⁵³.

Coordinator-General's conclusion

I am satisfied that the proponents have adequately identified the potential impacts that the proposed action could have on the Fitzroy River turtle.

To ensure no unacceptable impacts on this species, I require the proponents to manage impacts through conditions recommended in this report, including offsets for impacts on nesting and foraging habitat.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponents to design and construct a turtleway that is informed by a turtle movement study, which provides for the safe passage and maintains movement. I would expect the proponents to manage further impacts on turtle nests downstream and to maintain suitable aquatic habitat between and downstream of the impoundments.

In light of the proposed avoidance and mitigation measures, and conditions in this report, I consider the impacts of the project on the Fitzroy River turtle are not unacceptable or inconsistent with the threat abatement plans relevant to the species.

6.6.5 Listed threatened marine fauna

Background

The PMST report identified 11 EPBC Act listed threatened marine fauna including two marine mammals, three sharks and six marine turtles.

Impacts and mitigation

Given the distance of the project to marine areas the project is not expected to have a direct impact on listed threatened marine fauna.

As discussed in the 'World Heritage properties' section of this report, the proposed action is not expected to have any direct water quality or flow regime impacts on the estuarine/marine waters downstream of the Fitzroy Barrage and therefore no impacts on listed threatened marine fauna.

The increase in nitrogen and phosphorus entering the marine waters of the GBR from decaying vegetation in the impoundment areas is not expected to have a significant impact on listed threatened marine fauna (refer Section 6.6.5). The potential impact of the project's consequential FAD has also been described in Section 6.4.

⁵³ <https://www.qld.gov.au/environment/pollution/management/offsets/>

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on listed threatened marine fauna. I am satisfied that water quality impacts would be adequately managed to avoid adverse impacts on the receiving environment and subsequently the estuarine/marine water downstream of the project site, which provide habitat for these marine fauna species.

I also expect that the conditions I have recommended to the Commonwealth Environment Minister requiring the proponents to manage water quality impacts on the GBRWHA associated with FAD would provide water quality benefits for these marine fauna.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on listed threatened marine fauna would not be unacceptable.

6.7 Listed migratory species

In deciding whether or not to approve the proposal for purposes of section 20 or 20A of the EPBC Act, and what conditions to attach to such approval, the Commonwealth Environment Minister must not act inconsistently with Australia's obligations under the following conventions and agreements:

- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- Japan—Australia Migratory Bird Agreement (JAMBA)
- China—Australia Migratory Bird Agreement (CAMBA)
- Republic of Korea—Australia Migratory Bird Agreement (ROKAMBA).

An EPBC Act protected matters search identified 20 listed migratory marine species of fauna including seven marine mammals, six turtles, six sharks and the salt-water crocodile (*Crocodylus porosus*) and 18 species of marine bird.

6.7.1 Listed migratory marine fauna

Migratory marine birds

Most migratory bird species are not expected to use the project area. There are no records of any of these species in the immediate project area and most species are more likely to use the wetland and estuarine habitats downstream of the weirs. The site is therefore not considered to provide important habitat for any listed migratory bird species.

As discussed in the Section 6.4 of this report, the proposed action is not expected to have any direct water quality or flow regime impacts on the estuarine/marine waters downstream of the Fitzroy Barrage and therefore no impacts on potential listed migratory marine bird habitat.

Migratory marine fauna (non-bird species)

Due to the proximity of the project to the ocean (more than 100 km away) the project is not expected to have any direct impacts on any listed migratory marine fauna, with the exception of the saltwater crocodile.

Saltwater crocodile

Impacts and mitigation

Impacts on aquatic habitat

The existing Eden Bann Weir impoundment supports the highest density of saltwater crocodiles in the Fitzroy River and this is considered to be a healthy population. Consequently, the raising of the Eden Bann Weir is not expected to have an adverse impact on this population. Raising the weir would create more permanent areas of deep water, which may present suitable foraging and sheltering habitat for crocodiles. Similarly, the construction of Rookwood Weir would not be expected to have an adverse impact on crocodiles or their habitat. The construction of this weir may create similar conditions to Eden Bann Weir, but the extent to which this would result in crocodile colonisation in this area is difficult to predict.

Water quality impacts—construction

The EIS indicated that construction activities may result in temporary and localised impacts on water quality. Activities include ground disturbances associated with excavation and earthworks, road construction and the removal of vegetation. As discussed in previous section the proponents have proposed a number measures to manage potential water quality impacts including undertaking works during the dry season, complying with relevant sediment and control guidelines and ensuring the appropriate storage of hazardous chemicals and substances. These mitigation measures would be expected to reduce the potential for any adverse water quality impacts in the project area and subsequently any impacts on saltwater crocodiles using these areas.

Water quality impacts—operation

During operation, the project would not be expected to significantly contribute to nutrients downstream other than from decaying vegetation that would be retained within the impoundments. Modelling indicates that gradual die-back of vegetation retained within the impoundments would be expected to result in a temporary reduction in water quality, particularly with regard to nutrients (nitrogen and phosphorous). Nutrient levels within the impoundments would be expected to be elevated for the first few years after filling, however would reduce gradually over a period of six years.

It is considered that saltwater crocodiles may be affected by the elevated nutrient levels associated with impounded decaying vegetation. Elevated nutrients may potentially result in algal blooms within the impoundments and subsequently a reduction of DO levels and availability of prey resources. However, these impacts would likely be temporary and it is expected that wet season inflows, overtopping of the spillway, operational releases and releases through the fishways and outlet works would dilute

and flush any nutrients and materials from the impoundments overtime. The proponents have also proposed a number of other measures that would assist in maintaining water quality during operation including the inclusion of multi-level offtakes in the weir design; selective withdrawal outlets and manipulating flows to prevent the build-up of algae. These measures would be expected to assist in preventing a build-up of nutrients within the impoundments.

The proponents have committed to undertake water quality monitoring and would take corrective actions in the event that any adverse water quality impacts are identified.

Coordinator-General's conclusion

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on migratory marine fauna. I conclude that water quality impacts would be adequately managed to avoid adverse impacts on the receiving estuarine/marine water environments downstream of the weirs which provide habitat for these migratory fauna species.

I also expect that the conditions I have recommended to the Commonwealth Environment Minister requiring the proponents to manage water quality impacts on the GBRWHA associated with FAD would provide water quality benefits for migratory marine fauna.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on migratory marine fauna would not be unacceptable.

6.8 Principles of ecologically sustainable development

My assessment of the proposed action has taken into account the principles of ecologically sustainable development, as defined in Part 1, section 3A of the EPBC Act.

I have evaluated the long-term and short-term economic, environmental, social and equity considerations that are relevant to the proposed action. The potential impacts of the proposed action are addressed by conditions that restrict environmental impacts, impose strict monitoring and adopt environmental standards which, if not achieved, require the application of timely response mechanisms to avoid adverse impacts.

The proposed conditions would ensure protection of listed threatened species and communities and listed migratory species. These conditions allow for the proposed action to be developed and operated in a sustainable way to protect the environment for future generations and preserve MNES.

I have considered the importance of conserving biological diversity and ecological integrity in relation to all of the controlling provisions for this proposed action, and the assessment provided in my report reflects this consideration.

6.9 Coordinator-General's overall conclusion

I conclude that the proponents have adequately identified the impacts of the proposed action on the OUVs of the GBRWHA, outstanding heritage values of the GBR, threatened species and ecological communities and migratory species listed under the EPBC Act.

My conclusion on mitigation and management measures proposed by the proponents, and the conditions stated in this report is that the project is not inconsistent with any international conventions relevant to threatened species and communities, migratory species and world heritage properties.

6.9.1 Great Barrier Reef World Heritage Area

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the OUVs of the GBRWHA. The proponents would be required by the Fitzroy Basin ROP to ensure that water releases are made to meet the EFOs at the Fitzroy Barrage to the extent possible and therefore have no impact on flow regimes downstream of the Barrage and the waters of the GBRWHA.

To manage the potential impacts of the project on water quality flowing to the GBRWHA, I have recommended condition to the Commonwealth Environment Minister requiring the proponents to

- implement a water nutrient monitoring program to measure changes that may arise from the decay of vegetation within the impoundments
- use the results of that program to inform any potential management or offset program
- develop and implement a land management code of practice that is to be attached as a condition of sale of water for irrigated agriculture
- implement a water quality monitoring program that would inform a future water quality offsets program required by the Minister to address any impacts of FAD on water quality flowing to the GBRWHA.

In light of the proposed avoidance, mitigation and offset measures and conditions in this report, I consider that the project would not have unacceptable impact on the OUVs of the GBRWHA.

6.9.2 Great Barrier Reef National Heritage place

Consistent with the conclusion on World Heritage properties (Section 6.4.3) and the measures contained therein, I consider that the project would not have any unacceptable impacts on the GBR national heritage place.

6.9.3 Brigalow EC

I am satisfied the EIS has identified the potential impacts that the proposed action could have on the brigalow EC. I am satisfied that the proponents would implement fire reduction, weed and pest management measures and monitoring requirements that are appropriate for maintaining brigalow EC.

I have recommended conditions to the Commonwealth Environment Minister requiring the proponents ensure there are no unacceptable impacts on the brigalow EC, including:

- avoiding and limiting disturbance to habitat
- providing offsets for significant residual impacts

In light of the proposed avoidance, mitigation and offset measures and conditions recommended in this report, I consider the impacts on the brigalow EC are not unacceptable and the proposed management actions are not inconsistent with the relevant threat abatement plans and have considered the approved conservation advice for this species.

6.9.4 Black ironbox

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on the black ironbox. I am satisfied that the proponents have committed to weed and pest management measures and monitoring requirements that are appropriate for maintaining this species.

I require the proponents to manage impacts through the recommended conditions to ensure there are no unacceptable impacts on the black ironbox, including:

- avoiding and limiting disturbance to habitat
- undertaking pre-clearance surveys within clearing inundation footprint and applying appropriate measures to conserve individual plants identified during these surveys
- providing offsets for significant residual impacts.

In light of the proposed avoidance and mitigation measures and conditions recommended in this report, I consider the impacts on the black ironbox are not unacceptable and the proposed management actions have considered the approved conservation advice for this species.

6.9.5 Capricorn yellow-chat

I am satisfied that the EIS has adequately identified the potential impacts that the proposed action could have on the Capricorn yellow-chat. I am also satisfied that the proponents would be obligated by the Fitzroy Basin ROP to manage water releases to meet the EFOs for Fitzroy Barrage and therefore have no impact on flow regimes downstream of the Barrage that could impact this species.

I also expect that the conditions I have recommended to the Commonwealth Minister requiring the proponents to manage water quality impacts on the GBRWHA associated with FAD would prevent negative impacts on the Capricorn yellow-chat.

In light of the proposed avoidance and mitigation measures and conditions recommended in this report, I consider the impacts on the Capricorn yellow-chat are not unacceptable and the proposed management actions are not inconsistent with the recovery plan for the species and relevant threat abatement plans.

6.9.6 Red goshawk

I am satisfied that the EIS has adequately identified the potential impacts that the proposed action could have on the red goshawk.

I have recommend conditions to the Commonwealth Environment Minister requiring the proponents to ensure that there are no unacceptable impacts on the red goshawk, including:

- avoiding and limiting disturbance to habitat
- providing offsets for significant residual impacts.

In light of the proposed avoidance and mitigation measures and conditions in this report, I consider the impacts on the red goshawk are not unacceptable and the proposed management actions are not inconsistent with the recovery plan for the species and relevant threat abatement plans.

6.9.7 Squatter pigeon

I am satisfied that the proponents have adequately identified the potential impacts that the project could have on the squatter pigeon and that these impacts would be addressed in conditions required for impacts to brigalow EC. I consider the impacts on the squatter pigeon are not unacceptable. I also consider that the proposed mitigation measures are not inconsistent with the relevant threat abatement plans.

6.9.8 Fitzroy River turtle

I am satisfied that the proponents have adequately identified the potential impacts that the proposed action could have on the Fitzroy River turtle.

To ensure no unacceptable impacts on this species, I require the proponents to manage impacts through conditions recommended in this report, including offsets for impacts on nesting and foraging habitat.

I have recommended a condition to the Commonwealth Environment Minister requiring the proponents to design and construct a turtleway that is informed by a turtle movement study, which provides for safe passage and maintains movement. I would expect the proponents to manage further impacts on turtle nests downstream and to maintain suitable aquatic habitat between and downstream of the impoundments.

In light of the proposed avoidance and mitigation measures, and conditions in this report, I consider the impacts of the project on the Fitzroy River turtle are not unacceptable or inconsistent with the threat abatement plans relevant to the species.

6.9.9 Listed threatened marine fauna

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on listed threatened marine fauna. I am satisfied that water quality impacts would be adequately managed to avoid adverse impacts on the receiving environment and subsequently the estuarine/marine water downstream of the project site, which provide habitat for these marine fauna species.

I also expect that the conditions I have recommended to the Commonwealth Environment Minister requiring the proponents to manage water quality impacts on the GBRWHA associated with FAD would provide water quality benefits for these marine fauna.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on listed threatened marine fauna would not be unacceptable.

6.9.10 Migratory marine fauna

I am satisfied that the EIS has identified the potential impacts that the proposed action could have on migratory marine fauna. I am satisfied that water quality impacts would be adequately managed to avoid adverse impacts on the receiving environment and subsequently the estuarine/marine water downstream of the project site, which provide habitat for these migratory fauna species.

I also expect that the conditions I have recommended to the Commonwealth Environment Minister requiring the proponents to manage water quality impacts on the GBRWHA associated with FAD would provide water quality benefits for migratory marine fauna.

In light of the proposed mitigation measures and conditions recommended in this report, I consider the impacts on migratory marine fauna would not be unacceptable.

7. Conclusion

In undertaking my evaluation, I have considered the following:

- EIS and AEIS prepared for this project
- submissions on the EIS and AEIS, including agency advice.

I am satisfied that the requirements of the SDPWO Act have been complied with and that sufficient information has been provided to enable the necessary evaluation of potential impacts, and inform the development of mitigation strategies and conditions of approval.

The environmental assessment commenced with the declaration of this project as a coordinated project in May 2011 and has involved a comprehensive body of work by the proponents. More detailed work would occur in the detailed design phase of the project.

I have assessed and considered the potential impacts identified in the EIS documentation and all submissions. I consider that the mitigation measures and commitments proposed by the proponents together with the conditions and recommendations stated in this report would result in overall acceptable outcomes.

Section 6 of this report (MNES) describes the extent to which the material supplied by the Gladstone Area Water Board and SunWater Limited addresses the likely impacts on MNES of each controlled action for the project. I am satisfied that the proponents have addressed all potential impacts on MNES.

Based on the information provided by the proponents and outlined in this evaluation report, I conclude that the project could help deliver a secure water supply that would meet future demand for water from urban populations, industry and potential agricultural development in the Rockhampton, Gladstone and Capricorn Coast regions.

The project has the potential to generate economic benefits throughout the region, including the employment of 150 people during construction, five people during operation and capital expenditure of \$495 M, under the maximum development scenario. Accordingly, I recommend that the Lower Fitzroy River Infrastructure project proceed subject to the conditions in appendices 1 and 2 and the recommendations in appendices 6 and 7. In addition, I require the proponent's commitments to be fully implemented as presented in the EIS documentation and summarised in Appendix 8 of this report.

To proceed further, the proponents will be required to:

- obtain EPBC Act approval
- obtain the relevant environmental authorities under the EP Act
- obtain the relevant development approvals under the SPA
- finalise and implement the EMP
- finalise the environmental offsets plan which considers both MNES and MSES.

Copies of this report will be issued to:

- The Australian Government DEE
- DEHP
- DILGP
- DTMR
- DAF
- DNRM
- RRC
- LSC
- Treasurer, Minister for Aboriginal and Torres Strait Islander Partnerships and Minister for Sport
- Minister for Main Roads, Road Safety and Ports and Minister for Energy, Biofuels and Water Supply.

A copy of this report will also be available on the DSD website at
www.statedevelopment.qld.gov.au/lower-fitzroy

If there are any inconsistencies between the project (as described in the EIS documentation) and the conditions in this report, the conditions shall prevail. The proponents must implement all the conditions of this report.

Appendix 1. Imposed conditions—Eden Bann Weir

This appendix includes conditions imposed by the Coordinator-General under section 54B of the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This appendix applies only to stages 2 and 3 of the Eden Bann Weir component of the Lower Fitzroy River Infrastructure project (the project).

In accordance with section 54D of the SDPWO Act, these conditions apply to anyone who undertakes the construction and operation of Eden Bann Weir, such as the proponent, an assignee, agent, contractor, subcontractor or licensee of the proponent.

All of the conditions imposed in this appendix take effect from the date of this Coordinator-General's report.

These conditions do not relieve the obligation for all approvals and licences from relevant authorities required under any other Act to be obtained for Stages 2 and 3 of the Eden Bann Weir component of the project.

If the project is subject to a community infrastructure designation, the conditions in this appendix must be regarded as recommended requirements for the designation in accordance with section 43 of the SDPWO Act.

Schedule 1. White-throated snapping turtle

The imposed conditions in this schedule specifically apply to the management of impacts of Stages 2 and 3 of the Eden Bann Weir component of the project on the white-throated snapping-turtle (*Elseya albagula*).

The entity with jurisdiction for the conditions in this schedule is the Department of Environment and Heritage Protection (EHP).

Allied conditions applying to the Fitzroy River turtle (*Rheodytes leukops*), a protected species under the Commonwealth EPBC Act, are specified in Appendix 5.

Part A. Species management program

Condition 1. Species management program

The outcome sought by this condition is the development of a species management program that adequately addresses the project's impacts on the white-throated snapping-turtle.

- (a) Prior to commencement of construction, submit to EHP for approval, a species management program (SMP) for the white-throated snapping-turtle.
- (b) The SMP must detail how the population and habitat for the white-throated snapping-turtle would be managed during construction and operation of the project.
- (c) The SMP must be prepared generally in accordance with Appendix E of the additional information to the draft environmental impact statement (AEIS), and must be consistent with the conditions in this Coordinator-General's report.
- (d) Implement the approved SMP in the construction and operation phases of the project.

Part B. Turtle movement study and passage

Condition 2. Turtle movement study

The outcome sought by this condition is the provision of sufficient information on the movement of the white-throated snapping turtle to inform the design of turtle passage infrastructure and adaptive management strategies for the weir raising.

- (a) Prior to finalisation of the design for the turtle passage infrastructure, undertake a turtle movement study to collect baseline data for sections of the Fitzroy River, at locations approved by EHP.
- (b) The turtle movement study must:
 - (i) collect data on seasonal movement patterns and home ranges of the white-throated snapping turtle. The study should include wet and dry season movements, breeding periods and nesting distribution
 - (ii) be prepared and undertaken by a suitably qualified person in accordance with a methodology agreed in writing by EHP
 - (iii) inform the development of the criteria for monitoring the success of turtle movement around the weir (the turtle movement success criteria) based on the data collected during turtle movement study.
- (c) The methodology for the study must be submitted to EHP for approval, 90 days prior to commencing the turtle movement study, or as otherwise agreed with EHP.
- (d) The turtle movement success criteria must be approved by EHP, in writing, prior to the construction of turtle passage infrastructure at the weir site.

Condition 3. Turtle passage infrastructure

The outcome sought by this condition is that development of the weir does not restrict the long-term movement of the white-throated snapping-turtle upstream and downstream of the weir infrastructure.

This condition applies to both Stages 2 and 3 of the weir raising, whether constructed separately or as a combined development activity.

- (a) Turtle passage infrastructure must be built prior to the commencement of operation of each stage of the weir.
- (b) Construct turtle passage infrastructure at the weir site in accordance with a design informed by the turtle movement study and approved by EHP.
- (c) Ensure turtle passage infrastructure and weir design and operation minimise the incidence of turtle injury or mortality.
- (d) Monitor the effectiveness of the turtle passage infrastructure against the success criteria approved in accordance with Condition 2(d).
- (e) Report to EHP on the effectiveness of the turtle passage infrastructure in relation to the turtle movement success criteria twelve months after the construction of the relevant stage of the weir and annually thereafter.
- (f) The monitoring methodology and reporting of the effectiveness of the turtle passage infrastructure must be externally peer reviewed and undertaken by a suitably qualified person.
- (g) If monitoring evidence indicates that the turtle movement success criteria are not being met, the turtle passage infrastructure is to be modified to achieve the success criteria.
- (h) Maintain the operation of the turtle passage infrastructure while the weir remains in operation and provide for the safe access to the weir infrastructure (including the turtle passage) for monitoring and compliance purposes.

Condition 4. Turtle movement contingency program

The outcome sought by these conditions is the identification of actions to be implemented until the success criteria are met.

- (a) Should the monitoring specified by Condition 3(d) and Condition 3(g) provide evidence that turtle movement success criteria are not being met, implement an ongoing catch and release program until the criteria are met.
- (b) The catch and release program must ensure turtle passage upstream and downstream of the weir site.
- (c) The catch and release program must be prepared and implemented by a suitably qualified person in accordance with a methodology agreed by EHP.

Part C. Turtle nest impacts

The outcome sought by these conditions is to improve the breeding success for the white-throated snapping turtle.

Condition 5. Nest protection programs

- (a) Prior to construction submit to EHP, for approval, a nest protection management plan for the white-throated snapping-turtle
- (b) Implement nest protection measures for the white-throated snapping-turtle generally in accordance with Appendix G of the AEIS Offset Proposal for the Fitzroy River Turtle and White-throated Snapping Turtle.

Condition 6. Turtle nest management during construction

- (a) Construction works at Glenroy Crossing should be undertaken outside of the turtle nesting (May to July) and hatching seasons (December to January),
- (b) If construction works cannot be avoided during periods stated in (a), carry out surveys prior to construction to determine if turtles are nesting in the area to be disturbed.
- (c) If turtle nests, gravid female turtles and/or hatchlings are found during surveys, implement a turtle nest management plan to avoid and/or minimise disturbance to nesting turtles.

Condition 7. Impoundment water level management during operation

This condition applies to both Stages 2 and 3 of the weir raising, whether constructed separately or as a combined development activity, and only if Rookwood Weir is operational.

- (a) Subject to compliance with the Fitzroy Basin Water Plan and the weir operating plan, and where rainfall conditions permit, water levels in the impoundment must be managed to minimise the inundation of turtle nests.
- (b) During the period from May to January each year, the Eden Bann weir impoundment water levels must be managed to encourage high nesting positions and reduce the risk of nest inundation.

Definitions

Catch and release program: To capture turtles on one side of the physical barrier (weir infrastructure) and release them on the other side. The methodology and timing are to be approved by EHP.

Gravid female turtles: female white-throated snapping turtles carrying eggs.

Home range: The area within which a turtle moves that encompasses all of the resources the animal requires to survive and reproduce.

Suitably qualified person: means a person/s or entity who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give

authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

Schedule 2. Powerful owl

This schedule applies specifically to the management of project impacts on the powerful owl (*Ninox strenua*).

The entity with jurisdiction for the condition in this schedule is DNRM.

Condition 1. Regulated vegetation offsets

The offset required for the project's significant residual impact on regulated vegetation (Appendix 3, Part B, Condition 1) must provide habitat features that support powerful owl nesting.

Definitions

Habitat features for powerful owl nesting: Features that support powerful owl nesting habitat as defined in section 6.2.2 and 6.2.4 of the addendum to the AEIS. Nesting habitats include forests aged 60+ years on fertile soils in large old eucalypts (>100 cm diameter) with suitable hollows (45-75cm diameter, 50-180 cm deep, and 6-45 m above ground).

Schedule 3. Social impacts

The entity with jurisdiction for the conditions in this schedule is the Coordinator-General.

Condition 1. Social impact assessment review

The outcome sought by this condition is to review the social impact assessment for the project to ensure it reflects the current social and economic context.

- (a) If construction does not commence within two years of the public notification of this Coordinator-General's report, the proponent is required to undertake a social impact assessment review and report to the Coordinator-General.
- (b) The report is to be submitted to the Coordinator-General six months prior to commencement of construction of each stage of the weir.
- (c) The social impact assessment review will include:
 - (i) a review of the social baseline to ensure the assessment of impacts are accurate in the current social and economic context
 - (ii) a review of the proposed social impact mitigation strategies arising from stakeholder consultation on the project.
- (d) The report must be made publicly available on the proponent's website.

Condition 2. Report on implementation of social impacts

The outcome sought by this condition is to report on the implementation of measures to mitigate and manage the social impacts of the construction and operation of the weir on local and regional communities.

- (a) Provide an annual Social Impact Management Report (SIMR) to the Coordinator-General for approval for a period of five years from the commencement of construction of each stage of the weir.
- (b) The SIMR must describe the social impact management strategies and actions implemented and the outcomes achieved to:

- (i) inform, consult, collaborate and negotiate with stakeholders and the community, and to demonstrate that stakeholder and community concerns have been considered in making decisions to avoid, mitigate and manage social impacts
 - (ii) provide, local and regional employment, training and development opportunities and to mitigate and manage any project related impacts on local labour markets
 - (iii) mitigate and manage any impacts of the project on the local and/or regional housing markets
 - (iv) mitigate and manage any impacts of the project on community health, safety and wellbeing.
- (c) Make each SIMR publicly available on the proponent's website during each year of the reporting period.

Appendix 2. Imposed conditions— Rookwood Weir

This appendix includes conditions imposed by the Coordinator-General under section 54B of the *State Development and Public Works Organisation Act 1971* (SDPWO Act). This appendix applies only to stages 1 and 2 of the Rookwood Weir component of the Lower Fitzroy River Infrastructure project (the project).

In accordance with section 54D of the SDPWO Act, these conditions apply to anyone who undertakes the construction and operation of Rookwood Weir, such as the proponent, an assignee, agent, contractor, subcontractor or licensee of the proponent.

All of the conditions imposed in this appendix take effect from the date of this Coordinator-General's report.

These conditions do not relieve the obligation for all approvals and licences from relevant authorities required under any other Act to be obtained for Stages 1 and 2 of the Rookwood Weir component of the project.

If the project is subject to a community infrastructure designation, the conditions in this appendix must be regarded as recommended requirements for the designation in accordance with section 43 of the SDPWO Act.

Schedule 1. White-throated snapping turtle

The imposed conditions in this schedule specifically apply to the management of impacts of Stages 1 and 2 of the Rookwood Weir component of the project on the white-throated snapping turtle (*Elseya albagula*).

The entity with jurisdiction for the conditions in this schedule is the Department of Environment and Heritage Protection (EHP).

Allied conditions applying to the Fitzroy River turtle (*Rheodytes leukops*), a protected species under the Commonwealth EPBC Act, are specified in Appendix 5.

Part A. Species management programs

Condition 1. Species management program

The outcome sought by this condition is the development of a species management program that adequately addresses the project's impacts on the white-throated snapping-turtle.

- (a) Prior to commencement of construction, submit to EHP for approval, a species management program (SMP) for the white-throated snapping turtle.
- (b) The SMP must detail how the population and habitat for the white-throated snapping turtle would be managed during construction and operation of the project.
- (c) The SMP must be prepared generally in accordance with Appendix E of the additional information to the draft environmental impact statement (AEIS), and must be consistent with the conditions in this Coordinator-General's report.
- (d) Implement the approved SMP in the construction and operation phases of the project.

Part B. Turtle movement study and passage

Condition 2. Turtle movement study

The outcome sought by this condition is the provision of sufficient information on the movement of the white-throated snapping turtle to inform the design of turtle passage infrastructure and adaptive management strategies for constructing the weir.

- (a) Prior to finalisation of the design for the turtle passage infrastructure, undertake a turtle movement study to collect baseline data for sections of the Fitzroy River, at locations approved by EHP.
- (b) The turtle movement study must:
 - (i) collect data on seasonal movement patterns and home ranges of the white-throated snapping turtle. The study should include wet and dry season movements, breeding periods and nesting distribution
 - (ii) be prepared and undertaken by a suitably qualified person in accordance with a methodology agreed in writing by EHP
 - (iii) inform the development of the criteria for monitoring the success of turtle movement around the weir (the turtle movement success criteria) based on the data collected during the turtle movement study.
- (c) The methodology for the study must be submitted EHP for approval, 90 days prior to commencing the turtle movement study, or as otherwise agreed with EHP.
- (d) The turtle movement success criteria must be approved by EHP, in writing, prior to the construction of turtle passage infrastructure at the weir site.

Condition 3. Turtle passage infrastructure

The outcome sought by this condition is that development of the weir does not restrict the long-term movement of the white-throated snapping turtle upstream and downstream of the weir infrastructure.

This condition applies to both Stages 1 and 2 of the weir, whether constructed separately or as a combined development activity.

- (a) Turtle passage infrastructure must be built prior to the commencement of operation of each stage of the weir.
- (b) Construct turtle passage infrastructure at the weir site in accordance with a design informed by the turtle movement study and approved by EHP.
- (c) Ensure turtle passage infrastructure and weir design and operation minimises the incidence of turtle injury or mortality.
- (d) Monitor the effectiveness of the turtle passage infrastructure against the success criteria approved in accordance with Condition 2(d).
- (e) Report to EHP on the effectiveness of the turtle passage infrastructure in relation to the turtle movement success criteria twelve months after the construction of the relevant stage of the weir and annually thereafter.
- (f) The monitoring methodology and reporting of the effectiveness of the turtle passage infrastructure must be externally peer reviewed and undertaken by a suitably qualified person.
- (g) If monitoring evidence indicates that the turtle movement success criteria are not being met, the turtle passage infrastructure is to be modified to achieve the success criteria.
- (h) Maintain the operation of the turtle passage infrastructure while the weir remains in operation and provide for safe access to the weir infrastructure (including the turtle passage) for monitoring and compliance purposes.

Condition 4. Turtle movement contingency program

The outcome sought by these conditions is the identification of actions to be implemented until the success criteria are met.

- (a) Should the monitoring specified by Condition 3(d) and Condition 3(g) provide evidence that turtle movement success criteria are not being met, implement an ongoing catch and release program until the criteria are met.
- (b) The catch and release program must ensure turtle passage upstream and downstream of the weir site.
- (c) The catch and release program must be prepared and implemented by a suitably qualified person in accordance with a methodology agreed by EHP.

Part C. Turtle nest impacts

The outcome sought by these conditions is to improve the breeding success for the white-throated snapping turtle.

Condition 5. Nest protection programs

- (a) Prior to construction submit to EHP, for approval, a nest protection management plan for the white-throated snapping-turtle
- (b) Implement nest protection measures for the white-throated snapping-turtle generally in accordance with Appendix G of the AEIS (Offset Proposal for the Fitzroy River Turtle and White-throated Snapping Turtle).

Definitions

Catch and release program: To capture turtles on one side of the physical barrier (weir infrastructure) and release them on the other side. The methodology and timing are to be approved by EHP.

Gravid female turtles: female white-throated snapping turtles carrying eggs.

Home range: The area within which a turtle moves that encompasses all of the resources the animal requires to survive and reproduce.

Pool-riffle-run sequences: are different parts of a stream made up of a mixture of flows and depths that provide a variety of stream habitats for turtles. Pools are areas of a stream characterised by deep depths and slow currents. Riffles are areas of a stream characterised by of shallow depths with fast, turbulent currents. Runs are areas of a stream characterised by deep depths and moderate currents with little or no turbulence.

Suitably qualified person: means a person/s or entity who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

Schedule 2. Powerful owl

This schedule applies specifically to the management of project impacts on the powerful owl (*Ninox strenua*).

The entity with jurisdiction for the condition in this schedule is DNRM.

Condition 1. Regulated vegetation offsets

The offset required for the project's significant residual impact on regulated vegetation (Appendix 4, Part B, Condition 1) must provide habitat features that support powerful owl nesting.

Definitions

Habitat features for powerful owl nesting: Features that support powerful owl nesting habitat as defined in section 6.2.2 and 6.2.4 of the addendum to the AEIS. Nesting habitats include forests aged 60+ years on fertile soils in large (>100 cm diameter) old eucalypts with suitable hollows (45-75cm diameter, 50-180 cm deep, and 6-45 m above ground).

Schedule 3. Social impacts

The entity with jurisdiction for the conditions in this schedule is the Coordinator-General.

Condition 1. Social impact assessment review

The outcome sought by this condition is to review the social impact assessment for the project to ensure it reflects the current social and economic context.

- (a) If construction does not commence within two years of the public notification of this Coordinator-General's report, the proponent is required to undertake a social impact assessment review and report to the Coordinator-General.
- (b) The report is to be submitted to the Coordinator-General six months prior to commencement of construction of each stage of the weir.
- (c) The social impact assessment review will include:
 - (i) a review of the social baseline to ensure the assessment of impacts are accurate in the current social and economic context
 - (ii) a review of the proposed social impact mitigation strategies arising from stakeholder consultation on the project.
- (d) The report must be made publicly available on the proponent's website.

Condition 2. Social impacts

The outcome sought by this condition is to report on the implementation of measures to mitigate and manage social impacts of the construction and operation of the weir on local and regional communities.

- (a) Provide an annual Social Impact Management Report (SIMR) to the Coordinator-General for approval for a period of five years from the commencement of construction of each stage of the weir.
- (b) The SIMR must describe the social impact management strategies and actions implemented and the outcomes achieved to:
 - (i) inform, consult, collaborate and negotiate with stakeholders and the community and to demonstrate that stakeholder and community concerns have been considered in making decisions to avoid, mitigate and manage social impacts
 - (ii) provide local and regional employment, training and development opportunities and to mitigate and manage any project-related impacts on local labour markets
 - (iii) mitigate and manage any impacts of the project on the local and/or regional housing markets
 - (iv) mitigate and manage project-related impacts on community health, safety and wellbeing.
- (c) Make each SMIR publicly available on the proponent's website during each year of the reporting period.

Appendix 3. Stated conditions—Eden Bann Weir

This appendix contains conditions stated by the Coordinator-General under section 39(1)(a) of the *State Development Public Works Organisation Act 1971* (SDPWO Act). These conditions apply to stages 2 and 3 of the Eden Bann Weir component of the Lower Fitzroy River Infrastructure project (the project).

If the project is subject to a community infrastructure designation, the conditions in this appendix are recommended requirements for the designation in accordance with section 43 of the SDPWO Act.

Schedule 1. *Sustainable Planning Act 2009*

This schedule applies to decisions made under the *Sustainable Planning Act 2009* (SPA).

Part A. Waterway barrier works

Condition 1. Offsets for waterway barrier works

The outcome sought by this condition is to provide suitable fisheries offsets for waterway barrier works. The relevant other Act for this condition under section 18(1) of the *Environmental Offsets Act 2014* (EO Act) is the *Fisheries Act 1994*.

- (a) Subject to (b) the significant residual impacts on prescribed environmental matters are only authorised to the maximum extent of impact identified for the prescribed environmental matters in Table A1.

Table A1. Authorised maximum extent of impact on prescribed environmental matters

Prescribed environmental matter	Maximum extent of impact (ha) for stages 2 and 3
Waterway providing for fish passage— waterway barrier works	282

- (b) Significant residual impacts on prescribed environmental matters identified in Table A1 resulting from a prescribed activity are not authorised unless:
- (i) the proponent, in consultation with the administering agency, prepares a notice of election for each stage of the weir to counterbalance significant residual impacts of the prescribed environmental matters identified in Table A1
 - (ii) the notices of election are prepared generally in accordance with sections 18 and 19 of the EO Act and are given to the administering agency in the approved form (section 92 of the EO Act)
 - (iii) the notices of election are given to the administering agency for approval no less than 90 days prior to the commencement of any disturbance activity for each stage that will result in a significant residual impact on the identified prescribed environmental matters in Table A1
 - (iv) agreed delivery arrangements are entered into for each stage, in accordance with section 19 of the EO Act.
- (c) Prior to the commencement of each stage, a report completed by an appropriately qualified person, which includes an analysis of the following, must be provided to the administering agency:

- (i) for the forthcoming stage—the estimated significant residual impacts to each prescribed environmental matter
 - (ii) for the previous stage, if applicable—the actual significant residual impacts to each prescribed environmental matter, to date.
- (d) The report required by (c), must be approved by the administering agency before a notice of election for the forthcoming stage, if applicable, is given to the administering agency.

Definitions

Agreed delivery arrangement: as defined in the EO Act.

Notice of election: as defined in the EO Act.

Prescribed environmental matters: Is any of the following matters prescribed under a regulation:

- a matter of national environmental significance
- a matter of state environmental significance
- a matter of local environmental significance.

Refer to section 10(1) of the EO Act.

Significant residual impact: Generally, a significant residual impact is an adverse impact, whether direct or indirect; of a prescribed activity on all or part of a prescribed environmental matter that:

- remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site mitigation measures for the prescribed activity
- is, or will or is likely to be, significant.

Part B. *Vegetation Management Act 1999*

Condition 2. Regulated vegetation and connectivity offsets

The outcome sought by this condition is to ensure that suitable offsets are provided for any residual impacts of the weir on regulated vegetation and connectivity. The relevant other Act for this condition under section 18(1) of the EO Act is the *Vegetation Management Act 1999*.

- (a) Subject to (b) the significant residual impacts on prescribed environmental matters resulting from a prescribed activity are authorised to the maximum extent of impact identified for the prescribed environmental matters in Table A2.

Table A2. Authorised maximum extent of impact on prescribed environmental matters

Prescribed environmental matter	Estimated maximum disturbance (i.e. maximum residual impact to habitat) (ha)** for stages 2 and 3
Regulated vegetation	
Endangered regional ecosystem 11.3.1*	0.7 (impoundment)
Endangered regional ecosystem 11.3.8	Total of 4.0: 1.5 (weir construction area) and 2.5 (impoundment)
Endangered regional ecosystem 11.3.38a	2.3 (impoundment)
Of concern regional ecosystem 11.3.2	2.0 (impoundment)
Of concern regional ecosystem 11.3.3	Total of 13.5: 12.3 (impoundment) and 1.2 (Glenroy Crossing)
Of concern regional ecosystem 11.3.3c	0.1 (impoundment)
Of concern regional ecosystem 11.3.4	27 (impoundment)
Of concern regional ecosystem 11.11.10	0.5 (weir access road)
Regional ecosystems located within a defined distance of the defining banks of a watercourse	Total 211: 208 (impoundment) and 3 (weir construction area)
Connectivity	
Connectivity area [#]	661

*Overlaps with Commonwealth offset for the brigalow ecological community

** Estimated extents based on information in the EIS. These extents still need to be verified by the Queensland Herbarium.

[#]Includes regulated vegetation (endangered and of concern regional ecosystems) and least concern regional ecosystems

- (b) Significant residual impacts on prescribed environmental matters identified in Table A2 resulting from a prescribed activity are not authorised unless:
- (i) the proponent, in consultation with the administering agency, prepares a notice of election for each stage of the weir to counterbalance significant residual impacts of the prescribed environmental matters identified in Table A2
 - (ii) the notices of election are prepared generally in accordance with sections 18 and 19 of the EO Act and are given to the administering agency in the approved form (section 92 of the EO Act)
 - (iii) the notices of election are given to the administering agency for approval no less than 90 days prior to the commencement of any disturbance activity that will result in a significant residual impact on the identified prescribed environmental matters
 - (iv) agreed delivery arrangements are entered into for each stage, in accordance with section 19 of the EO Act.
- (c) Prior to the commencement of each stage, a report completed by an appropriately qualified person, which includes an analysis of the following, must be provided to the administering agency:
- (i) for the forthcoming stage—the estimated significant residual impacts to each prescribed environmental matter
 - (ii) for the previous stage, if applicable—the actual significant residual impacts to each prescribed environmental matter, to date.

- (d) The report required by (c), must be approved by the administering agency before a notice of election for the forthcoming stage, if applicable, is given to the administering agency.

Note: The proponents intend to co-locate all offsets for the prescribed environmental matters in Table A6. The proponent may be able to co-locate offsets for multiple prescribed environmental matters arising from the different authorities on one parcel of land regardless of whether the authorities are issued by Commonwealth, State or local government—provided that the proposed management activities provide benefits for all of the prescribed environmental matters, and that a conservation outcome can be achieved for all of the prescribed environmental matters.

Table A3. Multiple prescribed environmental matters being considered for offset co-location opportunities

Jurisdiction	Value impacted	Estimated significant residual impact (ha)**	Authority
Australian Government	Red goshawk	384	EPBC Act Could be co-located with regulated vegetation (including watercourse vegetation) and connectivity offsets
Australian Government	Brigalow threatened ecological community (brigalow EC)	0.7	EPBC Act Could be co-located with the regulated vegetation (including watercourse vegetation) offset
Queensland Government	Regulated vegetation * includes brigalow EC * includes riparian habitat suitable for red goshawk & powerful owl	Endangered regional ecosystems: 7 Of concern regional ecosystem: 43.10 Regional ecosystems located within a defined distance of the defining banks of a watercourse (211 ha)	An activity assessed under module 8 (vegetation clearing) of the State Development Assessment Provisions
Queensland Government	Connectivity areas *includes regulated vegetation and brigalow EC	661.1 Endangered/brigalow: 7 Of concern: 43.1 Least concern: 611	An activity assessed under module 8 (vegetation clearing) of the State Development Assessment Provisions
	Protected wildlife habitat—powerful owl	205	None applicable. Could be co-located with regulated vegetation (including watercourse vegetation) and connectivity offsets

** Estimated extents based on information in the EIS. These extents still need to be verified by the Queensland Herbarium.

Definitions

Notice of election: means a notice mentioned in section 18(2) of the *Environmental Offsets Act 2014* by which an authority holder elects to deliver an environmental offset.

Prescribed environmental matters: Is any of the following matters prescribed under a regulation:

- a matter of national environmental significance
- a matter of state environmental significance
- a matter of local environmental significance.

Refer to section 10(1) of the EO Act.

Significant residual impact: Generally, a significant residual impact is an adverse impact, whether direct or indirect; of a prescribed activity on all or part of a prescribed environmental matter that:

- remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site mitigation measures for the prescribed activity
- is, or will or is likely to be, significant.

Appendix 4. Stated conditions—Rookwood Weir

This appendix contains conditions stated by the Coordinator-General under section 39(1)(a) of the *State Development Public Works Organisation Act 1971* (SDPWO Act). These conditions apply to stages 1 and 2 of the Rookwood Weir component of the Lower Fitzroy River Infrastructure project (the project).

If the project is subject to a community infrastructure designation, the conditions in this appendix are recommended requirements for the designation in accordance with section 43 of the SDPWO Act.

Schedule 1. *Sustainable Planning Act 2009*

This schedule applies to decisions made under the *Sustainable Planning Act 2009* (SPA).

Part A. Waterway barrier works

Condition 1. Offsets for waterway barrier works

The outcome sought by this condition is to provide suitable fisheries offsets for waterway barrier works. The relevant other Act for this condition under section 18(1) of the *Environmental Offsets Act 2014* (EO Act) is the *Fisheries Act 1994*.

- (a) Subject to (b) the significant residual impacts on prescribed environmental matters are only authorised to the maximum extent of impact identified for the prescribed environmental matters in Table A4.

Table A4. Authorised maximum extent of impact on prescribed environmental matters

Prescribed environmental matter	Maximum extent of impact (ha) for stages 1 and 2
Waterway providing for fish passage— waterway barrier works	660

- (b) Significant residual impacts on prescribed environmental matters identified in Table A4 resulting from a prescribed activity are not authorised unless:
- (i) the proponent, in consultation with the administering agency, prepares a notice of election for each stage of the weir to counterbalance significant residual impacts of the prescribed environmental matters identified in Table A4
 - (ii) the notices of election are prepared generally in accordance with sections 18 and 19 of the EO Act and are given to the administering agency in the approved form (section 92 of the EO Act)
 - (iii) the notices of election are provided to the administering agency for approval no less than 90 days prior to the commencement of any disturbance activity for each stage that will result in a significant residual impact on the identified prescribed environmental matters in Table A4
 - (iv) agreed delivery arrangements are entered into for each stage, in accordance with section 19 of the EO Act.
- (c) Prior to the commencement of each stage, a report completed by an appropriately qualified person, which includes an analysis of the following, must be provided to the administering agency:

- (iii) for the forthcoming stage—the estimated significant residual impacts to each prescribed environmental matter
- (iv) for the previous stage, if applicable—the actual significant residual impacts to each prescribed environmental matter, to date.
- (d) The report required by (c), must be approved by the administering agency before a notice of election for the forthcoming stage, if applicable, is given to the administering agency.

Definitions

Agreed delivery arrangement: as defined in the EO Act.

Notice of election: as defined in the EO Act.

Prescribed environmental matters: Is any of the following matters prescribed under a regulation:

- a matter of national environmental significance
- a matter of state environmental significance
- a matter of local environmental significance.

Refer to section 10(1) of the EO Act.

Significant residual impact: Generally, a significant residual impact is an adverse impact, whether direct or indirect; of a prescribed activity on all or part of a prescribed environmental matter that:

- remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site mitigation measures for the prescribed activity
- is, or will or is likely to be, significant.

Part B. *Vegetation Management Act 1999*

Condition 2. Regulated vegetation and connectivity offsets

The outcome sought by this condition is to ensure that suitable offsets are provided for any residual impacts of the weir on regulated vegetation and connectivity. The relevant other Act for this condition under section 18(1) of the EO Act is the *Vegetation Management Act 1999*.

- (a) Subject to (b) significant residual impacts to prescribed environmental matters resulting from a prescribed activity are authorised to the maximum extent of impact identified for the prescribed environmental matters in Table A5.

Table A5. Authorised maximum extent of impact to prescribed environmental matters

Prescribed environmental matter	Estimated maximum disturbance (i.e. maximum residual impact to habitat) (ha)** for stages 2 and 3
Regulated vegetation	
Endangered regional ecosystem 11.3.1*	Total of 19.4: 1.4 (weir construction area), 17.8 (impoundment) and 0.2 (Foleyvale Crossing)
Of concern regional ecosystem 11.3.2	4.3 (impoundment)
Of concern regional ecosystem 11.3.3	Total of 188.10: 186.3 (impoundment), 1.2 (weir construction area), 0.4 (Foleyvale crossing) and 0.2 (Hanrahan Crossing)
Of concern regional ecosystem 11.3.4	4.2 (impoundment)

Prescribed environmental matter	Estimated maximum disturbance (i.e. maximum residual impact to habitat) (ha)** for stages 2 and 3
Regional ecosystems located within a defined distance of the defining banks of a watercourse	Total of 439: 435 (impoundment) and 3 (weir construction area)
Connectivity	
Connectivity area [#]	1285.7

*Overlaps with Commonwealth offset for the brigalow ecological community

** Estimated extents based on information in the EIS. These extents still need to be verified by the Queensland Herbarium.

[#]Includes regulated vegetation (endangered and of concern regional ecosystems) and least concern regional ecosystems.

- (b) Significant residual impacts on prescribed environmental matters identified in Table A5 resulting from a prescribed activity are not authorised unless:
- (i) the proponent, in consultation with the administering agency, prepares a notice of election for each stage of the weir to counterbalance significant residual impacts on the prescribed environmental matters identified in Table A5
 - (ii) the notices of election are prepared generally in accordance with sections 18 and 19 of the EO Act and are given to the administering agency in the approved form (section 92 of the EO Act)
 - (iii) the notices of election are given to the administering agency for approval no less than 90 days prior to the commencement of any disturbance activity for each stage that will result in a significant residual impact on the identified prescribed environmental matters
 - (iv) agreed delivery arrangements are entered into for each stage, in accordance with section 19 of the EO Act.
- (c) Prior to the commencement of each stage, a report completed by an appropriately qualified person, which includes an analysis of the following, must be provided to the administering agency:
- (i) for the forthcoming stage—the estimated significant residual impacts to each prescribed environmental matter
 - (ii) for the previous stage, if applicable—the actual significant residual impacts to each prescribed environmental matter, to date.
- (d) The report required by (c) must be approved by the administering agency before a notice of election for the forthcoming stage, if applicable, is given to the administering agency.

Note: The proponents intend to co-locate all offsets for the prescribed environmental matters in Table A6. The proponent may be able to co-locate offsets for multiple prescribed environmental matters arising from the different authorities on one parcel of land regardless of whether the authorities are issued by Commonwealth, State or local government—provided that the proposed management activities provide benefits for all of the prescribed environmental matters, and that a conservation outcome can be achieved for all of the prescribed environmental matters.

Table A6. Multiple prescribed environmental matters being considered for offset co-location opportunities

Jurisdiction	Value impacted	Estimated significant residual impact (ha)**	Authority
Australian Government	Red goshawk	588	EPBC Act Could be co-located with regulated vegetation (including watercourse vegetation) and connectivity offsets
Australian Government	Brigalow threatened ecological community (brigalow EC)	19.4	EPBC Act Could be co-located with the regulated vegetation (including watercourse vegetation) offset
Queensland Government	Regulated vegetation * includes brigalow EC * includes riparian habitat suitable for red goshawk & powerful owl	Endangered regional ecosystems: 19.4 Of concern regional ecosystem: 196.6 Regional ecosystems located within a defined distance of the defining banks of a watercourse) (439 ha)	An activity assessed under module 8 (vegetation clearing) of the State Development Assessment Provisions
Queensland Government	Connectivity areas *includes regulated vegetation and brigalow EC	1947.1 Endangered/brigalow: 19.4 Of concern: 196.6 Least concern: 1069.6	An activity assessed under module 8 (vegetation clearing) of the State Development Assessment Provisions
Queensland Government	Protected wildlife habitat–powerful owl	307	None applicable. Imposed Coordinator-General condition for offsets. Could be co-located with regulated vegetation (including watercourse vegetation) and connectivity offsets

** Estimated extents based on information in the EIS. These extents still need to be verified by the Queensland Herbarium.

Definitions

Notice of election: means a notice mentioned in section 18(2) of the *Environmental Offsets Act 2014* by which an authority holder elects to deliver an environmental offset.

Prescribed environmental matters: Is any of the following matters prescribed under a regulation:

- a matter of national environmental significance
- a matter of state environmental significance
- a matter of local environmental significance.

Refer to section 10(1) of the EO Act.

Significant residual impact: Generally, a significant residual impact is an adverse impact, whether direct or indirect; of a prescribed activity on all or part of a prescribed environmental matter that:

- remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site mitigation measures for the prescribed activity is, or will or is likely to be, significant.

Appendix 5. Recommended conditions for the Commonwealth Minister for the Environment and Energy

In accordance with clause 21 of the Bilateral agreement between the Commonwealth and the State of Queensland, this section recommends conditions for consideration by the Commonwealth Minister for the Environment in making a decision on the proposed action under sections 130(1) and 133 of the EPBC Act.

These recommended conditions relate to the Eden Bann Weir and Rookwood Weir components of the Lower Fitzroy River Infrastructure project (the proposed action).

Part A. World Heritage properties—Great Barrier Reef

Water quality impacts from decaying vegetation

Recommendation 1. Monitoring of changes in nutrient concentrations due to decaying vegetation

The outcome sought by this condition is to provide information on any increase in nutrients released from each weir caused by decaying vegetation within the impoundment.

- (a) From commencement of operation of each stage of each weir, monitor nutrient concentrations immediately upstream of the full supply level of the impoundment and immediately downstream of the water release point for each weir.
- (b) Report monthly to the Minister on the results of the monitoring.
- (c) The methodology for monitoring and reporting of the nutrient concentrations must be approved by EHP prior to the completion of construction of each weir.
- (d) Unless otherwise agreed between EHP and the proponents, monitoring and reporting must continue until the nutrient concentrations immediately downstream of each weir are less than 10 per cent different from upstream of the impoundment, for at least nine consecutive months.
- (e) The results of monitoring program must inform the need for a water nutrient offset strategy.
- (f) The offset amount is to be determined by the Minister and must have regard for net water quality benefits arising from other offset measures implemented by the proponent
- (g) If directed by the Minister, implement a nutrient offset strategy.

Note: Other offset measures may include revegetation of riparian zones within the Fitzroy Basin to meet offset obligations for State matters (e.g. regulated vegetation and connectivity areas).

Consequential impacts—FAD

Recommendation 2. Land management code of practice

The outcome sought by this condition is the implementation of best management practices in relation to achieving improved water quality outcomes for land subject to irrigated agriculture.

- (a) The person taking the action must develop a land management code of practice (the code), or equivalent tool, in consultation with the following Queensland Government departments:
 - (i) Department of Agriculture and Fisheries (DAF)
 - (ii) Department of Environment and Heritage Protection (EHP)
 - (iii) Department of Natural Resources and Mines (DNRM).
- (b) The code or equivalent tool must be approved by the Minister in consultation with EHP.
- (c) The code or equivalent tool may include:
 - (i) water quality objectives for nutrients, sediment and farm chemicals for the sub-catchment
 - (ii) practices that are to be used or avoided in order to achieve the water quality objectives, noting that such practices may be different for different cropping categories or water uses
 - (iii) an accreditation scheme for individual irrigators that may reduce any monitoring and compliance obligations
 - (iv) justification for how the water quality objectives meet the targets of the Reef 2050 Plan and offset policies being implemented under the Reef 2050 Plan.
 - (v) a process for:
 - (A) reviewing the effectiveness of the code or equivalent tool with respect to water quality outcomes, and
 - (B) amending the code or equivalent tool.
- (d) Each agreement for the supply of water from each weir for the purpose of irrigated agriculture must include a provision stating that the customer is to comply with the approved code or equivalent tool.

Recommendation 3. Water quality monitoring program

The outcome sought by this condition is to provide the information necessary to identify any changes in water quality of the Fitzroy River due to the use of water from each weir for irrigated agriculture and intensive animal husbandry (e.g. piggeries or cattle feedlots).

- (a) The approval holder must develop and implement a water quality monitoring program (the program) in consultation with the following Queensland Government departments:
 - (i) EHP
 - (ii) Department of Science Information Technology and Innovation.
 - (iii) DAF
 - (iv) DNRM.
- (b) Water from each weir must not be used for the purpose of irrigated agriculture until the program is approved in writing by the Minister in consultation with EHP and water sampling in accordance with the program has commenced.
- (c) The program should:

- (i) identify water sampling and analysis methodologies
- (ii) state reporting requirements, including timeframes
- (iii) enable the identification of water quality characteristics for:
 - (A) the lower Fitzroy River
 - (B) water entering irrigation areas from higher in the sub-catchment
 - (C) water flowing from irrigated areas, and comparable unirrigated areas.
- (iv) outline actions to be undertaken with monitoring equipment during major flood events, and
- (v) detail a process for:
 - (D) reviewing the effectiveness of the program
 - (E) amending and terminating the program.
- (d) If agreed by the Minister in consultation with EHP, the program must be integrated into relevant elements of the *Reef 2050 Integrated Monitoring and Reporting Program*.

Recommendation 4. Water quality offset strategy

The outcome sought by this recommended conditions is the development and implementation of an offset strategy to address consequential impacts of irrigated agriculture and intensive animal husbandry facilitated by the project on the GBRWHA.

- (a) The results of monitoring program in Recommendation 3 must inform the need for a water quality offset strategy.
- (b) If the water quality monitoring required by Recommendation 3 determines that there has been a net increase in sediment, nutrients or pesticides entering the Fitzroy River, the approval holder must submit for the Minister's written approval, a water quality offsets strategy. The water quality offsets strategy should have regard for any water quality benefits arising from the other measures implemented by the approval holder.
- (c) The approved water quality offset strategy must be implemented.

Note: Other offset measures may include revegetation of riparian zones within the Fitzroy Basin to meet offset obligations

Part B. Threatened species and ecological communities

Pre-clearance surveys for threatened species and ecological communities

Recommendation 5. Pre-clearance surveys

- (a) Prior to clearing/inundation of vegetation, the approval holder must undertake pre-clearance surveys in the impact area to identify the presence of any EPBC Act listed threatened species and ecological communities.
- (b) Pre-clearance surveys must:
 - (i) be undertaken in accordance with the Department of Environment and Energy survey guidelines in effect at the time of the survey, or a survey methodology agreed by the DEE prior to surveys being undertaken
 - (ii) be undertaken by a suitably qualified person/s
 - (iii) identify measures to prevent mortality of EPBC Act listed species and ecological communities

- (iv) identify measures to protect EPBC Act listed threatened species and ecological community habitat located adjacent to the cleared/inundated areas.
- (c) For any EPBC Act listed threatened species and ecological communities identified during these surveys, provide details of management and offset measures.

Brigalow ecological community impacts

Recommendation 6. Offset requirement for *Acacia harpophylla* dominant and co-dominant ecological community (brigalow EC)

- (a) Prior to commencement of the proposed action, the approval holder must undertake pre-clearance surveys that determine the area of brigalow EC that would be cleared and/or inundated as a result of the proposed action.
- (b) The approval holder must prepare and submit an offset management plan for the brigalow EC for the Minister's written approval. The area to be offset must be determined by pre-clearance surveys required at (a).
- (c) The approval holder must provide a report to the Minister within 10 days of the completion of the surveys. The survey report must include details of survey methods and timing.
- (d) Clearance/inundation of the brigalow EC must not occur until the offset management plan is approved in writing by the Minister.
- (e) The offset management plan for the brigalow EC must include, but is not limited to:
 - (i) the proposed legal mechanism and timeline for securing the offset area/s
 - (ii) details of the minimum offset area/s proposed to compensate for clearing/inundating the brigalow EC
 - (iii) evidence that the offset/s are in accordance with the *2012 EPBC Act Environmental Offsets Policy* including a populated copy of the *EPBC Act Offsets Assessment Guide* with detailed justification for each input
 - (iv) information about how the offset area/s provide connectivity with other relevant habitats and biodiversity corridors
 - (v) a textual description and map to clearly define the location and boundaries of the offset area/s accompanied by the offset attributes
 - (vi) a description of the management measures (including timing, frequency and longevity) that will be implemented on the offset area/s for the protection and management of habitat for the brigalow EC, including details of how the management measures proposed take account of the approved conservation advice for the Brigalow EC and relevant threat abatement plans.
 - (vii) performance and completion criteria for evaluating the management of the offset area/s and criteria for triggering remedial action (if necessary)
 - (viii) a program, including timelines to monitor and report on the effectiveness of the management measures, and progress against the performance and completion criteria
 - (ix) a description of potential risks to the successful implementation of the offset/s, a description of the contingency measures that would be implemented to mitigate against these risks.
- (f) The approved offset management plan must be implemented.
- (g) Note: All offset management plans may be submitted for the Ministers approval as one offset management plan.

Black ironbox impacts

Recommendation 7. Offset requirement for *Eucalyptus raveretiana* (black ironbox)

- (a) Prior to commencement of the proposed action, the approval holder must undertake preclearance surveys that determine the area or number of black ironbox that would be cleared and/or inundated as a result of the proposed action.
- (b) The approval holder must prepare and submit an offset management plan for the black ironbox for the Minister's written approval. The area to be offset must be determined by pre-clearance surveys required at (a).
- (c) The approval holder must provide a report to the Minister within 10 days of the completion of the surveys. The survey report must include details of survey methods and timing.
- (d) Clearance/inundation of the black ironbox must not occur until the offset management plan is approved in writing by the Minister.
- (e) The offset management plan for the black ironbox must include, but is not limited to:
 - (i) the proposed legal mechanism and timeline for securing the offset area/s
 - (ii) details of the minimum offset area/s proposed to compensate for clearing/inundating the black ironbox
 - (iii) evidence that the offset/s are in accordance with the 2012 *EPBC Act Environmental Offsets Policy* including a populated copy of the *EPBC Act Offsets Assessment Guide* with detailed justification for each input
 - (iv) information about how the offset area/s provide connectivity with other relevant habitats and biodiversity corridors
 - (v) a textual description and map to clearly define the location and boundaries of the offset area/s accompanied by the offset attributes
 - (vi) a description of the management measures (including timing, frequency and longevity) that will be implemented in the offset area/s for the protection and management of habitat for the black ironbox, including details of how the management measures proposed take account of the approved conservation advice for black ironbox and any relevant threat abatement plans
 - (vii) performance and completion criteria for evaluating the management of the offset area/s and criteria for triggering remedial action (if necessary)
 - (viii) a program, including timelines to monitor and report on the effectiveness of the management measure, and progress against the performance and completion criteria
 - (ix) a description of potential risks to the successful implementation of the offset/s, a description of the contingency measures that would be implemented to mitigate against these risks.
- (f) The approved offset management plan must be implemented.

Red goshawk—nesting habitat impacts

Recommendation 8. Offset requirement for *Erythrorchis radiatus* (red goshawk)

- (a) The approval holder must ensure no more than 972 ha (384 ha Eden Bann and 588 ha Rookwood) of nesting habitat for red goshawk is cleared and/or inundated as a result of the project

- (b) The approval holder must prepare and submit an offset management plan for the red goshawk for the Minister's approval. The offset management plan must provide an offset for impacts to 972 ha of red goshawk nesting habitat. The offset management plan must be approved in writing by the Minister prior to commencement of the action.
- (c) The offset management plan for red goshawk must include, but is not limited to:
 - (i) the proposed legal mechanism and timelines for securing the offset area/s
 - (ii) details of the minimum offset area/s proposed to compensate for clearing and/or inundation of nesting habitat for red goshawk
 - (iii) evidence that the offset/s are in accordance with the 2012 *EPBC Act Environmental Offsets Policy* including a populated copy of the *EPBC Act Offsets Assessment Guide* with detailed justification for each input.
 - (iv) information about how the offset area/s provide connectivity with other relevant habitats and biodiversity corridors
 - (v) a textual description and a map to clearly define the location and boundaries of the offset area/s accompanied by the offset attributes
 - (vi) A description of the management measures (including timing, frequency and longevity) that will be implemented on the offset area/s for the protection and management of habitat for red goshawk, including details of how the management measures proposed take account of the red goshawk recovery plan and relevant threat abatement plans
 - (vii) performance and completion criteria for evaluating the management of the offset area/s and criteria for triggering remedial action (if necessary)
 - (viii) a program, including timelines to monitor and report on the effectiveness of the management measures, and progress against the performance and completion criteria
 - (ix) a description of the potential risks to the successful implementation of the offset/s, a description of the contingency measures that would be implemented to mitigate against these risks.
- (d) The approved offset management plan must be implemented.

Note: All offset management plans may be submitted for the Ministers approval as one offset management plan.

Fitzroy River turtle—Species management

Recommendation 9. Species management program

- (a) Develop in consultation with EHP and implement a species management plan (SMP) for the Fitzroy River turtle (*Rheodytes leukops*).
- (b) The SMP must detail how the population and habitat for of the Fitzroy River turtle would be managed during construction and operation of the project.
- (c) The SMP must be prepared generally in accordance with Appendix E of the additional information to the draft environmental impact statement (AEIS), and must be consistent with the conditions in this Evaluation Report.

Fitzroy River turtle—movement studies and passage

Recommendation 10. Turtle movement study

The outcome sought by this condition is the provision of sufficient information on the movement of the Fitzroy River turtle (*Rheodytes leukops*) to inform the design of turtle passage infrastructure and adaptive management strategies.

- (a) Prior to finalisation of the design for the turtle passage infrastructure, the approval holder must undertake a turtle movement study to collect baseline data for sections of the Fitzroy River.
- (b) The turtle movement study must:
 - (i) be prepared and undertaken by a suitably qualified person in accordance with a methodology determined in consultation with EHP.
 - (ii) collect data on seasonal movement patterns and home ranges of the Fitzroy River turtle. The study should include wet and dry season movements, breeding periods and nesting distribution.
 - (iii) Inform the development of criteria for monitoring the success of turtle movements around the weir (success criteria) based on the data collected during the study.
- (c) The success criteria must be approved by the Minister in consultation with EHP prior to the construction of turtle passage infrastructure at the weir site.
- (d) The design of turtle passage infrastructure and success criteria apply to all stages of the project (Eden Bann Weir and Rookwood Weir).

Recommendation 11. Turtle passage infrastructure

The outcome sought by this condition is that the development of the weirs do not restrict the long-term movement of the Fitzroy River turtle upstream and downstream of the weir infrastructure.

- (a) This condition applies to all stages of weir constructions, whether constructed separately or as a combined development activity.
- (b) The approval holder for each weir must:
 - (i) construct turtle passage infrastructure prior to the commencement of operation of each stage of each weir.
 - (ii) construct turtle passage infrastructure at the weir site in accordance with a design informed by the turtle movement study
 - (iii) ensure turtle passage infrastructure and weir design and operation minimise the incidence of turtle injury or mortality
 - (iv) monitor the effectiveness of the turtle passage infrastructure against the success criteria approved by the Minister
 - (v) report to EHP on the effectiveness of the turtle passage infrastructure in relation to the turtle movement success criteria twelve months after the construction of the relevant stage of the weir and annually thereafter.
 - (vi) The monitoring methodology and reporting of the effectiveness of the turtle passage infrastructure must be externally peer reviewed and undertaken by a suitably qualified person.
- (c) If monitoring evidence indicates that the success criteria are not being met, the turtle passage infrastructure is to be modified to achieve the success criteria.

- (d) The approval holder must maintain the operation of the turtle passage infrastructure while the weirs remain in operation and provide for safe access to the weir infrastructure (including the turtle passage) for monitoring and compliance purposes.

Recommendation 12. Turtle movement contingency plan

The outcome sought by these conditions is the identification of actions to be implemented until the success criteria are met.

- (a) Should the monitoring specified by Recommendation 11(b) Recommendation 11(b)(iv) and Recommendation 11(b)(vi) provide evidence that the success criteria are not being met, implement an ongoing catch and release program until the criteria are met.
- (b) The catch and release program must ensure turtle passage upstream and downstream of the weir site.
- (c) The catch and release program must be prepared and implemented by a suitably qualified person in accordance with a methodology determined in consultation with EHP.

Fitzroy River turtle—nest impacts

The outcome sought by these conditions is to improve the breeding success for the Fitzroy River turtle.

Recommendation 13. Turtle nest management during construction

- (a) Construction works at Glenroy Crossing should be undertaken outside of the nesting (September to November) and hatching seasons (December to February)
- (b) If construction works cannot be avoided during periods stated in (a), carry out surveys prior to construction to determine if turtles are nesting in the area to be disturbed
- (c) If turtle nests, gravid female turtles and/or hatchlings are found during surveys, implement a turtle nest management plan to avoid and/or minimise disturbance to nesting turtles.

Recommendation 14. Impoundment water level management during operation

This recommended condition applies to both Stages 2 and 3 of the Eden Bann weir raising whether constructed separately or as a combined development activity, and is subject to the construction of the Rookwood Weir.

- (a) Subject to compliance with the Queensland Fitzroy Basin Water Plan and the weir operating plan, and where rainfall conditions permit, weir storage levels within the Eden Bann Weir impoundment must be managed to minimise the inundation of Fitzroy River turtle nests.
- (b) During the period from May to January each year, the Eden Bann Weir impoundment water levels must be managed to encourage high nesting positions and reduce the risk of nest inundation.

Recommendation 15. Offset requirements for the Fitzroy River turtle nest impacts

- (a) The approval holder must prepare and submit an offset management plan for the Fitzroy River turtle for the Minister's written approval.
- (b) The approval holder must provide an offset for the following impacts:
 - (i) inundation of Fitzroy River turtle nest sites within the weir impoundment areas and downstream of the weirs
 - (ii) modifying 942 ha of aquatic habitat for the Fitzroy River turtle
- (c) The proposed offset must be generally in accordance with Appendix G of the AEIS.
- (d) The offset management plan for Fitzroy River turtle must include, but is not limited to:

- (i) the proposed legal mechanism and timelines for securing the offset area/s
 - (ii) details of the minimum offset area/s proposed to compensate for the inundation of nesting habitat for the Fitzroy River turtle
 - (iii) justification that the offset/s are in accordance with the 2012 EPBC Act Environmental Offsets Policy including a populated copy of the EPBC Act Offsets Assessment Guide with detailed justification for each input.
 - (iv) a textual description and a map to clearly define the location and boundaries of the offset area/s accompanied by the offset attributes
 - (v) a description of the management measures (including timing, frequency and longevity) that will be implemented on the offset area/s for the protection and management of habitat for Fitzroy River turtle, including details of how the management measures proposed take account for the conservation advice and any relevant threat abatement plans for the species
 - (vi) performance and completion criteria for evaluating the management of the offset area/s and criteria for triggering remedial action (if necessary)
 - (vii) a program, including timelines to monitor and report on the effectiveness of the management measures, and progress against the performance and completion criteria
 - (viii) a description of the potential risks to the successful implementation of the offset/s, a description of the contingency measures that would be implemented to mitigate against these risks.
- (e) To ensure that effectiveness of the offset in achieving a long-term protection and management of Fitzroy River turtle nesting habitat, the offset must be undertaken for the life of the project.
 - (f) The approval holder must not commence the action until the offset management plan is approved by the minister in writing. The approved offset management plan must be implemented.
 - (g) For the offsets for modifying Fitzroy River turtle aquatic habitat, the approval holder may elect to provide a financial offset as calculated using the web-based Financial Settlement Offset Calculator on the Queensland Government website⁵⁴.
 - (h) The full amount of the financial settlement offset must be paid to an offset account or another financial facility administered by EHP or Federal government entity prior to commencing the proposed action.

Note: The proponent has indicated preference to provide a financial contribution to compensate for the significant residual impact on aquatic habitat for the Fitzroy River turtle. Based on the current calculation from the Queensland Environmental Offsets Calculator, the offset for both the Eden Bann and Rookwood Weirs at full development would be \$10,330,000.

Definitions applying to the conditions

Approval holder: means the person to whom the approval is granted or any person acting on their behalf, or to whom the approval is transferred under section 145B of the EPBC Act.

Best management practices: are best management practices (BMPs) in reef catchments, such as the Smartcane BMP and Grazing BMP programs described on the Queensland Government website⁵⁵.

⁵⁴ <https://environment.ehp.qld.gov.au/offsets-calculator/>

Black iron box: is a tree species, *Eucalyptus raveretiana*.

Brigalow EC: an ecological community, *Acacia harpophylla* dominant and co-dominant.

Catch and release program: To capture turtles on one side of the physical barrier (weir infrastructure) and release them on the other side. The methodology and timing are to be approved by EHP.

Eden Bann Weir Stage 2: raising the existing weir (Stage 1) to a full supply level (FSL) of 18.2 m Australian Height Datum (AHD) (from existing Stage 1 FSL of 14.5 m AHD) and associated impoundment of the Fitzroy River.

Eden Bann Weir Stage 3: the addition of two-metre-high flap gates to raise the weir structure to a FSL of 20.2 m AHD and associated impoundment of the Fitzroy River.

EPBC Act: is the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Fitzroy River turtle: a turtle species, *Rheodytes leukops*.

Home range: The area which an animal moves on a daily or periodic basis. It is the region that encompasses all of the resources the animal requires to survive and reproduce.

Matters of national significance: are defined in the EPBC Act, and include listed threatened species and communities.

Offset: means 'compensate for', and is interpreted in light of the *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy, October 2012.

Offset Account: has the same meaning as the Queensland *Environmental Offsets Act 2014*.

Pool-riffle-run sequences: are different parts of a stream made up of a mixture of flows and depths that provide a variety of stream habitats for turtles. Pools are areas of a stream characterised by deep depths and slow currents. Riffles are areas of a stream characterised by shallow depths with fast, turbulent currents. Runs are areas of a stream characterised by deep depths and moderate currents with little or no turbulence.

Red goshawk: is bird species, *Erythrorchis radiatus*.

Rookwood Weir Stage 1: construction of a roller-compacted concrete gravity weir with a FSL of 45.5 m AHD, saddle dams, and associated impoundment of the Fitzroy, Mackenzie and Dawson Rivers.

Rookwood Weir Stage 2: the addition of 3.5-m-high flap gates to raise the structure to a FSL of 49 m AHD and associated impoundment of the Fitzroy, Mackenzie and Dawson Rivers.

Seasonal movement: Seasonal shifts in the movement and distribution of the animal for breeding and/or foraging.

Suitably qualified person: means a person/s or entity who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

The Minister: is the Australian Government Minister administering the EPBC Act and includes the delegates of the Minister as established by a relevant legal instrument.

⁵⁵ <https://www.qld.gov.au/environment/agriculture/sustainable-farming/best-practice/>

Turtle movement success criteria: Criteria used to determine the effectiveness of the proposed turtle passage infrastructure in facilitating safe movement of turtles over the barriers (i.e. weir infrastructure). The criteria are to be determined from turtle movement studies approved by EHP.

Appendix 6. Coordinator-General's general recommendations—Eden Bann Weir

This appendix includes Coordinator-General's general recommendations.

While the recommendations guide assessment managers in assessing the development applications, they do not limit their ability to seek additional information or to impose conditions on any development approval required for the project.

These recommendations apply to stages 2 and 3 of the Eden Bann Weir component of the Lower Fitzroy River Infrastructure project (the project).

If the project is subject to a community infrastructure designation, the recommendations in this appendix are also recommended requirements for the designation in accordance with section 43 of the SDPWO Act.

Schedule 1. *Fisheries Act 1994*

This schedule is relevant to applications for which the Fisheries Act 1994 is applicable.

Recommendation 1. Waterway barrier works

The outcome sought by this recommendation is that the weir provides fish passage.

The weir would require development permits for operational works for constructing or raising waterway barrier works.

- (a) The design, construction, and operation of the weir must provide fish passage, as defined in the *Fisheries Act 1994*.
- (b) The proponent must construct fish passage infrastructure (fishway) at the weir site, generally in accordance with the fishway design concepts provided in Appendix X of Volume 3 of the draft EIS (Fish passage technical report).
- (c) A person who is a suitably qualified fishway professional must review (prior to operational works permits being issued), the fishway design and demonstrate that fish passage would be provided.
- (d) On completion of fishway works, a suitably qualified fishway professional must certify that the works are in accordance with the approved plans.
- (e) The fish passage infrastructure must cater for the whole fish community taking into account species, size classes, life stages and swimming abilities as well as seasonal and flow-related biomass of the fish community.
- (f) The waterway barrier/s and any associated infrastructure, including intakes, walls, access structures, pipe works, spillways and dissipation devices are to be designed, constructed and maintained to avoid fish injury, mortality and/or entrapment.
- (g) At all times, the design, construction and operation of the project must take into account the management of fish passage on all existing barriers both upstream and downstream of the project, to ensure that all existing barriers do not become greater barriers to fish passage as a result of the project.
- (h) The effective operation of the fish passage infrastructure must be maintained for the life of the barrier. This maintenance must include regular, documented inspections of the structures such as fishways, baffles and roughening, especially after flood events, and prompt clearing of debris or rectifying any other failures, malfunctions or other impediments to fish movement.

- (i) The permanent alteration of natural flows, are to be managed to avoid impacts on natural spawning and migration timing of the fish within the system.
- (j) A monitoring program must be developed and implemented by a person suitably qualified fishway professional, to demonstrate the performance of the fish passage infrastructure.
- (k) The monitoring program must:
 - (i) involve the provision of monitoring reports at intervals specified in the operational works approval
 - (ii) include an alert and action component, which will enable changes to be made to address any deficiencies in the structures promptly and no later than prior to the commencement of the following wet season.

Definitions

Suitably qualified fishway professional: is a person/s with personal experience of the design and construction of fishways (in similar circumstances to the design being applied for); have experience and knowledge of the aquatic biology of Queensland's native fish species; and has personal experience in fishway monitoring and maintenance (rectification in designs etc.).

Schedule 2. *Water Act 2000*

This part is relevant to applications for which the Water Act 2000 is applicable.

Part A. Resource operations

Recommendation 1. Resource operations licence

- (a) A raised Eden Bann Weir must be constructed and operated in accordance with a Resource Operations Licence granted by the Chief Executive administering the Water Act 2000.
- (b) The granted Resource Operations Licence must include conditions for an Operations Manual applicable to a raised Eden Bann Weir.
- (c) The Resource Operations Licence for a raised Eden Bann Weir must meet the objectives of the Water Resource (Fitzroy Basin) Plan, taken to be the Fitzroy Water Plan.
- (d) Prior to making an application for a Resource Operation Licence for a raised Eden Bann Weir, the proponent of the weir must:
 - (i) complete assessments of the impacts of the weir on water supplies available to existing water entitlement holders on the Fitzroy River
 - (ii) complete any necessary negotiations with holders of impacted water entitlements for proposed arrangements to ensure the provision of water supplies equivalent to those provided under current water entitlements, or suitable negotiated outcome
 - (iii) provide to the Chief Executive administering the Water Act 2000 the proposed arrangements for addressing impacts of the weir on holders of water entitlements for review and approval.
- (e) Prior to granting supplemented water allocations from the strategic water reserve, the proponent must satisfy the chief executive a raised Eden Bann Weir is substantially complete and the infrastructure may be regarded as operational.

Recommendation 2. Downstream turtle nest inundation management

The outcome sought by these recommendations is to ensure the breeding and survival success of the white-throated snapping turtle and Fitzroy River turtle.

- (a) During the period from May to January each year, subject to compliance with the Fitzroy Basin Water Plan and the weir operating plan and where impoundment water levels

permit, water releases should be managed to minimise the inundation on nests downstream of the weir site.

- (b) During the first year of operation of Stage 2 of the weir, engage with EHP and DNRM to establish volumetric flow performance regime that meets the objective stated in (a).
- (c) During the second year of operation of Stage 2 of the weir, implement the performance regimes derived in (b).

Recommendation 3. Maintenance of pool-riffle-run habitat

The outcome sought by this recommendation is to maintain suitable aquatic habitat of the white-throated snapping and Fitzroy River turtles.

- (a) Subject to compliance with the Fitzroy Basin Water Plan and the weir Operating Plan, and where impoundment water level conditions permit, manage operational releases to mimic natural flow conditions as much as possible in order to maintain downstream pool-riffle-run sequences and associated habitat.
- (b) During the first year of operation of Stage 2 of the weir, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).
- (c) During the second year of operation of Stage 2 of the weir, implement the performance regime derived in (b).

Definitions

volumetric flow performance regime: Water release rules defined by minimum daily release volumes for a period of days for each season. The model for this program would be the flow-rate rules that currently apply to the Teemburra Dam on the Pioneer River.

Resource Operations Licence (ROL): A ROL is a licence that may be granted in relation to existing infrastructure in an area where a resource operations plan has been approved.

ROLs include:

- the resource operations plan to which the licence relates
- the water infrastructure, such as dams and weirs, covered by the licence
- any conditions that the holder of the licence must comply with, including operating arrangements and water supply requirements
- any transitional arrangements that the holder of the licence requires until the requirements of the plan can be met.

Schedule 3. *Transport Infrastructure Act 1994*

This part is relevant to applications for which the Transport Infrastructure Act 1994 is applicable.

Recommendation 1. Road impact assessment

- (a) In consultation with the Department of Transport and Main Roads (DTMR) and the relevant LGA, the proponent must prepare a road impact assessment (RIA) to assess the impacts of the project on the safety, efficiency and condition of state-controlled and local roads. The RIA needs to be prepared and/or updated for each stage of the project and:
 - (i) be developed in accordance with the DTMR Guidelines for Assessment of Road impacts of Development (2006) (GARID) and/or as required by the relevant LGA and include a completed DTMR 'Transport Generation proforma' detailing project-related traffic and transport generation information or as otherwise agreed in writing with DTMR and the relevant LGA
 - (ii) use DTMR's Pavement Impact Assessment tools or such other method or tools as agreed in writing with DTMR and/or the relevant LGA

- (iii) where detailed estimates are not available, the assumptions and methodologies that have been previously agreed in writing with DTMR and the relevant LGA, should be documented prior to RIA finalisation
- (iv) detail the final impact mitigation proposals, including contributions to road works/maintenance, as applicable, for the Bruce Highway intersection upgrade at Atkinson Road, for Eden Bann Weir Stage 2
- (v) be submitted to DTMR and the relevant LGA no later than six months prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA
- (vi) be approved in writing by DTMR and the relevant LGA prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA
- (vii) be completed before significant project traffic commences in accordance with relevant DTMR standards, manuals and practices and as required by the relevant LGA.

Recommendation 2. Road-use management plan

In consultation with the DTMR and the relevant LGA, the proponent should prepare or update the road use management plan (RMP) for each phase of the project that should:

- (a) be developed in accordance with DTMR's Guide to Preparing a Road-use Management Plan and as required by the relevant LGA, to minimise the impacts of road-based trips on all state-controlled and local roads and optimise project logistics
- (b) include a table listing RMP commitments to ensure all road-use management strategies have been designed and will be undertaken in accordance with all relevant DTMR standards, manuals and practices and as required by the relevant LGA
- (c) be submitted to DTMR and the relevant LGA no later than six months prior to the commencement of significant weir construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA
- (d) be approved in writing by DTMR and the relevant LGA no later than six months prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA.

Recommendation 3. Approvals and standards of road works

- (a) Prior to the commencement of significant construction works relating to road/intersection and bridge works, the proponent should:
 - (i) obtain relevant licences and permits under the Transport Infrastructure Act 1994 and/or Sustainable Planning Act 2009 for works and project facilities/infrastructure within the State-controlled and/or local road corridors
 - (ii) undertake any required works and other impact mitigation strategies as required by the RIA and RMP, in accordance with latest relevant DTMR and LGA policies and standards at the time of approval or agreement, or as otherwise agreed to in writing by DTMR and/or the relevant LGA.

Recommendation 4. Infrastructure agreements

- (a) The proponent may enter into infrastructure agreements with DTMR and the relevant LGA's for works and project facilities and infrastructure within state controlled and/or local road corridors:
 - (i) project-specific works and contributions required to upgrade impacted road infrastructure and provide vehicular access

- (ii) project-specific contributions to the cost of maintenance and rehabilitation of road or pavement impacts
 - (iii) performance criteria for updating project-related traffic assessments and impact mitigation measures based on actual traffic volume and impacts, should previously advised project details, traffic volumes and/or impacts change.
- (b) Any infrastructure agreement should be concluded prior to commencement of construction of the works to which the infrastructure agreement pertains, or as otherwise agreed in writing between the proponent, DTMR and the relevant LGA.

Definitions

DTMR 'Transport Generation proforma: Available from Transport System Management Branch, Brisbane.

DTMR standards, manuals and practices: Available at: <http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications.aspx>

Phase: Phase refers to planning, construction, commissioning and operations

Significant construction works: Significant construction works means physical construction, including significant and continuous site preparation work such as major clearing or excavation for foundations or the placement, assembly or installation of facilities or equipment at any site related to the project.

Significant project traffic: Significant project traffic is an increase in project traffic equal to or greater than five per cent in either traffic numbers (annual average daily traffic) or axle loadings (equivalent standard axles), as outlined in the GARID

Table (for RMP commitments): Available from Transport System Management, Brisbane.

Appendix 7. Coordinator-General's general recommendations—Rookwood Weir

This appendix includes Coordinator-General's general recommendations.

While the recommendations guide assessment managers in assessing the development applications, they do not limit their ability to seek additional information or to impose conditions on any development approval required for the project.

These recommendations apply to stages 1 and 2 of the Rookwood Weir component of the Lower Fitzroy River Infrastructure project (the project).

If the project is subject to a community infrastructure designation, the recommendations in this appendix are also recommended requirements for the designation in accordance with section 43 of the SDPWO Act.

Schedule 1. *Fisheries Act 1994*

This schedule is relevant to applications for which the *Fisheries Act 1994* is applicable.

Recommendation 1. Waterway barrier works

The outcome sought by this recommendation is that the weir provides fish passage.

The weir would require development permits for operational works for constructing or raising waterway barrier works.

- (a) The design, construction, and operation of the weir must provide fish passage, as defined in the *Fisheries Act 1994*.
- (b) The proponent must construct fish passage infrastructure (fishway) at the weir site, generally in accordance with the fishway design concepts provided in Appendix X of Volume 3 of the draft EIS (Fish passage technical report).
- (c) A person who is a suitably qualified fishway professional must review (prior to operational works permits being issued), the fishway design and demonstrate that fish passage would be provided.
- (d) On completion of fishway works, a suitably qualified fishway professional must certify that the works are in accordance with the approved plans.
- (e) The fish passage infrastructure must cater for the whole fish community taking into account species, size classes, life stages and swimming abilities as well as seasonal and flow-related biomass of the fish community.
- (f) The waterway barrier/s and any associated infrastructure, including intakes, walls, access structures, pipe works, spillways and dissipation devices are to be designed, constructed and maintained to avoid fish injury, mortality and/or entrapment.
- (g) At all times, the design, construction and operation of the project must take into account the management of fish passage on all existing barriers both upstream and downstream of the project, to ensure that all existing barriers do not become greater barriers to fish passage as a result of the project.
- (h) The effective operation of the fish passage infrastructure must be maintained for the life of the barrier. This maintenance must include regular, documented inspections of the structures such as fishways, baffles and roughening, especially after flood events, and

prompt clearing of debris or rectifying any other failures, malfunctions or other impediments to fish movement.

- (i) The permanent alteration of natural flows, are to be managed to avoid impacts on natural spawning and migration timing of the fish within the system.
- (j) A monitoring program must be developed and implemented by a person suitably qualified fishway professional, to demonstrate the performance of the fish passage infrastructure.
- (k) The monitoring program must:
 - (i) involve the provision of monitoring reports at intervals specified in the operational works approval
 - (ii) include an alert and action component, which will enable changes to be made to address any deficiencies in the structures promptly and no later than prior to the commencement of the following wet season.

Definitions

Suitably qualified fishway professional: is a person/s with personal experience of the design and construction of fishways (in similar circumstances to the design being applied for); have experience and knowledge of the aquatic biology of Queensland's native fish species; and has personal experience in fishway monitoring and maintenance (rectification in designs etc.).

Schedule 2. *Water Act 2000*

This part is relevant to applications for which the *Water Act 2000* is applicable.

Part A. Resource operations

Recommendation 1. Resource operations licence

- (a) Rookwood Weir must be constructed and operated in accordance with a Resource Operations Licence granted by the Chief Executive administering the *Water Act 2000*.
- (b) The granted Resource Operations Licence must include conditions for an Operations Manual applicable to Rookwood Weir.
- (c) The Resource Operations Licence for Rookwood Weir must meet the objectives of the Water Resource (Fitzroy Basin) Plan, taken to be the Fitzroy Water Plan.
- (d) Prior to making an application for a Resource Operation Licence for Rookwood Weir, the proponent of the weir must:
 - (i) complete assessments of the impacts of the weir on water supplies available to existing water entitlement holders on the Fitzroy, Dawson and Mackenzie Rivers
 - (ii) complete any necessary negotiations with holders of impacted water entitlements for proposed arrangements to ensure the provision of water supplies equivalent to those provided under current water entitlements, or suitable negotiated outcome
 - (iii) provide to the Chief Executive administering the Water Act 2000 the proposed arrangements for addressing impacts of the weir on holders of water entitlements for review and approval.
- (e) Prior to granting supplemented water allocations from the strategic water reserve, the proponent must satisfy the chief executive Rookwood Weir is substantially complete and the infrastructure may be regarded as operational.

Recommendation 2. Downstream turtle nest inundation management

The outcome sought by this recommendation is to ensure the breeding and survival success of the white-throated snapping and Fitzroy River turtles.

- (a) During the period from May to January each year, subject to compliance with the Fitzroy Basin Water Plan and the weir operating plan and where impoundment water levels permit, water releases should be managed to minimise the inundation on nests downstream of the weir site.
- (b) During the first year of operation of Stage 1 of the weir, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).
- (c) During the second year of operation of Stage 1 of the weir, implement the performance regimes derived in (b).

Recommendation 3. Maintenance of pool-riffle-run habitat

The outcome sought by this recommendation is to maintain suitable aquatic habitat of the white-throated snapping and Fitzroy River turtles.

- (a) Subject to compliance with the Fitzroy Basin Water Plan and the weir Operating Plan, and where impoundment water level conditions permit, manage operational releases to mimic natural flow conditions as much as possible in order to maintain downstream pool-riffle-run sequences and associated habitat.
- (b) During the first year of operation of Stage 1 of the weir, engage with EHP and DNRM to establish a volumetric flow performance regime that meets the objective stated in (a).
- (c) During the second year of operation of Stage 1 of the weir, implement the performance regime derived in (b).

Definitions

Resource Operations Licence (ROL): A ROL is a licence that may be granted in relation to existing infrastructure in an area where a resource operations plan has been approved.

ROLs include:

- the resource operations plan to which the licence relates
- the water infrastructure, such as dams and weirs, covered by the licence
- any conditions that the holder of the licence must comply with, including operating arrangements and water supply requirements
- any transitional arrangements that the holder of the licence requires until the requirements of the plan can be met.

Volumetric flow performance regime: Water release rules defined by minimum daily release volumes for a period of days for each season. The model for this program would be the flow-rate rules that currently apply to the Teemurra Dam on the Pioneer River.

Schedule 3. *Transport Infrastructure Act 1994*

This part is relevant to applications for which the *Transport Infrastructure Act 1994* is applicable.

Recommendation 1. Road impact assessment

- (a) In consultation with DTMR and the relevant LGA, the proponent must prepare a road impact assessment (RIA) to assess the impacts of the project on the safety, efficiency and condition of state-controlled and local roads. The RIA needs to be prepared and/or updated for each stage of the project and:
 - (i) be developed in accordance with the DTMR *Guidelines for Assessment of Road Impacts of Development (2006)* (GARID) and/or as required by the relevant LGA and include a completed DTMR 'Transport Generation proforma' detailing project-related traffic and transport generation information or as otherwise agreed in writing with DTMR and the relevant LGA

- (ii) use DTMR's *Pavement Impact Assessment tools* or such other method or tools as agreed in writing with DTMR and/or the relevant LGA
- (iii) where detailed estimates are not available, the assumptions and methodologies that have been previously agreed in writing with DTMR and the relevant LGA, should be documented prior to RIA finalisation
- (iv) detail the final impact mitigation proposals, including contributions to road works/maintenance, as applicable, for:
 - (A) the Capricorn Highway intersection with Third Street upgrade at Gogango for Rookwood Weir Stage 1
 - (B) the Foleyvale Crossing on Duaringa-Apis Creek Road for Rookwood Weir Stage 2, or otherwise agreed based on the updated hydraulic assessment outlined in Recommendation 3.
- (b) be submitted to DTMR and the relevant LGA no later than six months prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA
- (c) be approved in writing by DTMR and the relevant LGA prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA
- (d) be completed before significant project traffic commences in accordance with relevant DTMR standards, manuals and practices and as required by the relevant LGA.

Recommendation 2. Road-use management plan

In consultation with the DTMR and the relevant LGA, the proponent should prepare or update the road use management plan (RMP) for each phase of the project that should:

- (a) be developed in accordance with DTMR's *Guide to Preparing a Road-use Management Plan* and as required by the relevant LGA, to minimise the impacts of road-based trips on all state-controlled and local roads and optimise project logistics
- (b) include a table listing RMP commitments to ensure all road-use management strategies have been designed and will be undertaken in accordance with all relevant DTMR standards, manuals and practices and as required by the relevant LGA
- (c) be submitted to DTMR and the relevant LGA no later than six months prior to the commencement of significant weir construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA
- (d) be approved in writing by DTMR and the relevant LGA no later than six months prior to the commencement of significant construction works, or as otherwise agreed between the proponent, DTMR and the relevant LGA.

Recommendation 3. Foleyvale Crossing

The proponent must:

- (a) update the hydraulic assessment with regard to the Foleyvale Crossing to provide further information regarding the potential impact of the operations of Rookwood Weir Stage 1 on minor flood events and the effect of those events on the immunity of the existing Foleyvale Crossing, including an assessment of Q1 month, Q3 month, Q6 month, Q9 month and Q12 month events
- (b) finalise the assessment, in consultation with DTMR and the relevant LGA, no later than six months prior to the construction of Rookwood Weir Stage 1, or as otherwise agreed with TMR

- (c) if the hydraulic assessment identifies the potential for increased time of closure for the crossing resulting from any of those flood events, mitigate those impacts by upgrading the Foleyvale Bridge prior to the commencement of significant construction of Rookwood Weir Stage 1.

Recommendation 4. Approvals and standards of road works

Prior to the commencement of significant construction works relating to road/intersection and bridge works, the proponent should:

- (a) obtain relevant licenses and permits under the *Transport Infrastructure Act 1994* and/or *Sustainable Planning Act 2009* for works and project facilities/infrastructure within the State-controlled and/or local road corridors
- (b) undertake any required works and other impact mitigation strategies as required by the RIA and RMP, in accordance with latest relevant DTMR and LGA policies and standards at the time of approval or agreement, or as otherwise agreed to in writing by DTMR and/or the relevant LGA.

Recommendation 5. Infrastructure agreements

- (a) The proponent may enter into infrastructure agreements with DTMR and the relevant LGA's for works and project facilities and infrastructure within state controlled and/or local road corridors:
 - (i) project-specific works and contributions required to upgrade impacted road infrastructure and provide vehicular access
 - (ii) project-specific contributions to the cost of maintenance and rehabilitation of road or pavement impacts
 - (iii) performance criteria for updating project-related traffic assessments and impact mitigation measures based on actual traffic volume and impacts, should previously advised project details, traffic volumes and/or impacts change.
- (b) Any infrastructure agreement should be concluded prior to commencement of construction of the works to which the infrastructure agreement pertains, or as otherwise agreed in writing between the proponent, DTMR and the relevant LGA.

Definitions

DTMR 'Transport Generation proforma: Available from Transport System Management Branch, Brisbane.

DTMR standards, manuals and practices: Available at: <http://www.tmr.qld.gov.au/business-industry/Technical-standards-publications.aspx>.

Phase: Phase refers to planning, construction, commissioning and operations.

Significant construction works: Significant construction works means physical construction, including significant and continuous site preparation work such as major clearing or excavation for foundations or the placement, assembly or installation of facilities or equipment at any site related to the project.

Significant project traffic: Significant project traffic is an increase in project traffic equal to or greater than five per cent in either traffic numbers (annual average daily traffic) or axle loadings (equivalent standard axles), as outlined in the GARID.

Table (for RMP commitments): Available from Transport System Management, Brisbane.

Appendix 8. Proponents' commitments

This appendix includes commitments made by the proponents in the EIS and additional information to the draft EIS. Unless otherwise specified, these commitments apply to both weirs.

Commitment number	Proponent Commitment
Climate, natural hazards and climate change	
1.	The potential risks climate hazards pose to the Project have been addressed through design, construction scheduling and measures within the Project EMP.
Scenic amenity and lighting	
2.	Commitments are provided within the EMP.
Topography, geology and soils	
3.	Commitments incorporated into design criteria and addressed within the EMP.
4.	Physical model studies will be undertaken to inform erosion protection works downstream.
5.	A geomorphological assessment will be undertaken to refine predictions in relation to potential impacts such as sedimentation, erosion prone soils, bank slump etc.
Land contamination	
6.	Commitments are provided within the EMP.
7.	Where potential areas of contamination have been identified, site inspections will be conducted and appropriate management measures developed as necessary.
Land use and tenure	
8.	Develop and implement a project land access strategy, land acquisition strategy and compensation strategy allocations.
9.	Land tenure will be obtained in accordance with applicable legislation at the appropriate time and by the appropriate entity, including the <i>Land Act 1994</i>
10.	Commitments are provided as part of the social commitments (Table D-13) and within the EMP.
Flora	
11.	Commitments are provided within the EMP.
12.	<p>The Project commits to providing offsets for black ironbox (<i>Eucalyptus raveretiana</i>) in accordance with the EPBC Act and EPBC Act Environmental Offsets Policy.</p> <p>As necessary and applicable prior to the commencement of project activities, further ecological surveys will be undertaken to verify the number of black ironbox present and impacted as a result of the Project in accordance with approved conservation advice for this species.</p> <p>An offset management plan will developed in accordance with the EPBC Act and EPBC Act Environmental Offsets Policy.</p>
13.	Prior to the commencement of Project activities, further flora surveys will be undertaken to verify the area of brigalow (<i>Acacia harpophylla</i> dominant and co-dominant) present and impacted as a result of the Project and a map of the area submitted to the Queensland Herbarium for verification.

Commitment number	Proponent Commitment
14.	Where loss of brigalow TEC due to impoundment is unavoidable an offset will be provided in accordance with an offset management plan developed under the provisions of the EPBC Act and EPBC Act Environmental Offsets Policy.
Aquatic ecology	
15.	Fish lock arrangements at both Eden Bann Weir and Rookwood Weir will facilitate upstream and downstream movement at low and high reservoir levels, provide passage for most flows and cater for small and large bodied fish.
16.	A Fish Monitoring Program will be designed by a person (or persons) or entity suitably qualified and experienced in fish passage biology and fishway design and in consultation with Department of Agriculture and Fisheries (Fisheries Queensland) and implemented to monitor the effectiveness of fish passage infrastructure.
17.	A Fishway Operations Plan will be developed in consultation with the Department of Agriculture and Fisheries.
18.	The Project will implement a species management program (SMP) for the Fitzroy River turtle (<i>Rheodytes leukops</i>) and white-throated snapping turtle (<i>Elseya albagula</i>).
19.	A specifically designed turtle passage facility (turtle ramp) will be constructed at Eden Bann Weir and Rookwood Weir.
20.	The Project will provide offsets for residual impacts to the Fitzroy River turtle and white-throated snapping turtle in accordance with the EO Act, Environmental Offsets Regulation and the Queensland Environmental Offsets Policy and the EPBC Act and EPBC Act Environmental Offsets Policy.
21.	Implement mitigation and management measures in relation to aquatic ecology impacts as described within the EMP.
Terrestrial fauna	
22.	Commitments to mitigating and managing terrestrial fauna impacts are provided within the EMP.
Water resources—surface water	
23.	<p>A detailed geomorphic site assessment will be undertaken including:</p> <ul style="list-style-type: none"> • A geomorphic condition assessment at selected sites upstream of the future impoundment area, within the future impoundment area and downstream of the weir • Stability assessments to describe pre-development characteristics of the river bed and banks, channel stability, the potential for failure and erodibility, amongst others • The identification of key indicators for long-term monitoring of geomorphic and fluvial characteristics within the project development area as part of an adaptive management programme.
24.	In the event that scouring, erosion and slumping do occur rehabilitation and restoration of impacted areas will be undertaken in accordance with protocols and guidelines as defined in the EMP.

Commitment number	Proponent Commitment
25.	<p>Further modelling will be undertaken once development of a specific infrastructure scenario is triggered to assess project yields against the performance of supplies delivered by the existing Eden Bann Weir Stage 1 and the Fitzroy Barrage.</p> <p>The project is committed to maintaining existing supply reliability for current water allocation licensees and ensuring that the additional yield for the project is wholly attributable to the new infrastructure.</p>
26.	<p>Augment and/or develop a new Resource Operations Plan (ROP) for the Fitzroy Basin to include a raised Eden Bann Weir and/or Rookwood Weir, including negotiation and compensation for changes to existing water entitlements. A ROP amendment will be required due to changes to existing operational rules for Eden Bann Weir Stage 1 and the Fitzroy Barrage.</p> <p>A ROP amendment will be sought, requiring compliance with water resource plan objectives, and recognising the capability of the existing water supply infrastructure in any conjunctive operational arrangements.</p>
27.	<p>Further commitments to mitigating and managing surface water impacts are provided within the EMP.</p>
	Water resources–groundwater
28.	<p>No specific commitments relating to groundwater as the Project is not expected to have a significant impact on groundwater in the area.</p>
	Water quality
29.	<p>Commitments are provided within the EMP.</p>
	Air quality
30.	<p>Commitments are provided within the EMP.</p>
	Greenhouse gas emissions
31.	<p>Commitments are provided within the EMP.</p>
	Noise and vibration
32.	<p>Commitments are provided within the EMP.</p>
	Waste
33.	<p>Commitments are provided within the EMP.</p>
	Transport
34.	<p>Discussions will be held with Aurizon and DTMR to inform the development of appropriate traffic management plans (as applicable) for use of Gogango rail crossing, including provision of dilapidation surveys and repair, maintenance and reinstatement requirements</p>
35.	<p>During detailed design refinement of Project activities will be facilitated through updating traffic counts, undertaking pavement impact assessments and road safety audits</p>
36.	<p>A road use management plan will be developed in consultation with DTMR, RRC and LSC governing upgrades, use, maintenance and restoration (as applicable) of these roads, along with identification of transport targets, updated traffic generation and road-use data and road-use management strategies</p>
37.	<p>Traffic management plans will be developed in consultation with DTMR, the Queensland Police Service and bus operators.</p>

Commitment number	Proponent Commitment
38.	New bridges will be constructed at Glenroy Crossing, Riverslea Crossing and Foleyvale Crossing (relative to infrastructure build and impoundment impacts).
39.	A bank of culverts and a causeway will be installed at Hanrahan Crossing to facilitate access during water releases from Rookwood Weir.
40.	Augmentation of Thirsty Creek Road will be undertaken to facilitate construction access and maintain operational access to Rookwood Weir.
41.	Eden Bann Road will be upgraded as necessary to accommodate construction traffic and support operations.
42.	A new permanent 12 km private access road will be constructed to the southern bank of the Eden Bann Weir to accommodate construction traffic and support operations.
43.	The Capricorn Highway intersection at Gogango and the Bruce Highway intersection with Atkinson Road Canoona will be upgraded to provide safer access and egress conditions. The final location and design of the intersection upgrade will be undertaken in consultation with DTMR and relevant councils.
44.	Dilapidation surveys will be undertaken at the Atkinson Road/Bruce Highway and Third Street/Capricorn Highway intersections prior to construction and provided to DTMR and RRC to facilitate that the intersection is restored to its original condition post-construction.
45.	Further commitments to mitigating and managing transport impacts are addressed within the EMP.
Cultural heritage	
46.	The Project will comply with the Cultural Heritage Management Plans developed with the relevant Aboriginal parties and approved by the State Government.
47.	Commitments are provided within the EMP.
Social impacts	
48.	Issues relating to the loss of land and/or loss of access to land along with impacts on productivity will be negotiated and agreed on a one-on-one basis with directly impacted landholders.
49.	Commitments are provided within the EMP.
Economics	
50.	Commitments provided as part of the social commitments (Table D-13)
Hazard and risk	
51.	The Project commits to an ongoing hazard and risk assessment process throughout the lifecycle of the Project that will focus on minimisation of risks to people, property and the environment as well as workers on the site.
52.	Commitments are provided within the EMP.
Cumulative impacts	
53.	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. No other specific commitments are proposed.

Commitment number	Proponent Commitment
Environmental management	
54.	The Project commits to the further refinement of the and implementation of the EMP, including the Construction EMP.
55.	The Project commits to the development and implementation of the Operational EMP in accordance with the Water Resource (Fitzroy Basin) Plan 2011, the Fitzroy Basin ROP and resource operations licence.

Appendix 9. Threat abatement plans, species recovery plans and conservation advices

The following threat abatement plans and recovery plans relate to MNES as discussed in Section 6 of my report.

Species recovery plans

Yellow chat (Capricorn subspecies) *Epthianura crocea macgregori* recovery plan—2008

The overall objective of the recovery plan is to improve the conservation status of the Capricorn yellow chat and manage its habitat.

Specific objectives and a summary of their recovery actions, identified in the recovery plan are as follows:

- (1) Protect, enhance and manage yellow chat habitat
 - (a) Survey the Curtis Island National Park where it overlaps the marine plain to establish its current use by Capricorn yellow chats and its habitat potential for chats.
 - (b) EPA establish management strategies for the conservation and enhancement of the Capricorn yellow chat habitat on Curtis Island Conservation and National Parks.
 - (c) Control numbers of feral animals considered to be a threat to yellow chats.
 - (d) Investigate possible voluntary conservation agreements over freehold land at all sites where appropriate.
 - (e) Investigate acquiring appropriate leasehold land at Inkerman and Twelve Mile Creeks or attaining secure Nature Refuge covenant over this land.
- (2) Address known threats, identify and quantify potential threats
 - (a) Ensure that the Plan is integrated into government agency and NRM strategies, including water managers
 - (b) Control feral pig numbers at Curtis Island to levels below thresholds damaging to chat habitat.
 - (c) Develop a fire management strategy for Curtis Island marine plain.
 - (d) Develop a weed management strategy including introduced ponded pasture grasses for Curtis Island marine plain.
 - (e) Consult with Fitzroy Shire as to the areas currently occupied by Capricorn yellow chats within their shire.
 - (f) Undertake fencing at Twelve Mile Creek area to exclude cattle from Capricorn yellow chat saltmarsh and sedge vegetation when breeding (October to April).
 - (g) Evaluate the impact of existing cattle grazing regimes and feral pigs (at Curtis Island) on chat habitat.
 - (h) Undertake research and monitoring of chat ecology and capture this information in technical reports and papers.
 - (i) Undertake regional ecosystem (RE) mapping at an appropriate scale (1:25,000 or greater) to permit definition of RE 11.1.2b from 11.2.1a and definition of narrow bands of RE 11.1.3.
 - (j) Research genetic structure, demographics and dispersal of the Capricorn yellow chat; identify linkages between chat breeding and productivity including key food requirements.

- (k) Search for further sub-populations.
- (3) Increase knowledge and awareness of the Capricorn yellow chat throughout the community, industry and landholders
 - (a) Liaise with landholders / managers as to the requirements of Capricorn yellow chats and the contribution they can make to maintaining chat habitat.
 - (b) Ensure that the environmental values of chats and their habitat requirements are recognized in industry operational plans.
 - (c) Continue community awareness of Capricorn yellow chat conservation issues at the local, regional, state and national levels through talks, medial releases, newsletter articles and brochures, and the involvement of Indigenous groups.

National recovery plan for the red goshawk (*Erythrorchis radiatus*)—2012

The overall objective of the plan is to maintain populations of red goshawk across their range and implement measures to promote recovery of the species.

Specific objectives and a summary of their recovery actions, identified in the recovery plan are as follows:

- (1) Identifying and mapping important red goshawk habitat by:
 - (a) collating information on known nest sites from the past 25 years
 - (b) producing descriptive maps of important habitat for the red goshawk.
 - (c) conducting searches to identify previously unknown pairs of red goshawks, nest sites, and habitats critical for red goshawk survival.
- (2) Protecting and appropriately managing important habitat areas to ensure long-term survival of the red goshawk by:
 - (a) providing specific information and advice to government agencies and non-government organisations to assist with the identification, acquisition and management of important red goshawk habitat
 - (b) reducing the effects of habitat fragmentation and habitat degradation by encouraging land owners to enter into voluntary conservation covenants/agreements in areas where red goshawks are located to protect both the birds and their habitat
 - (c) conducting research to understand the relationship between fragmentation, prey density and population persistence to better inform management
 - (d) monitoring red goshawk habitat.
- (3) Increasing knowledge about the red goshawk's productive success and its survival by:
 - (a) monitoring at least 20 nest sites each year to determine territory occupancy and productivity, and use DNA analyses of feathers to determine adult survival rates.
 - (b) training personnel from state and local government to identify and understand the threats to red goshawk habitat.
- (4) Identifying important populations of red goshawks by:
 - (a) identifying important populations and nest sites of red goshawks and use the information to inform monitoring programs and state and federal government planning frameworks
 - (b) ensuring location information about red goshawk nest sites is secure.
- (5) Increasing community awareness about the red goshawk and the conservation of the species by:
 - (a) producing and distributing information / educational materials on the conservation status and habitat requirements of the red goshawk.
 - (b) providing feedback to the public and agency personnel on progress of red goshawk recovery.
 - (c) reviewing the effectiveness of the community awareness program.

Threat abatement plans

Threat abatement plan for predation by the European red fox—2008

The goal of the European red fox TAP is to minimise the impact of foxes on biodiversity in Australia and its territories by protecting affected native species and ecological communities, and preventing further species and ecological communities from becoming threatened. The specific objectives and action items to achieve this are as follows:

- (1) Prevent foxes occupying new areas in Australia and eradicate foxes from high-conservation-value 'islands' by:
 - (a) collating data on offshore islands and isolated mainland 'islands', assess their conservation value, the likelihood of significant biodiversity impacts from foxes and, if there are no foxes present, rank the level of risk of foxes being introduced and establishing populations
 - (b) developing management plans to prevent, monitor and, if incursions occur, contain and eradicate any fox incursion, for 'islands' with high conservation values
 - (c) implementing management plans for high-conservation-value 'islands', including prevention and monitoring actions, and containment or eradication actions if incursions occur
 - (d) eradicating established populations of foxes from 'islands' with high conservation values (including Tasmania) where this is cost-effective, feasible and a conservation priority.
- (2) Promote maintenance and recovery of threatened species and ecological communities that are affected by fox predation by
 - (a) identifying priority areas for fox control based on:
 - (i) the significance of the population of the affected native species or of the ecological community
 - (ii) the degree of threat posed by foxes to species and ecological communities relative to other threats
 - (iii) the cost-effectiveness of maintaining fox populations below an identified 'damage threshold' in the region, and
 - (iv) the feasibility of effective remedial action
 - (b) conducting and monitoring regional fox control, through new or existing programs, in priority areas identified in Action 2.1
 - (c) applying incentives (other than bounties), partnerships and negotiated agreements to promote and maintain on-ground fox control on private or leasehold lands within or adjacent to priority sites identified in Action 2.1.
- (3) Improve knowledge and understanding of fox impacts and interactions with other species and ecological processes by:
 - (a) developing simple and cost-effective methods for monitoring populations of foxes and the impacts of foxes, including reliable methods for monitoring foxes and key native species at different densities, including very low densities
 - (b) investigating interactions between foxes and native carnivores to identify the significance of competition and predation by foxes to these native species
 - (c) determining the nature of interactions between foxes, feral cats, wild dogs and rabbits to effectively integrate fox control activities for all four species
 - (d) Identifying any unintended effects that fox control may have if conducted in isolation from other management activities
 - (e) developing means for estimating the environmental and other associated costs of impacts arising from foxes.
- (4) Improve the effectiveness, target specificity, integration and humaneness of control options for foxes by:

- (a) conducting research and extension to improve the effectiveness, target specificity and humaneness of existing toxin-bait media and baiting methods
 - (b) conducting further work on the development of new, or improvements to existing, control techniques
 - (c) testing and disseminating information on exclusion fence designs and other control methods regarding their cost-effectiveness for particular habitats or topography
 - (d) investigating the feasibility of control techniques to target foxes, but not dingoes, in some areas
 - (e) developing training programs to help land managers identify locally appropriate control method(s) and when (i.e. circumstances and times) to apply them in controlling foxes
 - (f) ensuring that habitat rehabilitation and management of potential prey, competitors and predators of foxes are considered in fox control programs
 - (g) continuing to promote the adoption and adaptation of the model codes of practice and standard operating procedures for humane management of foxes.
- (5) Increase awareness of all stakeholders of the objectives and actions of the TAP, and of the need to control and manage foxes by:
- (a) promoting:
 - (i) broad understanding of the threat to biodiversity posed by foxes and support for their control
 - (ii) support for the actions to be undertaken under this plan
 - (iii) the use of humane and cost-effective fox control methods
 - (iv) best-practice effective fox control in all tenures
 - (v) understanding of predation by foxes as a key threatening process.

Threat abatement plan for predation by feral cats—2015

The goal of the feral cat threat abatement plan (TAP) is to minimise the impact of cats on biodiversity in Australia and its territories by:

- (1) Protecting affected threatened species
- (2) Preventing further species and ecological communities from becoming threatened

To achieve this goal, the plan has four objectives:

- (1) Effectively control feral cats in different landscapes
 - (a) Ensure broad-scale toxic baits targeting feral cats are developed, registered and available for use across all of Australia, including northern Australia
 - (b) Develop and register other cat control tools, including devices exploiting cat grooming habits
 - (c) Continue research into understanding interactions between feral cats and other predators: (i) in different landscapes; and (ii) any potential beneficial/perverse outcomes if other predator populations are modified
 - (d) Continue research into understanding the role of other major landscape modifiers, such as fire or grazing by introduced herbivores, in feral cat activities and control
 - (e) Continue research into the scale, efficiency, cost-effectiveness, sustainability and risks of feral cat control options
 - (f) Continue development of new or enhanced attractants for cats to improve cat control and monitoring. Ensure availability of any attractants that are developed
 - (g) Research into other control and monitoring technologies and enhancing available technology
 - (h) Re-investigate diseases and other potential biocontrol agents, biotechnology and immunocontraceptive options for cats, and commence research on promising options. Undertake social research on promising options to gauge community support

- (i) Code of Practice and/or Standard Operating Procedures developed for new tools and agreed by governments
- (2) Improve effectiveness of existing control options for feral cats
 - (a) Understand motivations and provide incentives for land managers to include feral cat management into standard land management for biodiversity outcomes
 - (b) Provide information, in various media and through training, on best practice methods and standard operating procedures for controlling and monitoring feral cats
 - (c) Ensure areas prioritised for feral cat management across Australia maximise benefits to biodiversity at a local, regional and national level
 - (d) Governments agree to consistent legislation that identifies feral cats as a pest, has requirements for control, and identifies control techniques that may be used
- (3) Develop or maintain alternative strategies for threatened species recovery
 - (a) Eradicate, or control, cats on offshore islands of high, or potentially high, biodiversity value
 - (b) Establish, enhance or maintain biosecurity measures for cat-free offshore islands to prevent incursions
 - (c) Establish and maintain further fenced reserves ("mainland islands") for threatened species where it is identified cats cannot be controlled to the level required for threatened species recovery
 - (d) Research methods to understand thresholds of cat abundance required to improve survival rates for threatened species heavily preyed upon by feral cats. Research ways in which adaptation by threatened species may improve survival rates.
 - (e) Continue research into cat diseases, including *Toxoplasma gondii* and sarcosporidiosis, their prevalence, ability to transmit to other species (including livestock and humans) their impacts, and ways to mitigate the impacts.
- (4) Increase public support for feral cat management and promote responsible cat ownership.
 - (a) Quantify the proportion of the domestic and stray cat population that transitions to the feral cat population
 - (b) Promote to and seek engagement of the community in:
 - (i) an understanding of the threat to biodiversity posed by cats and support for their management;
 - (ii) an understanding of the transitions between domestic, stray and feral cats, and the need for responsible ownership;
 - (iii) support for the containment of domestic cats where their roaming may impact on identified conservation areas
 - (c) Promote and seek community engagement on the reduction of food and other resources to stray cats
 - (d) Develop specific communication campaigns to accompany the release of new broad-scale cat control techniques and other current/new cat control techniques and management programs—2015

Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads—2011

The goal of the cane toad TAP is to address the key threatening process (lethal toxic ingestion) of this species on native fauna in a feasible, effective and efficient manner. The three main objectives and associated recovery actions in order to achieve this goal are as follows:

- (1) Identifying priority native species and ecological communities at risk from the impact of cane toads by:
 - (a) identifying native species, ecological communities and off-shore islands currently known to be at high to moderate risk

- (b) identifying the ways in which cane toads impact the native species and ecological communities listed in (a)(i)
 - (c) establishing and supporting research where impacts are unknown but may be high, to further understand the impact of cane toads on the native species and ecological communities. Where appropriate, research ways to assist with the recovery of priority native species and ecological communities
 - (d) developing a prioritisation tool to guide allocation of resources for protection of native species and communities. Apply it to native species and ecological communities identified: first from (a)(i), then from (a)(iii)
- (2) Reducing the impact of cane toads on populations of priority native species and ecological communities by:
- (a) focusing the management of cane toad impacts by Australian Government agencies on designated high priority native species and ecological communities, and seek cooperative action on priorities by jurisdictions and other stakeholders
 - (b) implementing and monitoring emergency management of cane toad impacts for known high priority native species and ecological communities using currently available tools and techniques (e.g. trapping, fencing of small areas, manual removal from designated sites)
 - (c) implementing or adjusting the management of cane toad impacts using available tools and techniques as new species and communities are added to the list of priority native species and ecological communities. Additional tools and techniques will become available with the registration of toxins for euthanasia of captured toads and development of other impact management or cane toad control techniques. Codes of practice and standard operating procedures for cane toad control will provide guidance on these techniques
 - (d) preparing guidelines, including codes of practice and standard operating procedures that can be applied to both emergency responses and on-going management for high priority native species and ecological communities for endorsement by the VPC
 - (e) preparing and implementing management plans, (including identifying and addressing gaps in management techniques and tools) for designated high priority species and ecological communities on land managed by Australian Government agencies
 - (f) providing the guidelines for emergency and on-going cane toad management to all stakeholders. Liaising with responsible jurisdictions/agencies to encourage the preparation and implementation of such plans in their areas of responsibility. Where mutual obligations exist the Australian Government will work cooperatively to prepare such plans
 - (g) monitoring the development and implementation of guidelines and cane toad management plans for designated high priority species and ecological communities
 - (h) monitoring the literature about the spread and impact of the cane toad and review/amend guidelines and develop new management plans as required
 - (i) establishing guidelines for humane management actions to control cane toads for VPC and Animal Welfare Committee endorsement
 - (j) distributing guidelines to all Australian Government agencies with land management responsibilities
 - (k) seek cooperative adoption of guidelines by states/territories including incorporation in state based regulations as appropriate.
- (3) Communicating information about cane toads, their impacts and the TAP by:
- (a) implementing a one-stop-shop webpage on the Department of Environment website with links to jurisdictional and stakeholder information on cane toads and including information on:
 - (i) the threat cane toads pose to biodiversity
 - (ii) management actions to limit this threat

- (iii) guidelines for cane toad management
 - (iv) information to help identify cane toads from other amphibians
 - (v) codes of practice and standard operating procedures
 - (vi) management plans (as they are developed) for areas designated as high priority.
- (b) encouraging monitoring, evaluation and reporting on cane toad management actions is maintained and communicated to stakeholders
- (c) ensuring Australian Government fact sheets and other communications material on cane toads are current and reflect the strategy developed in this TAP.

Conservation advice

Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community—2013

Research and monitoring priorities:

- (1) Establish condition benchmarks across the range of the brigalow ecological community for each of the component vegetation communities.
- (2) Survey and continue to monitor a representative set of sites in Qld and NSW to assess condition and to identify relevant threats.
- (3) Identify, prioritise and map important areas for brigalow conservation in Qld and NSW.
- (4) Investigate methods to assist advanced regrowth to attain the structural and floristic characteristics of remnant brigalow.
- (5) Undertake monitoring to ensure and encourage compliance with legislation that protects the brigalow ecological community.

Priority recovery and threat abatement actions:

- (1) Threat reduction/control
 - (a) Protect and conserve remnant and regrowth areas of the ecological community. Prevent clearance of this endangered ecological community and of nearby native vegetation including buffer zones and connecting corridors.
 - (b) Where further clearance is unavoidable:
 - (i) mitigate the severity of impacts (e.g. avoid higher quality areas, avoid dissection of patches, act to minimise hydrological disruption and the spread of weeds)
 - (ii) offsetting should consider the location and emulate qualities of affected patches.
 - (c) Manage areas of the brigalow ecological community to reduce threats, including through:
 - (i) fire management that considers brigalow conservation, protection, and ecological heterogeneity
 - (ii) targeted weed and feral animal control with a particular focus on high biomass exotic grasses (buffel grass, Rhodes grass, green panic grass) and feral pigs.
 - (d) Manage all weeds appropriately within and close to the brigalow ecological community; e.g.: spot application of herbicides, rather than aerial spraying; avoid fertiliser application; minimise tree thinning and soil disturbance.
 - (e) Manage foxes and cats (as well as feral pigs) using a coordinated approach, preferably among groups of neighbours and across regions.
 - (f) Help woodland birds to avoid aggression from noisy miners by: encouraging and protecting shrubby understorey; managing grazing pressure so that it does not degrade native vegetation; and retaining dense stands of trees and regrowth
- (2) Land management

- (a) Encourage landholders to balance primary production and the conservation of native flora and fauna within and close to the ecological community. Examples of this are:
 - (i) managing stocking rates, paddock numbers/sizes, grazing practices and livestock camp sites to avoid damage to woodland understorey and ground cover – this may include adopting rotational or cell grazing regimes; or, excluding grazing entirely from intact stands of brigalow where appropriate (e.g. unless managing fuel loads through grazing)
 - (ii) leaving trees, or clumps of regrowth, in paddocks to maintain connections between patches of native flora and fauna habitat
 - (iii) connecting shade-lines to one another and keeping them as wide as possible (ideally more than 100 m)
 - (iv) avoiding the application of fertiliser, or the aerial / broad scale spraying of herbicides; and,
 - (v) leaving dead trees standing and allowing dead timber and leaf litter to rot where it falls on the ground.
 - (b) Undertake regeneration of high value regrowth sites and revegetation of degraded sites.
 - (c) Increase the area of the brigalow ecological community managed for conservation, such as through the reservation of high quality/large areas of remnant or regrowth and by facilitating conservation agreements with landholders.
 - (d) Establish adequate buffer zones to protect remnants.
 - (e) Devise and implement water management, sediment erosion and pollution control and monitoring plans.
- (3) Management for wildlife
- (a) Undertake management actions that help to increase the diversity of species and their abundance; this requires thinking about habitat use at multiple scales. General management actions that benefit many fauna species include:
 - (i) retaining fallen timber and leaf litter for small mammals and reptiles
 - (ii) retaining standing dead trees or old trees with hollow limbs for nesting sites for birds, mammals and reptiles
 - (iii) re-introducing microhabitat features (e.g. rocks, logs and other woody debris) to sites disturbed during proposed works
 - (iv) discouraging species like noisy miners and introduced predators by maintaining large patches of woodland with complex structure
 - (v) avoiding clearing remnant vegetation; and retaining areas of brigalow regrowth.
 - (b) Encourage woodland regeneration close to areas of existing woodland.
- (4) Develop and Propagate Conservation Information
- (a) In consultation with land managers, local and state authorities and Indigenous groups:
 - (i) develop and propagate environmentally sustainable management guidelines and technical material to assist land managers, including measure to address inappropriate fire regimes, plant pathogens, invasive animal management, weed management and health and maintenance of the ecological community.
 - (ii) develop or support appropriate existing education programs, information products and signage to help the public recognise the presence and importance of the ecological community, and encourage compliance with their responsibilities under state and local regulations and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Approved Conservation Advice for *Rheodytes leukops* (Fitzroy Tortoise)–2008

Research priorities that would inform future regional and local priority action include:

- (1) Undertake survey work in suitable habitat and potential habitat to locate any additional populations.
- (2) Undertake research into developing appropriate protection methods to ensure higher survival of eggs and hatchlings.
- (3) Develop and implement a monitoring program (including consideration of reproductive success).
- (4) The following regional priority recovery and threat abatement actions can be done to support the recovery of *Rheodytes leukops*.
- (5) Habitat Loss, Disturbance and Modification
 - (a) Identify populations of high conservation priority.
 - (b) Protect areas of riparian habitat where populations of *Rheodytes leukops* are known or have the potential to occur.
 - (c) Ensure mining operations and other infrastructure or development activities in areas where *Rheodytes leukops* occurs do not impact on known populations.
 - (d) Manage, in such a manner that there is no detrimental impact, any changes to hydrology that may result in changes to the water table levels, increased run-off, sedimentation or pollution, particularly from cotton/grazing production.
 - (e) Investigate formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure.
- (6) Trampling
 - (a) Develop and implement a stock management plan along riparian habitats and travelling stock routes.
 - (b) Animal Predation
 - (c) Develop a management plan to be implemented for the control and eradication of foxes, pigs, dingoes and cats around breeding colonies of the Fitzroy River turtle (Norris & Low, 2005).
- (7) Conservation Information
 - (a) Raise awareness of *Rheodytes leukops* within the local community, particularly with boat owners to minimise boat strike (EPA, 2007).
- (8) Enable Recovery of Additional Sites and/or Populations
 - (a) Improve recruitment of hatchling into the population.
 - (b) Maintain stream flow and the continuity of turtle populations between impoundments.

The following local priority recovery and threat abatement actions can be done to support the recovery of *Rheodytes leukops*:

- (9) Habitat Loss, Disturbance and Modification
 - (a) Monitor known populations to identify key threats.
 - (b) Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
 - (c) Control access routes to suitably constrain public access to known sites on public land.
 - (d) Suitably control and manage access to nest sites on private land.
 - (e) Adequately consider the requirements and protection of this species in all proposals for impoundment developments.
 - (f) Minimise adverse impacts from land use at known sites.
 - (g) Protect populations of *Rheodytes leukops* through the development of conservation agreements and/or covenants.

- (h) Maintain nesting banks used by the turtles and protect turtle nests from predation and disturbance.
 - (i) Improve water quality in the lower Fitzroy River catchment.
 - (j) Trampling
 - (k) Prevent trampling and riparian habitat damage by grazing animals at known sites on leased crown land through exclusion fencing or other barriers.
- (10) Animal Predation
 - (a) Manage threats at known sites in reserve areas to control pigs, foxes and cats.
 - (b) Manage threats at known sites on private property to control pigs, foxes and cats.
- (11) Enable recovery of additional sites and/or populations
 - (a) Develop ex situ breeding population.
 - (b) Evaluate the efficacy of removing eggs from the wild, hatching them in artificial sites, and returning hatchlings to the wild.

Approved conservation advice for *Eucalyptus raveretiana* (Black Ironbox)—2008

Research priorities that would inform future regional and local priority actions include:

- (1) Design and implement a monitoring program or, if appropriate, support and enhance existing programs.
- (2) More precisely assess population size, distribution, ecological requirements and the relative impacts of threatening processes, especially weeds.
- (3) Determine fire regime requirements for Black Ironbox and its habitat.

The following regional and local priority recovery and threat abatement actions can be done to support the recovery of Black Ironbox:

- (1) Habitat Loss, Disturbance and Modification
 - (a) Identify populations of high conservation priority.
 - (b) Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on Black Ironbox.
 - (c) Monitor known populations to identify key threats.
 - (d) Minimise adverse impacts from land use at known sites, particularly in relation to forest operations and maintenance of stream bank and riparian vegetation integrity.
 - (e) Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate inclusion in reserve tenure if possible.
- (2) Invasive Weeds
 - (a) Identify and remove weeds in the local area, which could become a threat to Black Ironbox, using appropriate methods.
 - (b) Manage sites to prevent introduction of invasive weeds, which could become a threat to the species, using appropriate methods.
 - (c) Implement a management plan for the control of Rubber Vine in the region.
- (3) Fire
 - (a) Develop and implement a suitable fire management strategy for Black Ironbox.
 - (b) Provide maps of known occurrences to local and state Rural Fire Services and seek inclusion of mitigative measures in bush fire risk management plans, risk register and/or operation maps.
- (4) Conservation Information
 - (a) Raise awareness of Black Ironbox within the local community.
- (5) Enable Recovery of Additional Sites and/or Populations
 - (a) Undertake appropriate seed collection and storage.

- (b) Investigate options for linking, enhancing or establishing additional populations.
- (c) Implement national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible.

Approved Conservation Advice for *Dichanthium queenslandicum* (king blue-grass)—2013

Research priorities that would inform future regional and local priority actions include:

- (1) Design and implement a monitoring program or, if appropriate, support and enhance existing programs.
- (2) More precisely assess population size, distribution, ecological requirements and the relative impacts of threatening processes.
- (3) Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants.
- (4) Undertake seed germination and/or vegetative propagation trials to determine the requirements for successful establishment.
- (5) Identify optimal fire regimes for regeneration (vegetative regrowth and/or seed germination), and response to other prevailing fire regimes.
- (6) Establish the grazing threshold of the species to determine what grazing management practices are consistent with sustaining populations of this species.

The following regional priority recovery and threat abatement actions can be done to support the recovery of king blue-grass:

- (1) Habitat Loss, Disturbance and Modification
 - (a) Monitor known populations to identify key threats.
 - (b) Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.
 - (c) Identify populations of high conservation priority.
 - (d) Ensure there is no disturbance in areas where king blue-grass occurs, excluding necessary actions to manage the conservation of the species/ecological community.
 - (e) Investigate formal conservation arrangements, management agreements and covenants on private land, and for crown and private land investigate and/or secure inclusion in reserve tenure if possible.
 - (f) Manage any other known, potential or emerging threats, including mining practices, grazing, weed invasion and climate change.
- (2) Invasive Weeds
 - (a) Develop and implement a management plan for king blue-grass for the control of parthenium (*Parthenium hysterophorus*) and parkinsonia (*Parkinsonia aculeata*) in the region.
 - (b) Ensure chemicals or other mechanisms used to eradicate weeds do not have a significant adverse impact on king blue-grass.
- (3) Trampling, Browsing or Grazing
 - (a) Develop and implement a stock management plan for roadside verges and travelling stock routes.
- (4) Conservation Information
 - (a) Raise awareness of king blue-grass within the local community, for example distribute fact sheets/information brochures or conduct field days in conjunction with known industry or community interest groups.
 - (b) Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions.
- (5) Enable recovery of additional sites and/or populations.
 - (a) Undertake appropriate seed collection and storage.

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- (b) Investigate options for linking, enhancing or establishing additional populations.
 - (c) Implement national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible.

Appendix 10. Statement of Outstanding Universal Value—Great Barrier Reef

Brief synthesis

As the world's most extensive coral reef ecosystem, the GBR is a globally outstanding and significant entity. Practically the entire ecosystem was inscribed as World Heritage in 1981, covering an area of 348 000 km² and extending across a contiguous latitudinal range of 14° (10°S to 24°S). The GBR includes extensive cross-shelf diversity, stretching from the low water mark along the mainland coast up to 250 km offshore. This wide depth range includes vast shallow inshore areas, mid-shelf and outer reefs, and beyond the continental shelf to oceanic waters over 2000 m deep.

Within the GBR there are some 2500 individual reefs of varying sizes and shapes, and over 900 islands, ranging from small sandy cays and larger vegetated cays, to large rugged continental islands rising, in one instance, over 1100 m above sea level. Collectively these landscapes and seascapes provide some of the most spectacular maritime scenery in the world.

The latitudinal and cross-shelf diversity, combined with diversity through the depths of the water column, encompasses a globally unique array of ecological communities, habitats and species.

This diversity of species and habitats, and their interconnectivity, make the GBR one of the richest and most complex natural ecosystems on earth. There are over 1500 species of fish, about 400 species of coral, 4000 species of mollusc, and some 240 species of birds, plus a great diversity of sponges, anemones, marine worms, crustaceans, and other species. No other World Heritage property contains such biodiversity. This diversity, especially the endemic species, means the GBR is of enormous scientific and intrinsic importance, and it also contains a significant number of threatened species. At time of inscription, the IUCN evaluation stated "...if only one coral reef site in the world were to be chosen for the World Heritage List, the GBR is the site to be chosen".

Criterion (vii): The GBR is of superlative natural beauty above and below the water, and provides some of the most spectacular scenery on earth. It is one of a few living structures visible from space, appearing as a complex string of reefal structures along Australia's northeast coast.

From the air, the vast mosaic patterns of reefs, islands and coral cays produce an unparalleled aerial panorama of seascapes comprising diverse shapes and sizes. The Whitsunday Islands provide a magnificent vista of green vegetated islands and spectacular sandy beaches spread over azure waters. This contrasts with the vast mangrove forests in Hinchinbrook channel, and the rugged vegetated mountains and lush rainforest gullies that are periodically cloud-covered on Hinchinbrook Island.

On many of the cays there are spectacular and globally important breeding colonies of seabirds and marine turtles, and Raine Island is the world's largest green turtle

breeding area. On some continental islands, large aggregations of over-wintering butterflies periodically occur.

Beneath the ocean surface, there is an abundance and diversity of shapes, sizes and colours; for example, spectacular coral assemblages of hard and soft corals, and thousands of species of reef fish provide a myriad of brilliant colours, shapes and sizes. The internationally renowned Cod Hole near Lizard Island is one of many significant tourist attractions. Other superlative natural phenomena include the annual coral spawning, migrating whales, nesting turtles, and significant spawning aggregations of many fish species.

Criterion (viii): The GBR, extending 2000 km along Queensland's coast, is a globally outstanding example of an ecosystem that has evolved over millennia. The area has been exposed and flooded by at least four glacial and interglacial cycles, and over the past 15 000 years reefs have grown on the continental shelf.

During glacial periods, sea levels dropped, exposing the reefs as flat-topped hills of eroded limestone. Large rivers meandered between these hills and the coastline extended further east.

During interglacial periods, rising sea levels caused the formation of continental islands, coral cays and new phases of coral growth. This environmental history can be seen in cores of old massive corals.

Today the GBR forms the world's largest coral reef ecosystem, ranging from inshore fringing reefs to mid-shelf reefs, and exposed outer reefs, including examples of all stages of reef development. The processes of geological and geomorphological evolution are well represented, linking continental islands, coral cays and reefs. The varied seascapes and landscapes that occur today have been moulded by changing climates and sea levels, and the erosive power of wind and water, over long time periods. One-third of the GBR lies beyond the seaward edge of the shallower reefs; this area comprises continental slope and deep oceanic waters and abyssal plains.

Criterion (ix): The globally significant diversity of reef and island morphologies reflects ongoing geomorphic, oceanographic and environmental processes. The complex cross-shelf, longshore and vertical connectivity is influenced by dynamic oceanic currents and ongoing ecological processes such as upwellings, larval dispersal and migration.

Ongoing erosion and accretion of coral reefs, sand banks and coral cays combine with similar processes along the coast and around continental islands. Extensive beds of halimeda algae represent active calcification and accretion over thousands of years.

Biologically the unique diversity of the GBR reflects the maturity of an ecosystem that has evolved over millennia; evidence exists for the evolution of hard corals and other fauna. Globally significant marine faunal groups include over 4000 species of molluscs, over 1500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others. The establishment of vegetation on the cays and continental islands exemplifies the important role of birds, such as the Pied Imperial Pigeon, in processes such as seed dispersal and plant colonisation.

Human interaction with the natural environment is illustrated by strong ongoing links between Aboriginal and Torres Strait Islanders and their sea-country, and includes numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems.

Criterion (x): The enormous size and diversity of the GBR means it is one of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation. The amazing diversity supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance.

As the world's most complex expanse of coral reefs, the reefs contain some 400 species of corals in 60 genera. There are also large ecologically important inter-reefal areas. The shallower marine areas support half the world's diversity of mangroves and many seagrass species. The waters also provide major feeding grounds for one of the world's largest populations of the threatened dugong. At least 30 species of whales and dolphins occur here, and it is a significant area for humpback whale calving.

Six of the world's seven species of marine turtle occur in the GBR. As well as the world's largest green turtle breeding site at Raine Island, the GBR also includes many regionally important marine turtle rookeries.

Some 242 species of birds have been recorded in the GBR. Twenty-two seabird species breed on cays and some continental islands, and some of these breeding sites are globally significant; other seabird species also utilize the area. The continental islands support thousands of plant species, while the coral cays also have their own distinct flora and fauna.

Integrity

The ecological integrity of the GBR is enhanced by the unparalleled size and current good state of conservation across the property. At the time of inscription it was felt that to include virtually the entire Great Barrier Reef within the property was the only way to ensure the integrity of the coral reef ecosystems in all their diversity.

A number of natural pressures occur, including cyclones, crown-of-thorns starfish outbreaks, and sudden large influxes of freshwater from extreme weather events. As well there is a range of human uses such as tourism, shipping and coastal developments including ports. There are also some disturbances facing the GBR that are legacies of past actions prior to the inscription of the property on the World Heritage list.

At the scale of the GBR ecosystem, most habitats or species groups have the capacity to recover from disturbance or withstand ongoing pressures. The property is largely intact and includes the fullest possible representation of marine ecological, physical and chemical processes from the coast to the deep abyssal waters enabling the key interdependent elements to exist in their natural relationships.

Some of the key ecological, physical and chemical processes that are essential for the long-term conservation of the marine and island ecosystems and their associated biodiversity occur outside the boundaries of the property and thus effective conservation programs are essential across the adjoining catchments, marine and coastal zones.

Protection and management requirements

The GBR covers approximately 348 000 km². Most of the property lies within the GBR Marine Park: at 344 400 km², this Federal Marine Park comprises approximately 99 per cent of the property. The GBR marine park's legal jurisdiction ends at low water mark along the mainland (with the exception of port areas) and around islands (with the exception of 70 Commonwealth managed islands which are part of the Marine Park). In addition the GBR also includes over 900 islands within the jurisdiction of Queensland, about half of which are declared as 'national parks', and the internal waters of Queensland that occur within the World Heritage boundary (including a number of long-established port areas).

The World Heritage property is and has always been managed as a multiple-use area. Uses include a range of commercial and recreational activities. The management of such a large and iconic world heritage property is made more complex due to the overlapping State and Federal jurisdictions. The Great Barrier Reef Marine Park Authority, an independent Australian Government agency, is responsible for protection and management of the GBR Marine Park. The Great Barrier Reef Marine Park Act 1975 was amended in 2007 and 2008, and now provides for "the long term protection and conservation ... of the Great Barrier Reef Region" with specific mention of meeting "...Australia's responsibilities under the World Heritage Convention". Queensland is responsible for management of the Great Barrier Reef Coast Marine Park, established under the *Marine Parks Act 2004* (Qld). This is contiguous with the GBR Marine Park and covers the area between low and high water marks and many of the waters within the jurisdictional limits of Queensland. Queensland is also responsible for management of most of the islands.

The overlapping jurisdictional arrangements mean that the importance of complementary legislation and complementary management of islands and the surrounding waters is well recognised by both governments. Strong cooperative partnerships and formal agreements exist between the Australian Government and the Queensland Government. In addition, strong relationships have been built between governments and commercial and recreational industries, research institutions and universities. Collectively this provides a comprehensive management influence over a much wider context than just the marine areas and islands.

Development and land use activities in coastal and water catchments adjacent to the property also have a fundamental and critical influence on the values within the property. The Queensland Government is responsible for natural resource management and land use planning for the islands, coast and hinterland adjacent to the GBR. Other Queensland and Federal legislation also protects the property's Outstanding Universal Value addressing such matters as water quality, shipping management, sea dumping, fisheries management and environmental protection.

The EPBC Act provides an overarching mechanism for protecting the World Heritage values from inappropriate development, including actions taken inside or outside which could impact on its heritage values. This requires any development proposals to undergo rigorous environmental impact assessment processes, often including public consultation, after which the Federal Minister may decide, to approve, reject or approve under conditions designed to mitigate any significant impacts. A recent amendment to

the EPBC Act makes the GBR Marine Park an additional 'trigger' for a matter of National Environmental Significance which provides additional protection for the values within the GBR.

The GBR Marine Park and the adjoining GBR Coast Marine Park are zoned to allow for a wide range of reasonable uses while ensuring overall protection, with conservation being the primary aim. The zoning spectrum provides for increasing levels of protection for the 'core conservation areas' which comprise the 115 000 km² of 'no-take' and 'no-entry' zones within the GBR.

While the Zoning Plan is the 'cornerstone' of management and provides a spatial basis for determining where many activities can occur, zoning is only one of many spatial management tools and policies applied to collectively protect the GBR. Some activities are better managed using other spatial and temporal management tools like Plans of Management, Special

Management Areas, Agreements with Traditional Owners and permits (often tied to specific zones or smaller areas within zones, but providing a detailed level of management not possible by zoning alone). These statutory instruments also protect the Outstanding Universal Value of the property.

Many Aboriginal and Torres Strait Island peoples undertake traditional use of marine resource activities to provide traditional food, practice their living maritime culture, and to educate younger generations about traditional and cultural rules and protocols. In the GBR these activities are managed under both Federal and Queensland legislation and policies including Traditional Use of Marine Resource Agreements (TUMRAs) and Indigenous Land Use Agreements (ILUAs). These currently cover some 30 per cent of the GBR inshore area, and support Traditional Owners to maintain cultural connections with their sea country.

Similarly non-statutory tools like site management and Industry Codes of Practice contribute to the protection of World Heritage values. Some spatial management tools are not permanently in place nor appear as part of the zoning, yet achieve effective protection for elements of biodiversity (e.g. the temporal closures that are legislated across the GBR prohibit all reef fishing during specific moon phases when reef fish are spawning).

Other key initiatives providing increased protection for the GBR include the comprehensive Great Barrier Reef Outlook Report (and its resulting 5-yearly reporting process); the Reef Water Quality Protection Plan; the GBR Climate Change Action Plan; and the Reef Guardians Stewardship Programs which involve building relationships and working closely with those who use and rely on the GBR or its catchment for their recreation or their business.

The 2009 Outlook Report identified the long-term challenges facing the GBR; these are dominated by climate change over the next few decades. The extent and persistence of damage to the GBR ecosystem will depend to a large degree on the amount of change in the world's climate and on the resilience of the GBR ecosystem to such change. This report also identified continued declining water quality from land-based sources, loss of coastal habitats from coastal development, and some impacts from

fishing, illegal fishing and poaching as the other priority issues requiring management attention for the long-term protection of the GBR.

Emerging issues since the 2009 Outlook Report include proposed port expansions, increases in shipping activity, coastal development and intensification and changes in land use within the GBR catchment; population growth; the impacts from marine debris; illegal activities; and extreme weather events including floods and cyclones.

Further building the resilience of the GBR by improving water quality, reducing the loss of coastal habitats and increasing knowledge about fishing and its effects and encouraging modified practices, will give the GBR its best chance of adapting to and recovering from the threats ahead, including the impacts of a changing climate.

Appendix 11. Facilitated Agricultural Development—technical note

Technical note

HowLeaky? modelling

Facilitated agricultural development

November 2016



Acronyms

Description	Acronym
Department of Agriculture and Fisheries (Qld)	DAF
Department of Environment and Energy (Cth) (formerly the Department of Environment)	DEE (DoE)
Department of Environment and Heritage Protection (Qld)	DEHP
Department of Natural Resources and Mines (Qld)	DNRM
Environmental impact statement	EIS
Environmentally relevant activity	ERA
Event mean concentration	EMC
Facilitated agricultural development	FAD
Field capacity	FC
Fitzroy Industry Infrastructure Study	FIIS
Gladstone Area Water Board	GAWB
Lower Fitzroy River Infrastructure Project	Project
Office of the Coordinator-General	OCG
Potential development areas	PDA
SunWater Limited	SunWater
Total nitrogen	TN
Total phosphorous	TP
Universal Soil Loss Erosion	USLE

Table of contents

1.	Introduction.....	1
1.1	Background.....	1
1.2	FAD working group	2
1.3	Purpose of the report	2
2.	Approach and methodology	3
2.1	2.1 Overview	3
2.2	Modelling method - HowLeaky?	6
3.	Reporting.....	9
3.1	Generated pollutant loads.....	9
3.2	Commentary on outputs.....	9
4.	References (not included in EIS)	14

Table index

Table 1-1	FAD working group key activities.....	3
Table 2-1	Summary of parameters adopted for HowLeaky?	8
Table 3-1	Annual pollutant loads and EMC (Yaamba climate).....	10
Table 3-2	Annual pollutant loads and EMC (Westwood Store climate).....	11
Table 3-3	Annual water balance summary (Yaamba).....	12
Table 3-4	Annual water balance summary (Westwood Store)	13

Figure index

Figure 2-1	Eden Bann Weir existing land use and PDAs	4
Figure 2-2	Proposed Rookwood Weir existing land use and PDAs.....	5
Figure 2-3	Conceptual model of crop and soil management in a water balance context	7

Appendices

Appendix A – HowLeaky parameter information

1. Introduction

1.1 Background

The Water Resource (Fitzroy Basin) Plan 2011 identifies unallocated water held as strategic water infrastructure reserve; a nominal volume of 76,000 ML (for supplemented water allocations) is reserved for water infrastructure on the Fitzroy River, within which the Lower Fitzroy River Infrastructure Project (Project) is included. 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 detailed project description and assessment of surface water resources are included in the draft environmental impact statement (EIS) (Volume 1, Chapter 2 and Volume 1, Chapter 9, respectively).

The Gladstone Area Water Board (GAWB) and SunWater Limited (SunWater) are joint proponents for the Project.

The Fitzroy Basin Resource Operations Plan specifies that the chief executive may accept submissions for making unallocated water available from the strategic infrastructure reserve on the Fitzroy River 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
- Person or entity: up to the remaining 42,000 ML of the reserve.

A water supply use for the remaining 42,000 ML of the strategic water infrastructure reserve is not specified. Based on development demand within the region it is reasonable to expect that this water could be utilised for a mix of industrial, urban and agricultural uses. Regional planning documents and policy indicate a focus on industrial development within the Gracemere-Stanwell Industrial Corridor (Fitzroy Planning Scheme 2005), urban residential development within the designated priority living areas of the regional plan (DSDIP, 2013) and potential agricultural development within the Fitzroy Agricultural Corridor (RDA 2014) (draft EIS, Volume 1, Chapter 1).

Agricultural development has been identified as a priority for the Fitzroy region (RDA, 2014). Previous studies, including the Fitzroy Industry Infrastructure Study (FIIS) (GHD 2006) and Queensland Agricultural Land Audit (DAFF 2013), have identified areas of suitable land for irrigated agricultural development which could be facilitated through the provision of water supply. The studies showed that the Lower Fitzroy Region is suitable for intensive livestock production and some horticultural activities (Department of Infrastructure, 2007) (Additional information to the draft EIS, Chapter 11).

Subsequently agricultural development opportunities within the region are focusing on the development of intensive animal husbandry, intensive agricultural/horticulture and broad acre cropping. The extent of future agricultural development will be dependent on a range of matters from availability of water and suitability of land, to the provision of supporting infrastructure and market demands for product, among others. The Department of Agriculture and Fisheries (DAF) has identified a potential long term scenario for development of agricultural activities which could be achieved through provision of water from a number of sources of which the Project represents one contributing source (Additional information to the draft EIS, Chapter 11).

1.2 FAD working group

Consequential or facilitated industrial, urban and agricultural development and the potential resulting impacts on matters of national environmental significance were addressed in the draft EIS prepared for the Project (Volume 2, Chapter 12).

Submissions made on the draft EIS sought further information in regard to the potential agricultural development that may be facilitated by the Project, herein referred to as facilitated agricultural development (FAD). These were addressed initially with regulatory agencies through a technical note (draft discussion document dated 23 February 2016 and follow up response to comments dated 9 March 2016). Following review and discussion with the Office of the Coordinator-General (OCG), the (now) Department of Environment and Energy (DEE), the Department of Environment and Heritage Protection (DEHP) and the Department of Natural Resources and Mines (DNRM) submissions were then formally addressed in the additional information to the draft EIS (Chapter 11).

Submissions on the additional information to the draft EIS from regulatory agencies (DEE, including the Great Barrier Reef Marine Park Authority), DEHP and DNRM) raised queries with regard to the approach and methodology used, and subsequently the predicted pollutant loads potentially attributed to the FAD.

The OCG coordinated a FAD working group to review the approach and methodology and advise further on assessment requirements. The working group comprised:

- OCG - Matthew Grant, Tanya Lavett and Raymond Barkmeyer
- DEE - Chris Murphy and Karina Richards
- DAF Agriculture - Bob Durance, Michelle Hinckfuss, Paul Walmsley, Karen Grindlay, Lew Markey
- DNRM - Dave Waters, Alison Hambleton, Kerri Whiting, Mark Silburn and Shawn Darr
- Project proponents - Ralph Woolley (GAWB), Peter MacTaggart and Michael Pitman (SunWater), Geraldine Squires, Lesa Delaere and Paul Priebbenow (GHD), and David Freebairn (specialist sub-consultant).

Table 1-1 provides a summary of FAD working group activities.

1.3 Purpose of the report

Further to meetings and ongoing liaison between the representatives of the FAD working group, this technical note seeks to document the outcomes of the working group's discussions and decisions and in particular to confirm the assessment approach and methodology as follows:

- FAD scenarios: land use, potential development areas and agricultural development types
- Pollutant load generation: pollutants and generated loads (sediment, nutrients and farm chemicals/pesticide) from existing and potential changes in land use
- Modelling: use of HowLeaky? and determination of model parameters and input assumptions (for example, climate, soils, land form/slope, cropping practices, etc)

The FAD assessment outcomes will be used to inform the Coordinator-General's evaluation of the EIS with regard to potential impacts on Great Barrier Reef water quality.

This report should be read in conjunction with the draft EIS (Volume 2, Chapter 12) and Chapter 11 of the additional information to the draft EIS.

Table 1-1 FAD working group key activities

Item	Activity/Description	Date
1	Draft technical note prepared in response to draft EIS submissions and provided for comment	23 February 2016
2	Technical note response to comments prepared and discussed	9 March 2016
3	Chapter 11 included within the additional information to the draft EIS to address FAD	May 2016
4	FAD working group meeting to discuss revised FAD assessment	23 August 2016
5	GHD and DNRM technical meeting to discuss data availability and modelling approaches	2 September 2016
6	Technical note prepared to outline proposed revised assessment approach, data availability, key stakeholders, etc.	28 September 2016
7	FAD working group meeting to agree model parameters and inputs	29 September 2016
8	FAD working group meeting to review and discuss revised assessment outputs	13 October 2016
9	Final technical note to consolidate FAD assessment	November 2016

2. Approach and methodology

2.1 Overview

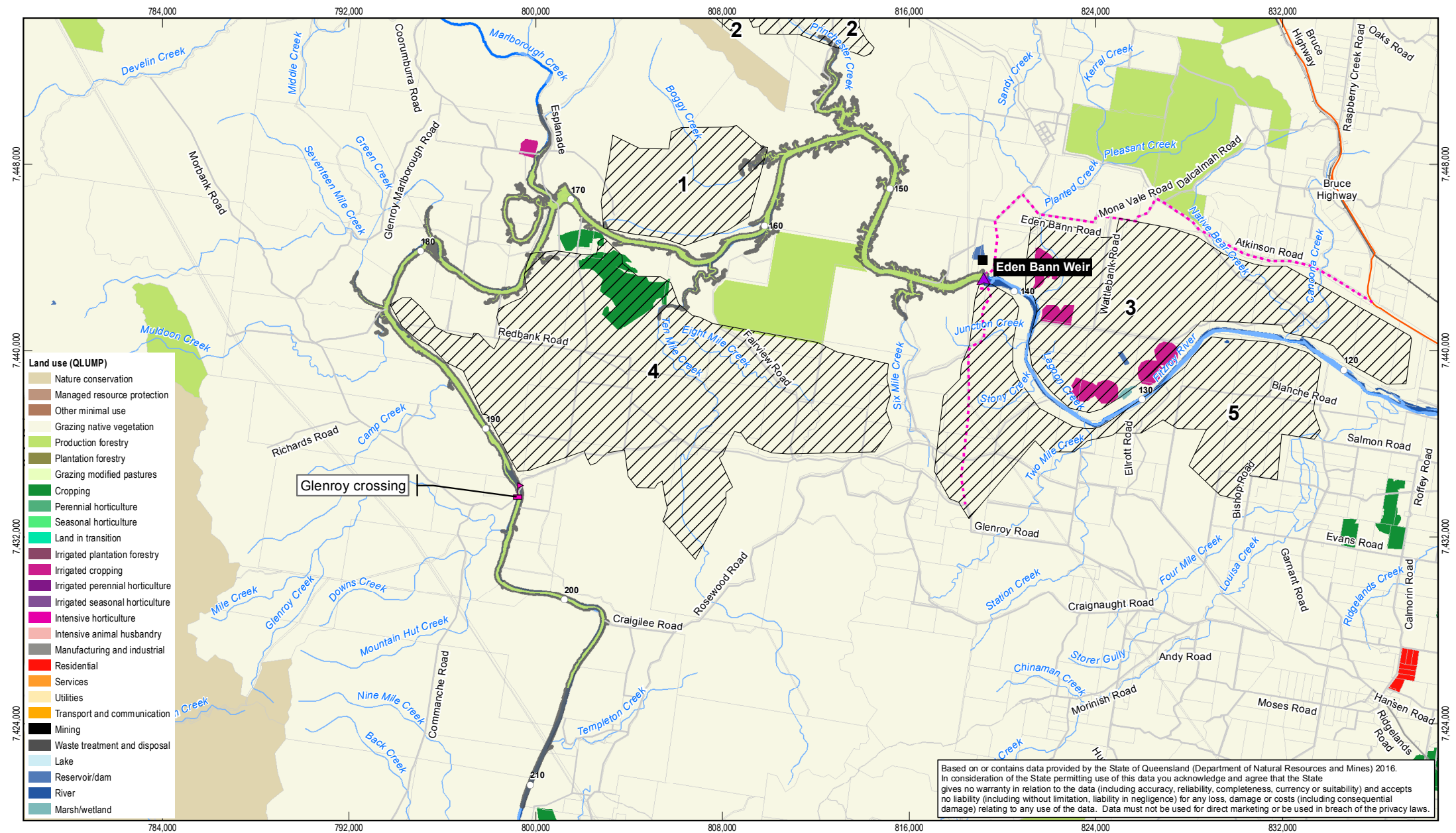
2.1.1 Potential FAD areas

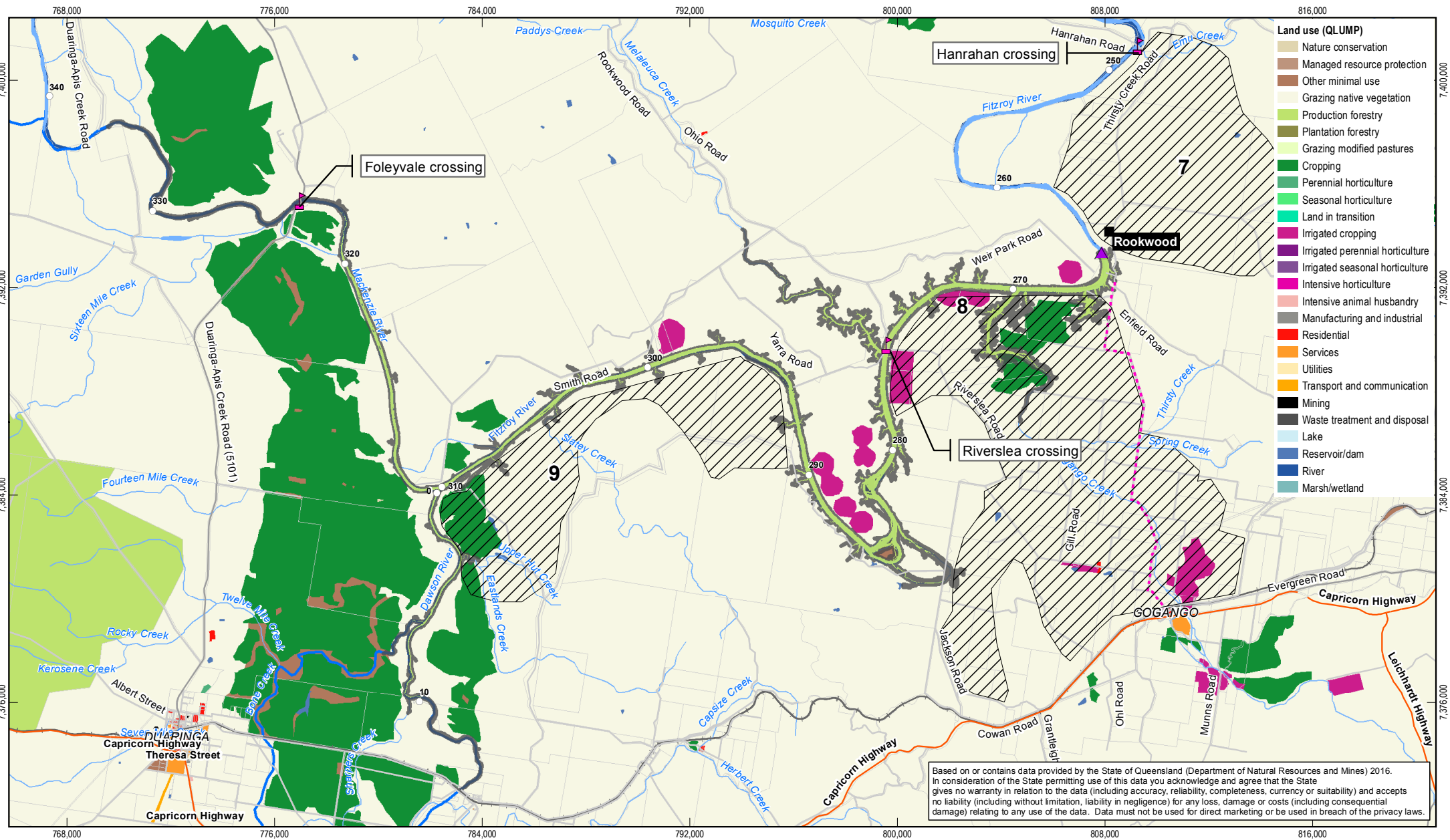
Potential (agricultural) development areas (PDAs) have been identified from the FIIS (GHD 2006). The FIIS identified nine PDAs within the vicinity of the Project.

PDAs are shown in Figure 2 1 and Figure 2 2 for the Eden Bann Weir and proposed Rookwood Weir Project areas, respectively.

2.1.2 Land use

Existing land uses are mapped as shown in Figure 2-1 and Figure 2-2 for the Eden Bann Weir and proposed Rookwood Weir Project areas, respectively.





1:195,000 (at A4)

0 2 4 6 8

Kilometres

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

LEGEND

Homestead	AMTD (km)	Highway	Property Boundary
River Crossing	Weir Location	Major Road	Rookwood Weir Stage 1 impoundment
Access Road		Streets (Local)	Rookwood Weir Stage 2 impoundment
		Railway	Potential Development Area
		Waterway	

GHD

CLIENTS | PEOPLE | PERFORMANCE

Gladstone Area Water Board

MAKING WATER WORK

SunWater

MAKING WATER WORK

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-29212
Revision A
Date 07 Mar 2016

Proposed Rookwood Weir
existing landuse and PDAs

Figure 2-2

Existing grazing land within the PDAs is considered to have potential to support irrigated broad acre crops and irrigated horticultural crops. FAD associated with the available water from the Project includes:

- 1,600 ha of irrigated broad acre crops (a mix a cereals and legumes); including sorghum, maize, mungbeans, chickpea and wheat
- 1,400 ha of irrigated horticultural crops (tree crops); including macadamia, mango, lychee, citrus and avocado.

Feedlots and associated cropping are excluded from further assessment in relation to FAD on the basis that the activity is separately regulated through the *Environmental Protection Act 1994* (Qld) as an environmentally relevant activity (ERA). As a prescribed ERA requiring an environmental authority, controls and conditions can be applied directly to the use to avoid, mitigate and manage water quality impacts.

2.1.3 Pollutants

Runoff generated from different land use types has been considered with regard to:

- Sediment, as total suspended solids
- Nutrients, as total nitrogen (TN) and total phosphorous (TP)
- Farm chemicals (as defined by cropping practices).

2.2 Modelling method - HowLeaky?

2.2.1 Overview

Assessing changes in hydrology and water quality for different land use and management practices can be based on empirical evidence from local and international studies and a range of modelling approaches. A classic example of a statistical-empirical model is the Universal Soil Loss Erosion (USLE) which represents a statistical summary of data from the United States and limited application in Australia. The USLE structure is however useful in understanding the main factors contributing to erosion and indirectly to water quality changes that is:

- Average annual soil loss = (rainfall erosivity) x (soil erodibility) x (slope length-slope factor) x (cover factor) x (practice factor).

For any area, the factor that has most impact on 'water quality' is normally soil cover and possibly slope and slope length. The other factors remain constant for specific situations.

Static models such as USLE while applied to estimating erosion are not well suited for estimating nutrient and pesticide or herbicide losses.

HowLeaky? is a water balance and water quality conceptual model developed to assess the impacts of different land uses, soil types, management practices and climates on hydrology and water quality.

A water balance deals with water flows explicitly and when combined with descriptions of climate, soil type, vegetation type, agronomic management and landscape features, provides a physical basis for estimating water quality. A conceptual model of hydrology can be summarised as;

- $\text{Runoff} = f(\text{rainfall, soil moisture, soil cover, compaction, constraining layers, soil permeability and water holding capacity of soil})$.

This methodology focuses on the paddock and small catchment scale and does not consider transformations along the hydrologic pathway. Runoff, sediment, nutrient and pesticide losses from a system are all strongly influenced by climate, landform and soil conditions. A generalised function describing the main influences on water quality is:

- Water quality = $f(\text{daily runoff, slope, soil cover, soil concentration, erodibility, slope length})$.

A conceptual model of crop and soil management in a water balance context is provided in Figure 2-3.

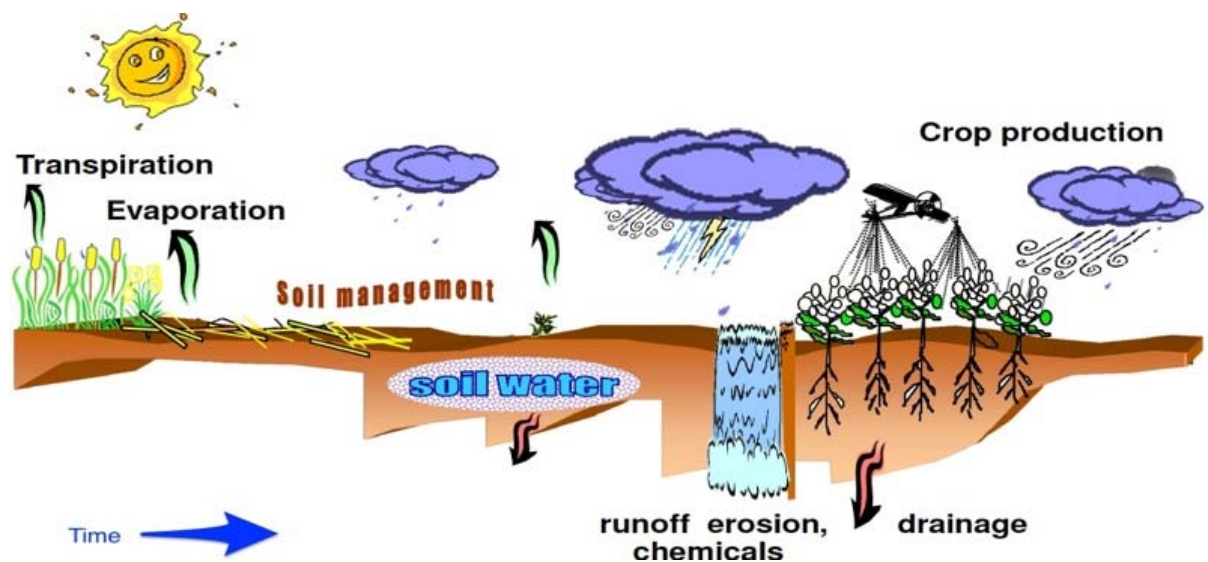


Figure 2-3 Conceptual model of crop and soil management in a water balance context

HowLeaky? replaces the rainfall factor with runoff (the primary driver) based on a daily water balance model. The important physical processes are simulated on a daily basis. For example, if heavy rain occurs on a wet soil with low soil cover, runoff and erosion will be high. This approach allows users to explore more management options and processes such as nutrients and pesticides. The detail of how these processes are dealt with in the model have been described by Littleboy et al. (1992) while more detail is available within the HowLeaky? model and associated material (www.howleaky.net).

David Freebairn (Environmental Analyst – Soil Scientist) was engaged to undertake paddock scale pollutant load modelling using HowLeaky? for the FAD associated with the project.

The revised FAD assessment has used representative samples of climate-soil type-land use-management combinations to explore likely impacts of moving from grazing to irrigated agriculture. Since land use and management practices are unknown at this stage, estimates for poor and best practice for each land use have been carried out rather than a literal simulation of each land unit. The reason for this approach is that the relative changes associated with land use management are important rather than a pseudo-realistic assessment of the whole potential development area.

HowLeaky? is widely used by DNRM and other regulatory agencies for exploring water balance and water quality implications of alternative land uses and management practices, including as part of Great Barrier Reef catchment pollutant load modelling. Also, HowLeaky? is well-developed and supported by regional empirical evidence of hydrology and deep drainage (Littleboy et al. 1992, Freebairn et al. 2009, Tolmie and Silburn 2003).

2.2.2 Input parameters and qualifications

In consultation with the FAD working group and using data provided by DAF and DNRM, model parameters were defined. Parameters adopted for HowLeaky? are summarised in Table 2-1. Detailed HowLeaky? parameter information is provided in Appendix A.

Table 2-1 Summary of parameters adopted for HowLeaky?

Parameter	Adopted for HowLeaky?	Qualifications
PDAs	Figure 2-1 and Figure 2-2	Potential agricultural development areas within proximity to the project
Pollutants	Sediment Nutrients (TN and TP) Farm chemicals (herbicides)	Herbicides - atrazine and glyphosate applied to irrigated broad acre cropping and irrigated horticulture, respectively; no herbicide/pesticide applications modelled for grazing pastures
Climate	Bureau of Meteorology SILO database	Daily weather data (1984 – 2014)
	Yaamba and Westwood Store	Representative climate from east to west of the PDAs Yaamba selected for proximity to the Eden Bann Weir project area and PDAs. Westwood Store selected for proximity to the Rookwood Weir project area and PDAs
Soil and landscape	Vertosol/sodosol mix	Representative of ~50% of floodplain soils Based on sodosol (loamy surface) with moderate A and deep B horizons Slowly permeable (group 210) 1% slope, 100 m slope length
	Slopes	Representative of ~50% of upland soils Slopes with sodosols (shallow sandy surface) with deep A and shallow B horizons Slowly permeable (group 270) 3% slope, 100 m slope length
	General	Soil erodibility was taken as the mean from the DNRM provided soil list Curve number and drainage rate of the lowest profile layer adjusted to the average values for the soil groups Changes in soil properties associated with cropping were ignored
Land use	Existing land use – grazing pasture	Three grazing management scenarios: Low stocking pasture – grazing system B; representing best practice Moderate stocking pasture – grazing system C, representing generally current practice Excess stocking pasture – grazing system D; representing poor practice
	FAD - broad acre irrigated cropping	Generic long term cropping system of three crops in two years in a rotation sequence Conservative in terms of water use and growing cover – a well-managed cropping system may have more cover even if there are brief periods of low cover at crop establishment
	FAD - irrigated horticulture tree crop	Crop type – mango Land layout – existing slope (3%) and a contoured system (0.5%)
Irrigation	Conventional	Fill to field capacity (FC) every 21 days
	Conservative	Irrigate 50 mm every 21 days

3. Reporting

3.1 Generated pollutant loads

Annual pollutant loads and event mean concentrations (EMC) for the Yaamba climate data and Westwood Store climate data are presented in Table 3-1 and Table 3-2, respectively.

Annual water balance summaries are provided in Table 3-3 and Table 3-4 for Yaamba and Westwood Store climate data, respectively.

3.2 Commentary on outputs

The HowLeaky? model was setup using best available soil, vegetation, herbicide/pesticide and soil nutrient information for two representative soil types at two representative locations. Land use and management comprised of three grazing practices to represent current land use practice and an intensive irrigated cropping sequence (three crops in two years) with two levels of irrigation and a horticulture tree crop with two variants of land layout to represent FAD.

It is considered that the results presented are similar to other analyses from other environments.

It is common for irrigated systems to be managed to a high level as a result of the investment in infrastructure and higher input costs. Overall, the increased intensity of cropping associated with irrigation results in:

- Greater runoff
- Increased deep drainage, although this can be mitigated by a more conservative irrigation regime where groundwater accession is determined to be an issue
- Reduced sediment, TN and TP losses as a result of increased soil cover
- Increased herbicide losses where applied
- Where tree crops are grown on a hilled and contoured system, losses are further reduced, mainly due to the reduction in slope from 3% to 0.5%.

Table 3-1 Annual pollutant loads and EMC (Yaamba climate)

Landscape, land use and management	Runoff (mm)	Hill slope erosion (t/ha)	Annual off-site pollutant loads				EMC			
			Sediment (t/ha)	Herbicide (g/ha)	Total P (kg/ha)	Total N (kg/ha)	Sediment (g/L)	Herbicide (µg/L)	Total P (mg/L)	Total N (mg/L)
(1) Floodplains: mix of vertosol/sodosols; based on sodosol (loamy surface; moderate deep A, deep B; slowly permeable (group 210)); 1% slope, 100 m slope length										
(a) Low stocking pasture 44% October (B)	108	1.7	0.34	-	1.1	0.68	0.3	-	1.0	0.6
(b) Moderate stocking pasture 34% October (C)	121	3.6	0.72	-	1.9	1.44	0.6	-	1.5	1.2
(c) Excess stocking pasture 20% October (D)	139	7.9	1.60	-	3.6	3.2	1.1	-	2.6	2.3
(d) Irrigated cropping, SWD100 Irrigate 50 mm every 21 days, Atrazine	126	1.2	0.23	0.9	1.0	0.46	0.2	0.7	0.8	0.4
(e) Irrigated cropping, SWD100 Fill to FC every 21 days, Atrazine	161	1.5	0.30	2.0	1.2	0.6	0.2	1.2	0.8	0.4
(2) Upland slopes: slopes with sodosols (shallow sandy surface; deep A, shallow B; slowly permeable (group 270)); 3% slope, 100 m slope length										
(a) Moderate stocking pasture 34% October (C)	123	9.3	1.90	-	4.0	3.8	1.5	-	3.3	3.1
(b) Irrigated horticulture - tree crop, Glyphosate	105	0.9	0.18	1.4	0.8	0.36	0.2	1.3	0.7	0.3
(c) Irrigated horticulture - tree crop on contour (0.5%, 300 m length), Glyphosate	105	0.3	0.06	1.3	0.6	0.12	0.1	1.3	0.5	0.1

Table 3-2 Annual pollutant loads and EMC (Westwood Store climate)

Landscape, land use and management	Runoff (mm)	Hill slope erosion (t/ha)	Annual off-site pollutant loads				EMC			
			Sediment (t/ha)	Herbicide (g/ha)	Total P (kg/ha)	Total N (kg/ha)	Sediment (g/L)	Herbicide (µg/L)	Total P (mg/L)	Total N (mg/L)
(1) Floodplains: mix of vertosol/sodosols; based on sodosol (loamy surface; moderate deep A, deep B; slowly permeable (group 210)); 1% slope, 100 m slope length										
(a) Low stocking pasture 44% October (B)	33	0.4	0.09	-	0.3	0.18	0.3	-	0.9	0.5
(b) Moderate stocking pasture 34% October (C)	39	1.0	0.19	-	0.5	0.38	0.5	-	1.4	1.0
(c) Excess stocking pasture 20% October (D)	49	2.6	0.51	-	1.2	1.02	1.0	-	2.4	2.1
(d) Irrigated cropping, SWD100 Irrigated 50 mm every 21 days, Atrazine	46	0.4	0.08	0.7	0.4	0.16	0.2	1.5	0.8	0.3
(e) Irrigated cropping, SWD100 Fill to FC every 21 days, Atrazine	70	0.6	0.13	1.6	0.5	0.26	0.2	2.3	0.8	0.4
(2) Upland slopes: slopes with sodosols (shallow sandy surface; deep A, shallow B; slowly permeable (group 270)); 3% slope, 100 m slope length										
(a) Moderate stocking pasture 34% October (C)	41	2.6	0.53	-	1.2	1.06	1.3	-	2.8	2.6
(b) Irrigated horticulture - tree crop, Glyphosate	35	0.3	0.07	0.8	0.3	0.14	0.2	2.2	0.8	0.4
(c) Irrigated horticulture - tree crop on contour (0.5%, 300 m length), Glyphosate	35	0.1	0.02	0.8	0.2	0.04	0.1	2.2	0.5	0.1

Table 3-3 Annual water balance summary (Yaamba)

Land use and management	Irrigation (mm/yr)	Runoff (mm/yr)	Soil evaporation (mm/yr)	Transpiration (mm/yr)	Drainage (mm/yr)
(1) Floodplains: mix of vertosol/sodosols; based on sodosol (loamy surface; moderate deep A, deep B; slowly permeable (group 210)); 1% slope, 100 m slope length					
(a) Low stocking pasture 44% October (B)	0	108	351	331	23
(b) Moderate stocking pasture 34% October (C)	0	121	359	307	26
(c) Excess stocking pasture 20% October (D)	0	139	367	277	29
(d) Irrigated cropping, SWD100 Irrigate 50 mm every 21 days, Atrazine	644	126	379	918	33
(e) Irrigated cropping, SWD100 Fill to FC every 21 days, Atrazine	833	161	336	1,041	105
(2) Upland slopes: slopes with sodosols (shallow sandy surface; deep A, shallow B; slowly permeable (group 270)); 3% slope, 100 m slope length					
(a) Moderate stocking pasture 34% October (C)	0	123	358	297	35
(b) Irrigated horticulture - tree crop, Glyphosate	744	105	333	1,081	36
(c) Irrigated horticulture – tree crop on contour (0.5%, 300 m length), Glyphosate	744	105	333	1,081	36

Table 3-4 Annual water balance summary (Westwood Store)

Land use and management	Irrigation (mm/yr)	Runoff (mm/yr)	Soil evaporation (mm/yr)	Transpiration (mm/yr)	Drainage (mm/yr)
(1) Floodplains: mix of vertosol/sodosols; based on sodosol (loamy surface; moderate deep A, deep B; slowly permeable (group 210)); 1% slope, 100 m slope length					
(a) Low stocking pasture 44% October (B)	0	33.1	319	240	4
(b) Moderate stocking pasture 34% October (C)	0	39.0	326	227	5
(c) Excess stocking pasture 20% October (D)	0	49.1	332	210	6
(d) Irrigated cropping, SWD100 Irrigate 50 mm every 21 days, Atrazine	689	46.5	354	878	7
(e) Irrigated cropping, SWD100 Fill to FC every 21 days, Atrazine	875	69.7	309	1,032	59
(2) Upland slopes: slopes with sodosols (shallow sandy surface; deep A, shallow B; slowly permeable (group 270)); 3% slope, 100 m slope length					
(a) Moderate stocking pasture 34% October (C)	0	41.3	324	224	7
(b) Irrigated horticulture - tree crop, Glyphosate	782	34.6	315	1,020	9
(c) Irrigated horticulture - tree crop on contour (0.5%, 300 m length), Glyphosate	782	34.6	315	1,020	9

4. References (not included in EIS)

Freebairn D.M., Wockner G.H., Hamilton N.A., & Rowland P. (2009) Impact of soil conditions on hydrology and water quality for a brown clay in the north eastern cereal zone of Australia. Aust. J. Soil Research 47:389–402.

Littleboy M., Silburn D.M., Freebairn DM., Woodruff D.R., Hammer G.L., Leslie J.K. 1992. Impact of soil erosion on production in cropping systems. I. Development and validation of a simulation model. Aust. J. Soil Res., 30:757-74

Tolmie P.E. and Silburn D.M., 2003. Estimating deep drainage in the Queensland Murray-Darling Basin. Review of past research. Department of Natural Resources, Mines & Energy, Queensland. QNRM04100

Appendices

Appendix A – HowLeaky parameter information

Parameter Information

Soil Descriptions

Floodplain - vertosol/sodosols

Based on Sodosol (loamy surface) Mod deep A, deep B, Slowly permeable (grp 210) (1% slope, 100m slope length)

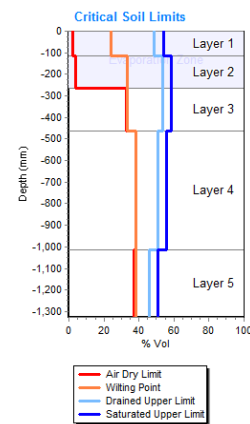
Modifications

CN = 82, being the mean of 5 similar soils, K= 0.5, being the mean of five similar soils and the same as horticulture soil

Rationale

- middle of the road soil description with close to average PAWC of 193mm being representative of 5 soils classed as A1 - suitable for cropping

Name	Current Value
Number of Horizons	5
Layer Depth (Cumulative)	115,265,465,1013,1327 mm
Air dry moisture	2.2,3.6,33,38,37 %Vol
Wilting point	24.1,33.3,33.3,38.2,38 %Vol
Field capacity	48.9,53.3,53.3,50.8,46 %Vol
Sat. water content	53.9,58.3,58.3,55.8,51 %Vol
Maximum drainage from layer	100,100,100,100,5 mm/day
Bulk density	1.5,1.4,1.4,1.5,1.6 g/cm ³
Plant-available water	28.6,30,40,69,25.1 mm (Total = 193mm)
Maximum drainable water	5.8,7.5,10,27.4,15.7 mm
Stage 2 evap., Cona	4 mm/day ^{0.5}
Stage 1 evap. limit, U	4 mm
Runoff curve no.(bare soil)	82
CN Reduction 100% cover	20
USLE K factor	0.5 metric
USLE P factor	1
Field slope	1 %
Slope length	100 m
Rill/interrill ratio	0.33 (0-1)
Sediment Delivery Ratio	0.2 (0-1)



Slopes - Sodosols (shallow sandy surface)

Based on Deep A, shallow B, Slowly permeable (grp 270) (3% slope, 100m slope length)

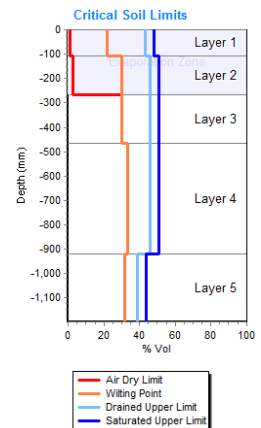
Modifications

CN = 82, being the mean of 5 similar soils, K= 0.5, being the mean of five similar soils and the same as horticulture soil

Rationale

- middle of the road soil description with close to average PAWC of 160mm for soils classed as A2 -suitable for Horticulture

Name	Current Value
Number of Horizons	5
Layer Depth (Cumulative)	108,267,467,918,1198 mm
Air dry moisture	1.3,2.6,29.8,33.4,31.6 %Vol
Wilting point	21.6,29.8,29.8,33.4,31.6 %Vol
Field capacity	43.3,46,46,45.9,38.8 %Vol
Sat. water content	48.3,51,51,50.9,43.8 %Vol
Maximum drainage from layer	100,100,100,100,5 mm/day
Bulk density	1.4,1.4,1.4,1.5,1.5 g/cm ³
Plant-available water	23.5,25.8,32.4,56.4,20 mm (Total = 158mm)
Maximum drainable water	5.4,8,10,22.6,14 mm
Stage 2 evap., Cona	4 mm/day ^{0.5}
Stage 1 evap. limit, U	4 mm
Runoff curve no.(bare soil)	82
CN Reduction 100% cover	20
USLE K factor	0.5 metric
USLE P factor	1
Field slope	3 %
Slope length	100 m
Rill/interrill ratio	0.33 (0-1)
Sediment Delivery Ratio	0.2 (0-1)



Vegetation Data

GRAZING SYSTEM (ABCD)	DESCRIPTION
<p>A</p> <p>Stocking rates well within land systems production capability, resultant resilient grazing land use, infrastructure used to exclude stock from vulnerable areas.</p> <p>Very conservative stocking - typical cover in 60% October cover</p>	<p>Grazing management recognises production capability and resilience of different land types and grazing adjusted accordingly. Landscape features all managed where appropriate (conservative grazing pressure, use of fire, summer spelling, riparian fencing, exclusion from gullies areas)</p> <p><i>Simulation conditions:</i></p> <p>I High green and litter cover all year with seasonal variation. Soil cover at 50-75% with peak in summer growing season. Summer spelling applied when pasture condition deteriorates Probably not realistic to maintain across all seasons.</p> <p>II Uses time series of soil cover derived from CGI (Satellite imagery)</p>
<p>B</p> <p>Highly responsive stocking rates based on land condition and seasonal forecasts</p> <p>Low stocking – typical cover in 44% Oct, (B)</p>	<p>Grazing management recognises production capability of different land types and stocking adjusted accordingly (use of fire, summer spelling)</p> <p><i>Simulation conditions:</i> Low stocking rate with 44% cover in October. This description mimics the low stocking rate from the Wambiana grazing study (O'Reagain et al, 2008).</p>
<p>C</p> <p>Fixed stocking rates best suited to average conditions that result in over grazing in drier seasons</p> <p>High stocking - typical cover in 34% Oct</p>	<p>Grazing management assumes uniform land resources, fixed stocking rates.</p> <p><i>Simulation conditions:</i> High stocking rate with 33% cover in October. This description attempts to mimic the high stocking rate from the Wambiana grazing study (O'Reagain et al, 2008).</p>
<p>D</p> <p>Stocking rates well above the land systems capacity to support grazing, even in average conditions. Degraded pasture composition</p> <p>Extreme stocking - typical cover in 20% Oct Poor soil</p>	<p>Grazing management assumes uniform land resources, fixed stocking rates based on average to good seasonal conditions (results in over grazing and stock loose condition when rainfall deficits occur.</p> <p><i>Simulation conditions:</i> Very high stocking rate such that total soil cover never exceeds 35% and gets as low as 15% at the end of the dry season. A <u>poor soil type</u> is used to describe hydrologic response resulting from scalds and degraded surface structure.</p>

Low stocking 44% October (grazing system B)

Name	Value
Plant day	1
SW prop for no crop stress	1
Days from planting to harvest	365
Data count	13
	Day,Grn(%),Res(%),roots(mm)
	1, 50, 10, 1500
	31, 50, 10, 1500
	60, 50, 10, 1500
	91, 45, 10, 1500
	121, 38, 10, 1500
	152, 28, 10, 1500
	182, 24, 10, 1500
	213, 21, 10, 1500
	244, 25, 10, 1500
	274, 38, 10, 1500
	305, 44, 10, 1500
	336, 49, 10, 1500
	365, 50, 10, 1500

Mod stocking 34% October (grazing system C)

Name	Current Value
Plant day	1
SW prop for no crop stress	1
Days from planting to harvest	365
Data count	13
	Day,Grn(%),Res(%),roots(mm)
	1, 39, 10, 1500
	31, 39, 10, 1500
	60, 39, 10, 1500
	91, 34, 10, 1500
	121, 27, 10, 1500
	152, 17, 10, 1500
	182, 13, 10, 1500
	213, 10, 10, 1500
	244, 15, 10, 1500
	274, 27, 10, 1500
	305, 33, 10, 1500
	336, 39, 10, 1500
	364, 39, 10, 1500

Excess stocking 20% October (grazing system D)

Name	Current Value
Plant day	1
SW prop for no crop stress	1
Days from planting to harvest	365
Data count	13
Day,Grn(%),Res(%),roots(mm)	
1, 30, 5, 1500	
31, 30, 5, 1500	
60, 28, 5, 1500	
91, 25, 5, 1500	
121, 20, 5, 1500	
152, 15, 5, 1500	
182, 12, 5, 1500	
213, 10, 5, 1500	
244, 12, 5, 1500	
274, 16, 5, 1500	
305, 20, 5, 1500	
336, 25, 5, 1500	
364, 30, 5, 1500	

Intensive irrigation cropping (3 crops in 2 years)

Based on previous analyses where water balance (all components) matched to two simulation runs offset by a year with 3 crops in a 2 year rotation, with results averaged over long term (DMF)

Name	Current Value
Plant day	1
SW prop for no crop stress	1
Days from planting to harvest	365
Data count	13
Day,Grn(%),Res(%),roots(mm)	
1, 60, 10, 1500	
32, 60, 10, 1500	
61, 60, 10, 1500	
92, 55, 15, 1500	
122, 50, 25, 1500	
153, 32, 45, 1500	
183, 30, 55, 1500	
214, 30, 52, 1500	
245, 35, 38, 1500	
275, 52, 20, 1500	
306, 60, 10, 1500	
336, 60, 10, 1500	
365, 60, 10, 1500	

Horticulture-Tree crop

Mango crop, inter-rows maintained as mown grass

Consider whether irrigation should be apportioned over a less area e.g. if wetted zone is 50%, halve water applied
per Lew Markey Sept 2016

Name	Current Value
Cover Chart	
Plant day	1
SW prop for no crop stress	1
Days from planting to harvest	365
Data count	13
Day,Grn(%),Res(%),roots(mm)	
1, 80, 5, 1500	
32, 90, 5, 1500	
60, 93, 5, 1500	
91, 85, 18, 1500	
121, 80, 30, 1500	
152, 68, 40, 1500	
182, 57, 43, 1500	
213, 55, 47, 1500	
244, 60, 43, 1500	
274, 75, 40, 1500	
305, 85, 30, 1500	
335, 89, 22, 1500	
365, 80, 5, 1500	

Irrigation Data:

Conventional irrigation Trigger_SWD100 Fill to FC every 21days

Name	Current Value
Irrigation Scheduling	Fixed Soil-Water Req. (within predefined irrigation window)
Start of irrigation window	1 Jan
End of irrigation window	30 Dec
SWD to trigger Irrigation	100 mm
Target Amount	Field Capacity (DUL)
Min days between irrigations	21
Runoff Options	Ignore Runoff
Evaporation Options	Ignore Surface Evap/spray drift
Use Ponding	No
Use Ring-Tank	No

Conservative irrigation Trigger_SWD100 Irrigate 50mm every 21days

Name	Current Value
Irrigation Scheduling	Fixed Soil-Water Req. (within predefined irrigation window)
Start of irrigation window	1 Jan
End of irrigation window	30 Dec
SWD to trigger Irrigation	100 mm
Target Amount	Fixed amount
Fixed Amount	50 mm
Min days between irrigations	21
Runoff Options	Ignore Runoff
Evaporation Options	Ignore Surface Evap/spray drift
Use Ponding	No
Use Ring-Tank	No

Pesticide Data

Per Dr Mel Shaw, DSITI

Atrazine annual

Name	Current Value
Application Timing	Fixed Date
Application Date	15 Oct
Product rate	2 l/ha
Subsequent Product rate	2 l/ha
Application Position	Below canopy/Above mulch
Half-life (Stubble)	44 days Shaw et al, Glasshouse Study.
Reference Temperature for Half-life (Stubble)	24.5 oC Shaw et al., Glasshouse Study
Half-life (Soil)	17 days Shaw et al., Glasshouse Study - average of all soils in the study.
Reference Temperature for Half-life (Soil)	24.5 oC Shaw et al., Glasshouse Study.
Degradation Activation Energy	54900 J/mol
Band Spraying (%)	100
Concentration of active ingredient	900 g/L For the Atradox product
Application efficiency	100 %
Mixing layer thickness	25
Sorption Coefficient	1.5 In P2R tools, this value gets overwritten for each simulation based on an equation for the herbicide and the soil specific inputs such as ph, OC and clay%. To change the equations used to calculate Kd, need to talk to Rob Ellis and ask for modifications to the ReefScape Tools 'Point Model Spatial PreProcessor' tool.
Extraction Coefficient	0.02 Based on Mark Silburn's thesis.
Cover washoff fraction	0.45 Values sourced from SWAT pesticides databsae. See if Mark Silburn has better values following Aaditit Dang's rainsim work in the lab.
Critical Pest Concentration	1 ug/l This value is never used anywhere - so can just leave it set at 1ug/L for all herbicides

Glyphosate-annual

Name	Current Value
Application Timing	Fixed Date
Application Date	15 Dec
Product rate	1 l/ha
Subsequent Product rate	0 l/ha
Application Position	Above Canopy
Half-life (Veg)	59 days
Reference Temperature for Half-life (Veg)	24.5 oC
Half-life (Stubble)	59 days
Reference Temperature for Half-life (Stubble)	24.5 oC
Half-life (Soil)	25 days
Reference Temperature for Half-life (Soil)	24.5 oC
Degradation Activation Energy	65400 J/mol
Band Spraying (%)	100
Concentration of active ingredient	450 g/L
	For RoundupCT product
Application efficiency	100 %
Mixing layer thickness	25
Sorption Coefficient	21.5
	This is old PPDB value...
Extraction Coefficient	0.02
Cover washoff fraction	0.6
Critical Pest Concentration	1 ug/l

Phosphorus Data:

Medium fertility P soil

based on Grey Vertosol (grey clay) medium fertility -Group III per Brett Robinson DNRM 2014

Name	Current Value
Dissolved P Methodology	QLD REEF
Total P Concentration	500 mg/kg Estimated total p range described for a grey vertosol (Norrish and Prosser)
ColwellP	16 mg/kg average used between low (12 mg/kg) and high (21 mg/kg) nutrient status clay soils (group III - non acidic) (Moody 2007)
Phosphorus Buffing Index	50 Nominal PBI defined for Clay Group III (non acidic) soils
Total P Enrichment Options	Empirical Clay fn.
Percentage Clay	34 % This is the average clay content in the topsoil (0-0.2 m) of Vertosols identified at the Brigalow research Station (Cowie et al 2007).

Nitrogen:

Annual offsite N load (kg/ha) = Sediment loss (t/ha) x surface N% x ER x 1000

where ER = Enrichment ratio – assumed to be 2

Event mean concentration (EMC)

$EMC_N \text{ (mg/L)} = \text{Total_N_load (kg/ha)} / \text{Runoff (mm)} \times 1000$

Acronyms and abbreviations

Acronym	Definition
$\mu\text{g}/\text{m}^3$	micrograms per cubic metre
AADT	Annual average daily traffic
AATOC	Annual average time of closure
ACH Act	<i>Aboriginal Cultural Heritage Act 2003</i> (Qld)
AEIS	Additional information to the draft environmental impact statement
AEP	annual exceedance probability
AHD	Australian Height Datum
AIPP	Australian Industry Participation Plan
AMTD	adopted middle thread distance
ARI	average recurrence interval
AS/NZS	Australian Standard/New Zealand Standard
BCA	benefit-cost analysis
BCR	benefit-cost ratio
CAMBA	China–Australia Migratory Bird Agreement
CHMP	cultural heritage management plan
CID	community infrastructure designation
CLR	Contaminated Land Register
CQRWSS	Central Queensland Regional Water Supply Strategy
DAF	Department of Agriculture and Fisheries
Db(A)	decibels measured at the ‘A’ frequency weighting network
DEE	Australian Government Department of the Environment and Energy
DET	Department of Education and Training
DEHP	Department of Environment and Heritage Protection
DEWS	Department of Energy and Water Supply
DILGP	Department of Infrastructure, Local Government and Planning
DIN	dissolved inorganic nitrogen
DNPSR	Department of National Parks, Sport and Racing
DNRM	Department of Natural Resources and Mines
DO	dissolved oxygen
DON	dissolved inorganic nitrogen
DSD	Department of State Development
DSITI	Department of Science, Information Technology and Innovation
DTMR	Department of Transport and Main Roads
EA	environmental authority
EC	ecological community
EFO	environmental flow objectives
EIA	economic impact assessment
EIS	environmental impact statement

Acronym	Definition
EMP	environmental management plan
EMR	Environmental Management Register
EP Act	<i>Environmental Protection Act 1994</i> (Qld)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cwlth)
EPP (Air)	Environmental Protection (Air) Policy 2008
EPP (Noise)	Environmental Protection (Noise) Policy 2008
EPP (Water)	Environmental Protection (Water) Policy 2009
ESA	equivalent standard axles
FAD	facilitated agricultural development
FIA	failure impact assessment
FHA	fish habitat area
Fitzroy Basin ROP	Fitzroy Basin Resource Operations Plan 2014
Fitzroy Basin WRP	Water Resource (Fitzroy Basin) Plan 2011
FSL	full supply level
GARID	<i>Guidelines for Assessment of Road Impacts of Development</i>
GAWB	Gladstone Area Water Board
GBR	Great Barrier Reef
GBR Coast MP	Great Barrier Reef Coast Marine Park
GBRMP	Great Barrier Reef Marine Park
GBRWhA	Great Barrier Reef World Heritage Area
GFP	Gladstone-Fitzroy Pipeline project
ha	hectare
ICH	Indigenous Cultural Heritage
ICN	Industry Capability Network
IECA	International Erosion Control Association
IQQM	Integrated Quantity Quality Model
JAG	Queensland Department of Justice and Attorney-General
JAMBA	Japan–Australia Migratory Bird Agreement
JCU	James Cook University
km	kilometres
LGA	local government area
LSC	Livingstone Shire Council
m	metre
M	million
MCU	material change of use
ML	megalitres
ML/a	megalitres per annum
ML/d	megalitres per day
MNES	matters of national environmental significance
MSES	matters of state environmental significance

Acronym	Definition
m ³ /s	cubic metres per second
NC Act	<i>Nature Conservation Act 1992 (Qld)</i>
NICH	Non-Indigenous cultural heritage
NPV	net present value
OUV	outstanding universal value
PM ₁₀	particulate matter with equivalent aerodynamic diameter less than 10µm
PMST	Protected Matters Search Tool
PN	particulate nitrogen
RE	regional ecosystem
Reef 2050 plan	<i>Reef 2050 Long Term Sustainability Plan</i>
RIA	road impact assessment
RMP	road-use management plan
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
ROP	resource operations plan
ROL	Resource Operations Licence
RRC	Rockhampton Regional Council
SARA	State Assessment and Referral Agency
SDPWO Act	<i>State Development and Public Works Organisation Act 1971 (Qld)</i>
SIA	social impact assessment
SIMR	social impact management report
SPA	<i>Sustainable Planning Act 2009 (Qld)</i>
SP Regulation	<i>Sustainable Planning Regulation 2009</i>
t	tonnes
TEC	threatened ecological community
TI Act	<i>Transport Infrastructure Act 1994</i>
TIA	traffic impact assessment
TMP	traffic management plan
TN	total nitrogen
TP	total phosphorus
TOR	terms of reference
TSP	total suspended particles
TSS	total suspended solids
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>
WASOs	Water Allocation Security Objectives
WMP	waste management plan
WQO	water quality objectives
WRR Act	<i>Waste Reduction and Recycling Act 2011 (Qld)</i>
WSSR Act	<i>Water Supply (Safety and Reliability) Act 2008</i>

Glossary

Term	Definition
Adopted Middle Thread Distance	The distance in km, measured along the middle of a watercourse that a specific point in the watercourse is from the watercourse's mouth.
assessment manager	For an application for a development approval, means the assessment manager under the <i>Sustainable Planning Act 2009</i> (Qld).
Benefit-cost ratio	The benefit-cost ratio identifies the relationship between discounted benefits and costs where a positive result is a ratio of greater than one
bilateral agreement	The agreement between the Australian and Queensland governments that accredits the State of Queensland's EIS process. It allows the Commonwealth Minister for the Environment to rely on specified environmental impact assessment processes of the state of Queensland in assessing actions under the EPBC Act
Construction areas	The construction worksites, construction car parks, and any areas licensed for construction or on which construction works are carried out.
Controlled action	A proposed action that is likely to have a significant impact on a matter of national environmental significance; the environment of Commonwealth land (even if taken outside Commonwealth land); or the environment anywhere in the world (if the action is undertaken by the Commonwealth). Controlled actions must be approved under the controlling provisions of the EPBC Act.
Controlling provision	The matters of national environmental significance, under the EPBC Act, that the proposed action may have a significant impact on.
Coordinated project	A project declared as a 'coordinated project' under section 26 of the SDPWO Act. Formerly referred to as a 'significant project'.
Coordinator-General	The corporation sole constituted under section 8A of the <i>State Development and Public Works Organisation Act 1938</i> and preserved, continued in existence and constituted under section 8 of the SDPWO Act.
Environment	As defined in Schedule 2 of the SDPWO Act, includes: <ul style="list-style-type: none"> a) ecosystems and their constituent parts, including people and communities b) all natural and physical resources c) the qualities and characteristics of locations, places and areas, however large or small, that contribute to their biological diversity and integrity, intrinsic or attributed scientific value or interest, amenity, harmony and sense of community d) the social, economic, aesthetic and cultural conditions that affect, or are affected by, things mentioned in paragraphs (a) to (c).
environmentally relevant activity	An activity that has the potential to release contaminants into the environment. Environmentally relevant activities are defined in Part 3, section 18 of the EP Act.

Imposed condition	A condition imposed by the Queensland Coordinator-General under section 54B of the SDPWO Act. The Coordinator-General may nominate an entity that is to have jurisdiction for the condition.
Initial advice statement (IAS)	<p>A scoping document, prepared by a proponent, that the Coordinator-General considers in declaring a coordinated project under Part 4 of the SDPWO Act. An IAS provides information about:</p> <ul style="list-style-type: none"> • the proposed development • the current environment in the vicinity of the proposed project location • the anticipated effects of the proposed development on the existing environment • possible measures to mitigate adverse effects.
Matters of national environmental significance	<p>The matters of national environmental significance protected under the EPBC Act. The eight matters are:</p> <ol style="list-style-type: none"> a) world heritage properties b) national heritage places c) wetlands of international importance (listed under the Ramsar Convention) d) listed threatened species and ecological communities e) migratory species protected under international agreements f) Commonwealth marine areas g) the Great Barrier Reef Marine Park h) nuclear actions (including uranium mines).
Nominated entity (for an imposed condition for undertaking a project)	An entity nominated for the condition, under section 54B(3) of the SDPWO Act.
Properly made submission (for an EIS or a proposed change to a project)	<p>Defined under Schedule 2 of the SDPWO Act as a submission that:</p> <ol style="list-style-type: none"> a) is made to the Coordinator-General in writing b) is received on or before the last day of the submission period c) is signed by each person who made the submission d) states the name and address of each person who made the submission e) states the grounds of the submission and the facts and circumstances relied on in support of the grounds.
proponent	The entity or person who proposes a coordinated project. It includes a person who, under an agreement or other arrangement with the person who is the existing proponent of the project, later proposes the project.
significant project traffic	An increase in project traffic equal to or greater than five per cent in either traffic numbers (AADT) or axle loadings (ESAs), as outlined in the GARID

stated condition	<p>Conditions stated (but not enforced by) the Coordinator-General under sections 39, 45, 47C, 49, 49B and 49E of the SDPWO Act. The Coordinator-General may state conditions that must be attached to a:</p> <ul style="list-style-type: none"> • development approval under the <i>Sustainable Planning Act 2009</i> • proposed mining lease under the <i>Mineral Resources Act 1989</i> • draft environmental authority (mining lease) under Chapter 5 of the <i>Environmental Protection Act 1994</i> (EPA) • proposed petroleum lease, pipeline licence or petroleum facility licence under the <i>Petroleum and Gas (Production and Safety) Act 2004</i> • non-code compliant environmental authority (petroleum activities) under Chapter 4A of the EPA.
works	<p>Defined under the SDPWO Act as the whole and every part of any work, project, service, utility, undertaking or function that:</p> <ol style="list-style-type: none"> a) the Crown, the Coordinator-General or other person or body who represents the Crown, or any local body is or may be authorised under any Act to undertake, or b) is or has been (before or after the date of commencement of this Act) undertaken by the Crown, the Coordinator-General or other person or body who represents the Crown, or any local body under any Act, or c) is included or is proposed to be included by the Coordinator-General as works in a program of works, or that is classified by the holder of the office of Coordinator-General as works.

The Coordinator-General

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