8. Terrestrial fauna

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8.1 Introduction

8.1.1 Overview

This chapter provides an assessment of terrestrial fauna values as they relate to the Lower Fitzroy River Infrastructure Project (Project). An ecological study was undertaken to determine the potential impacts on terrestrial fauna as a result of the Project. The assessment addresses Part B, Nature conservation Sections 5.30 – 5.34, and specifically terrestrial fauna in Sections 5.54 – 5.60 of the terms of reference (ToR) for the environmental impact statement. A table cross-referencing the ToR requirements is provided in Appendix B. Appendix N and Appendix O provide supporting baseline information in relation to terrestrial fauna values of the Project (Eden Bann Weir and the proposed Rookwood Weir, respectively). Where appropriate, management measures relating to terrestrial fauna values are used to inform the environmental management plan (EMP) (Chapter 23).

8.1.2 Approach and methodology

8.1.2.1 Desktop assessment

Prior to the commencement of field surveys conducted in 2009, and then again more recently, a desktop assessment was conducted. The following databases, mapping layers and literature were reviewed:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) Environmental Reporting Tool (2009) and Protected Matters Search Tool (2013)

  The search area was defined by a 2 km buffer following watercourses upstream and downstream from Eden Bann Weir and Rookwood Weir. The search area included Alligator Creek and the Fitzroy River and estuary downstream from Eden Bann Weir; Fitzroy River between Eden Bann Weir and Rookwood Weir; and Fitzroy River, Dawson River and Mackenzie River upstream from Rookwood Weir to the maximum proposed inundation extent.
- Queensland Government Wildlife Online database 2008 and updated 2013

  The search area was defined by search rectangles encompassing a 2 km buffer following watercourses upstream of Eden Bann Weir and Rookwood Weir to the maximum proposed inundation extent and approximately 20 km downstream of Eden Bann Weir.
- The Queensland Department of Natural Resources and Mines (DNRM) Regional Ecosystem (RE) (Version 6.1, 2011) and Essential Habitat (Version 3.1, 2011) mapping databases.
- Queensland Museum's Specimen Database

  Search rectangles encompassing the area around Eden Bann Weir, Rookwood Weir and the maximum upstream inundation extent were queried.
- Birds Australia Atlas database (BirdLife Australia 2005-2007)
- Back on Track Actions for Biodiversity document for the Fitzroy Natural Resource Management region (DERM 2008)
- Queensland Brigalow Belt Reptile Recovery Plan (Richardson 2006)
- Queensland Government's Biodiversity Planning Assessment mapping (2009)

- Studies and reports commissioned specifically for the Project by the (then) Department of Natural Resources and Water on behalf of the (then) Department of Infrastructure and Planning:
  - Eden Bann Weir Project Terrestrial Fauna Baseline Study (BAAM 2008a)
  - Rookwood Weir Project Terrestrial Fauna Literature Review and Gap Analysis (BAAM 2008b)
  - Proposal for raising Eden Bann Weir and construction of Rookwood Weir – An assessment of the potential implications on native vegetation and terrestrial ecosystems (Nangura 2007 (Appendix H)).

Scientific and grey literature on fauna species likely to occur and / or previously recorded in the study area was also reviewed.

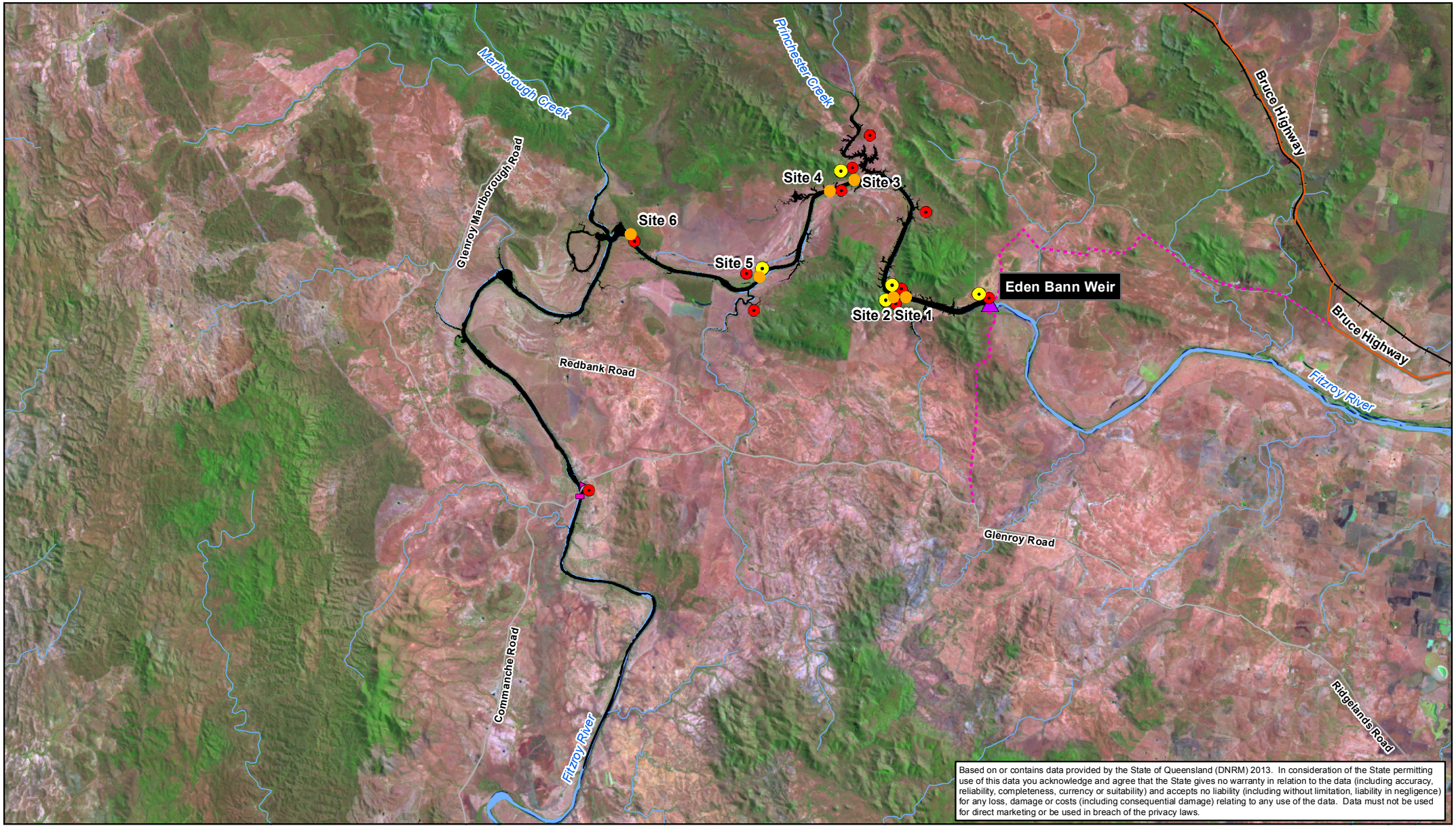
8.1.2.2 Field surveys

Six fauna survey trapping sites were selected for seasonal field surveys undertaken in late January/early February 2009 (wet season) and in August 2009 (dry season) across the Eden Bann Weir study area (Figure 8-1). Seasonal field surveys were conducted in April 2009 (end of the wet season) and July 2009 (dry season) for Rookwood Weir across six fauna survey trapping sites (Figure 8-2). Sites were selected following a review of satellite imagery, regional ecosystem mapping and field reconnaissance of the study area. Systematic and targeted surveys were undertaken at the sites. 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 a desktop analysis.

A standardised combination of hair tubes, pitfall traps, funnel traps, Elliot box traps and cage traps were used. Bats were surveyed using Anabat II Detectors and harp traps. Bird surveys were also undertaken. Opportunistic diurnal and nocturnal searches were conducted at each site, in order to detect rare or threatened species that may not be identified within traps. Scats that were found during opportunistic searches and trapping checks were collected and sent for independent analysis. A summary of the terrestrial fauna survey effort is provided in Table 8-1 and Table 8-2 for the Eden Bann Weir and Rookwood Weir, respectively. A summary of bird nest survey effort is provided in Table 8-3.

It is considered that surveys were undertaken using methodologies consistent with those described in the Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland (Eyre et al. 2012) and the relevant *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) Survey Guidelines for Nationally Threatened Species (DSEWPaC 2011) including:

- Survey guidelines for Australia's threatened bats
- Survey guidelines for Australia's threatened birds
- Survey guidelines for Australia's threatened mammals
- Survey guidelines for Australia's threatened reptiles.



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Kilometres

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

N

LEGEND

- Weir Location
- River Crossing
- Highway
- Streets (Local)
- Access Road
- Railway
- Waterway
- Impoundment Area
- Anabat
- Bird Census
- Trapping Site

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Date 20 Nov 2013

Eden Bann Weir terrestrial fauna survey sites

Figure 8-1

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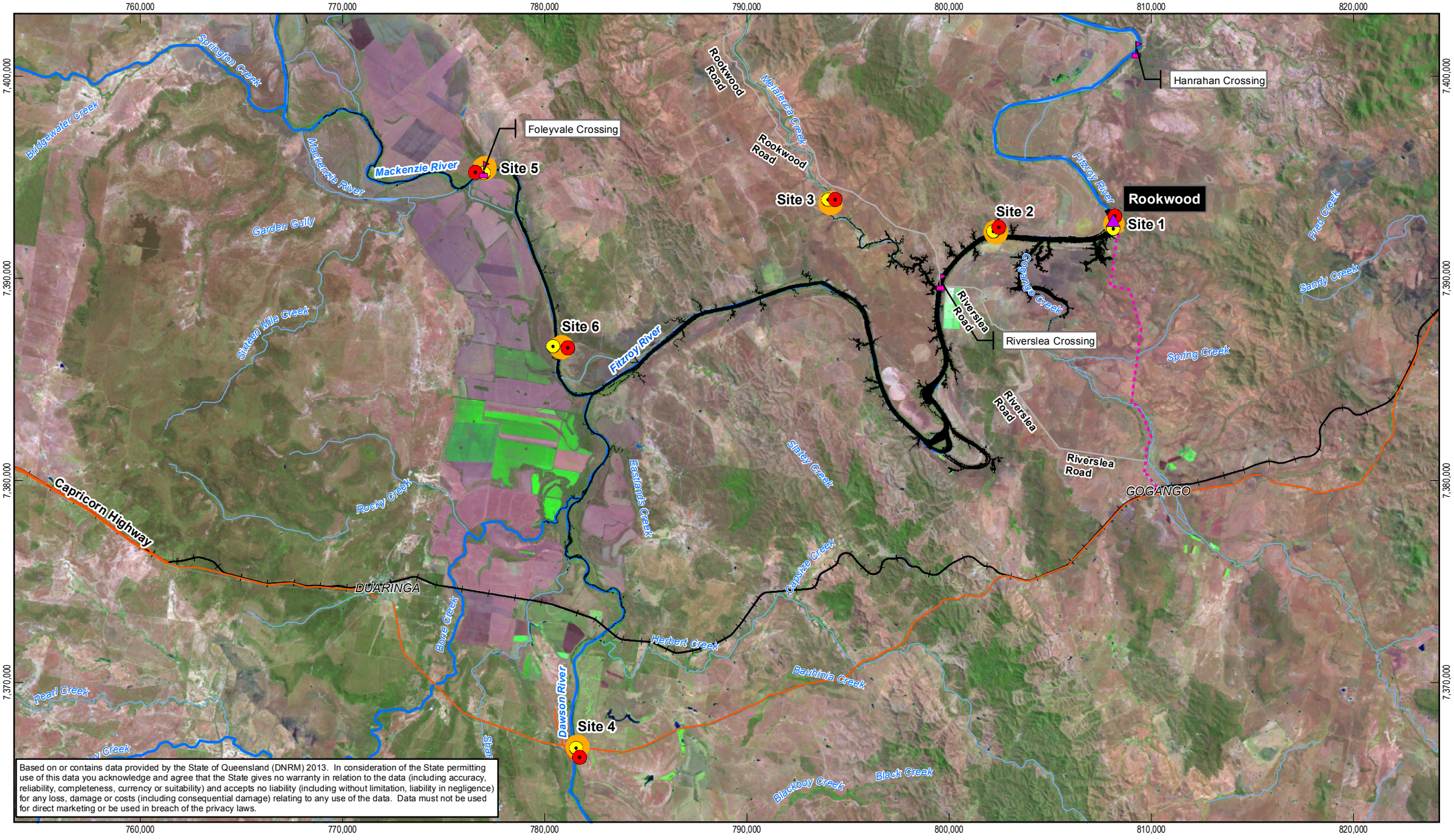

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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
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- Anabat
- Bird Census
- Trapping Site

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Rookwood Weir terrestrial fauna survey sites

Figure 8-2

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Table 8-1 Survey effort, techniques and locations – Eden Bann Weir

Systematic									Non-systematic	
Site	Number of trap nights*						Anabat detector (no. of nights#)	Bird survey (mins^)	Diurnal searches (mins^)	Nocturnal searches (mins^)
	Pit-fall trap	Funnel trap	Cage trap	Elliot box trap	Hair tube	Harp trap**				
Wet season										
1	16	32	40	80	80	2	1	100	90	90
2	16	32	40	80	80	2	1	100	90	90
3	8	32	40	80	80	-	-	100	90	-
4	16	32	40	80	80	-	-	100	90	-
5	16	32	40	80	80	-	1	100	90	-
6	16	32	40	80	80	-	1	100	90	-
Dry season										
1	16	32	40	80	80	-	-	100	90	-
2	16	32	40	80	80	2	-	100	90	-
3	8	32	40	80	80	-	1	100	90	-
4	16	32	40	80	80	4	-	100	90	-
5	16	32	40	80	80	-	-	100	90	-
6	16	32	40	80	80	-	-	100	90	-

*Number of nights in which traps were deployed multiplied by the number of traps at each site.

**Safety constraints limited nocturnal surveying upstream of Eden Bann Weir. This was exacerbated in the dry season by lower water levels in the impoundment. Due to potential suitability and abundance of habitat for bats immediately upstream of Eden Bann Weir, Anabat detectors and harp traps were deployed at this location in addition to the listed surveys sites. Nocturnal searches were also undertaken at this location.

#Number of nights Anabat detectors were deployed to remotely detect microchiropteran bat echolocation calls.

^Minimum time in person minutes spent surveying.

Table 8-2 Survey effort, techniques and locations – Rookwood Weir

Systematic									Non-systematic	
Site	Number of trap nights*						Anabat detector (no. of nights#)	Bird survey (mins^)	Diurnal searches (mins^)	Nocturnal searches (mins^)
	Pit-fall trap	Funnel trap	Cage trap	Elliot box trap	Hair tube	Harp trap				
Wet season										
1	16	32	40	80	80	6	1	100	90	90
2	16	32	40	80	80		1	100	90	90
3	16	32	40	80	80		1	100	90	90
4	16	32	40	80	80		1	100	90	90
5	16	32	40	80	80	2	1	100	90	90
6	16	32	40	80	80		1	100	90	90
Dry season										
1	16	32	40	80	80	2	1	100	90	90
2	16	32	40	80	80	-	1	100	90	90
3	16	32	40	80	80	-	1	100	90	90
4	16	32	40	80	80	-	1	100	90	90
5	16	32	40	80	80	2	1	100	90	90
6	16	32	40	80	80	-	1	100	90	90

*Number of nights in which traps were deployed multiplied by the number of traps at each site

#Number of nights Anabat detectors were deployed to remotely detect microchiropteran bat echolocation calls

^Minimum time in person minutes spent surveying

Table 8-3 Summary of nest survey effort

Method	Location	Description	Estimated effort
On foot	Eden Bann Weir and Rookwood Weir	As part of habitat assessments, targeted nest searches were undertaken at 17 fixed bird census sites (Figure 8-1 and Figure 8-2).	28 hours (100 minutes per site at 17 sites)
Boat-based	Eden Bann Weir	Boat-based nest searches were undertaken along the stretch of river between the existing Eden Bann Weir and Site 6 (Figure 8-1). This included all adjoining tributaries within this stretch of river.	72-96 hours (two boats for 12 days, three to four hours per day)
Canoe-based	Rookwood Weir	Canoe-based surveys were undertaken between the confluence of the Dawson and Mackenzie rivers and the proposed Rookwood Weir site.	24 hours (one canoe for six days, four hours per day)
Vehicle-based	Rookwood Weir	Opportunistic vehicle-based surveys were undertaken whilst driving between fixed terrestrial fauna sites. This included assessments of areas within the broader region, up to 1 km from the river.	72 hours (three teams for 12 days, two hours per day)

8.1.2.3 Likelihood of occurrence assessment

For conservation significant terrestrial fauna species a likelihood of occurrence assessment was undertaken to identify listed species that have a high potential (known or considered likely) to occur in the Project footprint. Determination of likelihood of occurrence considered information relating to:

- Habitat preferences
- Distribution and relative abundance
- Previous records from the region
- The occurrence of suitable habitat within the Project footprint based on field observations
- The confirmed presence of conservation significant species within the Project footprint.

A likelihood of occurrence ranking was attributed to each conservation significant species based on the framework outlined in Table 8-4. Where a difference in likelihood of occurrence outcome exists between the Eden Bann Weir and Rookwood Weir, the higher likelihood outcome was assumed across the Project footprint to provide a conservative understanding of the potential Project impact.

Table 8-4 Likelihood of occurrence determination

Likelihood	Category	Definition supporting information
High	The species or ecological has been observed on the site (known to occur) or there is a high probability that a species or ecological community occurs on the site (likely to occur).	Species / community has been recorded during field surveys in the Project footprint. **OR** Species has been recorded from desktop search extent **AND** suitable habitat is present in the Project footprint.
Moderate	Suitable habitat for a species or ecological community occurs on the site, but there is insufficient information to categorise the species or ecological community as high or low probability or occurring.	Species has not been recorded from desktop search extent although species' distribution incorporates the Project footprint (or part(s) thereof) **AND** potentially suitable habitat occurs in the Project footprint. **OR** Species has been recorded from desktop search extent **AND** suitable habitat is generally lacking from Project footprint.
Low	A very low to low probability that a species or ecological community occurs on the site.	Species has not been recorded from desktop search extent **AND/OR** current known distribution does not encompass Project footprint **AND** suitable habitat is absent from Project footprint.

8.1.2.4 Habitat assessment

Habitat assessments were undertaken for each of the trapping sites, along with other representative sites within the Eden Bann Weir and Rookwood Weir study areas. These habitat assessments incorporated the riparian fringe and adjacent 500 m. Habitat assessments included the structural integrity of vegetation present, habitat features, sources of disturbance and traces of wildlife. At each site, opportunistic wildlife searches were conducted.

The habitat types identified vary in their ecological value due to differences in the structural complexity of vegetation, substrate type and differing levels of disturbance. These factors influence the diversity and abundance of microhabitats and resources available to terrestrial fauna. The level of benefit that each habitat is considered to provide to native fauna, as determined by a combination of features within the habitat, is termed its 'Relative Ecological Value'.

The following categories were used to describe the relative ecological value of assessed habitat:

- **High:** Ground flora containing a high number of indigenous species; vegetation community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native fauna species; and/or habitat that supports or potentially supports conservation significant species through the provision of important foraging, breeding/nesting and/or shelter resources
- **Moderate:** Ground flora containing a moderate number of indigenous species; vegetation community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna species; and/or potential for utilisation by conservation significant species

- **Low:** Ground flora containing a low number of indigenous species; vegetation community structure, ground log, and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native fauna species; and little value to conservation significant species.

8.1.3 Regulatory framework

Legislation and polices relevant to terrestrial fauna conservation values are as follows:

- EPBC Act and EPBC Act Environmental Offset Policy (2012)
- *Nature Conservation Act 1992* (Qld) (NC Act) and Nature Conservation (Wildlife Management) Regulation 2006
- *Land Protection (Pest and Stock Route Management) Act 2002* (Qld)
- *Environmental Offsets Act 2014* (Qld), Environmental Offsets Regulation 2014 and Queensland Environmental Offsets Policy Version 1.0.

8.2 Existing environment

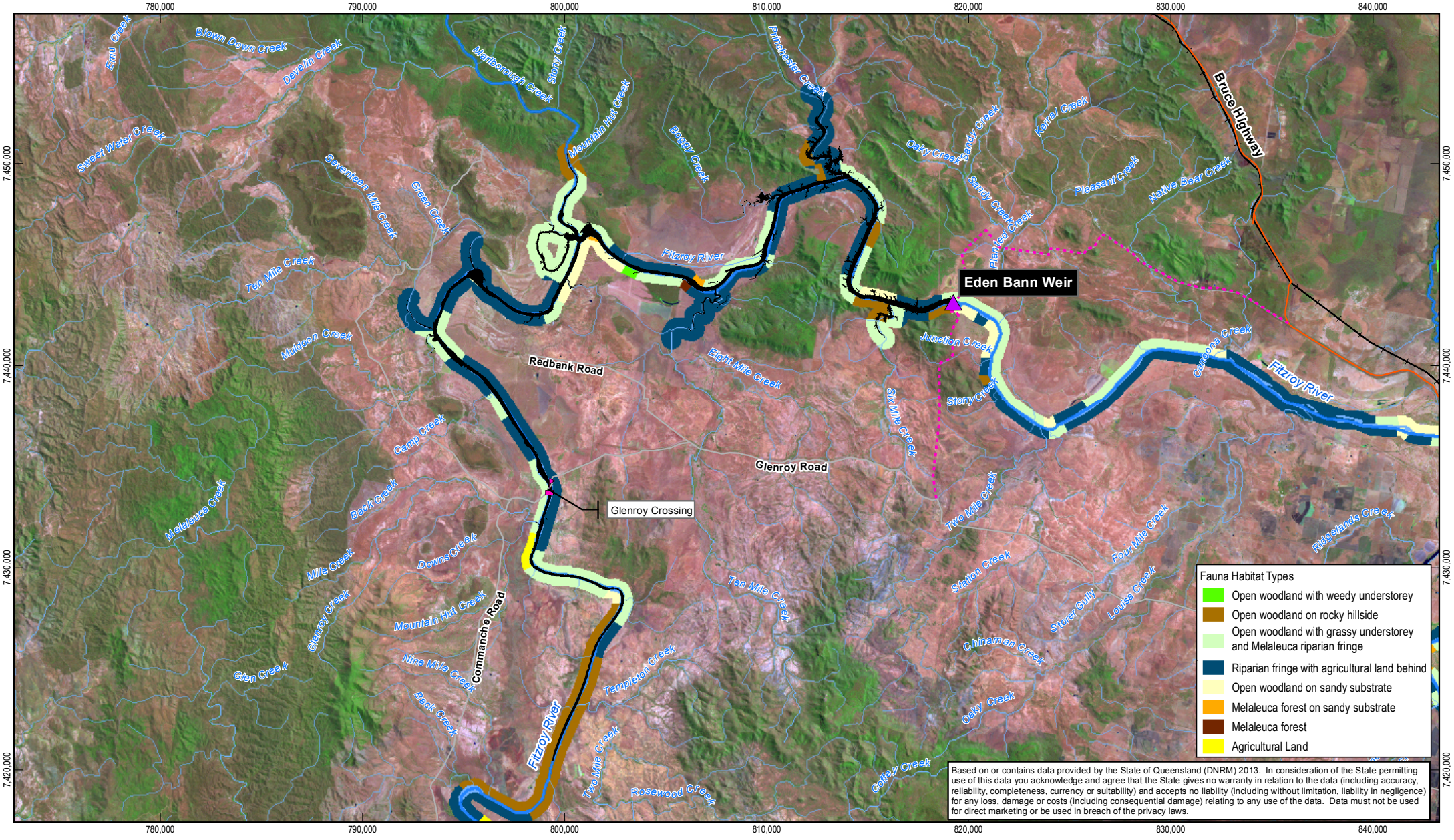
8.2.1 Habitat

8.2.1.1 Eden Bann Weir

The Eden Bann Weir study area occurs along the border of the Brigalow Belt North and Brigalow Belt South bioregions. Both bioregions are characterised by the presence of Brigalow (*Acacia harpophylla*). Dominant vegetation communities generally include eucalypt woodlands, grasslands, brigalow-belah forests (*Acacia harpophylla, Casuarina cristata*), semi-evergreen vine thickets and open forests of ironbarks (*Eucalyptus* spp.), bloodwoods (*Corymbia* spp.), poplar box (*Eucalyptus populnea*), spotted gum (*Corymbia citriodora*) and cypress pine (*Callitris glaucophylla*).

The landscape is a mix of rugged ranges, low undulating hills and alluvial plains. Lowland areas are predominantly cleared for grazing. However, large areas of woodland vegetation persist on low rocky hills. In this area, the river is wide and slow-flowing with a series of sand banks that are vegetated with *Melaleuca*s. The riparian fringe is typically narrow adjacent to grazing areas, and wider and more extensively vegetated adjacent to rocky hills. A series of creeks join the river between Eden Bann Weir and Glenroy Crossing. These generally have more natural, complex riparian vegetation and are expected to provide habitat for a range of species. The existing Eden Bann Weir modifies flows along this section of river.

Vegetation communities are discussed in detail in Chapter 6 Flora. Ten broad terrestrial fauna habitat types were identified at Eden Bann Weir as mapped in Figure 8-3 and described in Table 8-5.



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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA94)
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N

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- Streets (Local)
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- Impoundment Area

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Revision F
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Eden Bann Weir fauna habitat types

Figure 8-3

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Data Source: : © Copyright Commonwealth of Australia (Geoscience Australia): Waterways, State (2007); Sunwater: Waterways, Weir Locations - 2008; DNRM: Roads - 2010, Railways - 2010, Imagery - 2005;GHD: Fauna Habitat Types/2009, Access Roads/2013. Created by IH.

Table 8-5 Terrestrial habitat types, characteristics and values – Eden Bann Weir

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Open woodland with grassy understorey and *Melaleuca* riparian fringe	• Riparian fringe of Melaleuca • Low-moderate density mature eucalypts • Sparse shrub layer • Complex understorey with native grasses and sedges • Fallen woody debris and leaf litter • Hollows and stags.	Habitat value for: • Canopy-nesting birds • Skinks, dragons, geckos and snakes • Tree frogs and burrowing frogs • Possums and gliders • Bandicoots, rodents and macropods. Relative ecological value: Moderate Possible habitat for listed threatened species: squatter pigeon, yakka skink, little pied bat, koala	
Open woodland with weedy understorey and *Melaleuca* riparian fringe	• Sparse density mature eucalypt canopy present • Shrub layer dominated by weed species • Understorey dominated by weedy grass.	Habitat value for: • Canopy, shrub and grassland birds • Snakes, skinks and dragons • Macropods and bandicoots • Rodents and common possums. Relative ecological value: Moderate Possible habitat for listed threatened species: little pied bat	
Open woodland on rocky hillside	• Low density stunted eucalypts • Areas of casuarina and vine thicket • Sparse understorey vegetation • Rocky substrate • Abundance of fallen logs and woody debris.	Habitat value for: • Canopy nesting birds • Snakes, skinks, dragons and geckos • Small ground mammals. Relative ecological value: High Possible habitat for listed threatened species: northern quoll	

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Open woodland with sandy substrate	• Sandy substrate • Relatively simple understorey • Shrub layer largely absent • Mature eucalypts • Stags abundant • Many hollows.	Habitat value for: • Canopy birds and waterbirds • Possums, koalas and gliders. Relative ecological value: Moderate Possible habitat for listed threatened species: squatter pigeon	
Melaleuca on sandy substrate	• No tall canopy trees • Dense low Melaleucas • No understorey vegetation • Sandy substrate • Relatively low habitat complexity • Seasonally inundated.	Habitat value for: • Shrub-nesting birds and waterbirds • Skinks, dragons and snakes • Nesting habitat for crocodiles and turtles. Relative ecological value: High Possible habitat for listed terrestrial threatened species: none	
Melaleuca forest	• Dense canopy of short Melaleucas • Shrub layer dominated by castor oil plant (*Ricinus communis*) • Bare muddy substrate • Often inundated (seasonally) • Low diversity of ground-level microhabitats.	Habitat value for: • Shrub and canopy-nesting birds • Waterbirds • Rodents. Relative ecological value: Moderate Possible habitat for listed threatened species: none	
Narrow riparian fringe	• Moderate-density tree layer of eucalypts • Dense but narrow shrub layer of juvenile eucalypts • Understorey of leaf litter, grass and woody debris • Very narrow, exposed to edge effects of noise, light and weeds • Corridor for wildlife movement.	Habitat value for: • Pasture-adapted birds • Possums • Grass skinks, wall skinks and bearded dragons • Introduced and native rodents. Relative ecological value: Moderate Possible habitat for listed threatened species: squatter pigeon	

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Agricultural land	• Tree and shrub layer absent; • Uniform ground cover of short to long grazed grass • Few logs or woody debris • Structurally simple.	Habitat value for: • Pasture land birds • Raptors • Snakes • Macropods. Relative ecological value: Low Possible habitat for listed threatened species: none	
Creeks	• Narrow stream • Shallow slow-flowing water • High density of overhanging vegetation • High density of shrub and ground-level vegetation • High density of in-stream debris.	Habitat value for: • Forest birds and waterbirds • Water dragons and snakes • Frogs • Ground mammals • Microchiropteran bats. Relative ecological value: High Possible habitat for listed threatened species: little pied bat, black-necked stork, star finch, cotton pygmy-goose, ornamental snake	
Off-stream water bodies	• Seasonally connected to main river system by floodwaters • High density of overhanging vegetation • High abundance of in-stream debris.	Habitat value for: • Forest birds and waterbirds • Burrowing and ephemeral breeding frogs • Snakes • Ground mammals • Microchiropteran bats. Relative ecological value: High Possible habitat for listed threatened species: little pied bat, black-necked stork, cotton pygmy-goose, Australian painted snipe, ornamental snake	

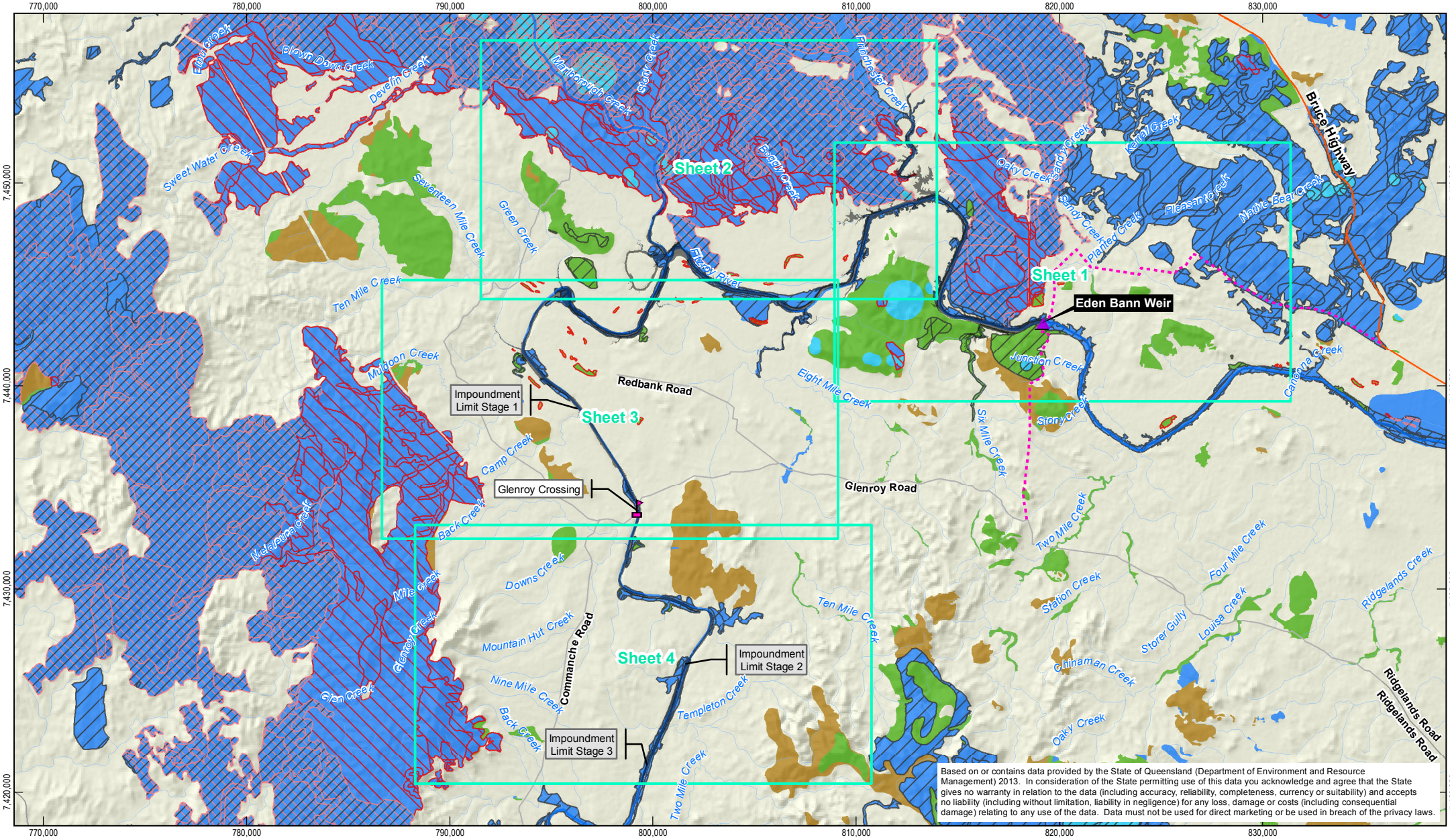
The ten broad terrestrial fauna habitat types described in Table 8-5 for the Eden Bann Weir include:

- Open woodland with grassy understorey and *Melaleuca* riparian fringe
- Open woodland with weedy understorey and *Melaleuca* riparian fringe
- Open woodland on a rocky hillside
- Open woodland with sandy substrate
- *Melaleuca* forest
- *Melaleuca* forest with sandy substrate
- Narrow riparian fringe
- Agricultural land
- Creeks
- Off-stream water bodies (palustrine wetlands (vegetated swamps, billabongs), oxbow lakes, and farm dams in the floodplain adjacent to the main channel and adjoining creeks, and flood-runners / secondary channels within the bed and banks (i.e. including riparian zone))

The open woodland with grassy understorey and *Melaleuca* riparian fringe' was characterised by substantial habitat complexity and as a result this habitat supported a notable diversity of terrestrial fauna. 'Open woodland and *Melaleuca* forest habitats with weedy understorey' had a more homogenous ground layer, although the structural complexity of this layer still provided shelter resources for fauna. The 'open woodland on rocky hillside' was also structurally complex, providing a diversity of resources for generalist and potentially niche species. 'Open woodland' and '*Melaleuca* forests with sandy substrates' generally had low ground-level and canopy complexity but still supported important habitat resources for many shrub and tree dwelling animals (such as woodland and forest birds and arboreal mammals).

Large areas of the Eden Bann Weir study area have been cleared for agriculture and only a narrow fringe of eucalypt (and to a lesser extent *Melaleuca*) riparian vegetation remains. This habitat type had lower structural complexity and provided fewer resources for native wildlife than the other habitat types. Agricultural land had reduced species richness but retained important foraging habitat values for raptors, snakes, small ground mammals, macropods and other birds. Creeks and off-stream water bodies provide important resources (particularly foraging) for an array of terrestrial fauna including frogs, waterbirds and microchiropteran bats.

Habitat connectivity has been impacted on in lower lying areas by vegetation clearing for agriculture. The most extensive areas of interconnected habitat exist on higher ground where limited vegetation clearing has occurred. These areas support extensive networks of open woodland habitats with rocky substrate. Given their connectivity and unique resource values, these areas have high ecological value as habitat and regional corridors for wildlife movement. Under the Queensland Government's Biodiversity Planning Assessment mapping, these areas are classified as being state significant bioregional wildlife corridors. Biodiversity Planning Assessment mapping for Eden Bann Weir shows state significant bioregional wildlife corridors adjacent to the lower portion of the impoundment (Figure 8-4).



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Kilometres

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LEGEND

- Weir Location
- River Crossing
- Access Road
- Waterway
- Highway
- Road
- Impoundment Area
- Grid Index

BPA Qualifying Information
- Bioregional Corridor
- Habitat Remnant
- Habitat Remnant and Bioregional Corridor

Biodiversity Significance
- State Habitat for EVR taxa
- State
- Regional
- Local or Other Values

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Eden Bann Weir Biodiversity Planning Assessment mapping

Index Map Figure 8-4

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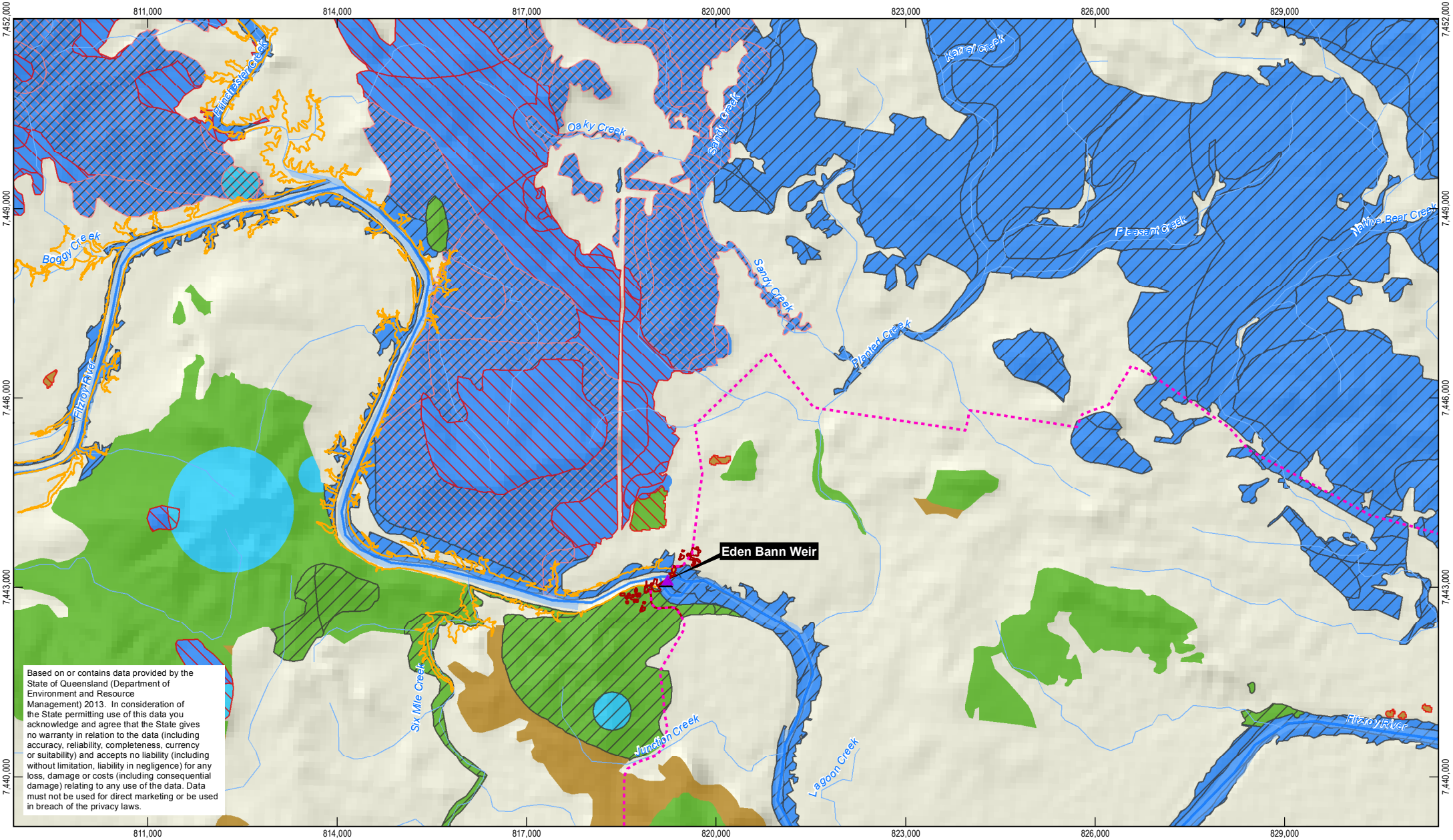

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Kilometres

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

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- Waterway
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- Highway
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Eden Bann Weir Biodiversity Planning Assessment mapping

Figure 8-4
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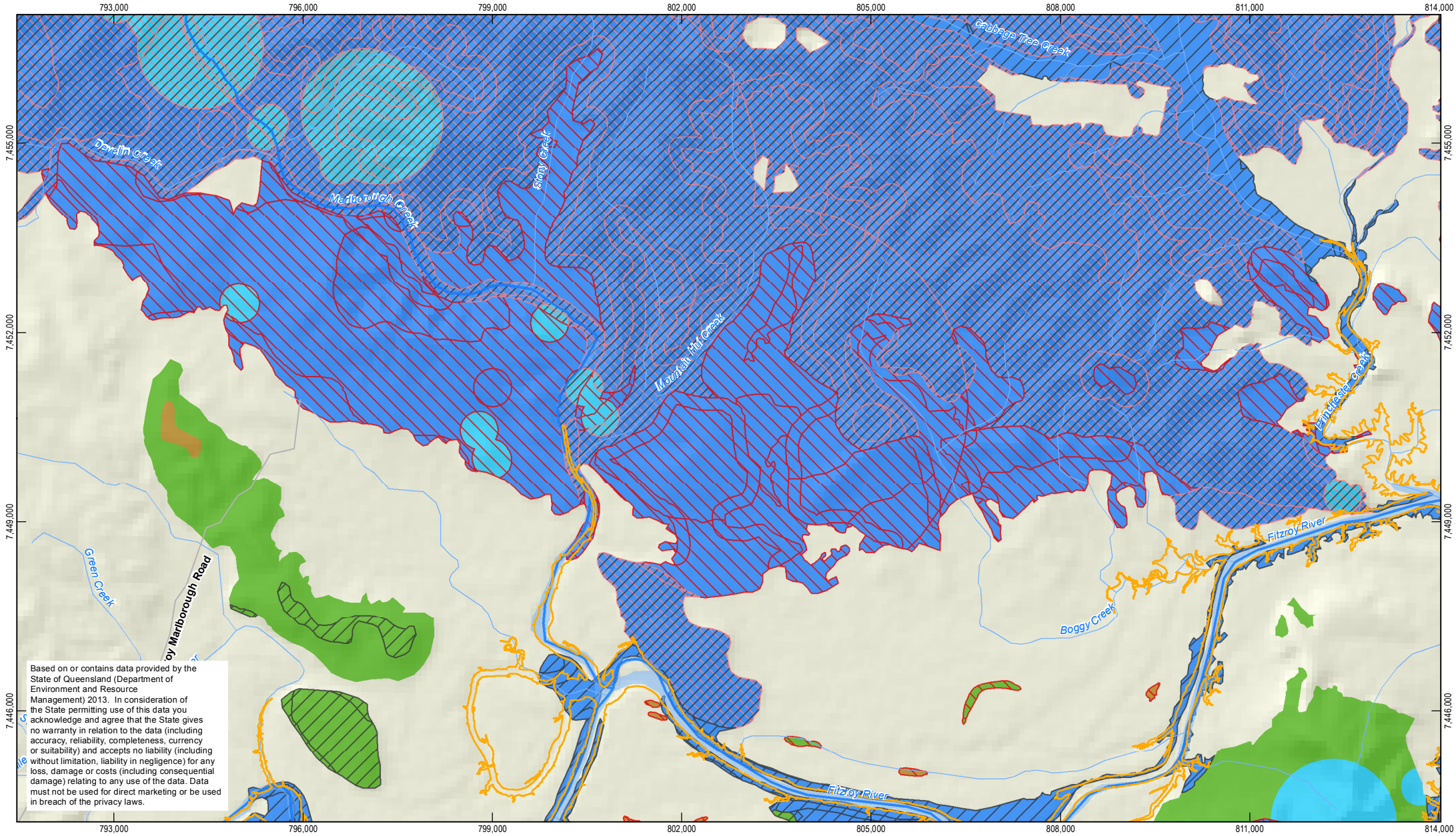

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Kilometres

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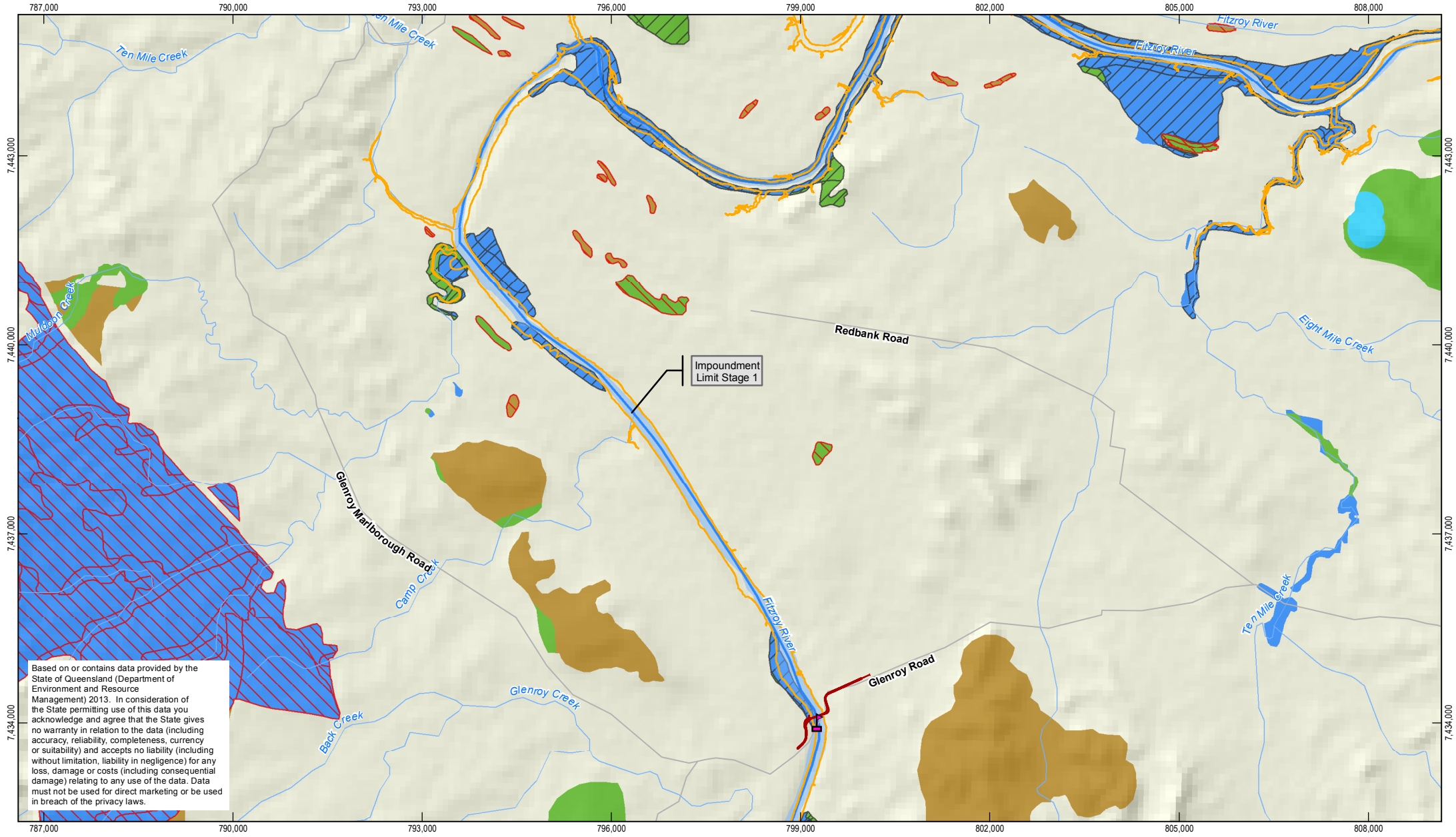

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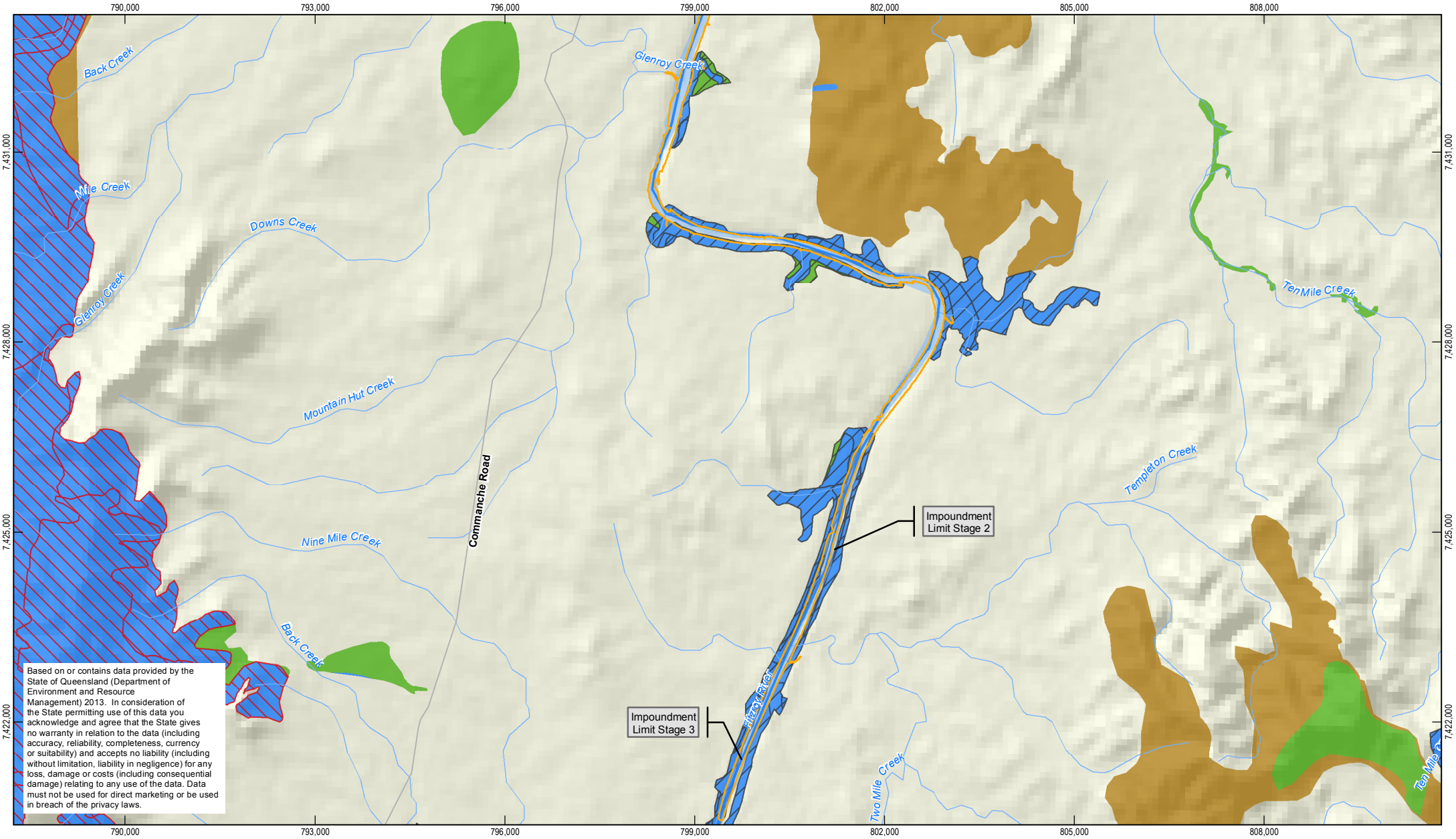

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Within the agricultural lowland areas, vegetation has been retained predominantly along the riparian fringe. Although this lowland vegetation has been subjected to significant edge effects and impacts from cattle, it plays an important ecological role, providing both habitat and a level of connectivity between habitat remnants. Connectivity and biodiversity values in the upper reaches of the proposed impoundment are limited to fragmented patches of riparian fringe vegetation largely unconnected to other remnant habitat.

The proposed new right bank access road to Eden Bann Weir traverses largely cleared agricultural land with small, fragmented patches of native vegetation. Alignment of the new access road has avoided as far as practicable the need to clear native vegetation. Riparian fringe and agricultural land dominate the eastern approach to the Glenroy Crossing with open woodland with a grassy understory and Melaleuca riparian fringe flanking the western approach.

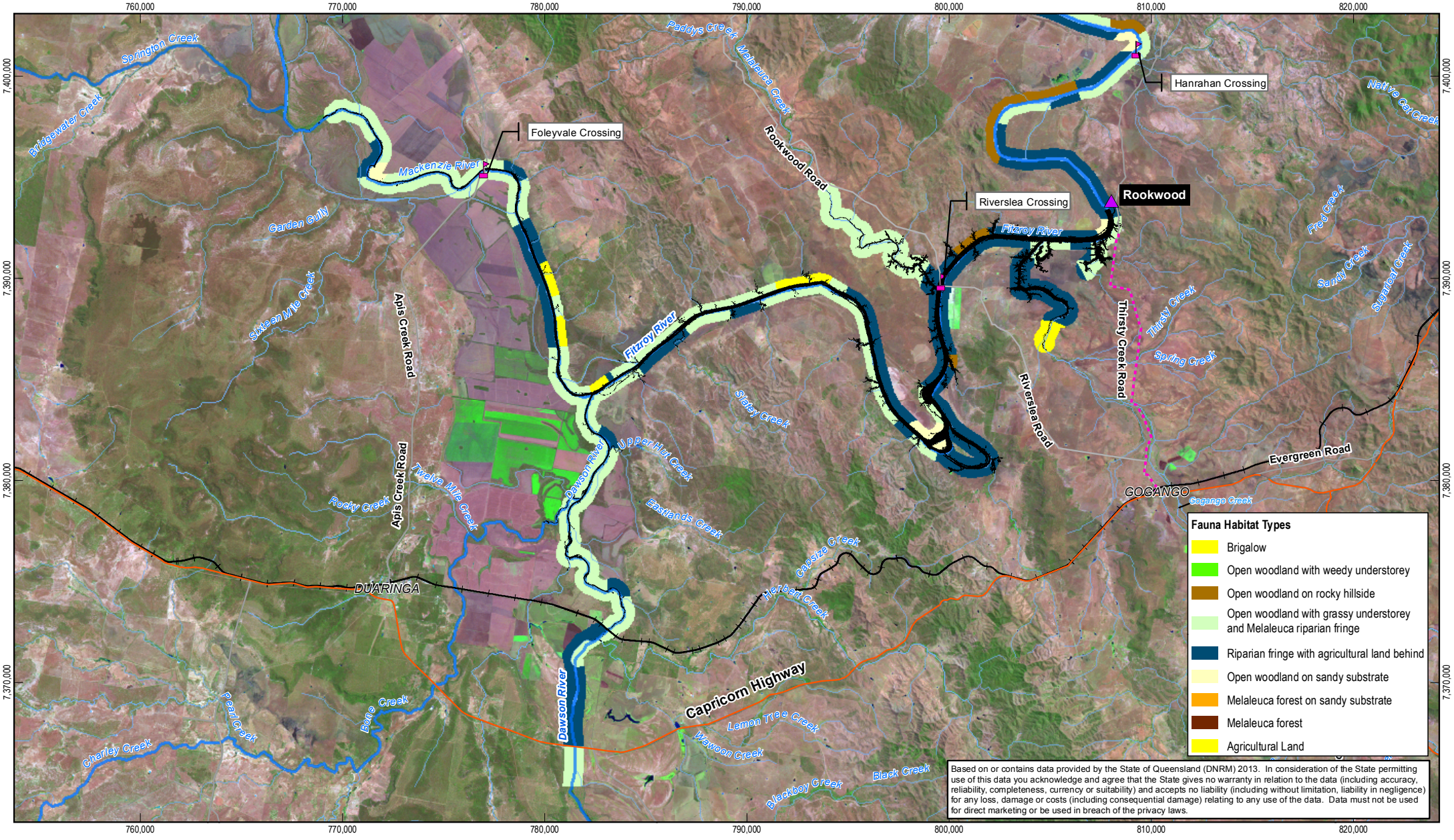
8.2.1.2 Rookwood Weir

The Rookwood Weir study area is located within the northern extent of the Brigalow Belt South bioregion. The bioregion is also characterised by high areas of habitat loss. This is primarily due to agricultural clearing in the lowland and riparian areas. The vegetation in the region varies with topography. The bioregion is categorised into two subregions: the Mount Morgan Ranges and Boomer Range. Approximately 52 – 54 per cent of ecosystems within these subregions are endangered or vulnerable (DEWHA 2009b).

The confluence of the Dawson and Mackenzie rivers is contained within the Rookwood Weir study area. The landscape is predominantly flat and cleared, due to agricultural uses. However, there are still fragments of remnant woody vegetation which vary in size, condition and connectivity. The upper Fitzroy River and the lower Dawson and Mackenzie rivers are generally narrower and more dynamic than areas further downstream. There is no in-stream infrastructure in these sections of river.

Vegetation communities are discussed in detail in Chapter 6 Flora. Nine broad terrestrial habitats were identified within the Rookwood Weir study area, as mapped in Figure 8-5 and described in Table 8-6. These include:

- Open woodland with grassy understorey and *Melaleuca* riparian fringe
- Open woodland on rocky hillside
- Brigalow habitat
- Open woodland with sandy substrate
- *Melaleuca* on sandy substrate
- Narrow riparian fringe
- Agricultural land
- Creeks
- Off-stream water bodies (palustrine wetlands (vegetated swamps, billabongs), oxbow lakes, and farm dams in the floodplain adjacent to the main channel and adjoining creeks, and flood-runners / secondary channels within the bed and banks (i.e. including riparian zone)).



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Kilometres

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

N

LEGEND

- Weir Location
- River Crossing
- Highway
- Streets (Local)
- Access Road
- Railway
- Waterway
- Impoundment Area

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Rookwood fauna habitat types

Figure 8-5

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Data Source: : © Copyright Commonwealth of Australia (Geoscience Australia): Waterways, State (2007); Sunwater: Waterways, Weir Locations - 2008; DNRM: Roads - 2010, Railways - 2010, Imagery - 2005;GHD: Fauna Habitat Types/2009. Created by IH.

Table 8-6 Terrestrial habitat types, characteristics and values – Rookwood Weir

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Open woodland with grassy understorey and *Melaleuca* riparian fringe	• Riparian fringe of Melaleuca • Low-moderate density mature eucalypts • Sparse shrub layer • Complex understorey with native grasses and sedges • Fallen woody debris and leaf litter • Hollows and stags.	Habitat value for: • Canopy-nesting birds • Skinks, dragons, geckos and snakes • Tree frogs and burrowing frogs • Koalas, possums and gliders • Bandicoots, rodents and macropods. Relative ecological value: Moderate Possible habitat for listed threatened species: squatter pigeon, yakka skink, little pied bat	 
Open woodland on rocky hillside	• Low density stunted eucalypts • Areas of Casuarina and vine thicket • Sparse understorey vegetation • Rocky substrate • Abundance of fallen logs and woody debris.	Habitat value for: • Canopy nesting birds • Snakes, skinks, dragons and geckos • Small ground mammals. Relative ecological value: High Possible habitat for listed threatened species: northern quoll	

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Brigalow	• Few mature canopy trees • Moderate density acacia shrub layer • Sparse understorey vegetation • Relatively complex ground substrates • Leaf litter, fallen woody debris.	Habitat value for: • Shrub-nesting birds • Skinks, dragons, geckos and snakes • Macropods. Relative ecological value: High Possible habitat for listed threatened species: brigalow scaly-foot, yakka skink, ornamental snake, Dunmall's snake, northern quoll	
Open woodland on sandy substrate	• Sandy substrate • Relatively simple understorey • Shrub layer largely absent • Mature eucalypts • Stags abundant • Many hollows.	Habitat value for: • Canopy birds and waterbirds • Possums, koalas and gliders. Relative ecological value: Moderate Possible habitat for listed threatened species: squatter pigeon	
Melaleuca on sandy substrate	• No tall canopy trees • Dense low Melaleucas • No understorey vegetation • Sandy substrate • Relatively low habitat complexity • Seasonally inundated.	Habitat value for: • Shrub-nesting birds and waterbirds • Skinks, dragons and snakes • Nesting habitat for crocodiles and turtles. Relative ecological value: High Possible habitat for listed threatened species: Fitzroy River turtle, white-throated snapping turtle, estuarine crocodile	

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Narrow riparian fringe	• Moderate-density tree layer of eucalypts • Dense but narrow shrub layer of juvenile eucalypts • Understorey of leaf litter, grass and woody debris • Very narrow, exposed to edge effects of noise, light and weeds • Corridor for wildlife movement.	Habitat value for: • Pasture-adapted birds • Common possums • Grass skinks, wall skinks and bearded dragons • Introduced and native rodents. Relative ecological value: Moderate Possible habitat for listed threatened species: squatter pigeon	
Agricultural land	• Tree and shrub layer absent • Uniform ground cover of short to long grazed grass • Few logs or woody debris • Structurally simple.	Habitat value • Pasture land birds • Raptors • Snakes • Macropods. Relative ecological value: Low Possible habitat for listed threatened species: none	
Creeks	• Narrow stream • Shallow-slow flowing water • High density of overhanging vegetation • High density of shrub and ground-level vegetation • High density of in-stream debris.	Habitat value for: • Forest birds and waterbirds • Water dragons and snakes • Frogs • Ground mammals • Microchiropteran bats. Relative ecological value: High Possible habitat for listed threatened species: little pied bat, black-necked stork, star finch, cotton pygmy-goose, ornamental snake	

Habitat type	Characteristics	Value for wildlife	Representative example of habitat
Off-stream water bodies	• Seasonally connected to main river system by floodwaters • High density of overhanging vegetation • High abundance of in-stream debris.	Habitat value for: • Forest birds and waterbirds • Burrowing and ephemeral breeding frogs • Snakes • Ground mammals • Microchiropteran bats. Relative ecological value: High Possible habitat for listed threatened species: little pied bat, black-necked stork, cotton pygmy-goose, Australian painted snipe, ornamental snake	

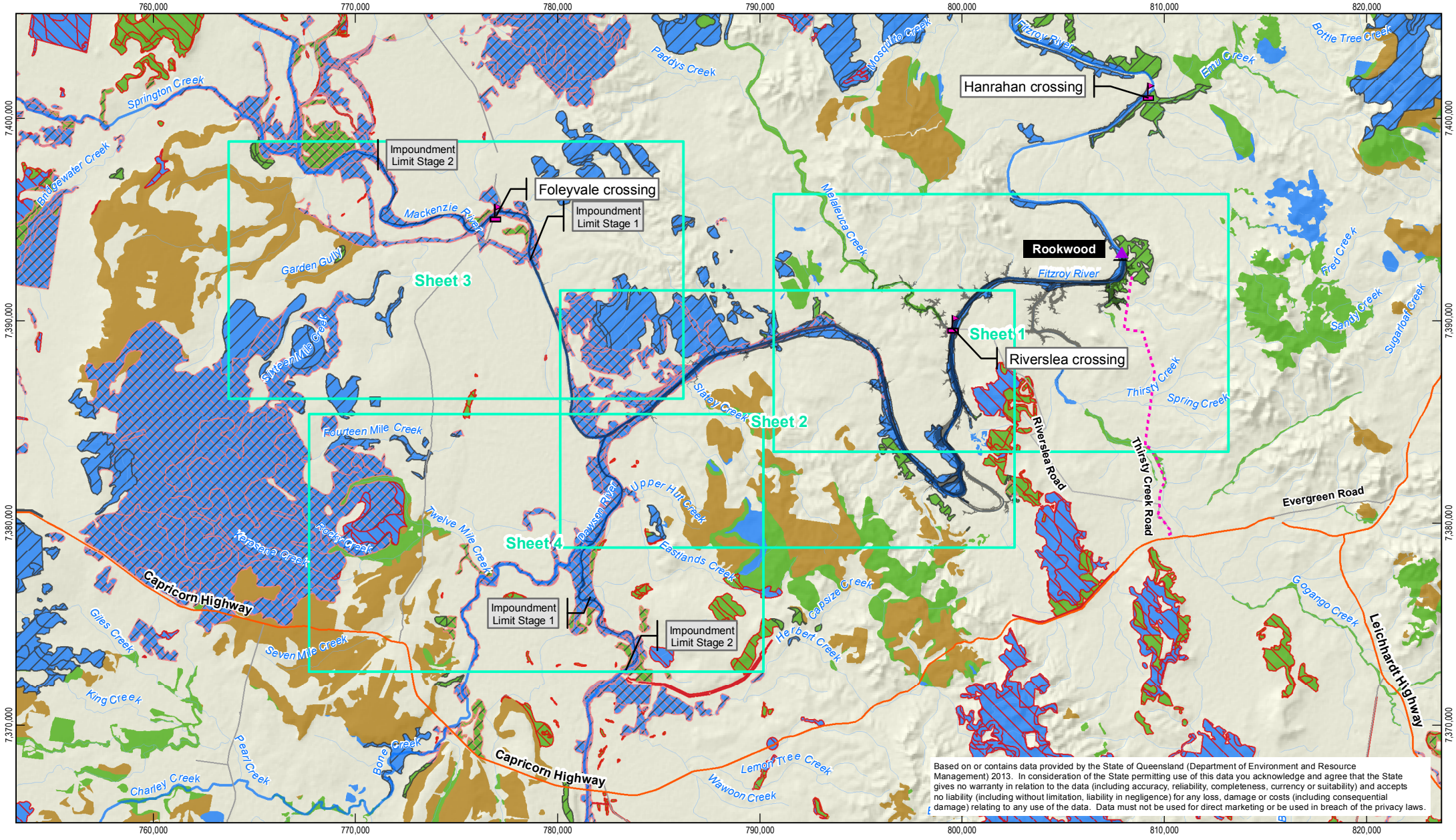
The 'open woodland with grassy understorey and *Melaleuca* riparian fringe' is characterised by high structural complexity/diversity and as a result supports a diversity of terrestrial fauna. The 'open woodland on rocky hillside' is also structurally complex and provides a diversity of resources for generalist and potentially niche species. Areas of brigalow (*Acacia harpophylla*) occur in several locations, including near the confluence of the Mackenzie and Dawson Rivers. Due to its potential to provide habitat for a number of NC Act and EPBC Act listed reptiles including the brigalow scaly foot, Dunmall's snake (*Furina dunmalli*), yakka skink (*Egernia rugosa*) and ornamental snake (*Denisonia maculata*), this habitat type was considered to have high ecological value. 'Open woodlands' and '*Melaleuca* on sandy substrates' generally have low ground-level and canopy complexity but support many shrub and tree dwelling animals (such as woodland and forest birds and arboreal mammals).

Large areas of the Rookwood Weir study area have been cleared for agriculture and only a narrow fringe of eucalypt (and to a lesser extent, *Melaleuca*) riparian vegetation remains. This habitat type has lower structural complexity and provides fewer resources for native wildlife than the other habitat types. Agricultural land supports a lower species richness but retains foraging habitat values for raptors, snakes, small ground mammals, macropods and other birds. Creeks and off-stream water bodies provide important resources (particularly foraging) for an array of terrestrial fauna including frogs, waterbirds and microchiropteran bats.

Habitat connectivity has (evidently) been reduced on lower lying areas by vegetation clearing for agriculture. The most extensive areas of interconnected habitat exist on higher ground, where limited vegetation clearing has occurred. These areas support extensive networks of open woodland habitats with rocky substrate. Given their connectivity and unique resource values, these areas have high ecological value as habitat and regional corridors for wildlife movement. Under the Queensland Government's Biodiversity Planning Assessment mapping, these areas are classified as being state significant bioregional wildlife corridors.

Within the agricultural lowland areas, vegetation has been retained predominantly along the riparian fringe. Although this lowland vegetation has been subjected to significant edge effects and impacts from cattle, it plays an important ecological role, providing both habitat and a level of connectivity between habitat remnants. In the upper reaches of the proposed impoundment (in the vicinity of the confluence) larger tracts of remnant vegetation provide more connection between areas of State and regional biodiversity value.

Access to the proposed Rookwood Weir site and river crossing locations is facilitated by existing access. While some upgrades will be required, works are largely confined to existing road reserve and previously disturbed or agricultural areas limiting the need to clear native vegetation. Habitat associated with river crossings as depicted in Figure 8-5 and described in Table 8-6.



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Kilometres

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Rookwood Biodiversity Planning Assessment mapping

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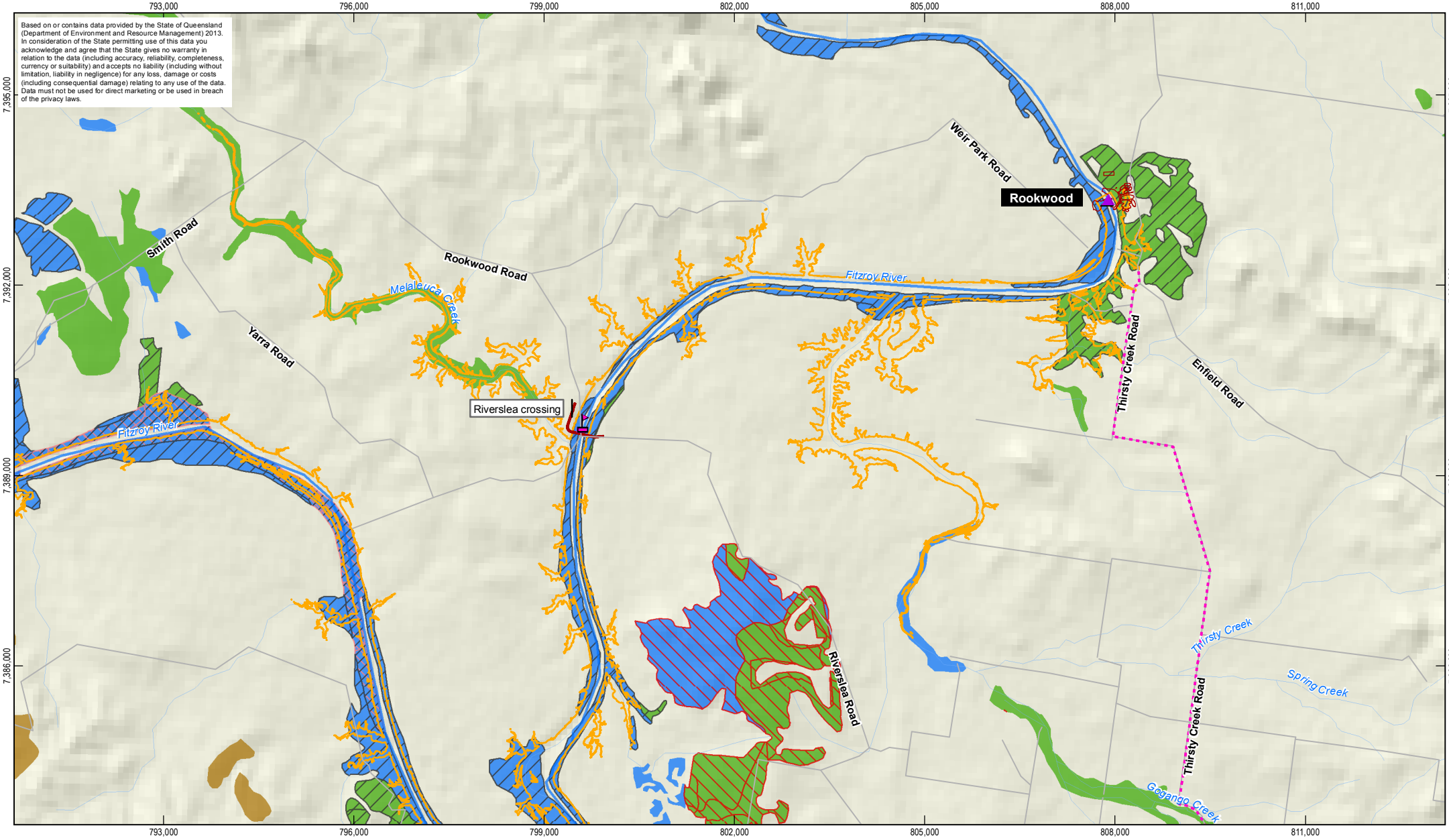

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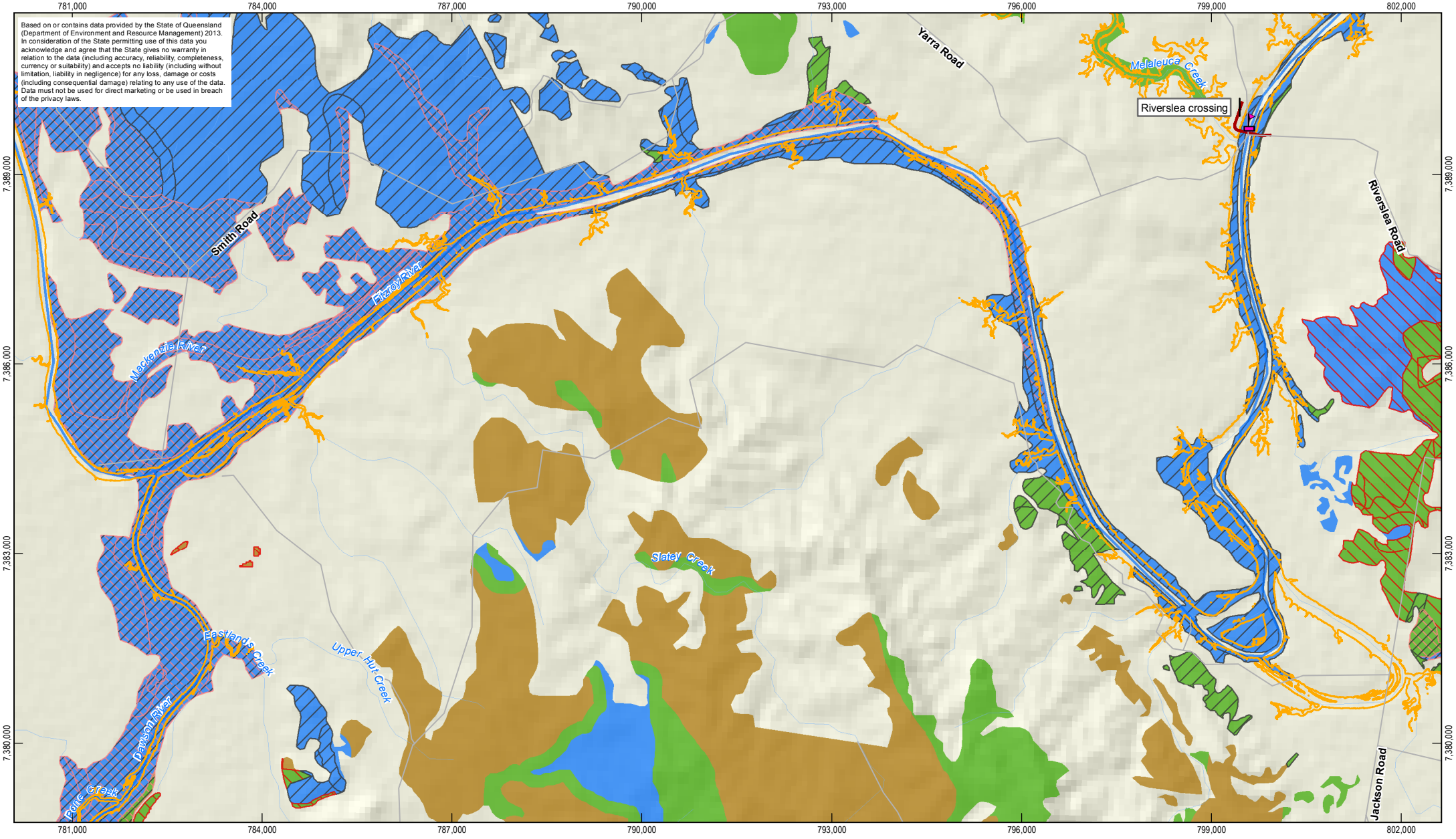

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LEGEND

- Weir
- Location
- River Crossing
- Highway
- Road
- Access Road
- Waterway
- Impoundment Area
- Construction Footprint

BPA Qualifying Information
- Bioregional Corridor
- Habitat Remnant
- Habitat Remnant and Bioregional Corridor

Biodiversity Significance
- State
- Regional
- Local or Other Values

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Rookwood Biodiversity Planning Assessment mapping

Figure 8-6 Sheet 2 of 4

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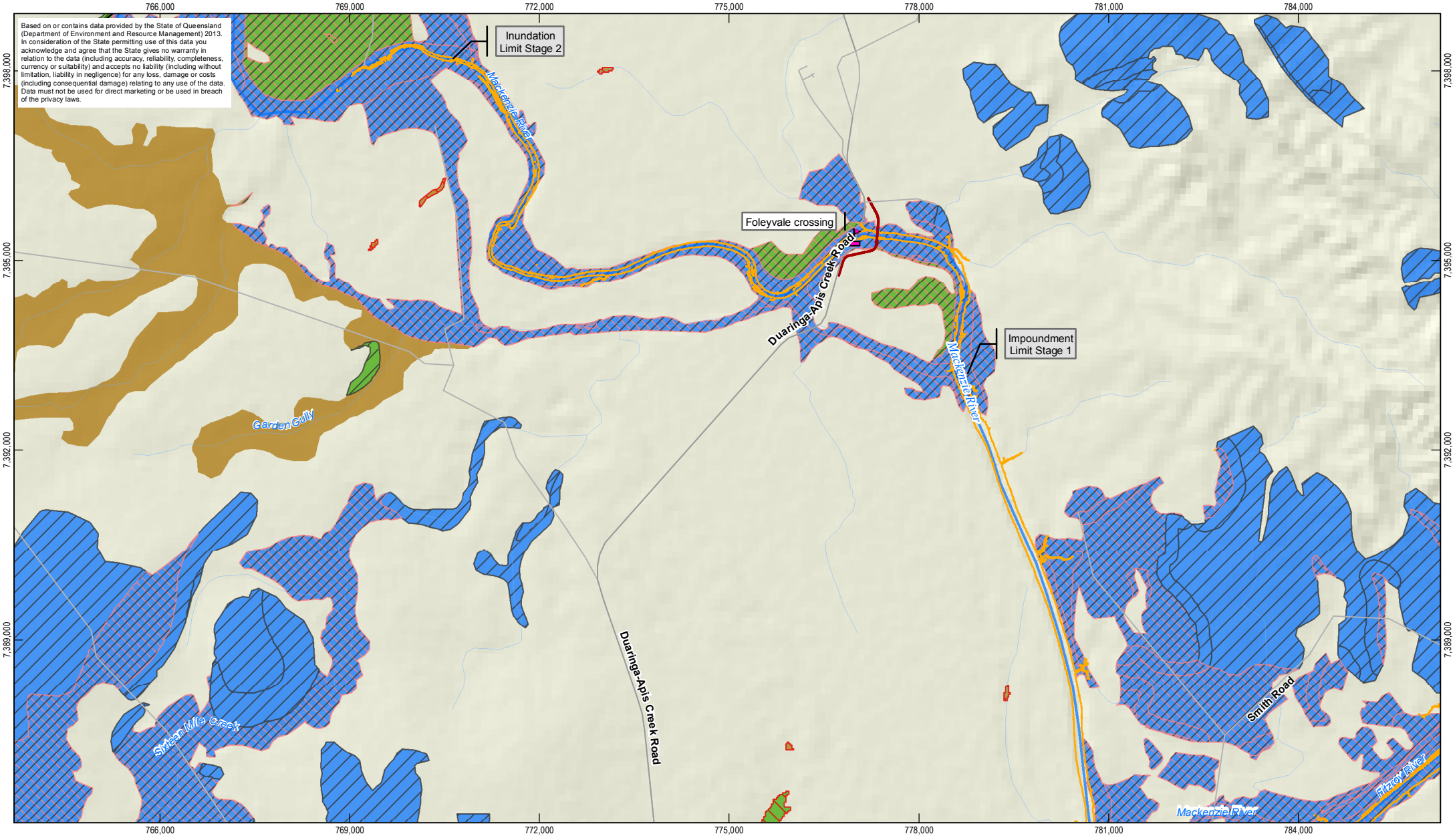

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Kilometres

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

N

LEGEND

- Weir
- Location
- River Crossing
- Highway
- Road
- Access Road
- Waterway
- Impoundment Area
- Construction Footprint

BPA Qualifying Information
- Bioregional Corridor
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Rookwood Biodiversity Planning Assessment mapping

Figure 8-6 Sheet 3 of 4

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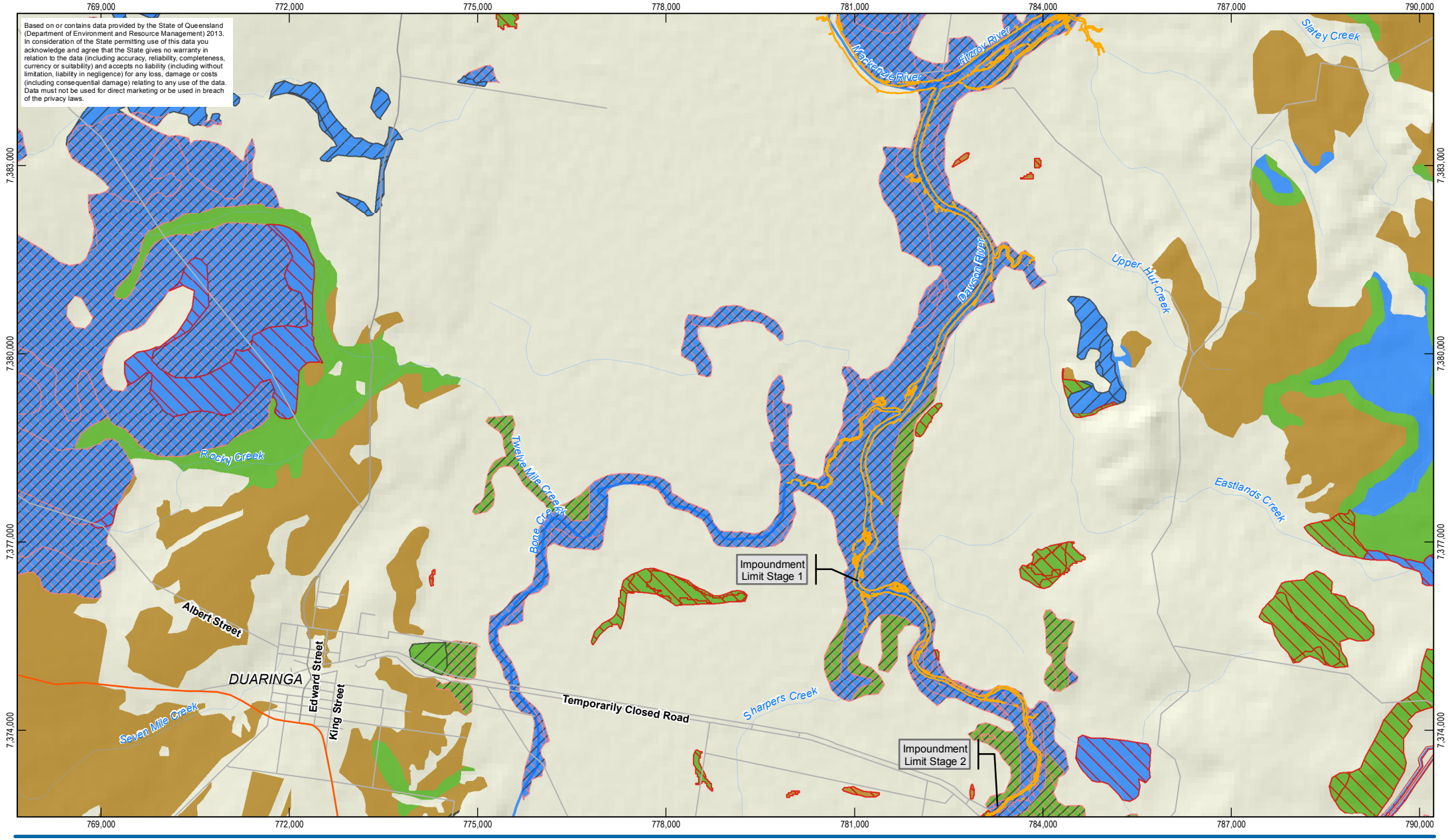

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Map Projection: Universal Transverse Mercator
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N

LEGEND

- Weir
- Location
- River Crossing
- Highway
- Road
- Access Road
- Waterway
- Impoundment Area
- Construction Footprint

BPA Qualifying Information
- Bioregional Corridor
- Habitat Remnant
- Habitat Remnant and Bioregional Corridor

Biodiversity Significance
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Figure 8-6
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8.2.2 Fauna species

8.2.2.1 Overview

Fauna species diversity (including common species, threatened species, marine and/or migratory species and introduced species) was recorded through desktop analysis and field fauna surveys. Table 8-7 and Table 8-8 present the number of mammals, birds, reptiles and amphibians recorded according to survey method for Eden Bann Weir and Rookwood Weir respectively. Full species lists including locations of records are provided in Appendix I and Appendix J.

Table 8-7 Eden Bann Weir fauna species predicted to occur or recorded as occurring

Value	EPBC Act Environmental Reporting Tool (predicted to occur)	DERM Wildnet database (historically recorded)	Queensland Museum specimen database (historically recorded)	Birds Australia Atlas (historically recorded)	Field surveys
Species diversity		4 amphibians 7 reptiles 9 mammals 75 birds	5 amphibians 13 reptiles 1 mammal	70 birds	12 amphibians 20 reptiles 28 mammals 98 birds
EPBC Act / NC Act threatened species	4 reptiles 3 mammals 6 birds	2 mammal 2 birds	1 reptile	1 bird	1 mammal 3 birds
EPBC Act 'marine' / 'migratory' species	16 birds	16 birds	-	17 birds	24 birds
Introduced / pest species	4 mammals	1 amphibian 4 mammals	-	-	1 amphibian 5 mammals

Table 8-8 Rookwood Weir fauna species predicted to occur or recorded as occurring

Value	EPBC Act Environmental Reporting Tool (predicted to occur)	DERM Wildnet database (historically recorded)	Queensland Museum specimen database (historically recorded)	Birds Australia Atlas (historically recorded)	Field surveys
Species diversity		6 amphibians 9 reptiles 14 mammals 112 birds	6 reptiles 3 mammals	148 birds	12 amphibians 22 reptiles 41 mammals 133 birds
EPBC Act / NC Act threatened species	4 reptiles 3 mammals 5 birds	3 birds	1 mammal	3 birds	2 mammals 4 birds
EPBC Act 'marine' / 'migratory' species	14 birds	21 birds	-	39 birds	23 birds
Introduced / pest species	5 mammals	1 amphibian 5 mammals	-	-	1 amphibian 8 mammals

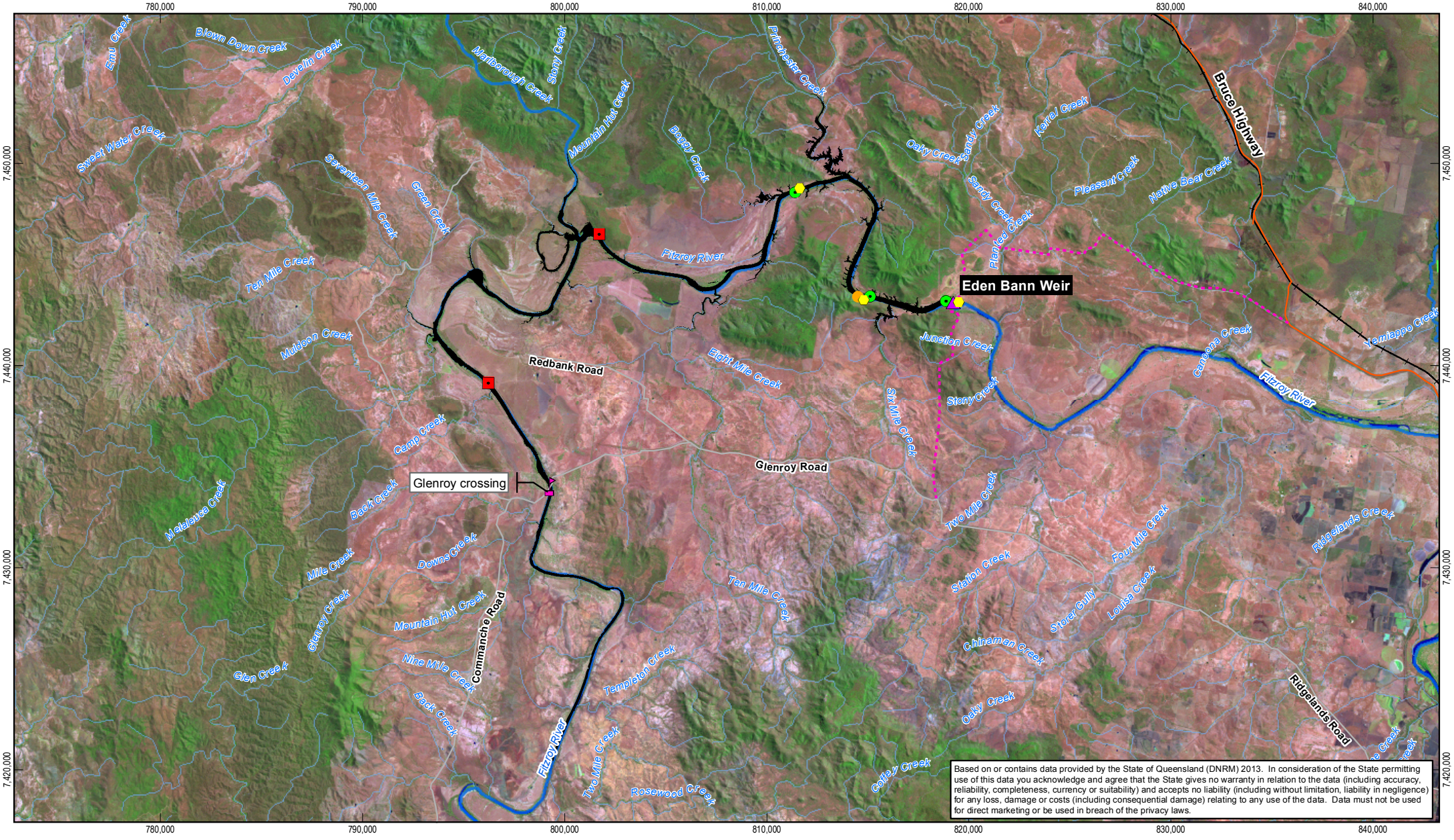
The locations of threatened terrestrial fauna species identified during field surveys are shown in Figure 8-7 and Figure 8-8 for Eden Bann Weir and Rookwood Weir, respectively.

8.2.2.2 Birds

A total of 98 bird species from 41 families were recorded in wet and dry season surveys at Eden Bann Weir study area and 133 bird species from 50 families were recorded during the wet and dry season surveys within the Rookwood Weir study area. This comprised a range of different bird groups including waterbirds, raptors, parrots, forest birds, grassland birds, open woodland birds and nocturnal birds.

A likelihood of occurrence assessment for conservation significant birds species identified through desktop assessments is provided in Table 8-9.

Three threatened species were encountered during surveys at both Eden Bann Weir and Rookwood Weir. The southern sub-species of squatter pigeon (*Geophaps scripta scripta*), listed as vulnerable under the EPBC Act and the NC Act, was encountered on several occasions in woodland habitats with a grass understorey. The black-necked stork (*Ephippiorhynchus australis*) (Figure 8-9) and the black-chinned honeyeater (*Melithreptus albogularis*), both listed as near threatened under the NC Act, were also observed during field surveys. In addition to these three threatened species, the cotton pygmy-goose (*Nettapus coromandelianus*), listed as near threatened under the EPBC Act and the NC Act, was observed at Rookwood Weir.



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Kilometres

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

N

LEGEND

- Weir
- Location
- River Crossing
- Highway
- Road
- Access Road
- Railway
- Waterway
- Impoundment Area
- Little pied bat
- Squatter pigeon (southern)
- Black-necked stork
- Black-chinned honeyeater

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Eden Bann Weir – location of threatened terrestrial fauna species

Figure 8-7

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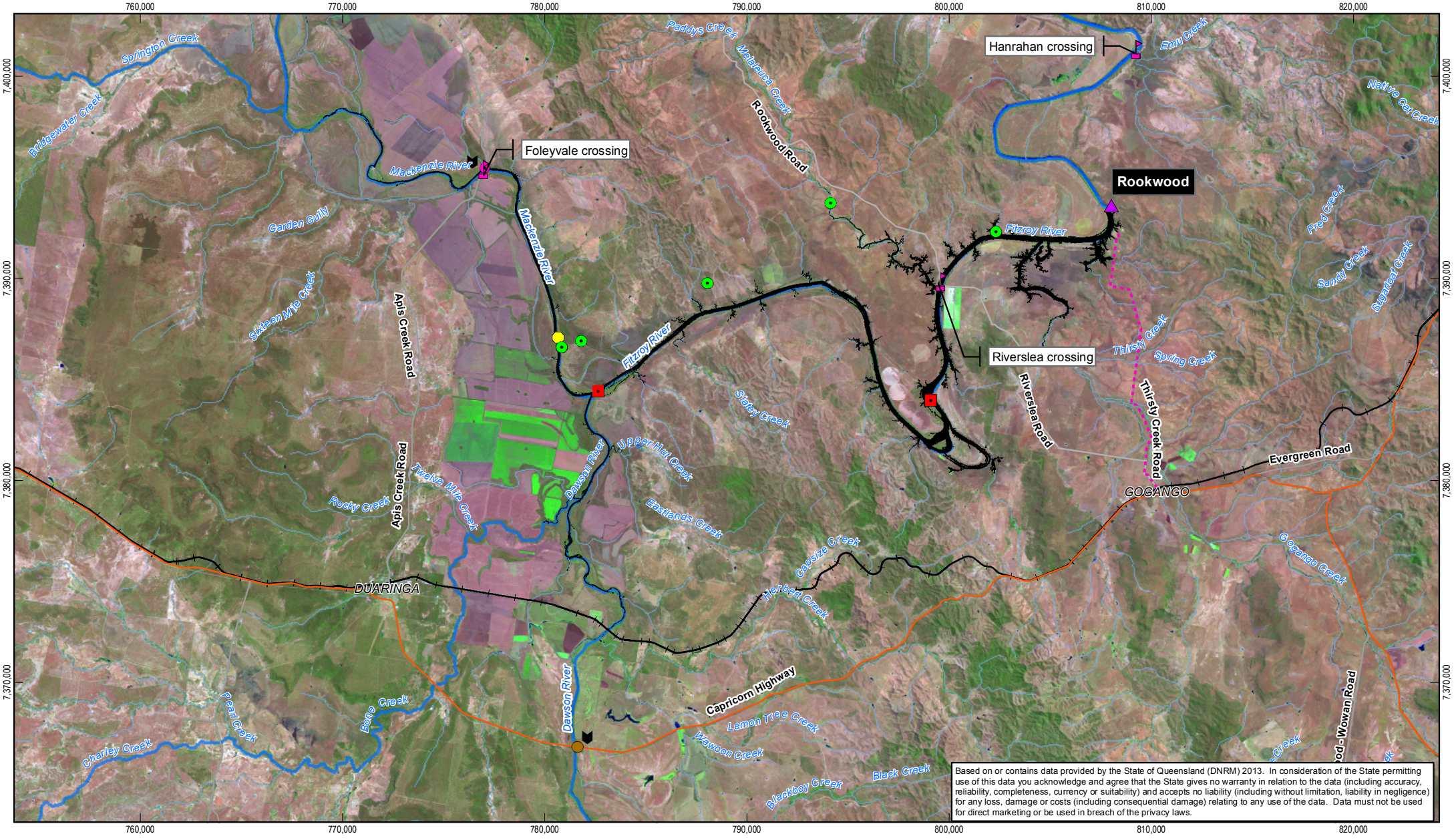

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Kilometres

Map Projection: Universal Transverse Mercator
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N

LEGEND

- Weir Location
- River Crossing
- Highway
- Streets (Local)
- Railway
- Waterway
- Access Road
- Impoundment Area
- Little pied bat
- Squatter pigeon (southern)
- Black-necked stork
- Troughton's sheathtail-bat
- Cotton pygmy-goose
- Black-chinned honeyeater

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Rookwood location of threatened terrestrial fauna species

Figure 8-8

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Table 8-9 Conservation significant birds – likelihood of occurrence assessment

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Birds							
Ephippiorhynchus australis	Black-necked stork	-	NT	Wildlife Online Birds Australia	Occurs in a range of wetland and inundated habitats, from the coast to irrigated inland regions (Marchant and Higgins 1990).	Occur along the river, and in adjacent farm land where irrigated crops and / or farm dams occur. The abundance of large trees abutting the river for much of its length above Eden Bann Weir provide suitable nesting habitat for the black-necked stork. This species was observed during wet and dry season surveys at Eden Bann Weir, upstream of Riverslea Crossing during the wet season surveys and just downstream of the Dawson/Mackenzie confluence during the dry season surveys. Shallow margins of the Fitzroy, Dawson and Mackenzie Rivers, as well as creeks and associated off-stream water bodies represent suitable foraging habitat for this species.	High
Melithreptus gularis	Black-chinned honeyeater	-	NT	No previous recording	Habitat preferences include upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. Also inhabits well wooded margins of watercourses (Higgins et al. 2001).	Suitable habitat may occur for this species along the river where riparian woodland/forest is intact and woodland/forest areas occurring in the cleared agricultural landscape. This species was observed in the open woodland habitat along the Dawson River (Site 4) during the dry season. This habitat is suitable for the black-chinned honeyeater, which shows a preference for open woodland and forest habitats, particularly near water. Such habitats occur in fragmented patches throughout the study area, and have the potential to support this uncommon species.	High

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Geophaps scripta scripta	Squatter pigeon (southern)	V	V	Wildlife Online	Occurs mainly in grassy woodlands and open forests that are dominated by eucalypts. It has also been recorded in sown grasslands with scattered remnant trees, disturbed habitats (e.g. around stockyards, along roads and railways, and around settlements), in scrub and *Acacia* growth, and remains common in heavily-grazed country north of the Tropic of Capricorn. The species is commonly observed in habitats that are located close to bodies of water (DEWHA 2009a). This particularly occurs in RE 11.3.2 and 11.12.2.	This species is not uncommon in the region and has the potential to occur in woodland and grassland wherever there is tall grass interspersed with cleared areas. This species was encountered in wet and dry season surveys in open woodland and grassland habitats. 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. While considered vulnerable, squatter pigeons appear to be relatively common at Eden Bann Weir based on survey findings.	High
Nettapus coromandelianus	Cotton pygmy-goose	-	NT	Wildlife Online; BAAM 2008a	Most commonly found in freshwater lakes, swamps and large water impoundments of coastal and sub-coastal environments. Preference for deep permanent waters with abundant aquatic vegetation (both floating and submerged). It is a predominantly aquatic species (Marchant and Higgins 1990).	Suitable habitat for this species occurs in the Fitzroy River and tributaries above the Eden Bann Weir, and in billabongs and larger permanent farm dams adjacent to the river. This species was observed in off-stream water body habitats during the wet season bird surveys. Suitable foraging and breeding habitat for the cotton pygmy-goose occurs throughout the study area in creeks, off-stream water bodies and well vegetated margins of rivers and tributaries	High
Ninox strenua	Powerful owl	-	V	BAAM (2008a) Wildlife Online Birds Australia	Occurs in a range of habitats boasting large trees including mountain forests and woodlands, coastal forests, woodlands, pine plantations and urban areas. Mating pairs occupy a large home range (Marchant and Higgins 1993).	Potential to occur in habitats where large trees have not been cleared. Has been previously recorded in the study area.	High

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Lophoictinia isura	Square-tailed kite	-	NT	Wildlife Online	This species is patchily distributed through much of coastal Australia, extending inland through central Queensland (Marchant and Higgins, 1993). In inland areas the square-tailed kite generally occurs along timbered watercourses. This species occasionally forages in open habitats but is more generally restricted to woodland and forest habitats supporting high numbers of passerines (a key food source) (Marchant and Higgins, 1993).	This species has previously been recorded in the study area. Suitable habitat for this species occurs in the riparian woodlands along the Fitzroy River and its tributaries.	High
Poephila cincta cincta	Black-throated Finch (southern)	E	V	No previous recording	This species occupies woodland savannah and riverine vegetation. Inland it prefers grassy woodland dominated by eucalypts, paperbarks or acacias, where there is access to seeding grasses and water. On the coast, it occupies open grassy plains with pandanus (DSEWPaC 2011).	Potentially suitable habitat exists however the species has not previously been recorded and was not recorded during surveys.	Moderate
Rostratula australis/ Rostratula benghalensis s. lat.	Australian painted snipe	V	V	No previous records	This species has potential to move into Queensland during summer (Pizzey and Knight 2007). Generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, inundated or waterlogged grassland or saltmarsh, dams. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*) (DoE 2014).	Potential to occur among reeds in shallow water along the edge of the river and adjacent billabongs (REs 11.3.3, 11.3.25). However, the species has not previously been recorded and was not recorded during surveys.	Moderate

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Neochmia ruficauda ruficauda	Star finch (eastern), star finch (southern)	E	E	No previous records	Occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water. It also occurs in cleared or suburban areas such as along roadsides and in towns. Habitats are dominated by trees that are typically associated with permanent water or areas that are regularly inundated; the most common species are *Eucalyptus coolabah*, *E. tereticornis*, *E. tessellaris*, *Melaleuca leucadendra*, *E. camaldulensis* and *Casuarina cunninghamii* (Marchant and Higgins 1993)	Reed beds and tall grasses along rivers edge and within side tributaries represent suitable habitat.	Moderate
Erythrotriorchis radiatus	Red goshawk	V	E	No previous records	This bird occupies a range of habitats in northern and eastern Australia, including coastal and sub-coastal tall open forests and woodlands. The red goshawk has a large home range covering between 50 and 220 km^2. It prefers a mix of vegetation types with its habitat including tall open forest, woodland, lightly treed savannah and the edge of rainforest (Marchant and Higgins 1993).	Given the red goshawk's large home range and the presence of suitable habitat within the Project footprint, it is considered to have the potential to occur. However, the species has not previously been recorded in the region and is considered unlikely to nest within the Project footprint as no nests were observed during field surveys despite nest survey effort (Table 8-3) that is broadly consistent with the EPBC Act Survey Guidelines (80 hours of survey over ten days).	Moderate
Turnix melanogaster	Black-breasted button-quail	V	V	No previous records	This species is typically found in the leaf litter and vine thickets of drier rainforests; scrubby eucalypt, she-oak and *Acacia* woodlands; and thickets of lantana on rainforest fringes (Pizzey and Knight 2007).	Suitable habitat occurs in vine thicket (RE 11.12.4) not found within the Project footprints. The current known geographic extent of this species is to the south of the Project footprint.	Low

*CE= critically endangered, E = endangered, V = vulnerable, R = rare, NT = near threatened, SLC = special least concern.

^Previously recorded within search extents defined in text for Wildlife Online, Queensland Museum and Birds Australia Database searches.

Figure 8-9 Bird species within Project study areas

(a) Black-necked stork

(b) Rainbow bee-eater

(c) Forest kingfisher

(d) Striated pardalote

As well as the three threatened species recorded at Eden Bann Weir, 24 other conservation significant bird species listed under the EPBC Act were identified. This included 21 species listed as marine and three species listed as both marine and migratory. Twenty-three species listed as marine and / or migratory under the EPBC Act were observed within the Rookwood Weir study area, one of the most common of which was the rainbow bee-eater (*Merops ornatus*) (Figure 8-9).

Waterbirds encountered within the Eden Bann Weir and Rookwood Weir study areas included the pied cormorant (*Phalacrocorax varius*), white-faced heron (*Egretta novaehollandiae*), black bittern (*Ixobrychus flavicollis australis*), nankeen night heron (*Nycticorax caledonicus*), Pacific black duck (*Anas superciliosa*) and plumed whistling duck (*Dendrocygna eytoni*). Other waterbirds recorded at Eden Bann Weir included the royal spoonbill (*Platalea regia*), great egret (*Ardea alba*), white-necked heron (*Ardea pacifica*), Australian wood duck (*Chenonetta jubata*) and Australasian darter (*Anhinga melanogaster*). Waterbirds recorded within the Rookwood Weir study area included the grey teal (*Anas gracilis*), Australasian shoveler (*Anas rhynchotis*), green pygmy-goose (*Nettapus pulchellus*), Australian pelican (*Pelecanus conspicillatus*) and the great crested grebe (*Podiceps cristatus*).

Forest birds encountered within the Eden Bann Weir and Rookwood Weir study areas included the restless flycatcher (*Myiagra inquieta*), Lewin's honeyeater (*Meliphaga lewinii*) and the forest kingfisher (*Todiramphus macleayii*) (Figure 8-9).

Other forest birds recorded at Eden Bann included the bar-breasted honeyeater (*Ramsayornis fasciatus*), weebill (*Smicrornis brevirostris*), Horsfields bronze cuckoo (*Chalcites basalis*) and grey-shrike thrush (*Colluricincla harmonica*). More heavily vegetated habitats along the riparian fringe and in/along ephemeral gullies provide suitable habitat for such species. Forest birds recorded within the Rookwood Weir study area included the white-throated treecreeper (*Cormobates leucophaeus*), topknot pigeon (*Lopholaimus antarcticus*), leaden flycatcher (*Myiagra rubecula*) and brown thornbill (*Acanthiza pusilla*).

Birds recorded in more open woodland areas within the Eden Bann Weir and Rookwood Weir study areas included the spangled drongo (*Dicrurus bracteatus*), red-winged parrot (*Aprosmictus erythropterus*), blue-winged kookaburra (*Dacelo leachii*), laughing kookaburra (*Dacelo novaeguineae*), grey crowned babbler (*Pomatostomus temporalis*), common koel (*Eudynamys scolopacea*), pheasant coucal (*Centropus phasianinus*), white-winged chough (*Corcorax melanorhamphos*), pale-headed rosella (*Platycercus adscitus*) and striate pardalote (*Pardalotus striatus*) (Figure 8-9). Other open woodland birds recorded at Eden Bann Weir included the cicadabird (*Coracina tenuirostris*), channel-billed cuckoo (*Scythrops novaehollandiae*) and the dollarbird (*Eurystomus orientalis*). Woodland bird diversity was relatively high and comprised species that are common in fragmented agricultural landscapes.

Seven raptor species were observed within the Eden Bann Weir study area and eight raptor species within the Rookwood Weir study area. Species common to both study areas included the Pacific baza (*Aviceda subcristata*), wedge-tailed eagle (*Aquila audax*), whistling kite (*Haliastur sphenurus*) and white-bellied sea-eagle (*Haliaeetus leucogaster*). Whistling kites and white-bellied sea-eagles were frequently encountered during travel by boat up and down the river. Brown goshawk (*Accipiter fasciatus*), black kite (*Milvus migrans*), nankeen kestrel (*Falco cenchroides*) and brown falcon (*Falco berigora*) were also encountered in the Rookwood Weir study area.

Three nocturnal birds, namely the barn owl (*Tyto alba*), southern boobook (*Ninox novaeseelandiae*) and tawny frogmouth (*Podargus strigoides*) were recorded during nocturnal surveys within the Eden Bann and Rookwood Weir study areas. The nankeen night heron (*Nycticorax caledonicus*) and the Pacific barn owl (*Tyto javanica*) were also observed in the Rookwood Weir study area.

8.2.2.3 Mammals

Twenty-eight mammal species were detected during field surveys at Eden Bann Weir including five introduced species and two conservation significant species: the little pied bat (*Chalinolobus picatus*) and the echidna (*Tachyglossus aculeatus*). Forty-two mammal species were recorded during both the wet and dry season surveys at Rookwood Weir including eight introduced species and two conservation significant species: the little pied bat and echidna. Indirect evidence of koalas (*Phascolarctos cinereus*) in the form of faecal pellets was observed within both the Eden Bann Weir and Rookwood Weir study areas.

A likelihood of occurrence assessment for conservation significant mammal species identified through desktop assessments is provided in Table 8-10.

Table 8-10 Conservation significant mammals – likelihood of occurrence assessment

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Mammals							
Chalinolobus picatus	Little pied bat	-	NT	No previous recording	Riverine open forest communities in central western Queensland have been identified as a key habitat type for this species (Churchill 2008).	This species was detected in open mature eucalyptus woodland in the riparian zone and adjacent alluvial floodplain, remnant eucalyptus woodland at the foot of a large rocky hill adjacent to the Fitzroy River and open woodland featuring a grassy understorey and *Melaleuca* riparian fringe.	High
Phascolarctos cinereus	Koala	V**	SLC	Wildlife Online	Koalas occupy a range of habitats including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated eucalypt species (DSEWPaC 2012b). In central Queensland, the species occurs in scattered populations within eucalypt woodlands generally along watercourses.	Suitable habitat is present. Whilst no koalas were observed, evidence of koalas was found in the form of faecal pellets at the base of eucalypts within both the Eden Bann Weir and Rookwood Weir study areas.	High
Tachyglossus aculeatus	Echidna	-	SLC	No previous recording	The echidna is a habitat generalist, occurring in most areas that support ants and / or termites. As this species has no specialised habitat requirements, the entire Project footprint represents potential echidna habitat.	The species (or evidence of) was observed during field assessments at several locations throughout the Project footprint.	High
Dasyurus hallucatus	Northern quoll	E	-	No previous records	Found in a variety of treed habitats, particularly in broken, rocky country and open eucalypt forest near the coast. This species dens in hollow tree trunks, and tends to breed more successfully when access to surface water is available (Strahan 1995).	Potential to occur in rocky outcrops within remnant vegetation.	Moderate

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Macroderma gigas	Ghost bat	-	V	Wildlife Online	Occurs in a range of habitats from arid regions to tropical rainforests. Patchily distributed across northern Australia. Roosts in rock fissures, caves and mine shafts (Strahan 1995).	Although potential foraging habitat is widely distributed throughout the Project footprint, no roosting habitat is likely to be impacted. The ghost bat roosts selectively in undisturbed caves or mine shafts. Potential roosting habitat occurs in rocky hillsides near Eden Bann Weir. However, these areas occur outside the Project footprint. The abundance of potential foraging habitat is such that there will be no significant impact on the species.	Moderate
Nyctophilus timoriensis	Eastern long-eared bat	V	V	No previous records	Occurs in Callitris/ironbark/box open forest and Buloke woodland (Van Dyck and Strahan 2008)	This species has the potential to occur in open ironbark or box woodland including RE 11.3.3. However the species has not previously been recorded and was not recorded during surveys.	Moderate
Chalinolobus dwyeri	Large-eared pied bat, large pied bat	V	V	No previous records	Found in well-timbered areas with gullies. Roosts in caves and crevices (Menkhorst and Knight 2004).	Species may occur in woodland and vegetated gullies adjacent to the river. This species has not previously been recorded and was not recorded during surveys. Caves along the river are generally lacking and therefore potential suitable habitat is limited.	Low

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Onychogalea fraenata	Bridled nailtail wallaby	E	E	QLD Museum	This species occurs in semiarid areas, with a preference for open eucalypt woodland/forest and brigalow scrub growing on fertile soils. It grazes in grassy woodland. It has a very restricted range and is only found in Taunton and Idalia National Parks in central Queensland (Van Dyck and Strahan 2008).	Suitable habitat may occur in patches, however this species' sensitivity to human impacts (pastoral activities, feral animals) and highly restricted range (Taunton National Park, approximately 50 km to the west of the confluence of the Dawson and Mackenzie Rivers) suggests it is unlikely to utilise such habitats.	Low

*CE= critically endangered, E = endangered, V = vulnerable, R = rare, NT = near threatened, SLC = special least concern.

^Previously recorded within search extents defined in text for Wildlife Online, Queensland Museum and Birds Australia Database searches.
**The koala is currently listed as vulnerable under the EPBC Act. At the time of assessment and referral decision (EPBC 2009/56) being made the koala was however not listed as a threatened species. For this reason, under the EPBC Act further assessment as a matter of National Environmental Significance is not required.

Mammalian diversity varied between seasons with 28 native species recorded in the wet season at Eden Bann and 20 native species observed during the dry season. At Rookwood Weir, 23 native species were recorded during the wet season while 33 native species were detected in the dry season.

Sixteen microchiropteran bat species were identified at Eden Bann Weir via bat calls and/or captures in harp traps. Twelve of these species (all common) belonged to the family Vespertilionidae. Seventeen microchiropteran bat species were recorded within the Rookwood Weir study area.

The little pied bat, listed as near threatened under the NC Act, was recorded at three sites at Eden Bann Weir: the boat ramp just upstream of Eden Bann Weir, and at two sites adjacent to the existing impoundment area upstream from the weir wall and Princhester Creek (Sites 2 and 4, respectively). This species is known to inhabit dry timbered habitats including sclerophyll forest, woodland and scrubland, with foraging concentrated along watercourses (Menkhorst and Knight 2004). The open eucalyptus woodland habitat along the riparian zone and floodplain at the boat ramp, and Sites 2 and 4, represents suitable habitat for this species. The little pied bat was also detected during the dry season at Sites 4 and 5 (characterised by open woodland with a grassy understorey and *Melaleuca* riparian fringe).

Arboreal mammals encountered within the Eden Bann Weir and Rookwood Weir study areas include the common brushtail possum (*Trichosurus vulpecula*) (Figure 8-10), greater glider (*Petauroides volans*) and squirrel glider (*Petaurus norfolcensis*). While no koalas were observed during the survey program, scats belonging to the species were recorded at a number of sites within the Eden Bann Weir and Rookwood Weir study areas. Although fragmented, the open eucalypt woodland along the riparian fringe and adjacent floodplain at these sites represents suitable koala habitat. Koalas have been previously recorded in the study area.

Within the Rookwood Weir study area, macropods were represented by five species: the agile wallaby (*Macropus agilis*), whiptail wallaby (*Macropus parryi*), eastern grey kangaroo (*Macropus giganteus*), euro (*Macropus robustus*) (Figure 8-10), and swamp wallaby (*Wallabia bicolor*). The whiptail wallaby was also recorded at Eden Bann Weir.

The water rat (*Hydromys chrysogaster*), delicate mouse (*Pseudomys deliculatus*) and fawn-footed melomys (*Melomys cervinipes*) were the only native rodents recorded. Other ground dwelling animals observed included the northern brown bandicoot (*Isoodon macrourus*) (Figure 8-10) and echidna. These species were encountered in open woodland habitats with grass understorey at several sites within the Eden Bann Weir and Rookwood Weir study areas. Rufous bettong (*Aepyprymnus furescens*) was also observed within the Rookwood Weir study area (Figure 8-10). Indirect evidence of these species in the form of dirt diggings and scats was abundant within both the Eden Bann Weir and Rookwood Weir study areas.

Figure 8-10 Mammal species within Project study areas

(a) Common brushtail possum

(b) Euro

(c) Northern brown bandicoot

(d) Rufous bettong

8.2.2.4 Reptiles

A total of 20 terrestrial reptile species were detected in the wet and dry season surveys at Eden Bann Weir and 22 terrestrial reptile species were recorded at Rookwood Weir. No conservation significant terrestrial reptile species were detected.

Reptile diversity was greatest during the wet season with 18 species recorded within the Eden Bann Weir study area and 17 species recorded within the Rookwood Weir study area. Only 10 species were recorded during the dry season surveys at Eden Bann Weir and 13 at Rookwood Weir. The higher diversity of reptiles observed during the wet season was expected due to the positive relationship that exists between environmental temperature and reptile activity level.

A likelihood of occurrence assessment for conservation significant reptile species identified through desktop assessments is provided in Table 8-11.

No conservation significant reptile species were confirmed present during field surveys. The brigalow scaly-foot was identified as having a high potential to occur in the Eden Bann Weir Project area based on a desktop assessment and has been previously recorded (Queensland Museum database) 5 km upstream of the limit of the impoundment along Marlborough Creek (associated with Eden Bann Weir). At this location (outside of the impoundment) mapped Essential Habitat for the species occurs. This species inhabits an array of woodland communities on varying substrates and may occur in less disturbed habitats (land not under agricultural production).

Brigalow-scaly foot is represented in the Queensland Brigalow Belt Reptile Recovery Plan (Richardson 2006). The plan identifies a number of threats to reptiles of the Brigalow Belt, including the following that are relevant impoundment associated with the Project:

- Loss of habitat due to clearing and thinning
- Hydrological changes
- Removal of woody debris and rocks

The plan recommends a halt to clearing and fragmentation in the vicinity of significant populations or the presence of key habitat.

Species encountered within the Eden Bann Weir and Rookwood Weir study areas included Martin's skink (*Eulamprus martini*), wall skink (*Cryptoblepharus virgatus*) (Figure 8-11), Bynoe's gecko (*Heteronotia binoei*), bearded dragon (*Pogona barbata*), eastern water dragon (*Physignathus lesueurii*), coastal carpet python (*Morelia spilota mcdowelli*) and black-headed python (*Aspidites melanocephalus*) (Figure 8-12).

Table 8-11 Conservation significant reptiles – likelihood of occurrence assessment

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Reptiles							
Paradelma orientalis	Brigalow scaly-foot		V	Eden Bann - QLD Museum Rookwood - no previous record	This lizard occurs in open forest habitats including remnant Brigalow (*Acacia harpophylla*) woodland with sparse tussock grasses on grey cracking clay soils; eucalypt open forest on loose sandy clay substrate; and in *Allocasuarina luehamannii* closed forest on a similar substrate. Specimens are often found sheltering under sandstone slabs, surface debris or in grass hummocks (DEWHA 2009f).	Potential to occur in open forest and woodland throughout the study area. Previous record was located approximately 5 km upstream of the existing Eden Bann Weir impoundment along Marlborough Creek.	High
Delma torquata	Collared delma	V	V	No previous recording	This species normally inhabits eucalypt dominated woodland and open forest where it is associated with suitable micro-habitats (exposed rocky outcrops) (DSEWPaC 2012c).	Suitable habitat occurs in woodland however the species has not previously been recorded and was not recorded during surveys.	Moderate
Denisonia maculata	Ornamental snake	V	V	No previous records	Known only from the Brigalow Belt region within the drainage system of the Fitzroy and Dawson rivers. This nocturnal species occurs in Brigalow (*Acacia harpophylla*) woodland growing on clay and sandy soils, riverside woodland, and open forest growing on natural levees (DoE 2014).	Suitable habitat occurs in woodland and shrubland on deep cracking clay soils including REs 11.3.1. However the species has not previously been recorded and was not recorded during surveys.	Moderate
Egernia rugosa	Yakka skink	V	V	No previous records	This species is generally found in dry sclerophyll forest and open woodlands. It takes cover under fallen vegetation and timber (Cogger 2000). Log piles, burrows and rocky crevices are utilised by the species as communal refugia.	Suitable habitat and resources are present within the Project footprint. However, the species has not previously been recorded and was not recorded during surveys.	Moderate

Species name	Common name	EPBC Act status*	NC Act status*	Previous recordings^	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Furina dunmalli	Dunmall's snake	V	V	No previous records	This species occurs in Brigalow (*Acacia harpophylla*) forest and woodland growing on cracking black clay and clay loam soils. It is known from very few localities, most records are from sites between 200 and 500 m above sea level (DEWHA 2009e).	Suitable habitat occurs in open forest and woodland on deep cracking clay soils, e.g. REs 11.3.1 and 11.3.25. However the species has not previously been recorded and was not recorded during surveys.	Moderate

*CE= critically endangered, E = endangered, V = vulnerable, R = rare, NT = near threatened, SLC = special least concern.

^Previously recorded within search extents defined in text for Wildlife Online, Queensland Museum and Birds Australia Database searches.

Figure 8-11 Lizard species within Project study areas

(a) Wall skink

(b) Ocellated velvet gecko

Figure 8-12 Snake species within the Project study areas

(a) Black-headed python

(b) Red-naped snake

Other reptiles recorded at Eden Bann included *Carlia munda*, eastern striped skink (*Ctenotus robustus*), fire-tailed skink (*Morethia taeniopleura*), Tim Low's skink (*Menetia timlowi*), dubious gecko (*Gehyra dubia*), blind snake (*Ramphotyphlops ligatus*), red-naped snake (*Furina diadema*) (Figure 8-12) and Burton's legless lizard (*Lialis burtonis*).

Rainbow skinks from the genus *Carlia* were observed frequently within the Rookwood Weir study area in both the wet and dry season surveys. Less frequently encountered species included: eastern water skink (*Eulamprus quoyii*), copper-tailed skink (*Ctenotus taeniolatus*), *Morethia taeniopleura* and *Morethia boulengeri*. The oscellated velvet gecko (*Oedura monilis*) (Figure 8-11), dubious dtella (*Gehyra dubia*), *Gehyra catenata,* keelback (*Tropidonophis mairii*) and eastern brown snake (*Pseudonaja textilis*) were also observed.

Elapid and colubrid snakes were poorly represented. However, due to the presence of suitable habitat within the Eden Bann Weir and Rookwood Weir study areas, it is likely that a range of common snakes including the taipan (*Oxyuranus scutellatus*), yellow-faced whip snake (*Demansia psammophis*) and common tree snake (*Dendrelaphis calligastra*) occur. Goanna tracks were also commonly observed on the sand banks suggesting one or more species from the family Varanidae may occur.

Habitat suitable for a range of reptiles occurs within the Eden Bann Weir and Rookwood Weir study areas. Defoliating bark on mature trees (e.g. eucalypts, *Melaleucas* etc.) provides refuge for geckos and arboreal skinks. Open woodland with grassy understorey retains fallen timber, leaf litter and other natural ground-level structures that provide microhabitat for reptiles. Rocky hillsides support a range of reptiles including skinks, ground-dwelling geckos, dragons, elapid snakes and pythons.

8.2.2.5 Amphibians

A total of 12 amphibian species were detected in the wet and dry season surveys in the Eden Bann Weir study area (11 recorded in wet season, three recorded in dry season) and 12 amphibian species were recorded in the Rookwood Weir study area. No conservation significant amphibian species were observed in either study area. Amphibians detected at both Eden Bann Weir and Rookwood Weir included the green tree frog (*Litoria caerulea*) (Figure 8-13), Peron's tree frog (*Litoria peronii*) and the spotted grass frog (*Limnodynastes tasmaniensis*).

Amphibians detected in the Eden Bann Weir study area include the eastern sedge frog (*Litoria fallax*) (Figure 8-13), desert tree frog (*Litoria rubella*), striped marsh frog (*Limnodynastes peronii*), spotted grass frog and New Holland frog (*Cyclorana novaehollandiae*). Amphibian diversity in the Rookwood Weir study area comprised tree frog species such as stony creek frog (*Litoria wilcoxi*), broad palmed frog (*Litoria latopalmata*), red tree frog (*Litoria rubella*), Roth's tree frog (*Litoria rothii*), Peter's frog (*Litoria inermis*) and the salmon-striped frog (*Limnodynastes salmini*) (Figure 8-13).

The ornate burrowing frog (*Platyplectrum ornatum*) and cane toad (*Rhinella marina*) were the most commonly encountered amphibian species in the wet season. Both species were detected at all survey sites. Only one species, the northern banjo frog (*Limnodynastes terraereginae*) (Figure 8-13) was encountered in the dry season but not in the wet season. As expected, amphibian diversity and abundance was notably higher in the warm, humid wet season compared to the cooler dry season. This trend is associated with frog activities levels and the availability of habitat resources.

Figure 8-13 Frog species within the Project study areas

(a) Green tree frog

(b) Eastern sedge frog

(c) Salmon-striped frog

(d) Northern banjo frog

Habitat suitable for common amphibian species occurs within the riparian zones and side tributaries within the Eden Bann Weir and Rookwood Weir study areas. Semi-permanent and ephemeral off-stream water bodies represent an important breeding resource for many amphibian species. Many of the treefrog species only breed in ephemeral waterbodies. A number of smaller fossorial frog species (such as those from the genera *Crinias* and *Pseudophrynes*) were not detected but are likely to occur due to presence of suitable habitat.

8.2.2.6 Back on Track Biodiversity Action Plan species

The former Department of Environment and Resource Management (DERM) in partnership with the Fitzroy Basin Association (FBA) has developed a 'Back on Track' Biodiversity Action Plan for the Fitzroy Natural Resource Management (NRM) Region (Biodiversity Action Plan) (DERM 2008). The purpose of the biodiversity is plan is to:

- Identify priority threatened species for the Fitzroy NRM region so that resources for conservation and management effort can be focussed and effective
- Provide a framework to direct management and research as well as a strategic approach to address threats to species recovery
- Raise awareness to a broader range of threatened species and threatened species issues
- Guide regional investment on biodiversity conservation and ensure progress towards the targets of the FBA Central Queensland Strategy for Sustainability: 2004 and Beyond Plan

- Achieve species recovery.

The action plan identifies species that are in decline at a "whole-of-Queensland" scale and have good potential for recovery. No terrestrial fauna species listed under the Biodiversity Action Plan were detected during the wet and dry season surveys. However, the ornamental snake (Section 8.2.2.4), yakka skink (Section 8.2.2.4) and the eastern long-eared bat (Section 8.2.2.3) have a moderate potential to occur in the Project footprint.

8.2.2.7 Introduced species

Based on the database search results and the wet and dry season field survey results, ten introduced fauna species occur, or are predicted to occur, within the study area (Table 8-12).

Table 8-12 Introduced terrestrial fauna species

Species	Observed / previously recorded*	Predicted to occur**	Probable abundance	Impact
Domestic cow (*Bos taurus)*	EB/RW		High	Erode soil and damage vegetation; pollute water; spread weeds
Wild dog *Canis familiaris)*	RW		Low	Predate on native mammals and birds; compete with native predators
Goat *(Capra hircus)*		EB/RW	Low	Damage vegetation; degrade land
Deer (*Cervus sp)*	RW		Low	Damage vegetation; degrade land
Feral cat (*Felis catus)*	EB/RW	EB/RW	Low	Compete with native predators; transmit disease to native fauna, domestic livestock and humans; prey on native fauna (mammals, birds and reptiles).
House mouse (*Mus musculus)*	EB/RW		Medium[#]	Compete with native rodents; transmit disease to native fauna and humans
European rabbit [#] (*Oryctolagus cuniculus)*	RW	EB/RW	Low	Damage vegetation; compete with native mammals
Cane toad *(Rhinella marinus)*	EB/RW		High	Compete with other insectivores; toxic to native mammals and birds; may transmit disease to native fauna; prey on tadpoles of native amphibians
Pig (*Sus scrofa*)	EB/RW	RW	High	Erode soil and damage vegetation; predate on native wildlife
Fox (*Vulpes vulpes)*	RW	EB/RW	Low	Predate on native mammals and birds; compete with native predators; transmit disease to domestic livestock and humans

*EB = Eden Bann Weir study area, RW = Rookwood Weir study area

**Based on the search results of the EPBC Protected Matters Search Tool

[#]This species is susceptible to rapid population increases and declines

8.3 Potential impacts and mitigation measures

8.3.1 Overview

Activities associated with raising Eden Bann Weir and constructing Rookwood Weir have the potential to cause a number of direct and indirect impacts on local terrestrial fauna. As the infrastructure already exists, potential impacts associated with raising Eden Bann Weir are likely to be lower in magnitude and significance than developing a greenfield site at Rookwood. It is anticipated that the following construction activities may have short-term (over the two dry season construction period) impacts upon local fauna and flora assemblages:

- Vehicle and plant movement to, from and around the construction site
- Removal of vegetation within the immediate construction footprint, storage / stockpiling areas and access tracks
- Storage of potentially hazardous materials
- Acquisition of materials (aggregate) for use in construction
- Flow diversion.

Following construction, filling of the impoundments also has the potential to impact local fauna and flora assemblages through the inundation of riparian vegetation.

Impacts associated with construction activities and impoundment may include:

- Individual fauna injury and mortality
- Disruption to behaviour of localised wildlife assemblages
- Loss of terrestrial habitat
- Increased predation and competition
- Degradation of habitats
- Encroachment of feral animal species.

During the operations phase of the Project, potential impacts may result from:

- Water capture and storage (impoundment)
- Releases of water captured and stored behind the weir to downstream reaches
- Vehicle movements associated with ongoing maintenance activities

Potential impacts are discussed below and mitigation measures described will inform the development of a species management program (SMP). The SMP will provide the working arrangements to minimise Project impacts on animal breeding places in accordance with the requirements of the NC Act. Pre-clearing surveys (as necessary and appropriate) will be undertaken to identify the location of breeding structures and habitats, such as ground hollows, nests, mounds and burrows, nests in tree hollows, constructed nests on branches, ant nests and hollow nests. The SMP will inform the construction EMP developed for the Project (Chapter 23).

8.3.2 Individual fauna injury and mortality

8.3.2.1 Potential impacts

Construction activities associated with the Project will involve a temporary increase in vehicular traffic and plant movement to, from and at the site, including traffic on existing and new access roads (Chapter 16 Transport). This has the potential to increase the incidence of wildlife and livestock mortality from vehicle strike. Fauna at particular risk of vehicle strike include the squatter pigeon, echidna and reptiles such as the black-headed python, carpet python and bearded dragon that commonly occur on tracks throughout the region.

Clearing to facilitate construction (including along access tracks) may result in direct mortality to individual animals residing in trees and other vegetation, and within ground cover, litter or debris to be cleared.

Fauna mortality may result from the drowning of less mobile animals during the initial filling (commissioning) of the impoundments. Native fauna in the Fitzroy, Mackenzie and Dawson rivers exist within a system in which flooding (often rapid and extensive) is a regular event and most animals are able to seek refuge above rising flood water and similarly it is expected that animals will move away from rising water within the impoundment. The inundation of terrestrial habitats above the full supply level of the existing Eden Bann Weir impoundment and the high water mark at Rookwood Weir is likely to result in the death of less-mobile animals that are unable to retreat from the rising water. Small terrestrial animals within the impoundments such as skinks, geckos, rodents and juvenile animals in nests or borrows, may be trapped by rising water and be injured or drowned.

Beyond the initial filling of the raised Eden Bann Weir and Rookwood Weir, regular draw-down and filling of the storage during operation is considered unlikely to result in significant fauna mortalities. Vegetation is expected to re-establish on riverbanks at the full supply levels and loss of vegetation from within the impoundment (Section 8.3.4.2) will deter use of the impoundment for foraging and breeding by terrestrial fauna species. The water levels within the existing Eden Bann Weir impoundment already fluctuate due to seasonal variations in inflows and managed water extraction and this cycle will continue and is unlikely to have a notable long-term impact on terrestrial faunal assemblages upstream. Water levels within the Fitzroy, Mackenzie and Dawson rivers associated with the Rookwood Weir fluctuate annually in their natural state (high flows and flood to no or very low flow) and it is unlikely that the operation of the weir will have a notable long-term impact on upstream terrestrial fauna.

During operations, as draw-down occurs, livestock have the potential to become bogged within areas along the edge of the impoundment. This is discussed further in Chapter 18 Social impact.

Operational releases downstream will be made within the river channel and injury and mortality of terrestrial fauna and livestock are not expected.

Vehicle movements during operation are not anticipated to be more than a few times a week and as such operational impacts on fauna and livestock due to vehicle strike are considered negligible.

8.3.2.2 Mitigation measures

These impacts will be mitigated by:

- Enforcing on-site speed limits to restrict the incidence of vehicle strike

- Minimise the need to travel near dawn or dusk by adhering to standard daytime work hours, limit haulage and delivery of materials to the day time and/or minimise the number of vehicles travelling during this period through the use of buses to transport construction personnel
- Educating employees regarding the presence of the EPBC Act and NC Act listed squatter pigeon and other fauna and livestock on access roads
- Erecting temporary fencing to exclude mobile animals such as macropods, echidnas and livestock from the construction areas
- Checking of trenches, excavations and machinery daily for the presence of reptiles
- Fauna spotter catchers present prior to and during clearing activities associated with construction to implement the SMP, including assisting wildlife to disperse into adjacent habitat.
- If injuries occur, the fauna spotter catcher will capture and transport the injured animal to a qualified veterinarian for treatment or euthanasia (unless suitably-qualified). Prior to clearing for construction, formalise arrangements with local veterinary services to treat and care for injured animals
- Clearly demarcating no-go areas of sensitive vegetation and habitat, including all vegetation and habitat not to be cleared
- Sequential clearing of vegetation to allow resident fauna the opportunity to disperse away from the immediate construction area
- Providing notification to landholders regarding construction activities and negotiate requirements to move livestock
- Establish stock fencing, gates and cattle grids on the new permanent access road as applicable and agreed with the landholder for construction and operations phases
- Providing notification to landholders regarding operational releases to the downstream environment (Chapter 18 Social impact).

8.3.3 Disruption to behaviour of localised wildlife assemblages

8.3.3.1 Potential impacts

Construction activities will cause a temporary localised and intermittent increase in light, noise and vibration adjacent to construction sites. This has the potential to cause short-term disruption to the behaviour and activities of nearby wildlife. There are no noteworthy terrestrial fauna communal nesting, breeding, roosting or foraging resources directly adjacent to the construction footprints. Nevertheless, construction activities have the potential to deter terrestrial wildlife from foraging, drinking or nesting within the vicinity of construction activities. Operational noise impacts are limited to maintenance activities and vehicles accessing the sites and are considered negligible.

Project impacts in relation to noise and vibration on terrestrial fauna and livestock are discussed in Chapter 14 Noise and vibration.

Construction activities may require works to be undertaken at night. In the event that lighting is required to facilitate night works (for example concrete pour operations), there is potential for light pollution to disrupt nocturnal fauna behaviour. During operations, lighting at the weirs is limited to

directional sensor activated lighting for safety and security purposes and night works during emergency situations. It is not expected that operational lighting will impact on terrestrial fauna.

8.3.3.2 Mitigation measures

Proposed mitigation during the construction phase to minimise the impacts of noise, light and vibration disturbance include:

- Service and maintain all plant and equipment to minimise machinery noise as much as possible
- Prior to blasting, landholders will be notified and provided the opportunity to move cattle away from the area
- Night works will be restricted as far as is possible during the construction phase.
- During operations scheduled maintenance will be undertaken during day light hours
- Directional lighting and shields will be installed (construction and operation) to minimise light spill outside of the immediate work areas having consideration for health and safety requirements.

8.3.4 Loss of terrestrial habitat due to clearing

8.3.4.1 Potential impacts

Conservatively, in the order of 78.5 ha of fauna habitat (excluding agricultural land) will be cleared for construction activities associated with all Project areas as detailed in Table 8-13. For the most part, habitats with moderate relative ecological values will be impacted by clearing (open woodland with a grassy understorey and Melaleuca riparian fringe and the narrow riparian fringe) although some high value open woodland on rocky hillside near Eden Bann Weir will be impacted.

Most terrestrial fauna are mobile and able to escape to surrounding habitat. Clearing of vegetation is considered negligible (0.4 per cent of habitat available within the 500 m survey boundary) and unlikely to constitute a substantial impact on local faunal assemblages which are adapted to a fragmented landscape. It is not expected that direct clearing undertaken in accordance with appropriate mitigation and management (Section 8.3.4.2, Chapter 23 EMP) will result in long-term impacts on fauna habitat and will not result in the decline of fauna species at a local, regional or state wide level.

Table 8-13 Habitat types lost to clearing for construction

Habitat type	Weir construction areas (ha)		River crossings (ha)				Eden Bann Weir access road (ha)	Total (ha)	% loss*
	Eden Bann	Rookwood	Glenroy	Riverslea	Foleyvale	Hanrahan			
Open woodland with grassy understorey and *Melaleuca* riparian fringe	24	-	1	-	3	0.5	-	28.5	0.3
Open woodland on a rocky hillside	19	-	-	-	-	-	3	22	1
Open woodland with sandy substrate	4	-	-	-	-	1	-	5	0.4
Narrow riparian fringe	-	19	2	2	-	0.02	-	23.02	0.2
Agricultural land	-	-	-	-	-	-	7	7	5
Total	47	19	3	2	3	1.52	10	85.52	0.4

*Per cent loss based on available habitat within 500 m survey buffer.

8.3.4.2 Mitigation measures

Design of weir construction footprints (storage / stockpile areas and access roads) and river crossing construction areas has minimised the amount of habitat to be cleared as far as possible by locating infrastructure and work areas within existing cleared or non-remnant vegetation and making use of existing roads and tracks and co-locating new access along utility easements. Some clearing is unavoidable and, to mitigate the loss of habitat resultant from construction activities, the following measures will be implemented:

- Undertake a pre-clearing survey to inform the SMP (Section 8.3.1)
- All vegetation that is not to be cleared should be easily identifiable through demarcation, fencing and/or signage
- Habitat features such as hollows and log piles will as far as practicable be salvaged and placed in nearby habitat areas.
- Where practicable, revegetation activities will be commenced in and adjacent to construction areas as soon as possible after the completion of construction.

8.3.5 Loss of terrestrial habitat due to impoundment

8.3.5.1 Overview

Raising Eden Bann Weir and construction of Rookwood Weir will result in the impoundment of terrestrial vegetation within the riparian zone, both along the main Fitzroy River channel, and in the lower reaches of tributaries and adjoining creeks. Impoundment of riparian vegetation will result in the loss and alteration of potential fauna habitat as detailed in Table 8-14.

Vegetation within the impoundment will not be cleared prior to impoundment. Consequently total habitat loss within the impoundments will occur over a prolonged period as the weirs fill and are drawn down annually. On first filling, it is anticipated that an immediate loss of ground cover vegetation within the impoundment will occur. Larger and woody vegetation such as trees will remain for a period of time before dieback occurs. Given that water levels in the impoundment will rise and fall with filling and drawdown (as already occurs within the existing Eden Bann Weir impoundment), habitat loss at the limits of the impoundment will occur more gradually, in response to intermittent inundation.

An assessment of the implications of raising Eden Bann Weir and constructing Rookwood Weir on native vegetation undertaken by Nangura (2007) concluded that potential impacts on fringing vegetation will be greatest in the lower quarter of the impoundment (closest to the weir walls where the deepest ponding will occur). Upstream of the confluence of the Dawson and Mackenzie rivers, the impoundments will be shallower and direct impacts on vegetation from inundation will likely be confined to in-stream habitats (sand banks) (Nangura 2007).

Riparian vegetation in the lower sections of the Eden Bann Weir impoundment are characterised by eucalypt woodland, compared to fringing / overhanging *Melaleucas* in upper sections. Raising Eden Bann Weir and subsequently increasing the impounded area is expected to drown out eucalypts in the lower reaches and despite their tolerance for temporary inundation, fringing *Melaleucas* under extended periods of inundation will be eventually drowned and lost. The spatial extent of the loss will be related to topography and channel morphology. Riparian vegetation loss is likely to occur over a narrower spatial extent where the banks are steep compared with lower relief banks.

Table 8-14 Habitat types lost to impoundment

Habitat type	Relative ecological value	Eden Bann Weir impoundment		Rookwood Weir impoundment		Total (ha)	% loss**
		Stage 2 (ha)	Stage 3 (ha)*	Stage 1 (ha)	Stage 2 (ha)*		
Open woodland with grassy understorey and *Melaleuca* riparian fringe	Moderate	255	153	441	472	1,321	14
Open woodland with weedy understorey and *Melaleuca* riparian fringe	Moderate	1	1	-	-	2	7
Open woodland on a rocky hillside	High	22	82	32	12	148	7
Open woodland with sandy substrate	Moderate	24	41	83	34	182	13
Brigalow	High	-	-	54	17	71	16
Melaleuca forest	Moderate	0.5	1	-	-	1.5	8
Melaleuca forest with sandy substrate	High	2	4	-	-	6	23
Narrow riparian fringe	Moderate	284	206	598	394	1,482	15
Agricultural land	Low	7	1	-	-	8	5

*Eden Bann Weir Stage 3 and Rookwood Weir Stage 2 impoundment impacts are presented incrementally that is the hectares lost for Stage 3 and Stage 2, respectively, are in addition to those impacted during Stage 2 and Stage 1, respectively.

**Per cent loss based on available habitat within 500 m survey buffer.

At the Rookwood Weir site, sand banks and islands within and adjacent to the river will be lost within the impoundment extent. Creeks within the impoundment extent will be altered as a result of widening, deepening, and inundation of marginal riparian habitats, particularly in the lower reaches.

As provided in Table 8-14, at the upper limits of development, habitat types with predominantly (93 per cent) moderate relative ecological value will be impacted by impoundments. These habitat types are widespread and persist beyond the impoundments. Habitats with high relative ecological value comprise seven per cent of habitat loss associated with impoundments at the upper limits of development. Agricultural land with low ecological value accounts for less than half a per cent of the habitat impacted by impoundments.

The impacts associated with the loss / alteration of terrestrial habitat on fauna species are discussed below.

8.3.5.2 Potential impacts on birds

Bird diversity in the Project footprint is concentrated around riparian vegetation and woodland (alluvial plain and rocky hillside) habitat. Waterbirds are prevalent within the existing Eden Bann Weir impoundment, as well as within shallow water habitats associated with river margins, creeks and billabongs.

Potential impacts on birds associated with habitat loss and / or alteration within the Project footprint may include:

- Loss of mature trees over time (months to years) in the riparian zone that provide foraging, roosting and nesting resources for a range of woodland and forest birds
- Short-term reduction in dense, low growing (<4 m) riparian vegetation along the main river channels and creeks that provide habitat for small woodland and forest birds
- Short-term loss of overhanging vegetation that provides perching habitat for kingfishers, cormorants and raptors. The loss of this overhanging vegetation also reduces suitable nesting habitat for birds including cormorants and egrets
- Short-term loss of existing marginal and emergent vegetation in shallow water aquatic habitats utilised by waterbirds such as crakes, rails, ducks, egrets, herons and storks
- Inundation of sand banks and other features which may support waterbird nesting

In the short-term, more cryptic species that inhabit dense riparian vegetation may become less prevalent. It is important to note that as the riparian zone is already disturbed through clearing, weed infestation and cattle grazing in many parts of the Project footprint, dense native understorey vegetation supporting large communities of small, cryptic forest birds were not observed to be present. The increased water level associated with raising Eden Bann Weir and the weir at Rookwood is therefore unlikely to impact notably on such birds.

Positively, waterbirds may benefit from the larger and more permanent water body created by the impoundments. The creation of more slow-flowing deep water habitat is likely to benefit ducks, pelicans, geese and pygmy-geese. Although inundation of existing emergent and marginal vegetation may have short-term impacts on wading birds and cryptic species, it is likely to serve medium- to long-term benefits in the creation of more linear habitat that is likely to be recolonised by emergent and marginal vegetation. The permanency of water in the impoundment and lower reaches of adjoining creeks flowing into it is likely to foster greater habitat utilisation by waterbirds. The potential loss of nesting and perching sites for cormorants and darters may result in a spatial

shift (i.e. upstream) for nesting, although it is likely that overhanging vegetation will still be present in downstream reaches of the impoundments.

For the most part, impacts are considered to be short-term and bird populations have the ability to move between areas of suitable habitat returning once vegetation has re-established above the impoundment.

Potential impacts on conservation significant species may differ from those on generalist / common species. Conservation significant birds that have a high potential (known or likely) to occur within the Project footprint include:

- Black-necked stork

  This species was observed during field surveys upstream of the existing Eden Bann Weir impoundment and upstream of the proposed Rookwood Weir site between Riverslea and the Mackenzie-Dawson confluence. The foraging habitat requirements of this species are such that the provision of more permanent water bodies (shallow pools and billabongs) that are likely to result from impoundment of low lying riparian areas adjacent to the Fitzroy River and adjoining creeks may benefit the species. Large trees in the riparian zone which may act as potential nesting habitat will be lost over time. This is considered to be of little consequence as large trees adjacent to the river will still be prevalent throughout the Project footprint.

- Squatter pigeon (southern)

  This species was observed in woodland habitats boasting a grassy understorey at a number of locations in the Project footprint and in the wider study area and appears to be relatively common. Impoundment of riparian woodland habitat may diminish the area of habitat available to this species in the short-term. However, suitable habitat for this species will persist in large fragments on low rocky hills and uncleared alluvial plains. Access to water is an important determinant of habitat utilisation for this species and the creation of new permanent water bodies will benefit this species. It is unlikely that small, localised losses of habitat along the largely disturbed riparian fringe will adversely impact the regional viability of this species.

- Black-chinned honeyeater

  The black-chinned honeyeater inhabits a variety of dry woodland habitats, often along watercourses. This species was recorded in open eucalypt woodland habitat growing on low rocky hills. Eucalypt woodlands, such as those present on the upper slopes of hilly terrain in the Project area, are known preferred habitat for this species. While suitable habitat is present within the Project area it occurs in fragmented patches within the upper reaches of the impoundment areas. Given the variety of woodland habitat used by the species it is considered unlikely that the loss of habitat estimated as a result of impoundment will detrimentally impact upon the viability of the black-chinned honeyeater population in the study area.

- Cotton pygmy-goose

  The species has been recorded in the Eden Bann Weir study area and was observed in off-stream billabong habitats during field surveys in the Rookwood Weir study area. Increasing the extent of impoundments may have short-term impacts on the species, by drowning foraging habitat (aquatic vegetation). Suitable foraging and breeding habitat for the cotton pygmy-goose occurs throughout the study area in the backwaters, billabongs and well vegetated margins of the river and its tributaries However the species is unlikely to be

adversely impacted in the medium to long-term by the impoundments area and will likely benefit from the creation of more habitat as this species is known to utilise dams and standing dead hollow-bearing trees close to water for roosting and breeding.

- Powerful owl

  Although not detected during the wet and dry season surveys in the Project footprint areas, this species has previously been recorded within the study area (BAAM 2008a). The preferred habitat of the powerful owl includes forests and woodlands with a high abundance of large trees. As the powerful owl has a large home range, the Project footprint may be visited by birds that occur within the wider study area. The loss of large trees in the Project footprint may incur a minor disturbance to habitat utilisation however it is unlikely that this disturbance will be sufficient to cause a localised decline in this species (Section 8.3.9.3).

- Square tailed kite

  Although not detected during the wet and dry season surveys in the Project footprint, this species has previously been recorded within the study area (Wildnet). This species nests independently in mature trees along watercourses, and has been known to range into open, treeless regions, but not extensively (DEH 2014). The square tailed kite, a migratory bird, has a large home range and as such the impacts resultant from the Project impoundments are unlikely to affect the ability of this species (if present) to access resources necessary for survival. Foraging resources, namely small passerine birds, are unlikely to decline in availability as a result of the Project. A minor reduction in potential nesting habitat may occur in the long-term due to die-off of inundated trees in the riparian zone.

- Listed migratory species

  A number of EBPC Act listed migratory species were identified through desktop assessments and field surveys as either occurring or having the potential to occur within the study area. No recognised critical breeding or feeding aggregations of such EPBC Act listed species are known to occur within the study area. The creation of more permanent aquatic and semi-aquatic habitat is likely to benefit marine and migratory birds that utilise freshwater bodies for foraging and other important behaviours. While impoundments associated with Eden Bann Weir and Rookwood Weir may have localised and generally short-term impacts on the availability of habitat for some of these species, it is unlikely that the increased impoundment extents will have a detrimental impact on the viability of the populations of these species (Volume 2, Chapter 11 Migratory and marine species).

8.3.5.3 Potential impacts on mammals

Loss of vegetation will reduce the local availability of resources for terrestrial mammals. Mature trees, particularly *Melaleuca spp.*, *Eucalyptus spp.* and *Corymbia spp.*, provide shelter and foraging resources for arboreal mammals and bats, while localised microhabitats on the ground provide resources for ground-dwelling mammals. It is possible that increased competition for diminished resources may arise, particularly in fragmented, narrow riparian habitat strips abutted by agricultural land.

Potential impacts on mammals within the Project footprints as a result of habitat loss and / or alteration may include:

- Loss or reduction of foraging, breeding and shelter resources for ground-dwelling mammals

- Loss or reduction of shelter habitat for arboreal mammals reliant on tree hollows and shedding bark
- Loss or reduction of food resources, such as leaves, nectar, pollen, fruit, sap and invertebrates, for arboreal mammals.

The predicted proportional impoundment of remnant vegetation within a 1 km buffer of the Project footprint is 15 per cent (10 per cent within a 2 km buffer of the river). At the landscape scale, the significance of localised increases in competition for resources resultant from this proportionally small loss / alteration of habitat on common native mammals (macropods, native rodents, possums, gliders, flying foxes and microchiropteran bats) are considered, without mitigation, to be of medium significance. Suitable habitat for these species is present throughout the wider study area, with large tracts of land to the north and west of the Project footprints mapped as State significant habitat remnants.

Potential impacts on conservation significant mammal species may differ from those on generalist / common species. Conservation significant mammals with a high potential to occur in the Project footprint include:

- Little pied bat

  Shelter habitat for these microchiropteran bats species such as caves and cliffs would not be impacted by the impoundments associated with Eden Bann Weir or Rookwood Weir. Loss of hollow-bearing trees may reduce available roost habitat for the little pied bat. While mature trees will be inundated and lost, the hollows within these trees will remain available for utilisation by bats in the short- to medium-term. It is considered unlikely that the Project will adversely impact these species. The increased extent of permanent slow flowing water bodies adjacent to floodplain and rocky hillside woodlands may provide important foraging resources for these species, by supporting increased invertebrate assemblages.

- Koala

  While no koalas were observed during the survey program, fresh koala scats were collected within the Project footprint areas. Although fragmented, the open eucalypt woodland along the riparian fringe and adjacent floodplain within the Project footprint areas represents potentially suitable koala habitat. Koalas have been previously recorded within the broader Project area (Wildlife Online database). Impoundments may result in a localised reduction in the availability of potential habitat. However, a high proportion of potential koala habitat will remain in the landscape (Section 8.3.9.2).

- Echidna

  The species (or evidence of) was observed during field assessments at several locations throughout the Project footprint areas. The echidna is a habitat generalist, occurring in most areas that support ants and / or termites. As this species has no specialised habitat requirements, the entire Project footprint represents potential echidna habitat. Inundation of terrestrial habitats in the riparian zone of the lower Dawson, lower Mackenzie and Fitzroy rivers is unlikely to have an adverse impact on the long-term survival of the species given its adaptive nature and the proportion of suitable habitat remaining for this species adjacent to the impoundments and in the wider landscape.

8.3.5.4 Potential impacts on reptiles

Potential impacts on terrestrial reptiles within the Project footprint include:

- A reduction in availability of habitats supporting a structurally complex ground layer, that is inundation of riparian habitats supporting fallen timber, log piles, leaf litter and burrowing / cracking soils
- A temporary reduction in overhanging vegetation that comprises important habitat for the common and disturbance tolerant eastern water dragon (*Physignathus lesueurii*)
- Loss of niches, particularly for threatened species.

Terrestrial reptile species (common skinks, legless lizards, geckos, dragons and snakes) identified during background reviews and encountered during field surveys in the Project footprint are generalist species that are widespread and relatively abundant in the study area and the wider central Queensland region. Suitable habitat although disturbed and fragmented in places is prevalent at Eden Bann Weir and Rookwood Weir and considered likely to support viable assemblages of common terrestrial reptiles. In particular, suitable habitat is likely to persist in tracts of land mapped as regional and state significant habitat remnants (Section 8.2.1). These areas occur to the west of Gogango Creek, immediately north of the Dawson / Mackenzie confluence and along the lower reaches of the Dawson River. A large habitat remnant occurs approximately 10 km west of the Dawson / Mackenzie confluence (Duaringa State Forest). Impoundments associated with Eden Bann Weir and Rookwood Weir are unlikely to adversely affect regional population viability of these common species.

The loss of high relative ecological value habitat associated with *Melaleuca* on a sandy substrate (in the order of 23 per cent of available habitat within a 500 m survey boundary (Table 8-14)) impacts primarily on aquatic species, namely turtle and crocodile species addressed in Chapter 7 Aquatic fauna.

Brigalow scaly-foot is assessed as having a high potential to occur within the vicinity of the Eden Bann Weir impoundment area based on historic records and availability of a range of potentially suitable habitat (eucalypt open forests (open woodlands) habitat), although none were recorded during wet and dry season field surveys. Essential habitat for the Brigalow scaly-foot occurs outside of the Eden Bann Weir impoundment area on land adjacent to the upstream extents of Marlborough Creek. This species is however unlikely to occur in seasonally inundated areas within the bed and banks of the river comprising the inundated Project footprint.

8.3.5.5 Mitigation measures

Loss of some terrestrial fauna habitat is an unavoidable impact associated with impoundment and mitigation opportunities are limited. Important habitat features such as hollow bearing trees, timber that will become in-stream snag and perch material will be retained.

8.3.6 Fragmentation of riparian habitat

8.3.6.1 Potential impacts

Much of the landscape surrounding the Project footprint has been cleared, predominantly for agriculture. This is particularly the case on lowland alluvial floodplains, where cattle grazing on cleared pasture is the dominant land use. Vegetation in these otherwise cleared or fragmented landscapes tends to be concentrated along the riparian fringe of the Fitzroy, Dawson and

Mackenzie rivers and adjoining creeks. Extensive open woodland communities on low rocky hills and less disturbed floodplains represent important habitat nodes within the disturbed landscape matrix. Large tracts of land to the north and west of the Project footprint are mapped as state significant habitat remnants. These large, relatively in-tact habitats are also likely to act as a source for fauna dispersal across the landscape. Fauna dispersal across the fragmented landscape is likely to be facilitated, at least in part, by vegetation corridors adjacent to the Fitzroy, Dawson and Mackenzie rivers and adjoining creeks.

The impoundment of riparian vegetation resultant from the Project has the potential to disrupt connectivity between habitats, thereby further fragmenting habitats within the Project footprint (and the wider study area). This is likely to be most prevalent in the lower reaches of the impoundment, where the raised water level will inundate riparian bankside vegetation (as opposed to in-stream vegetation only in the upper reaches of the impoundment). This reduction in connectivity along the riparian zone is likely to be most notable where only a thin strip of fringing riparian vegetation, abutted by cleared agricultural land, occurs. The inundation and drowning of this vegetation will disrupt the corridor along which fauna can move between more extensively vegetated habitats. This is likely to be of particular consequence to more mobile species that undertake occasional to frequent foraging, reproductive and / or dispersal movements, and / or species that may become more exposed to predation due to reduced habitat connectivity. Further, climate-driven changes (such as extreme weather events) (Chapter 4 Climate, natural hazards and climate change) have the potential to exacerbate existing and Project impacts on biodiversity and ecosystems.

The widening of the river, and the reduced occurrence of shallow water and seasonally dry riverine habitats will also reduce the ability of terrestrial fauna (namely mammals and reptiles) to move back and forth across the river.

The potential impacts of reduced connectivity and subsequent habitat fragmentation on common terrestrial fauna (namely reptiles, small ground-dwelling and arboreal mammals and birds) and species of conservation significance (such as koala, squatter pigeon (southern), black-chinned honeyeater, and powerful owl) may include:

- Greater competition (intraspecific and interspecific) for resources in increasingly isolated habitat patches in an already fragmented landscape
- Increased habitat degradation due to concentration of animals in isolated patches
- Dominance of isolated habitat patches by competitive, generalist species (plants and animals)
- Increased exposure to predation for animals that are forced to move across disturbed, open landscapes
- Greater magnitude of impact of environmental changes (fire, drought, disease etc.) when animals are unable to move between habitat patches due to hostile surrounding landuse (unsuitable resources, greater risk of predation).

While the impoundments have the potential to disrupt terrestrial fauna movement corridors, bioregional corridors of local, regional and state significance, will still prevail directly adjacent to the high water level of the impoundment. This is particularly notable immediately upstream of Eden Bann Weir on the northern bank and near Princhester and Marlborough creeks. It is also notable in the upper reaches of the Rookwood Weir impoundment, namely along the northern bank of the upper Fitzroy River, the eastern bank of the lower Mackenzie River, and the lower Dawson River. As the impoundment is more extensive in the lower reaches, the persistence of

these mapped corridors is important. Furthermore, large tracts of state significant bioregional corridor are mapped as occurring in the regional landscape, to the northeast, north and west (Goodedulla National Park and Duaringa State Forest) of the Project footprint. This is considered to be advantageous to more mobile species, particularly birds.

The Fitzroy, Mackenzie and Dawson rivers are dynamic systems with flows either in flood or receded to isolated pools seasonally. While impoundment will widen the river (particularly directly behind the weir wall), drawdown will facilitate reduced flows upstream and creation of isolated pools as is displayed in the natural system. Movement of fauna between banks is thus maintained during these periods. More mobile species may opportunistically utilise weir and/or bridge infrastructure.

8.3.6.2 Mitigation measures

Fragmentation of some riparian habitat is an unavoidable impact associated with impoundment and mitigation opportunities are limited.

8.3.7 Degradation of habitat

8.3.7.1 Potential impacts

Based on field observations, the largest contributors to habitat degradation within the Eden Bann Weir and Rookwood Weir study areas are historic land clearing associated with agriculture, livestock (within the riparian zone and in shallow water areas), feral animals (Section 8.3.8) and weeds. Construction activities have the potential to introduce and / or spread weeds, which can increase the edge effects associated with vegetation clearing. Generally, the landscape surrounding the site of Eden Bann Weir and Rookwood Weir is highly fragmented, and as such, isolated patches of vegetation are presently exposed to these processes. Earthworks and increased vehicle movements associated with construction activities at the weir site have the potential to exacerbate local levels of weed infestation.

Vegetation clearing and earthworks, including the sourcing of aggregate from excavations or river bed deposits, associated with construction activities may result in point-source pollution from erosion, sedimentation, run-off and dust emissions. These impacts may have a localised adverse effect on local wildlife by reducing the quality of habitats (amount of refuges, microhabitats and food availability), smothering native vegetation with sediment, and increasing turbidity. This can lead to indirect secondary habitat degradation through weed infestation (terrestrial) and reduced water quality (aquatic).

The inundation of riparian vegetation and the disruption to terrestrial habitats bordering the new high water level of the impoundments may also foster habitat degradation. This degradation may result from:

- Edge effects occurring in newly fragmented riparian habitat
- Isolation of remnant vegetation patches, allowing for domination by generalist and invasive plants and animals
- Increased competition for resources in riparian vegetation habitats due to a reduction in the overall extent of this habitat.

Adverse impacts associated with edge effects include:

- Increased penetration of light and wind into habitat patch, potentially altering vegetation communities
- Alteration to microclimate
- Increased invasion of exotic plants and animals
- Increased sensitivity to fire
- The impacts of increased habitat degradation in the Project footprint are likely to be applicable to both common and conservation significant species.

Releases of water from Eden Bann Weir and Rookwood Weir will be made in accordance with environmental flow objectives, defined in a Resource Operations Plan. Environmental flow objectives will be established to maintain base flow and first wet season flow, among other flow characteristics. The objectives will be set in accordance with the *Water Resource (Fitzroy Basin) Plan 2011*, and in consultation with the Department of Environment and Heritage Protection. It is considered that releases from Eden Bann Weir and Rookwood Weir will have no adverse effect on the downstream riparian habitat.

Off-stream habitats are ephemeral in nature and, in the existing environment, may be inundated by seasonal flows. Off-stream habitats adjacent to the impoundments may be more readily inundated during seasonal flows, and remain inundated for longer periods (Chapter 9 Surface water resources). It is not considered that this change will negatively impact the value of these habitats. Off-stream habitats downstream of Eden Bann Weir and Rookwood Weir are not expected to be adversely impacted due to the maintenance of seasonal flows, in accordance with the Resource Operations Plan (Chapter 7 Aquatic ecology, Chapter 9 Surface water resources).

8.3.7.2 Mitigation measures

To minimise habitat degradation, the following mitigation measures will be implemented:

- Prepare a Weed Management Plan that outlines practices to prevent the introduction of new weeds and minimise the spread of declared weeds
- Manage pest species in coordination with adjacent landholders and catchment management groups. Identification and management of pest species will be undertaken in accordance with the plans and strategies set out by Biosecurity Queensland (Department of Agricultural, Fisheries and Forestry). As such, identification and management of declared pests will be undertaken accordance with the *Land Protection (Pest and Stock Route Management) Act 2002 and Plant Protection Act 1989*. Likewise, management of declared local pests will be undertaken in accordance with relevant local government strategies and plans, including the Rockhampton Regional Council Pest Management Plan 2012-2016 and the Central Highlands Regional Council Draft Area Pest Management Plan 2014-16
- Erosion and sediment control measures employed during construction will be consistent with the practices described in the International Erosion Control Association, Best Practice Erosion and Sediment Control Guideline and/or Queensland Division of the Australian Institute of Engineers' Erosion and Sediment Control: Engineering Guidelines for Queensland Construction Sites (Chapter 5 Land)
- The construction EMP will include a Dust Management Plan (Chapter 12 Air quality)
- Restrict speed limits and other traffic control mechanisms to minimise the generation of dust

- Rehabilitate disturbed ground surfaces as soon as is practicable to minimise exposed surface periods
- Suitably contain soil stockpiles, rubbish and waste materials on site until disposal
- Develop a Waste and Hazardous Materials Management Plan including fuel and chemical storage protocols and spill responses
- Retention of important habitat features (hollow bearing trees, timber that will become in-stream snag and perch material) – this includes no clearing of vegetation prior to filling of the impoundment as this inundated vegetation will provide important habitat features for some terrestrial fauna species.

Impacts and mitigation in relation to water quality are addressed in Chapter 11 Water quality.

8.3.8 Encroachment of feral animal species

8.3.8.1 Potential impacts

Construction activities may foster greater utilisation of the area by introduced fauna. The incorrect disposal of rubbish and other refuse may encourage competitive introduced species including pigs, dogs, foxes and cats to the area, which in turn may increase predation pressure on local native wildlife. These species may also out-compete resident native predators.

During operations the impoundments may provide a more permanent water source potentially attracting feral animals to resources in the area.

8.3.8.2 Mitigation measures

To reduce the likelihood of introduced animals becoming more prevalent within and adjacent to the construction footprints the following mitigation measures would be implemented:

- Prevention and management of pest animal species will be undertaken in accordance with the *Land Protection (Pest and Stock Route Management) Act 2002 and Public Health Act 2005.* Likewise, management of declared local pests will be undertaken in accordance with relevant local government strategies and plans, including the Rockhampton Regional Council Pest Management Plan 2012-2016 and the Central Highlands Regional Council Draft Area Pest Management Plan 2014-16
- All rubbish and other refuse that may potentially attract introduced animals (food scraps) should be appropriately disposed of in sturdy waste disposal receptacles that are frequently emptied
- No domestic animals should be allowed on the construction site.

8.3.9 Impacts on conservation significant terrestrial fauna

8.3.9.1 Overview

Further assessment has been undertaken where residual impacts on an endangered, vulnerable or near threatened species that have a high potential (known or likely) to occur in the Project footprint have been identified. The Queensland Government Significant Residual Impact Guideline (DSDIP 2014) has been adopted for the assessment of the significance of residual impacts on koala and powerful owl listed under the NC Act. The Commonwealth Matters of National Environmental Significance Significant impact guidelines 1.1 have been adopted for the

assessment of the significance of residual impacts on squatter pigeon as this species is listed as vulnerable under the EPBC Act and the NC Act.

8.3.9.2 Koala

While no koalas were observed during the survey program, fresh koala scats were collected within the Project footprint. Although fragmented, the open eucalypt woodland along the riparian fringe and adjacent floodplain within the Project footprint represents potentially suitable koala habitat. Koalas have been previously recorded within the broader Project area (Wildlife Online database). Evidence indicates that koalas occur in low densities within the Project area.

The Project may result in a localised reduction in the availability of potential habitat, where this habitat is lost to inundation. However, a high proportion of potential koala habitat associated with regional ecosystems (RE) 11.3.25 (72 per cent), RE 11.3.4 (92 per cent) and RE 11.3.3 (96 per cent) will remain in the landscape (calculated within 2 km of the impoundments) (Table 8-15).

Table 8-15 Koala habitat within the Project footprint

RE	Class	Description	Within Project footprint	Within 2 km of the Project footprint	Within the Fitzroy Basin catchment
11.3.25	Least concern	*Eucalyptus camaldulensis* or *E. tereticornis* open forest or woodland	1,311 ha	4,703 ha (72% remains)	109,576 ha (98.8% remains)
11.3.4	Of concern	*Eucalyptus tereticornis* woodland to open forest	31 ha	380 ha (92% remains)	109,013 ha (99.9% remains)
11.3.3	Of concern	*Eucalyptus coolabah* open woodland to woodland with a grassy understorey	202 ha	4,932 ha (95.9% remains)	49,567 ha (99.5% remains)

Construction activities at and adjacent to the Project site will involve a temporary increase in vehicular traffic and plant movement to, from and at the site. In addition to this, the clearing of a limited amount of vegetation to facilitate construction (including access and storage areas) may result in injury or direct mortality of koalas residing in areas to be cleared. Prior to any tree clearing, an experienced fauna spotter /catcher will assess the site to ensure fauna, including koalas, have been identified, dispersed and/or relocated in an acceptable manner prior to tree felling and before habitat is directly disturbed.

Impacts on koalas during construction will be further mitigated by:

- Enforcing on-site speed limits
- Educating employees regarding the potential presence of the koala
- Cleary demarcating no-go areas of highly sensitive vegetation, including all vegetation not to be cleared
- Sequential clearing of vegetation, to allow resident fauna the opportunity to disperse away from the immediate construction area.

These mitigation and management measures are incorporated into the EMP (Chapter 23).

Given the proportionally small amount of habitat to be inundated relative to that remaining within the wider landscape, it is unlikely that habitat loss will have an adverse impact on koalas in the study area. As koalas are predicted to occur at low densities based on field surveys and species ecology, it is unlikely that habitat loss as a result of the Project would increase intraspecific competition for resources. An assessment of the significance of residual impacts on the koala has been undertaken and is presented in Table 8-16. The assessment indicates that the Project will not result in a significant impact to the koala.

Table 8-16 Significance of impact on the koala

Significance criterion	Assessment
An action is likely to have a significant residual impact on habitat for an animal that is endangered or vulnerable wildlife if the action will:	
Lead to a long term decrease in the size of a local population	The Project is not expected to result in a decrease in the size of the local koala population. Evidence indicates that koalas occur in low densities within the Project area. Given that relatively large areas of habitat remain within the surrounding landscape, local koalas are not expected to experience a significant reduction in foraging and breeding success due to any increase in competition for resources.
Reduce the extent of occurrence of the species	Large areas of suitable koala habitat will persist within the local area. The project will not disrupt connectivity to the extent that movement between remnant patches will be disrupted. As such, there will be no change in the extent of occurrence of the species.
Fragment an existing population	Fragmentation of existing koala population is not expected as the loss of connectivity between habitat will not be of sufficient magnitude to disrupt koala movement between populations.
Avoid genetically distinct populations forming as a result of habitat fragmentation	Loss of connectivity is not expected to be of sufficient magnitude to disrupt koala movement or result in genetic isolation of populations. Woodland habitats persist in areas beyond the Project footprint and will allow opportunities for movement. The magnitude of impact on connectivity is considered negligible within the context of the environment in which woodlands are generally open in nature and contain many natural gaps.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species habitat	The Project area already supports invasive species (that is feral dogs) that are harmful to the local koala population. The implementation of a Weed and Pest Management Plan will help in limiting the impact that dogs have on the local koala population.
Introduce disease that may cause the population to decline	The Project is not expected to introduce any disease that could cause a decline in the local koala population. While the stress of habitat loss can induce outbreaks of naturally occurring chlamydia, this is not expected to occur for the Project given the low density of the local koala population, the relatively benign nature of the development in its operational phase (that is lack of noise and vehicle traffic) and the relative abundance of suitable habitat within the region.
Interfere with the recovery of the species	Given the relative abundance of suitable habitat remaining within the region, the Project is not expected to interfere with the recovery of the species.

Significance criterion	Assessment
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	Habitats within the Project footprint will be important for foraging and breeding, however, they are part of a broader area of habitat within the floodplain that will be utilised by the species.

8.3.9.3 Powerful owl

The powerful owl occurs throughout the sub-tropical and temperate climatic zones of eastern Australia with the known distribution extending north of Eungella (north-west of Mackay) in central Queensland (Garnett and Crowley 2000). Although not detected during the wet and dry season surveys in the Project footprint, this species has previously been recorded within the study area (BAAM 2008a). Powerful owl has a large home range and given its' capacity to forage over open areas, is not particularly susceptible to fragmentation.

The Project will result in loss of mature Eucalypt woodlands habitat for the powerful owl. The powerful owl typically nests in old growth eucalypts. Loss of vegetation within the Project footprint will reduce the availability of potential nesting habitat. Despite this, loss of individual nesting trees is not expected to have a significant impact on the species as:

- Mature trees containing suitable nesting habitat are relatively widespread and abundant within the landscape surrounding the Project footprint
- Powerful owls typically occur in low densities, maintaining independent territories that are generally several kilometres apart. This would tend to reduce competition for local nesting resources
- The rate of habitat loss attributed to the project will be gradual, taking place over a period of approximately of five to ten years, as vegetation is inundated and consequently dies. The period of actual impact is highly variable considering the vegetation type and periods of annual inundation. This will allow time for breeding pairs to find alternative breeding habitat within the surrounding landscape.

An assessment of the significance of residual impacts on the powerful owl has been undertaken and is presented in Table 8-17. The assessment indicates that the Project will not result in a significant impact to the powerful owl.

Table 8-17 Significance of impact on the powerful owl

Significance criterion	Assessment
An action is likely to have a significant residual impact on habitat for an animal that is endangered or vulnerable wildlife if the action will:	
Lead to a long term decrease in the size of a local population	The Project is not expected to result in a decrease in the size of the local powerful owl population. Powerful owls are not expected to experience a significant reduction in foraging and breeding success due to any increase in competition for resources. While the Project will result in localised loss of nesting habitat, the loss will be gradual, suitable alternative breeding trees are relatively abundant within the local area, and given the low density at which powerful owls typically occur, competition for nesting habitat is expected to be relatively low.

Significance criterion	Assessment
Reduce the extent of occurrence of the species	Large areas of suitable powerful owl habitat will persist within the local area. The project will not disrupt connectivity to the extent that movement between remnant patches will be disrupted. As such, there will be no change in the extent of occurrence of the species.
Fragment an existing population	The Project is not expected to result in any significant fragmentation of habitat for the powerful owl. The species maintains large home ranges and given its' capacity to forage over open areas, is not particularly susceptible to fragmentation.
Avoid genetically distinct populations forming as a result of habitat fragmentation	Given the species capacity to fly over cleared areas, the Project is unlikely to disrupt movement of powerful owls such that it would result in the formation of genetically distinct populations.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species habitat	The Project Area already supports invasive species (i.e. foxes) that are potentially harmful to the local powerful owl population, which have some potential to prey on fledglings. The implementation of the Weed and Pest Management Plan will help in limiting the impact that foxes have on the local powerful owl population.
Introduce disease that may cause the population to decline	Recognised threats to powerful owl do not include diseases. It is however not expected that the Project would result in the introduction of disease.
Interfere with the recovery of the species	Given the relative abundance of suitable habitat remaining within the region, the Project is not expected to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	Habitats within the Project footprint will be important for foraging and breeding, however, they are part of a broader area of habitat within the floodplain that will be utilised by the species.

8.3.9.4 Squatter pigeon

The main identified threats to the squatter pigeon (southern) include ongoing clearance of habitat for farming or development purposes; grazing of habitat by livestock and feral herbivores; and predation, especially by feral cats and foxes (TSSC 2008).

While considered threatened at the State and Commonwealth level, squatter pigeons (southern) appear to be relatively common within the Project footprint and wider study area based on survey findings. Squatter pigeon (southern) within the Project footprint are not considered to be part of an 'important population' and it is not considered that this area represents 'habitat critical to the survival of the species'.

The most suitable habitats for squatter pigeon (southern) within the Project footprint are those contained within RE 11.3.2 and RE 11.12.2. In the order of 6.3 ha and 15.2 ha of these habitats, respectively, will be lost to inundation, which may diminish the area of habitat available to this species at a local scale. However, suitable habitat for this species will persist in large fragments on low rocky hills and uncleared alluvial plains (Volume 2, Chapter 10 Threatened species and ecological communities). Approximately 95 per cent of RE 11.3.2 and 96 per cent of RE 11.12.2 will remain in the surrounding landscape (calculated within 2 km of the impoundments).

Access to water is an important determinant of habitat utilisation for this species (DoE 2014f) and the creation of new permanent water bodies resulting from the impoundment of water behind the weirs may also benefit this species. As such, it is unlikely that small, localised losses of habitat along the largely disturbed riparian fringe will adversely impact the regional viability of this species.

Construction activities within the Project footprint will involve a temporary increase in vehicular traffic and plant movement to, from and at the site. This has the potential to increase the incidence of fauna injury and/or mortality due to vehicle strike. The clearing of a limited amount of vegetation to facilitate construction (including access and storage areas) may also result in injury or direct mortality of squatter pigeon (southern), residing in areas to be cleared. While there is no on-site worker accommodation proposed for the Project, if not managed, production of general waste has the potential to encourage the presence of feral animals such as cats and foxes.

The risk of these impacts occurring can be mitigated and managed through implementation of the following specific actions including:

- Enforcing on-site speed limits
- Educating employees regarding the potential presence of squatter pigeon (southern)
- Fauna spotters present during clearing activities
- Clearly demarcate no-go areas of highly sensitive vegetation, including all vegetation not to be cleared
- Sequential clearing of vegetation, to allow resident fauna the opportunity to disperse away from the immediate construction area
- All general waste to be appropriately stored and covered and disposed of offsite at regular intervals
- Undertake feral animal control through the use of baits and traps (as necessary and appropriate) in accordance with existing local and regional programmes.

These mitigation and management measures are incorporated into the EMP (Chapter 23).

An assessment of the significance of residual impacts on the squatter pigeon (southern) has been undertaken and is presented in Table 8-18. The assessment indicates that the Project will not result in a significant impact to the squatter pigeon (southern).

Table 8-18 Significance of impact on the squatter pigeon (southern)

Significance criterion	Assessment
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to long-term decrease in the size of an important population of a species	Squatter pigeon (southern) present within the Project footprint are not known to form part of an important population of the sub-species; there are three important sub-populations that have been defined (DoE 2013) and these lie outside of the Project footprint. Whilst small numbers of individuals may be temporarily or permanently displaced from parts of the Project footprint, this is unlikely to lead to a long-term decrease in the broader population.
Reduce the area of occupancy of an important population	While the impoundment of areas of open woodland habitat will result in a localised reduction in area of occupancy, squatter pigeon (southern) present within the Project footprint are not known to form part of an important population of the sub-species. Creation of a new permanent water body is considered to benefit the population in the long-term.
Fragment an existing important population into two or more populations	The impoundment of open woodland habitat areas used by the species will increase the fragmentation of these habitats at a local scale, although the existing landscape is already highly fragmented. Squatter pigeon (southern) present within the Project footprint are not known to form part of an important population of the sub-species.
Adversely affect habitat critical to the survival of a species	While the impoundment of areas of open woodland habitat will result from the Project, these areas are not considered to constitute habitat critical to the survival of the sub-species. The creation of new permanent water bodies resulting from the impoundment of water behind the weirs is considered to provide long-term benefit to the species.
Disrupt the breeding cycle of an important population	Squatter pigeon (southern) present within the Project footprint are not known to form part of an important population of the sub-species. The Project footprint is likely to contain a small number of pairs that may be temporarily disrupted by construction works.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The losses of open woodland habitat to result from the Project are not sufficient to threaten the broader availability or quality of habitat for the sub-species such that this could cause a decline in the population of the sub-species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Project footprint is currently impacted by weed and pest species that could be harmful to squatter pigeon (southern). The presence of these invasive species will not be exacerbated by the Project and any risks of their establishment will be managed via a Project Weed and Pest Management Plan.
Introduce disease that may cause the species to decline	Recognised threats to squatter pigeon (southern) do not include diseases. It is however not expected that the Project would result in the introduction of disease.
Interfere substantially with the recovery of the species	It is not expected that the Project could substantially interfere with the recovery of squatter pigeon (southern) across the broader region.

8.4 Summary

The baseline terrestrial fauna assessment revealed that the Project footprint supports a diversity of common amphibians, reptiles, mammals and birds, and a limited number of threatened and other conservation-significant species. Furthermore, the Project footprint has the potential to support a number of threatened species based on field survey records, previous records and the availability of suitable habitat within the Project footprint.

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

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

Although the landscape has been significantly altered through land clearing, remnants of fauna habitat types identified within the Project footprint provide sufficient foraging, shelter and breeding resources for at least 158 species within the Eden Bann Weir Project footprint and at least 208 species within the Rookwood Weir Project footprint (as identified during wet and dry season field surveys). This comprises:

- Eden Bann Weir: 12 amphibians, 20 reptiles, 28 mammals and 98 birds (including 24 'migratory' and/or 'marine species)
- Rookwood Weir: 12 amphibians, 22 reptiles, 41 mammals and 133 birds (including 23 'migratory' and/or 'marine' species).

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

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

To address these impacts, mitigation measures are outlined including undertaking pre-clearing surveys (within construction footprints) and development of a SMP, weed and pest control measures, revegetation activities, and the preparation of dust, weed and other relevant management plans.

Six threatened terrestrial fauna species were recorded within the Project footprint during field surveys. Two special least concern species (echidna and koala) were also recorded or evidenced during the field surveys. An additional three conservation significant species were identified in desktop assessments as having a high potential to occur within the Project footprint but not recorded during surveys. With the above mitigation and management measures in place, adverse impacts on these conservation significant species are not anticipated as a result of the Project.