10. Threatened species and ecological communities

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10.1 Overview

This chapter provides an assessment of impacts on listed threatened species and ecological communities as a result of the Lower Fitzroy River Infrastructure Project (Project). The chapter has been prepared in accordance with Part C of the terms of reference (ToR) for the environmental impact statement (EIS).

Threatened ecological communities (TECs) are ecological communities that have been assessed under the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and assigned to one of three categories related to the status of the threat to the community: vulnerable, endangered or critically endangered. Similarly, listed threatened species as declared under the EPBC Act include the following categories: vulnerable, endangered, critically endangered and extinct in the wild.

EPBC Act Protected Matters searches (Appendix U) undertaken for the Project identified no extinct in the wild species or TECs as being potentially present within, near to or downstream of the Project footprint. Listed TECs and threatened species are identified and assessed as per the Matters of National Environmental Significance - Significant impact guidelines 1.1 (MNES guidelines) (DoE 2013) as follows:

- TECs are addressed in Section 10.3
- Critically endangered and endangered species and vulnerable species within or near to Project footprint are addressed in Section 10.4 and Section 10.5, respectively, including:
  - Squatter pigeon *(Geophaps scripta scripta)* (Section 10.5.3.1)
  - Black ironbox (*Eucalyptus raveretiana*) (Section 10.5.3.2)
  - Fitzroy River turtle (*Rheodytes leukops*) (Section 10.5.3.3).
- Threatened species predicted to occur downstream of the Project (that is downstream of Eden Bann Weir) and within the Fitzroy estuary are addressed in Section 10.6.2, including:
  - Yellow chat (Dawson[1]) (*Epthianura crocea macgregori*) (Section 10.6.2.2).

Migratory species are discussed in Chapter 11 Migratory and marine species. Cumulative impacts on threatened species and ecological communities are assessed in Chapter 12 Cumulative and consequential impacts.

In accordance with Section 158A of the EPBC Act, matters of national environmental significance (MNES) listed after a controlled action decision has been made cannot be taken into consideration in the approval assessment and decision. As such, only threatened species and ecological communities listed prior to the Project being declared a controlled action (January 2010) have been assessed in this chapter.

The white-throated snapping turtle (*Elseya albagula*) was listed as critically endangered under the EPBC Act in October 2014. The management actions proposed for the Project, particularly the implementation of a predator control program, provision of turtle ramps, and protection and management of Fitzroy River turtle nesting habitat will also directly benefit the white-throated snapping turtle. However as the species was listed after the project decision in regard to controlling provisions, further assessment has not been included in this section.

[1] The sub-species is also known as yellow chat (Capricorn), however yellow chat (Dawson) is accepted.

A summary of survey methodologies is provided in Section 10.2. Detailed survey methods are described in Chapter 6 and included within Appendices J, K, N and O.

10.2 Approach and methodology

A description of the existing environmental values of the Project area was achieved using a combination of desktop assessments and field studies. The desktop assessment comprised a review of relevant literature, database searches and existing technical reports. Field studies were conducted to obtain ecological information relevant to the Project and to ground truth results from desktop assessments. For conservation significant flora and fauna species and ecological communities, a likelihood of occurrence assessment (Table 10-1) was undertaken to focus assessment on those taxa that are known or likely to occur within the Project footprint. The significance of residual impacts, post-mitigation, was evaluated with consideration to the significance criteria provided in the Matters of National Environmental Significance - Significant impact guidelines 1.1.

Table 10-1 Key to likelihood of occurrence

Likelihood	Category	Definition supporting information
High	The species or ecological has been observed within the Project footprint (known to occur) or there is a high potential that a species or ecological community occurs within the Project footprint (likely to occur)	Species / community has been recorded during field surveys in the Project footprint **OR** Species has been recorded within the Project footprint from desktop searches **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 potential to occur	Species' distribution incorporates the Project footprint (or part(s) thereof) **AND** potentially suitable habitat occurs in the Project footprint
Low	A very low to low potential that a species or ecological community occurs within the Project footprint	Suitable habitat is absent from Project footprint

10.3 Threatened ecological communities

10.3.1 Ecological communities predicted to occur

Four TECs listed as endangered under the EPBC Act were identified as having the potential to occur in the Project footprint based on desktop searches as described in Table 10-2:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Brigalow)
- Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
- Weeping Myall Woodlands.

Table 10-2 Threatened ecological communities predicted to occur

Threatened ecological communities	EPBC Act status[#]	Predicted to occur^		Recorded during field surveys	
		Eden Bann Weir to Rookwood Weir	Rookwood Weir impoundment	Eden Bann	Rookwood
Brigalow	Endangered	✓	✓	✓	✓
Natural Grasslands	Endangered	×	✓	×	×
Semi-evergreen vine thicket	Endangered	×	✓	×	×
Weeping Myall Woodlands	Endangered	✓	✓	×	×

Status as per the EPBC Protected Matters Search reported in EPBC referral 2009/5173

✓ = record supports presence, x = record does not support presence

^ Predicted to occur within proximity of the Project footprint based on EPBC Act Protected Matters Search Tool

10.3.2 Likelihood of occurrence

Table 10-3 details the likelihood of occurrence assessment undertaken for each TEC predicted to occur with the Project footprints. The likelihood of occurrence assessment criteria are provided in Chapter 6 Methodology.

While four TECs were predicted to occur in the Project footprint only Brigalow TEC (Figure 10-1) has a high potential to occur. Brigalow TEC is mapped as occurring within and adjacent to the Project footprint as shown in Figure 10-2 and Figure 10-3 for Eden Bann Weir and Rookwood Weir, respectively. Importantly, the likelihood of occurrence assessment is conservatively based on both field verified data (Appendix H) and unverified Department of Natural Resources and Mines (DNRM) mapping (Version 6.1) (including polygons of RE 11.3.1 only and the percentage of RE 11.3.1 in mixed polygons, primarily RE 11.3.3/11.3.1). The potential for the Project to impact upon Brigalow TECs is assessed in Section 10.3.2.

Natural grasslands, semi-evergreen vine thicket and Weeping Myall Woodlands TECs have a low potential to occur and are not considered further by this assessment (the basis for their exclusion is presented in Table 10-3).

Table 10-3 Listed threatened ecological communities – likelihood of occurrence

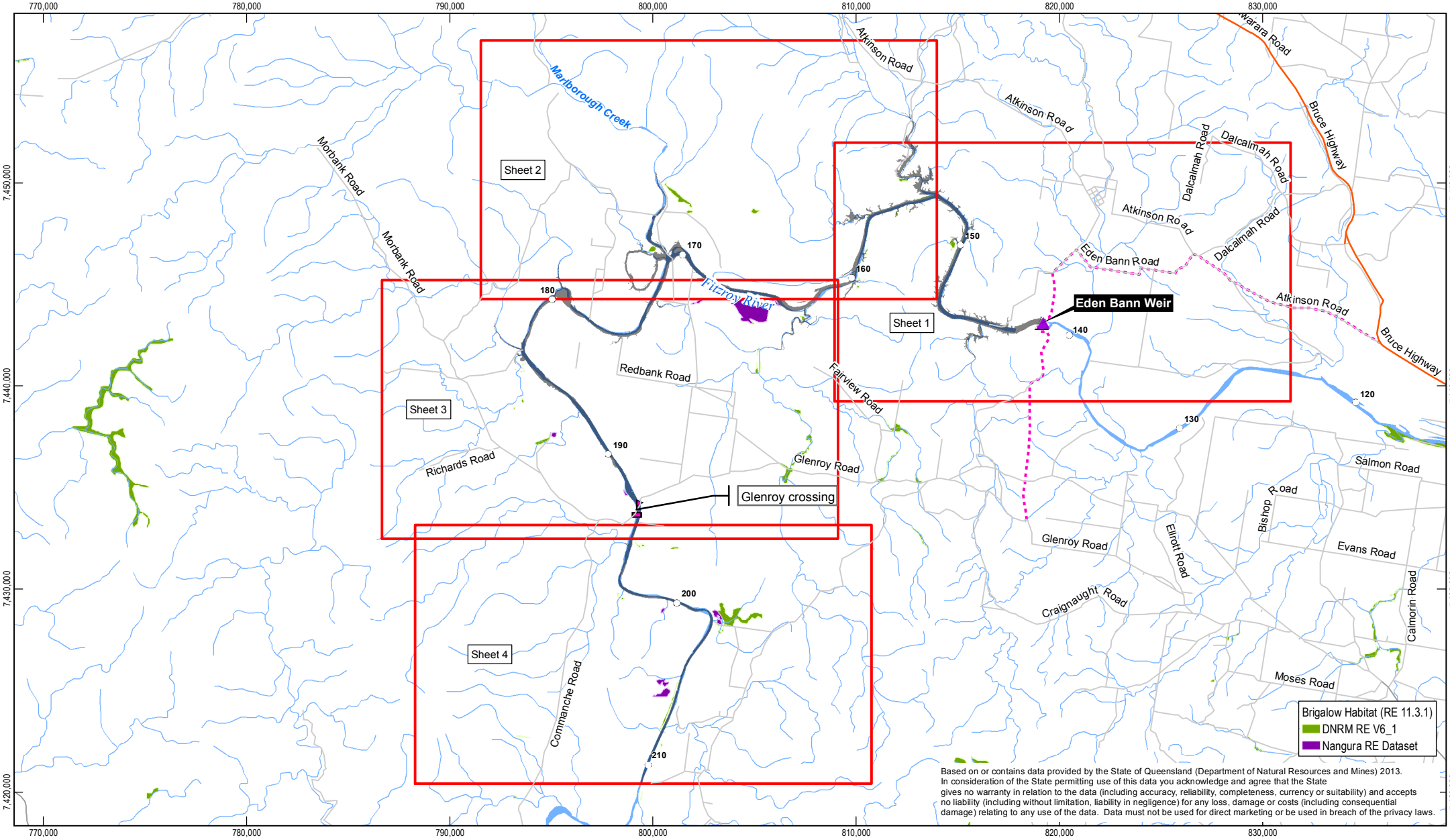
Threatened ecological community	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint	Likelihood of occurrence
Brigalow	Endangered	This TEC is defined by the following regional ecosystem (REs): 6.4.2, 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21, 12.8.23, 12.9-10.6 (DoE 2014a). RE 11.3.1 Brigalow /belah open forest on alluvial plains comprises open fort dominated by *Acacia harpophylla* and/or *Casuarina cristata*, with or without emergent Eucalypts, sometimes with an extensive array of native grasses or introduced pasture species (Appendix H, Nangura 2007). RE 11.3.1 is typically found on upper banks and levees and on alluvial plains.	RE 11.3.1 is mapped by DNRM within the Project footprint and field surveys verified the presence at sites within the Rookwood Weir Project footprint (Figure 10-3). Two small patches of RE 11.3.1 are located above the right bank at the Rookwood Weir site.	High
Semi-evergreen vine thickets	Endangered	This TEC is considered an extreme form of dry seasonal subtropical rainforest and comprises the following 10 REs: 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8 and 11.11.18. These REs include areas of low microphyll rainforest, notophyll vine forest, semi-deciduous notophyll rainforest and microphyll / notophyll vine forest.	Two small patches of RE 11.4.1 were mapped by Nangura (2007) as occurring in the landscape outside of the Project footprint. RE 11.4.1 was not detected within the impoundments during field surveys.	Low
Weeping Myall Woodlands	Endangered	The Weeping Myall Woodlands occur in open woodlands to woodlands, generally 4-12 m high, in which weeping myall (*Acacia pendula*) trees are the sole or dominant overstorey species. This TEC generally occurs on flat areas, shallow depressions or gilgais on raised (relict) alluvial plains. These areas are not associated with active drainage channels and are rarely if ever flooded. This TEC is restricted to small patches that occur within RE 11.3.2 and RE 11.3.28 (TSSC 2008a).	RE 11.3.2 is mapped along the Fitzroy River, however the floristic composition of RE 11.3.2 is variable such that not all areas of mapped RE 11.3.2 necessarily meet the requirements to be considered this TEC. The flora species that is characteristic of this TEC, namely *Acacia pendula,* was not identified during field surveys such that it is concluded that the Weeping Myall Woodlands TEC does not occur in the Project footprint.	Low
Natural Grasslands	Endangered	The Natural Grasslands TEC is defined by the following REs: 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12, 11.11.17 (TSSC 2008b).	None of the REs associated with this TEC are mapped within the Project footprint nor were they identified during field surveys.	Low

Figure 10-1 Brigalow woodland

Brigalow woodland with a leafy understorey and a grazed and sparse grassy ground layer on the left bank of Mackenzie River at the Fitzroy River junction (Source: Nangura 2007).

Brigalow woodland with a grassy ground layer on a sandy ridge along the top of the river bank in the vicinity of Rookwood. *Terminalia oblongata* dominates the shrub/low tree layer and grazing is present (Source: Nangura 2007).

Brigalow woodland with sparse grassy layer on an alluvial terrace with grazing present (Source: Nangura 2007) in the vicinity of Rookwood.



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Kilometres

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Brigalow TEC within the Eden Bann Weir Project footprint

Figure 10-2

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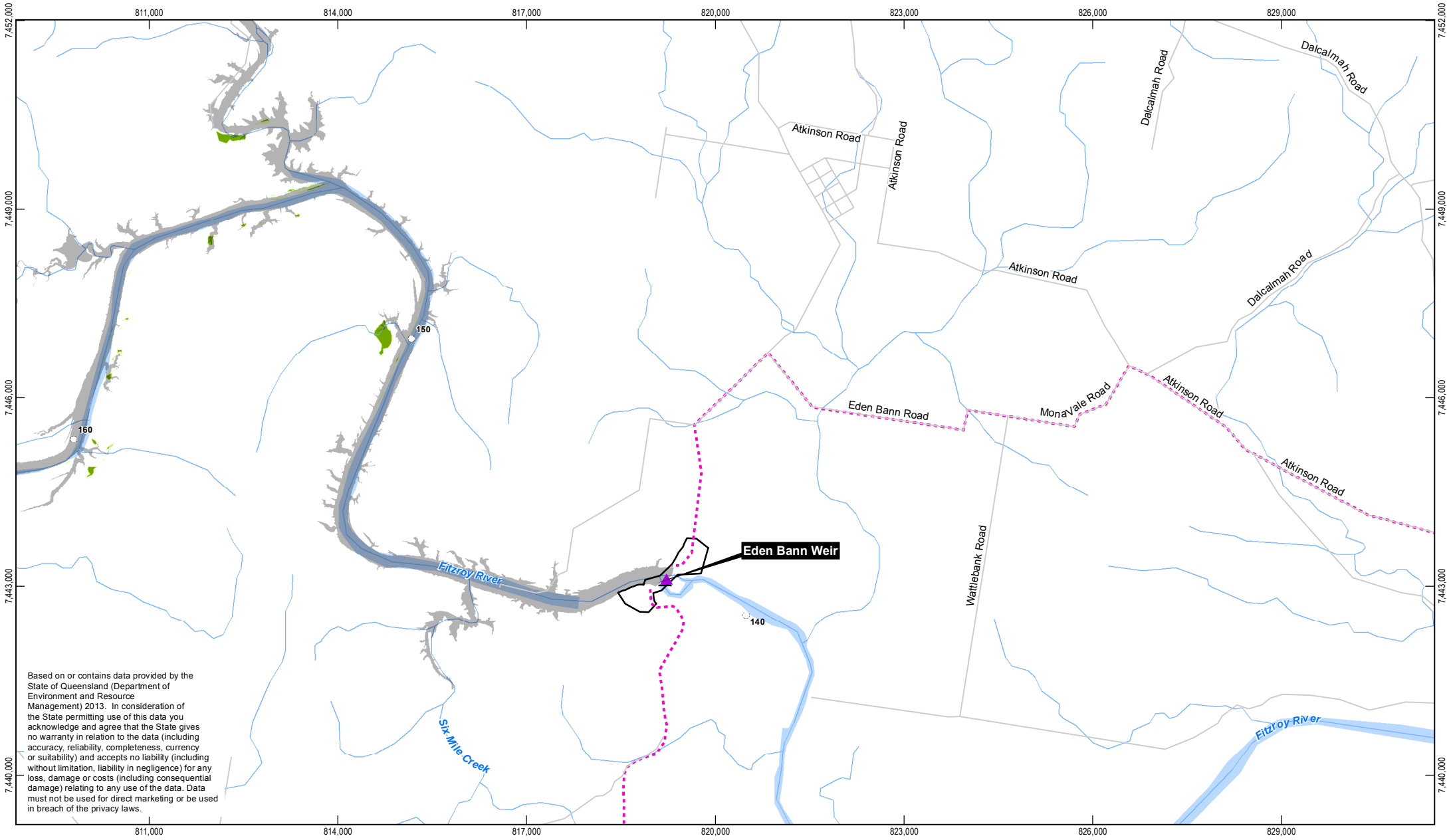

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Kilometres

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Horizontal Datum: Geocentric Datum of Australia (GDA94)
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Figure 10-2 Sheet 1 of 4

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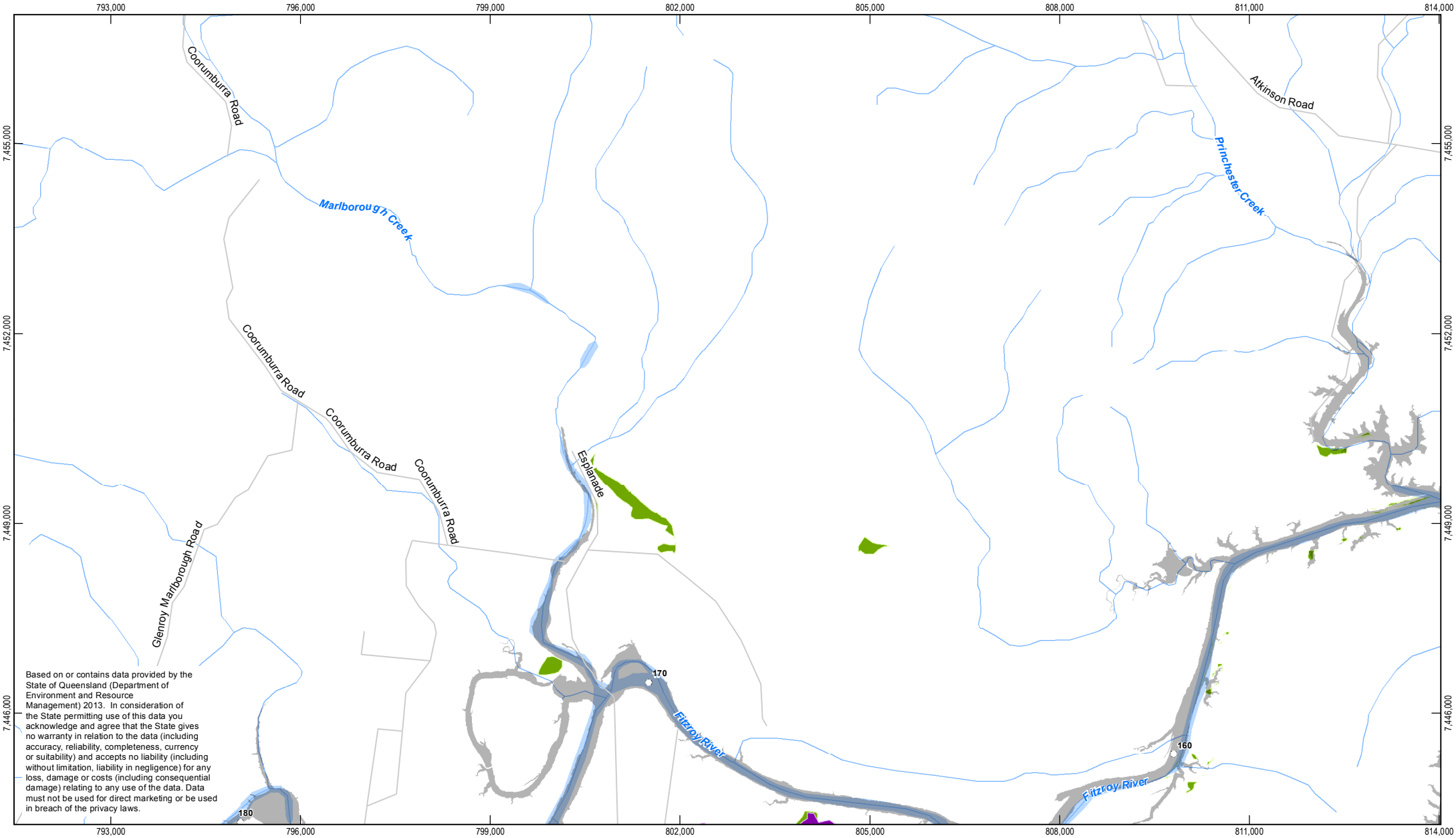

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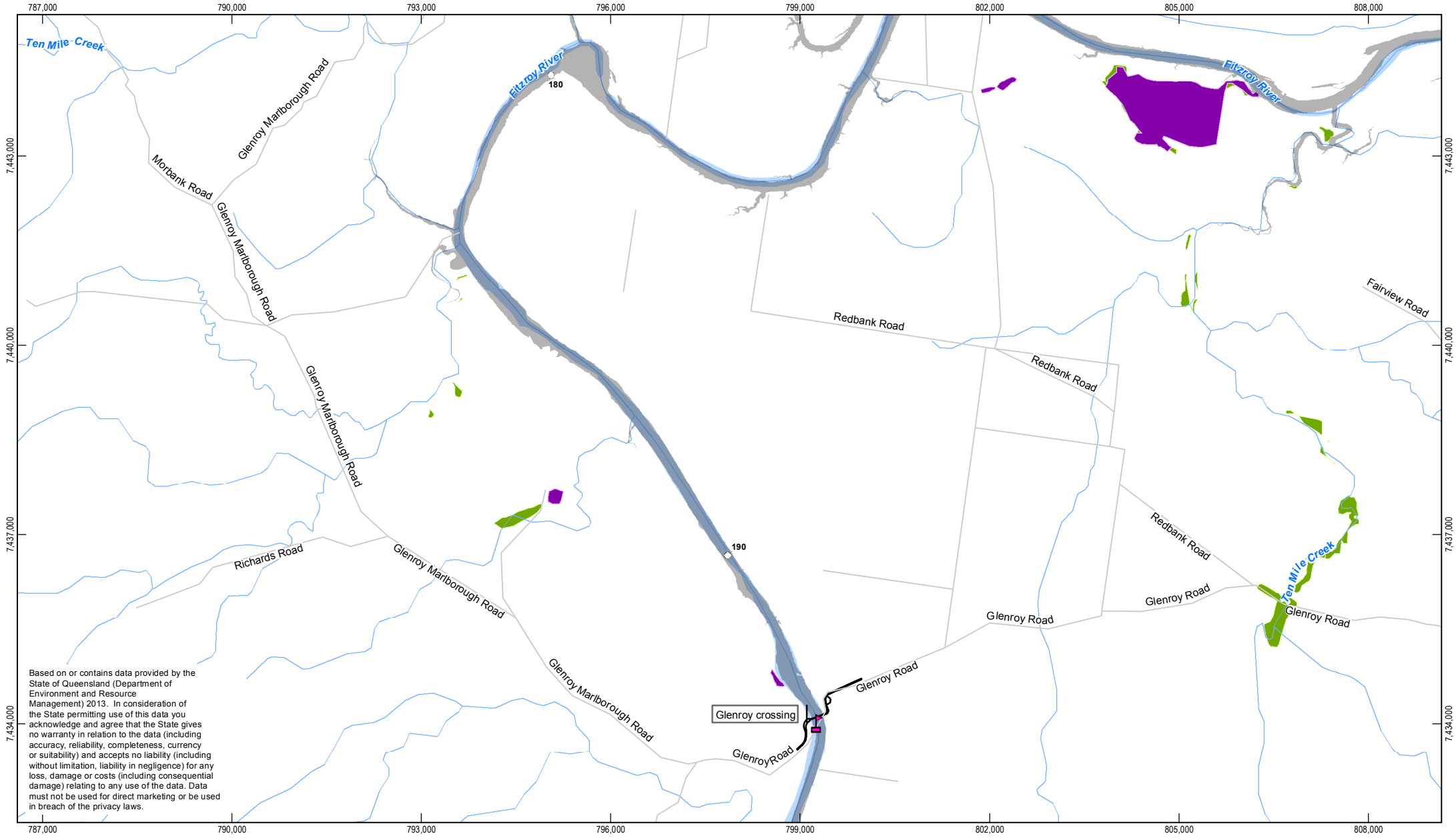

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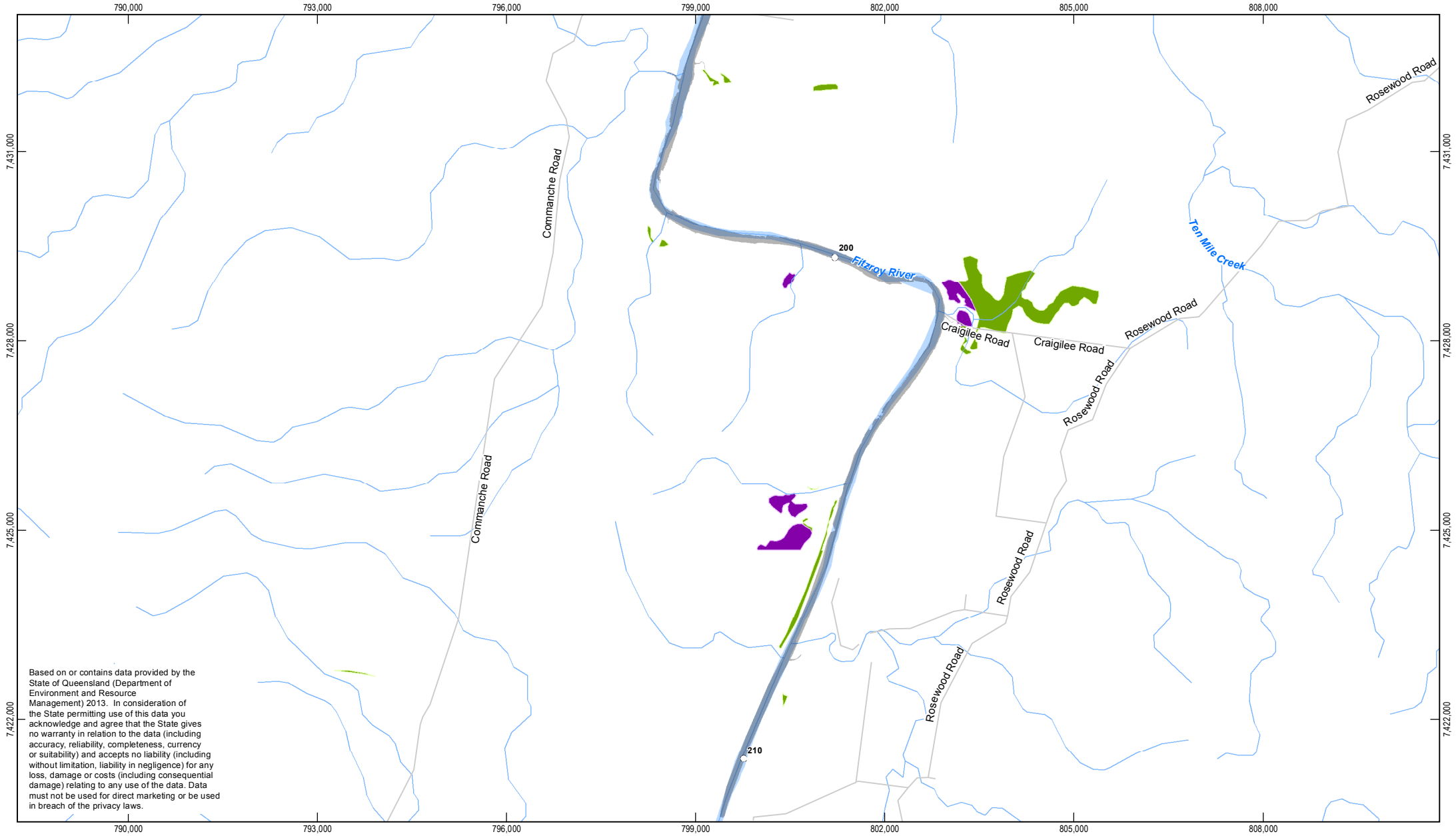

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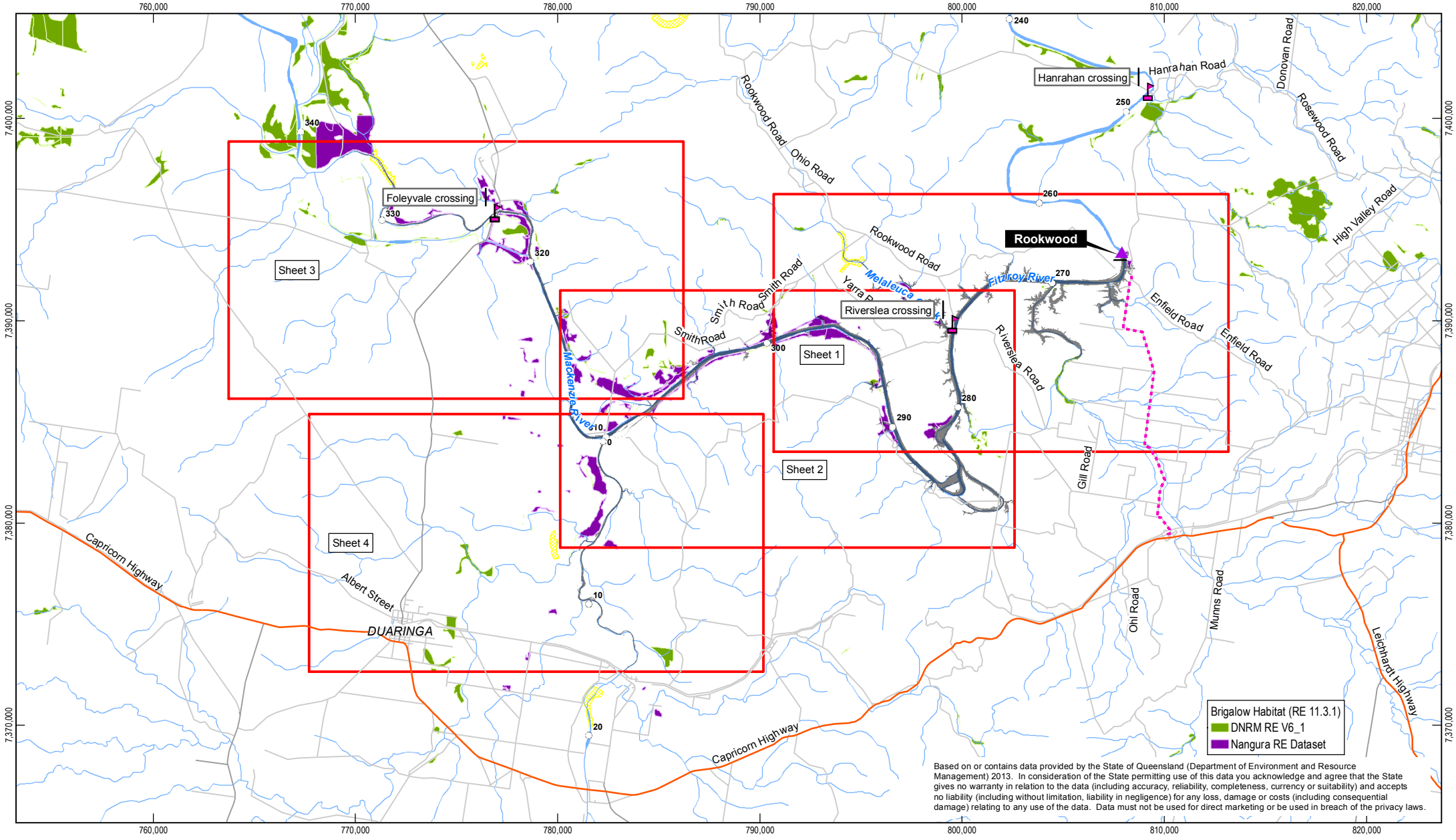

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Kilometres

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Brigalow TEC within the Rookwood Project footprint

Figure 10-3

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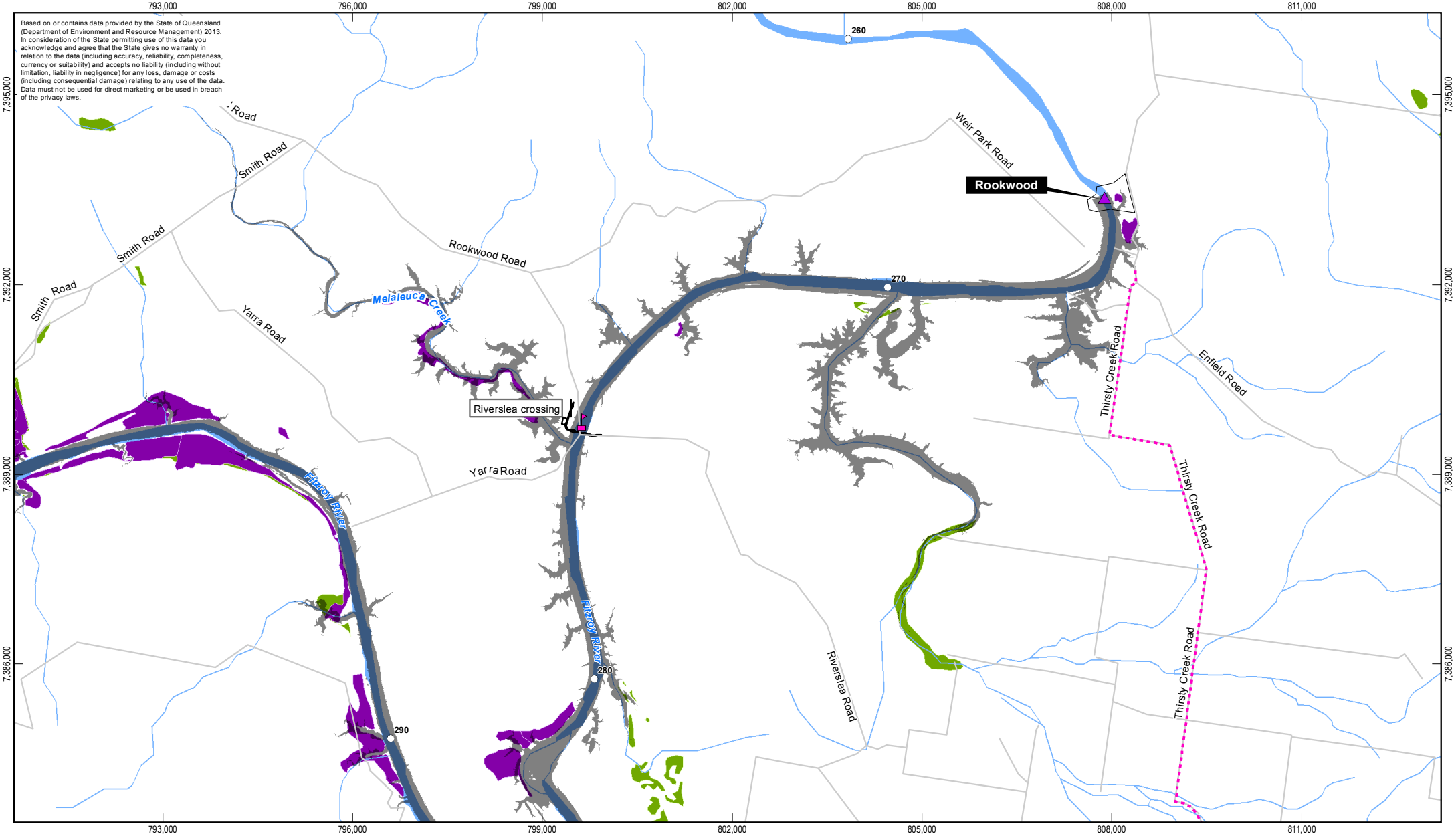

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Kilometres

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Figure 10-3 Sheet 1 of 4

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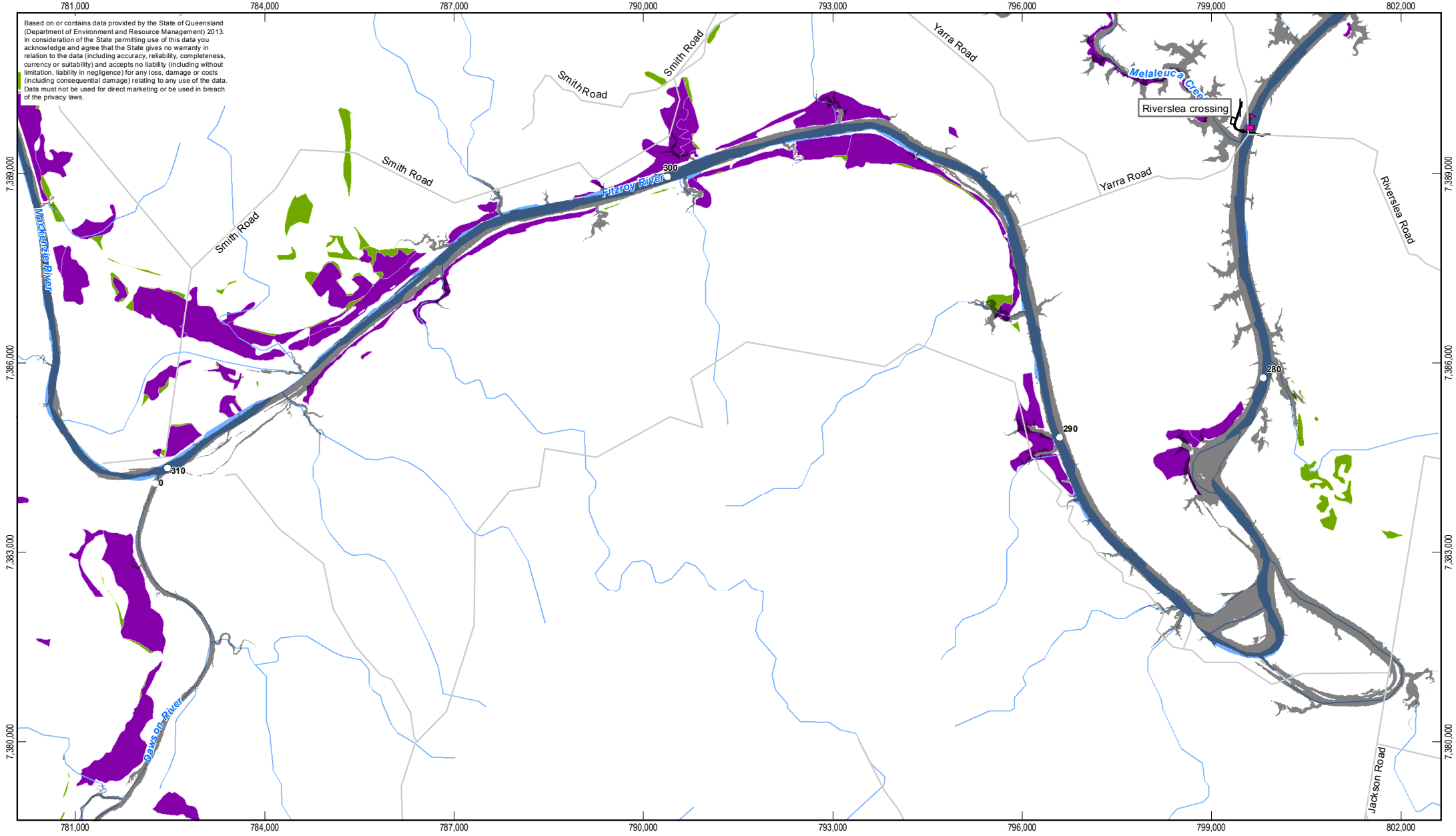

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Kilometres

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

N

LEGEND

- AMTD (km)
- Weir Location
- River Crossing
- Highway
- Major Road
- Secondary Roads
- Waterway
- Waterway
- Impoundment area
- Construction Footprint
- Access Road

Brigalow Habitat (RE 11.3.1)

- DNRM RE V6_1
- Nangura RE Dataset

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Brigalow TEC within the Rookwood Weir Project Footprint

Job Number 41-20736
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Figure 10-3 Sheet 2 of 4

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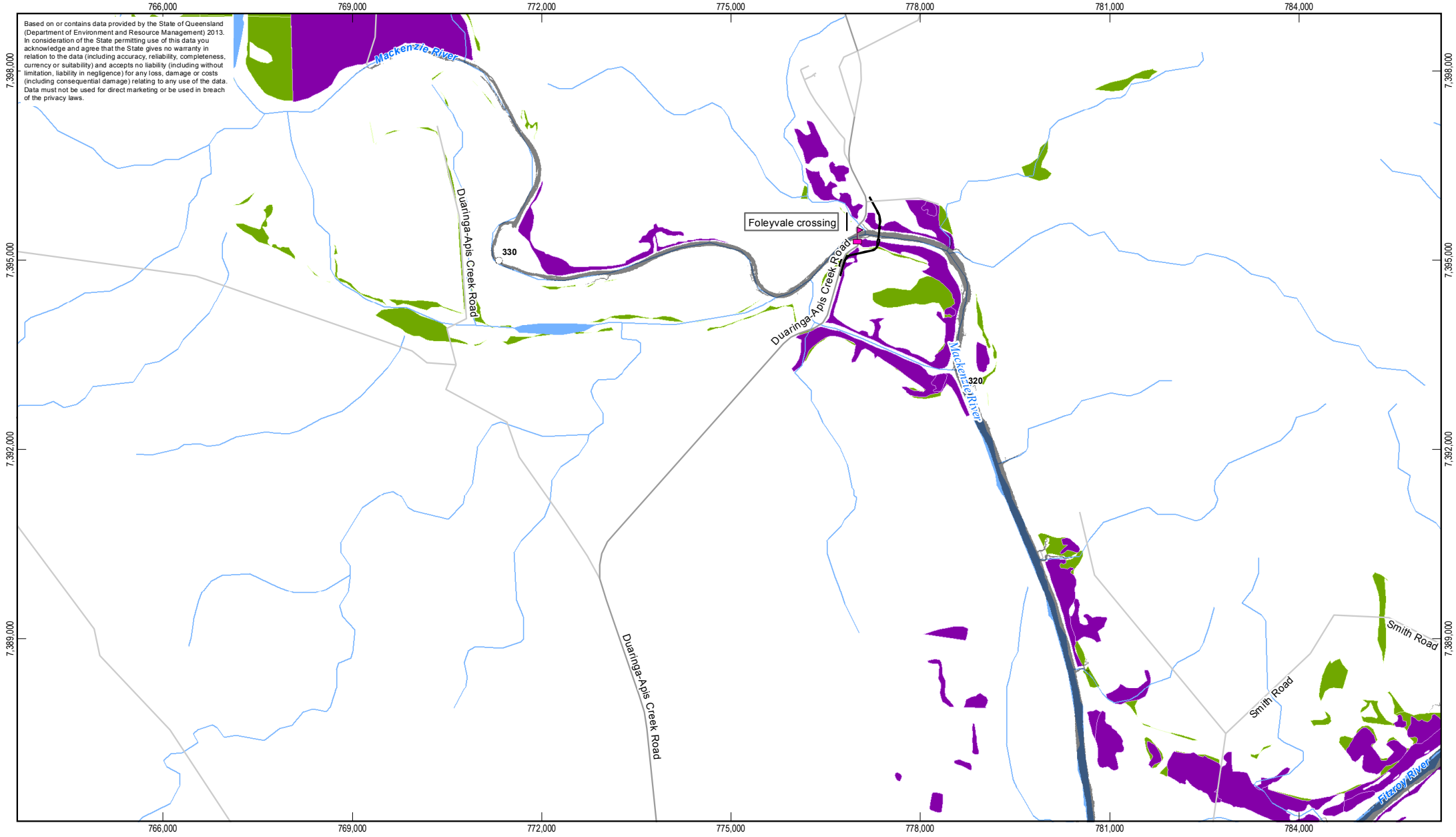

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Kilometres

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Figure 10-3 Sheet 3 of 4

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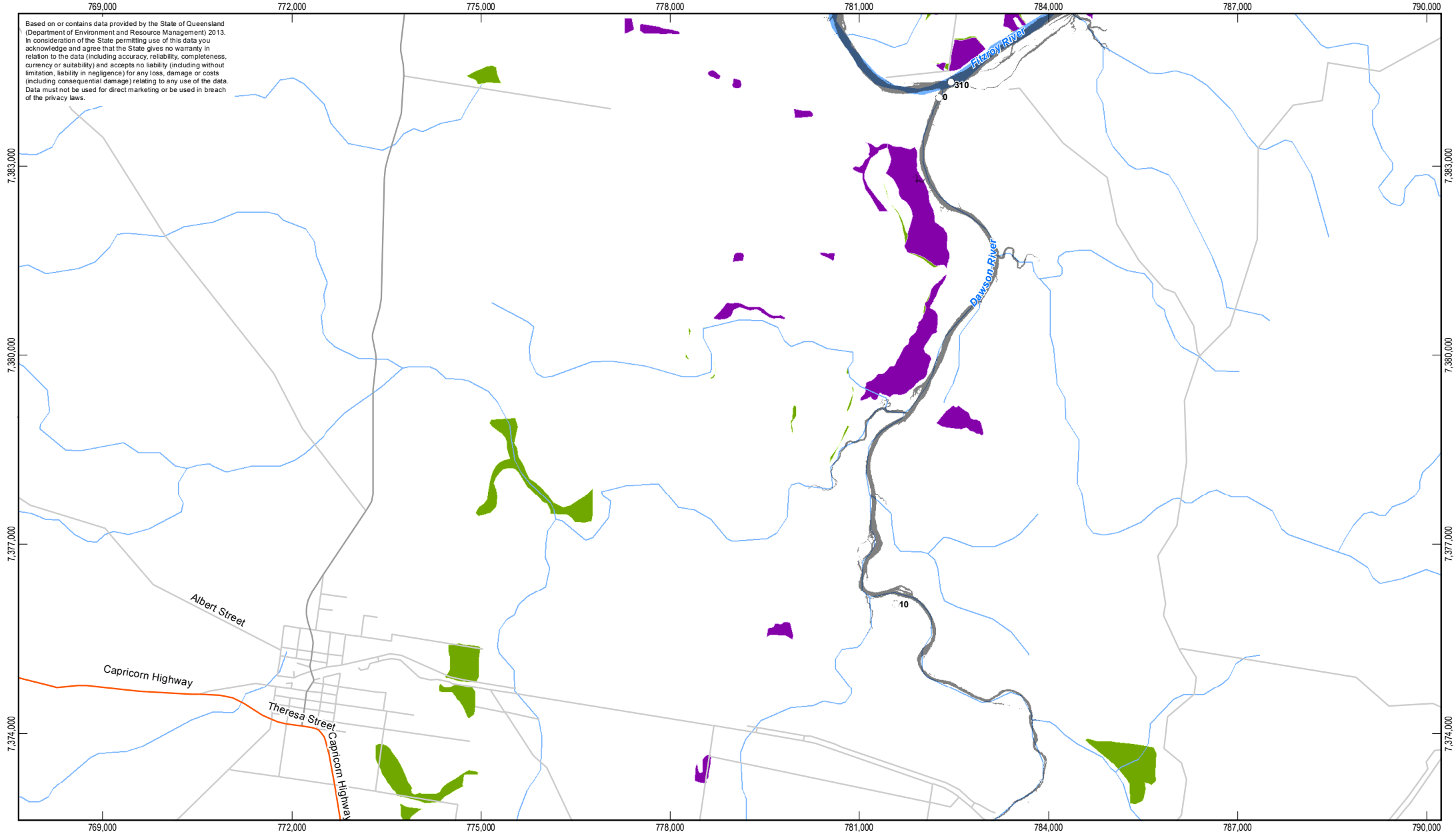

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10.3.3 Potential impacts

Primary threats to Brigalow TEC include vegetation clearing, fire, pest animals and plants, inappropriate grazing regimes and climate change (approved conservation advice (TSSC 2013)).

Clearing of Brigalow TEC, to facilitate construction activities at the weir sites, along existing and new access roads and at river crossings has been avoided as far as is practicable based on current survey and design. In the order of 1.6 ha is predicted to be cleared during construction activities associated with Rookwood Weir. While geological constraints dictate the location of the weir at Rookwood, further opportunities to limit the extent of clearing will be considered during detailed design. No Brigalow TEC is predicted to be cleared during construction activities associated with Eden Bann Weir.

Inundation of Brigalow TEC is an unavoidable consequence of the Project. Based on existing mapping, in the order of 18.5 ha of Brigalow TEC may be impacted by operation (impoundment) of the Project at the upper limits of development. Areas impacted for Eden Bann Weir and Rookwood Weir, respectively and include:

- Eden Bann Weir: 0.3 ha associated with Stage 2 impoundment; and 0.7 ha (cumulative) associated with Stage 3 impoundment
- Rookwood Weir: 2.3 ha associated with Stage 1 impoundment; and 17.8 ha (cumulative) associated with Stage 2 impoundment.

It is likely that the total area of Brigalow TEC impacted by impoundment will be substantially less than the estimated 18.5 ha. Of this total, 8.1 ha have been field verified (Appendix H, Nangura 2007) while the remaining 10.4 ha were determined based on unverified DNRM mapping. The estimated 18.5 ha also comprises mixed polygons, and where these polygons extend into adjacent alluvial areas, the percentage containing RE 11.3.1 may occur outside of the proposed impoundment.

An estimated 6.3 ha of the unverified Brigalow TEC is mapped as occurring within and along Gogango Creek. It is rare that Brigalow TEC persists within creeks due to the sensitivity of *Acacia harpophylla* to prolonged or frequent inundation (Appendix H, Nangura 2007). Nevertheless, the community is known to occasionally occur in association with river and creek flats (DoE 2014a) and therefore the presence of the TEC along Gogango Creek cannot currently be discounted.

The protected Brigalow TEC RE 11.3.1 mapped within the Project footprint is known to occur within the landscape immediately surrounding the Project footprint and across the region. Residual impacts from losses within the Project area are less than 0.03 per cent of the bioregional extent of the TEC. In the order of 612 ha of remnant RE 11.3.1 is mapped within 500 m from the watercourse, and 35,153 ha is mapped within the catchment, with the area of impact equating to 3.3 per cent and 0.06 per cent respectively. Brigalow TEC is well represented in the surrounding landscape and a very small proportion will be impacted by the Project footprint.

Table 10-4 provides an assessment of the significance of Project impacts on Brigalow TEC with regard to the MNES guidelines.

Taking in to consideration the fragmented and disturbed nature of the Brigalow communities within the Project footprints, the representation of this community within the surrounding landscape and the small proportion potentially impacted, the Project is considered unlikely to have a significant impact on this ecological community. However, where loss due to impoundment and clearing is unavoidable an offset is proposed (Chapter 14 Offsets). Prior to the

commencement of Project activities, further ecological surveys will be undertaken to verify the area of Brigalow TEC present and likely to be impacted as a result of the Project in accordance with approved conservation advice for this community (TSSC 2013).

Table 10-4 Significance of impact on Brigalow TEC

Significance criterion	Assessment
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community	The proposed works have the potential to reduce the extent of Brigalow TEC by a maximum of 20.1 ha (based on existing mapping) as a result of prolonged inundation. In assessing significant impacts to this TEC, it is relevant to consider the total area of Brigalow present within the surrounding landscape. Specifically, the 20.1 ha represents approximately 3.5 per cent of the mapped polygons that will potentially be impacted (572 ha). In the order of 612 ha of remnant RE 11.3.1 is mapped within 500 m from the watercourse, and 35,153 ha is mapped within the Fitzroy Basin, with the area of impact equating to 3.3 per cent and 0.06 per cent respectively. As such, given the representation of this community within the surrounding landscape and the small proportion impacted, the Project is unlikely to significantly reduce the extent of this TEC.
Fragment or increase fragmentation of an ecological community	Brigalow TEC within the Project footprint are already substantially fragmented as a result of historic and current land use practices. It is not anticipated that the Project will further fragment this TEC. Potential impacts will predominantly be limited to a number of small areas along the boundaries of vegetation along the water's edge.
Adversely affect habitat critical to the survival of an ecological community	In accordance with approved conservation advice, habitat critical to the survival of the Brigalow TEC includes all patches that meet the key diagnostic characteristics and condition thresholds for the ecological community. As such, the potentially impacted areas of Brigalow habitat are likely to constitute habitat critical to the survival of this ecological community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The Project will modify abiotic factors through impoundment of water within the river bed and banks resulting in loss of 20.1 ha of Brigalow. This change to abiotic factors is the impact on which this assessment is based, and it is noted above (Section 10.3.3) that this extent of impact considered unlikely to constitute a significant impact given the representation of this community within the surrounding landscape and the small proportion impacted.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	It is anticipated that any potential changes in species composition will be limited to the area of impact. As described above, impact to 20.1 ha of Brigalow is not considered significant. It is not anticipated that decline or loss of functionally important species will occur in areas adjacent to impacted areas, such that this TEC will continue to persist in the surrounding landscape.

Significance criterion	Assessment
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community	The Project will not assist in the introduction, establishment or spread of an invasive species. Environmental management plans (EMPs) developed to ensure weed and pest management is undertaken so as to prevent introduction of invasive species. The Project will not involve mobilisation of fertiliser, herbicides or other chemicals or pollutants into the ecological community.
Interfere with the recovery of an ecological community	Taking in to consideration the extent of impact as compared to the representation of this community within the landscape, together with the intent for environmental offsets to be put in to place, it is not anticipated that the Project will interfere with the recovery or long-term survival of this TEC.

10.4 Critically endangered and endangered species

10.4.1 Species predicted to occur

The EPBC Act Protected Matters search (Appendix U) identified eight endangered species that are predicted to occur within or near the Project footprint as listed in Table 10-5. In addition, three endangered species of marine turtles which breed and forage exclusively in estuary/marine habitat were predicted to occur. While these species are not known or likely to occur in the Project footprint, suitable habitat for these species exists downstream of the Project footprint. Impacts on marine turtles are assessed in Chapter 11 Migratory and marine species.

Table 10-5 also provides an indication of whether endangered species have been previously recorded based on desktop searches or whether the species was recorded from field surveys.

No critically endangered species were predicted to occur within or near to the Project footprint. The critically endangered yellow chat (Dawson) was predicted to occur downstream of the Fitzroy Barrage in the Fitzroy River estuary. This matter is addressed in Section 10.6.2.2.

10.4.2 Likelihood of occurrence

Table 10-6 summarises findings of an assessment of the likelihood of occurrence of endangered species identified as potentially occurring within or near to the Project footprint based on habitat preferences, distribution, previous records from the region and the presence of suitable habitat within the Project footprint. The likelihood of occurrence assessment criteria are provided in Chapter 6 Methodology.

No endangered species have a high potential (known or likely) to occur within the Project footprint.

Table 10-5 Listed endangered species potentially present within or near to the Project footprint

Species	Common name	EPBC Act status[#]	Predicted to occur^		Previously recorded*		Recorded during field surveys**	
			Eden Bann Weir to Rookwood Weir	Rookwood Weir impoundment	Eden Bann	Rookwood	Eden Bann	Rookwood
Birds								
Neochmia ruficauda ruficauda	Star finch (eastern), star finch (southern)	Endangered	✓	✓	×	×	×	×
Poephila cincta cincta	Black-throated finch (southern)	Endangered	✓	✓	×	×	×	×
Mammals								
Dasyurus hallucatus	Northern quoll	Endangered	✓	✓	×	×	×	×
Plants								
Cycas megacarpa		Endangered	✓	✓	×	×	×	×
Cycas ophiolitica	Marlborough blue	Endangered	✓	×	✓	×	×	×
Digitaria porrecta	Finger panic grass	Endangered	✓	✓	×	×	×	×
Streblus pendulinus	Siah's backbone, Sia's backbone, Isaac wood	Endangered	✓	×	×	×	×	×
Phaius australis	Lesser swamp-orchid	Endangered	✓	×	×	×	×	×

Status as per the EPBC Protected Matters Search reported in EPBC referral 2009/5173

✓ = record supports presence, x = record does not support presence

^ Predicted to occur within proximity of the Project footprint based on EPBC Act Protected Matters Search Tool

* Previously recorded within proximity of the Project footprint based on desktop searches

**Recorded during field surveys within the Project footprint for flora species and within or near to the Project footprint for fauna species

Table 10-6 Listed critically endangered and endangered species - likelihood of occurrence within the Project footprint

Species	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Birds				
Star finch (eastern), Star finch (southern)	Endangered	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
Black-throated finch (southern)	Endangered	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
Mammals				
Northern quoll	Endangered	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
Plants				
Cycas megacarpa	Endangered	*Cycas megacarpa* is found in woodland, open woodland and open forests, often in combination with a grassy understory, including RE 11.3.25 that is present within the Project footprint (DoE 2014b).	Species has not been recorded within desktop search extent however, potentially suitable habitat is present within the Project footprint.	Moderate

Species	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Marlborough blue	Endangered	Grows on hills and slopes in sparse, grassy open forest at altitude from 80 to 400 m, and is frequently found on shallow, stony, infertile soils that are developed on sandstone and serpentinite (DoE 2014c). Eucalypt woodland and forest often on serpentinite, with patchy distribution. Serpentine endemic, may occur in surrounding hills within 1.0 km of the Eden Bann Weir impoundment.	Species recorded within desktop search extent, but potentially suitable habitat is absent from the Project footprint. Therefore, only incidental plants may occur rather than any naturally sustainable populations of this species within the impoundments.	Low
Siah's backbone, Sia's backbone, Isaac wood	Endangered	Siah's backbone is found in rainforests, mainly along watercourses. It grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest (DoE 2014d).	Species has not been recorded within desktop search extent, and potentially suitable habitat is absent from project footprint.	Low
Lesser swamp-orchid	Endangered	The Lesser Swamp-orchid is commonly associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest It is often associated with rainforest elements such as Bangalow Palm or Cabbage Tree Palm (DoE 2014e).	Unlikely to be any naturally sustainable populations of this species as no suitable habitat occurs in the Project area and species has not previously been recorded in the Project area.	Low
Finger panic grass	Endangered	Finger panic grass usually occurs in grasslands and in undulating woodlands and open forests with an underlying basaltic geology. In Queensland, it occurs in communities dominated by *Eucalyptus orgadophila* on hills and slopes and *E. tereticornis* and *E. populnea* in drainage lines (Doe 2014f).	Species not previously recorded in the Project footprint however potentially suitable habitat is present within the Project footprint.	Moderate

10.4.3 Potential impacts

In accordance with the Part C of the ToR, potential impacts on species identified as known or likely to occur within the Project footprint are required to be assessed. The likelihood of occurrence assessment presented in Table 10-6 filters listed species to focus impact assessment on taxa that have a high potential (known or likely) to occur within the Project footprint. As there were no critically endangered or endangered species with a high potential to occur in the Project footprint, no further assessment has been undertaken in this regard.

10.5 Vulnerable species

10.5.1 Species predicted to occur

A search using the EPBC Act Protected Matters Search Tool identified 22 vulnerable species that are predicted to occur within or near to the Project footprint as shown in Table 10-5. Of these species, 21 are predicted to occur between Eden Bann Weir and Rookwood Weir and 13 within or near to the Rookwood Weir impoundment. In addition, three vulnerable species of marine turtles which breed and forage exclusively in estuary/marine habitat were predicted to occur. While these species are not known or likely to occur in the Project footprint, suitable habitat for these species exists downstream of the Project footprint. Impacts on marine turtles are assessed in Chapter 11 Migratory and marine species.

Table 10-7 Listed vulnerable species potentially present with the Project footprint

Species	Common name	EPBC Act status#	Predicted to occur^		Previously recorded*		Recorded in during field surveys**	
			Eden Bann Weir to Rookwood Weir	Rookwood Weir impoundment	Eden Bann	Rookwood	Eden Bann	Rookwood
Birds								
Erythrotriorchis radiatus	Red goshawk	Vulnerable	✓	✓	×	×	×	×
Geophaps scripta scripta	Squatter pigeon (southern)	Vulnerable	✓	✓	✓	×	✓	✓
Rostratula australis	Australian painted snipe	Vulnerable	✓	✓	×	×	×	×
Turnix melanogaster	Black-breasted button-quail	Vulnerable	✓	×	×	×	×	×
Mammals								
Chalinolobus dwyeri	Large-eared pied bat, large pied bat	Vulnerable	✓	✓	×	×	×	×
*Nyctophilus corbeni***	South-eastern long-eared bat	Vulnerable	✓	✓	×	×	×	×
Plants								
Cadellia pentastylis	Ooline	Vulnerable	×	✓	×	✓	×	×
Capparis thozetiana		Vulnerable	✓	×	✓	×	×	×

Species	Common name	EPBC Act status#	Predicted to occur^		Previously recorded*		Recorded in during field surveys**	
			Eden Bann Weir to Rookwood Weir	Rookwood Weir impoundment	Eden Bann	Rookwood	Eden Bann	Rookwood
Corymbia xanthope	Glen Geddes bloodwood	Vulnerable	✓	×	✓	×	×	×
Dichanthium queenslandicum	King blue-grass	Vulnerable	✓	✓	×	×	×	×
Eucalyptus raveretiana	Black ironbox	Vulnerable	✓	✓	×	✓	×	✓
Hakea trineura	Three-veined hakea	Vulnerable	✓	×	✓	×	×	×
Neoroepera buxifolia		Vulnerable	✓	×	✓	×	×	×
Marsdenia brevifolia		Vulnerable	✓	×	✓	×	×	×
Parsonsia larcomensis	Mt Larcom silk pod	Vulnerable	✓	×	×	×	×	×
Pimelea leptospermoides		Vulnerable	✓	×	✓	×	×	×
Pultenaea setulosa		Vulnerable	✓	×	✓	×	×	×
Reptiles								
Delma torquata	Collared delma	Vulnerable	✓	✓	×	×	×	×
Denisonia maculata	Ornamental snake	Vulnerable	✓	✓	×	×	×	×
Egernia rugosa	Yakka skink	Vulnerable	✓	✓	×	×	×	×
Furina dunmalli	Dunmall's snake	Vulnerable	✓	✓	×	×	×	×
Rheodytes leukops	Fitzroy River turtle	Vulnerable	✓	✓	✓	✓	✓	✓

Status as per the EPBC Protected Matters Search reported in EPBC referral 2009/5173

✓ = record supports presence, x = record does not support presence

^ Predicted to occur within proximity of the Project footprint based on EPBC Act Protected Matters Search Tool

* Previously recorded within proximity of the Project footprint based on desktop searches

** Previously eastern long-eared bat (*Nyctophilus timoriensis* (south-eastern form). Taxanomic revision as at 17/08/2011

**Recorded during field surveys within the Project footprint for flora species and within or near to the Project footprint for fauna species

10.5.2 Likelihood of occurrence

Table 10-8 summarises findings of an assessment of the likelihood of occurrence of vulnerable species identified as potentially occurring within the Project footprint based on habitat preferences, distribution, relative abundance, previous records from the region and the presence of suitable habitat within the Project footprint. The likelihood of occurrence assessment criteria are provided in Chapter 6 Methodology. Squatter pigeon (southern), black ironbox and the Fitzroy River turtle are species known to occur within the Project footprint.

Table 10-8 Listed vulnerable species - likelihood of occurrence within the Project footprint

Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Birds				
Squatter pigeon (southern)	Vulnerable	This species 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. stockyards, roads, 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 (DoE 2014g). This particularly occurs in RE 11.3.2 and 11.12.2.	This species is not uncommon in the region and was recorded in the Project footprint during survey in open woodland and grassland habitat. Nesting and foraging habitat occurs in riparian woodland habitats on alluvial floodplains and grasslands within the fragmented agricultural landscape. Figure 10-4 shows the squatter pigeon (southern) field survey record locations and potential habitat areas.	High
Australian painted snipe	Vulnerable	This cryptic species has the potential to occur among well-vegetated shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub and open timber (Pizzey and Knight 2007).	Potential to occur among reeds in shallow water along the edge of the river and adjacent billabongs (e.g. RE 11.3.3, 11.3.25). However, the species has not previously been recorded and was not recorded during surveys.	Moderate
Red goshawk	Vulnerable	This bird occupies a range of habitats in northern and eastern Australia, including coastal and subcoastal tall open forests and woodlands. The red goshawk has an enormous 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 (Chapter 6 Methodology) that is broadly consistent with the EPBC Act Survey Guidelines (80 hours of survey over 10 days).	Moderate

Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Black-breasted button-quail	Vulnerable	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
Mammals				
South-eastern long-eared bat	Vulnerable	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, 11.3.2, 11.11.9 and 11.11.1 however the species has not previously been recorded and was not recorded during surveys.	Moderate
Large-eared pied bat, large pied bat	Vulnerable	Found in well-timbered areas with gullies. Roosts in caves and crevices (Menkhorst and Knight 2007).	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
Plants				
Black ironbox	Vulnerable	Black ironbox is a medium to large tree from riparian habitats with a natural distribution that roughly includes sub-coastal ranges between Rockhampton and Charters Towers. There are 23 recorded sites throughout its range in two main areas of occurrence: Nebo to Ayr, and Apis Creek to Rockhampton (DoE 2014h). Black ironbox is found along rivers and creeks and prefers a silty to loamy soil in the inland Rockhampton region to the northern Fitzroy Catchment (Appendix H, Nangura 2007). The total population is unknown. A number of populations occur in areas of remnant vegetation (RE 11.3.25a) and are therefore protected from broad-scale vegetation clearing.	A population of black ironbox (200 trees over 5 m high) (Figure 10-5) occurs along Melaleuca Creek (Figure 10-6) within riparian woodland on the creek bed and banks on alluvium with grazing and spreading growth of noxious rubber vine(*Cryptostegia grandiflorus*). The population of black ironbox along Melaleuca Creek includes what appears to be a reasonable proportion of larger mature trees (diameter at breast height > 0.8 m) and a patchy mix of younger trees and saplings. The population does not appear to be in any rapid state of decline albeit at the southern extent of its natural range. However, this population is currently facing the very real threat of habitat disruption from a rubber vine infestation (Figure 10-5) though it is currently healthy. Black ironbox was recorded along several creeks near to but outside the Eden Bann Weir impoundment at Glenroy Creek (a single specimen), Ten Mile Creek and an unnamed tributary of Green Creek (Appendix H, Nangura 2007).	High

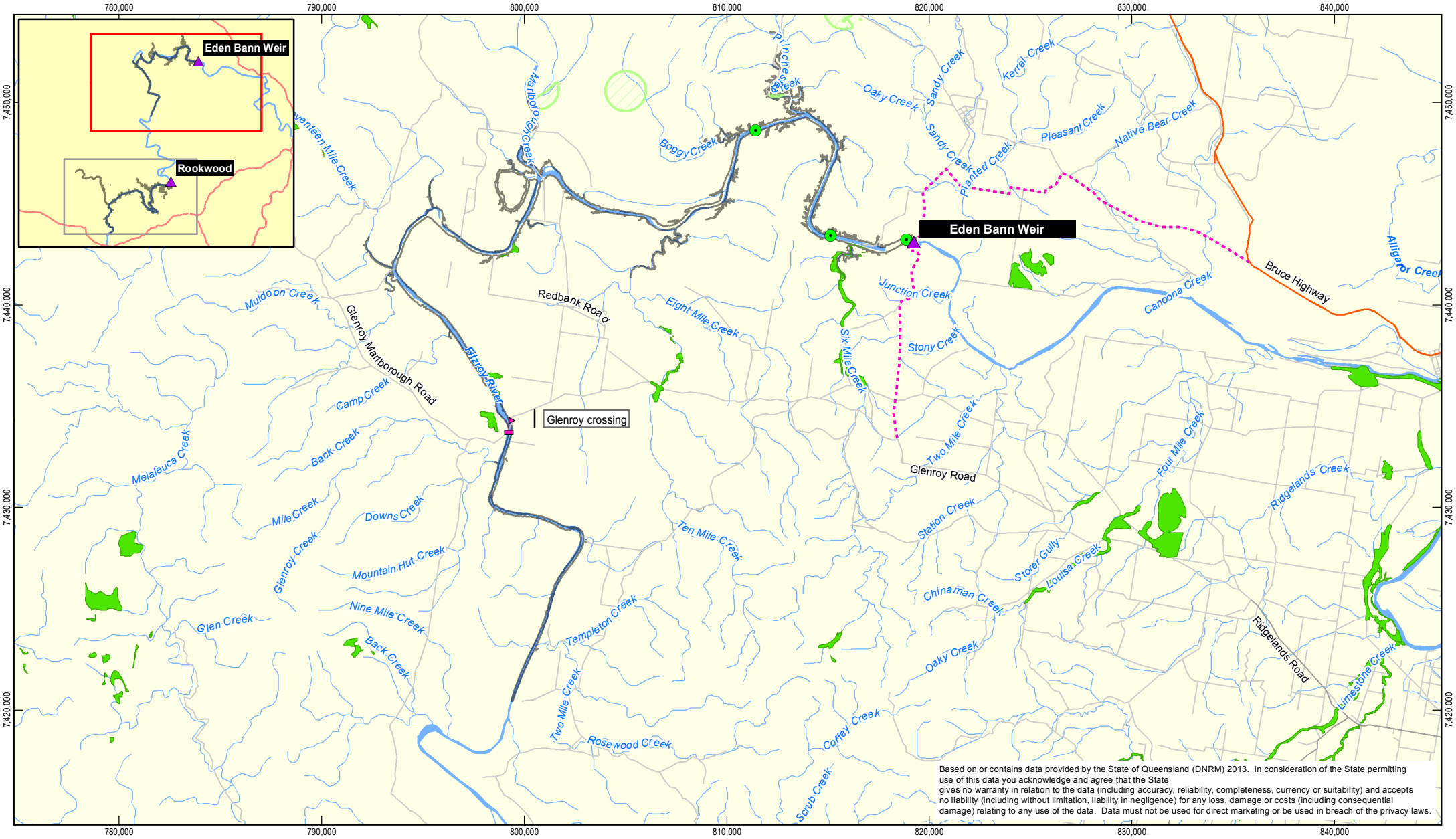
Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Neoroepera buxifolia	Vulnerable	The species comprises a small tree or shrub (between 4 m and 5 m) found in serpentine communities especially on alluvium, including riparian vine thicket, vine forest, melaleuca or eucalypt woodland or open forest with rainforest species. The species has been recorded on creeklines and beds situated on serpentinite soils, vine forests, melaleuca and eucalypt woodlands and open forests containing rainforest species (TSSC 2008e). Populations are known from Princhester Creek and Marlborough Creek area and associated drainage lines (Appendix H, Nangura 2007) as is reflected in essential habitat mapping for Marlborough Creek relating to serpentine endemics on hills and colluvials as shown on Figure 10-7.	The species was recorded within the desktop search extent and a population was located during field surveys in the upper regions of Princhester and Marlborough creeks outside of the Project footprint. Figure 10-7 shows the location of essential habitat for the species. No specimens were recorded during field surveys within the proposed impoundment however potentially suitable habitat for the species was found to occur and incidental plants could be present. Incidental plants, if present, are not considered likely to comprise a significant population.	Moderate
Ooline	Vulnerable	Ooline is a medium to large tree (to 25 m) that grows in dry rainforest, semi-evergreen vine thickets and sclerophyll ecological communities including Brigalow, often locally dominant or as an emergent (TSSC 2008d).	A small population of ooline was located during field surveys along the banks of the Mackenzie River in the upper reaches of the Rookwood Weir impoundment. The population is predicted to be 8 m (vertical) above the Stage 2 full supply level and will not be impacted. At this location the impoundment remains within the bed and banks of the Mackenzie River. Field observations for this small population noted the relatively poor health of the remnant community, the fragmented nature of the landscape and ongoing habitat disturbances. As such this population is not considered to be naturally sustainable in the long-term. Relic populations are considered possible in Brigalow/scrub pockets adjacent to riparian systems. Unlikely to be any naturally sustainable populations of this species within the Project footprint.	Low

Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Capparis thozetiana	Vulnerable	This species is a prostrate shrub (to 40 cm high) within *Ecalyptus fibrosa* woodlands on serpentine hill slopes. The species is mapped within essential habitat along Marlborough Creek relating to serpentine endemics on hills and colluvials (Figure 10-7).	The species is recorded within desktop search extent and is known to occur on serpentine soils in nearby hills and ranges (Appendix H, Nangura 2007) however potentially suitable habitat is absent from the Project footprint. Given the species' preference for serpentine soils on stony hillsides it is considered unlikely that any naturally sustainable populations occur within impoundment areas. Incidental plants may occur but none were recorded during field surveys.	Low
Glen Geddes bloodwood	Vulnerable	Glen Geddes bloodwood is a small to medium height tree that inhabits soils derived from serpentinite in hills and ranges, with the geographic distribution restricted from Rockhampton to Marlborough.	The species is recorded within desktop search extent but potentially suitable habitat is absent from the Project footprint. Given the species' preference for serpentine soils on stony hillsides it is considered unlikely that any naturally sustainable populations occur within impoundment areas. Incidental plants may occur but none were recorded during field surveys.	Low
Three-veined hakea	Vulnerable	Three-veined hakea is a multi-stemmed open shrub (to 3 m tall) within habitat that consists of eucalypt woodland on serpentine soils, but more frequently found on stony/gravel soils with low clay content.	Species recorded within desktop search extent (within approximately 1.5 km of Eden Bann Weir impoundment), but potentially suitable habitat is absent from the Project footprint. Incidental plants may occur rather than any naturally sustainable populations within the impoundments.	Low
Marsdenia brevifolia	Vulnerable	*Marsdenia brevifolia* is a herbaceous vine that grows on serpentine rock outcrops or crumbly black soils derived from serpentine in eucalypt woodland, often with *Eucalyptus fibrosa* and *Corymbia xanthope* (TSSC 2008f).	Species recorded within desktop search extent within local serpentine hills. Given the species' preference for serpentine soils on stony hillsides potentially suitable habitat is absent from the Project footprint. Incidental plants may occur rather than any naturally sustainable populations of this species within the impoundments.	Low

Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Pimelea leptospermoides	Vulnerable	This species comprises a small upright shrub (to 1.2 m) and occurs on stony hillsides and in sandy clay soils, in open eucalypt forest with a grassy and/or healthy understorey, and in Melaleuca woodland where prolonged flooding occurs. It is found in most serpentine soil vegetation communities, but not in riverine forest on black clays, or dry rainforest on stony red and brown clay loams and clays (TSSC 2008g). The species is mapped within essential habitat along Marlborough Creek relating to serpentine endemics on hills and colluvials (Figure 10-7).	Species are known from within the desktop search extent on serpentine soils in nearby hills and ranges. The preferred habitat for the species is on serpentine hills that exclude alluvial clay and loams within the impoundment areas. During field survey specimens were found on hillsides above the inundation areas within serpentine woodlands. Incidental plants may occur but it is considered unlikely that there are any naturally sustainable populations within the proposed impoundment areas based on soil properties and the proximity to seasonal flooding (Appendix H, Nangura 2007).	Low
Pultenaea setulosa	Vulnerable	*Pultenaea setulose* is an upright shrub (to about 1.5 m tall) that grows on serpentinite substrates in *Eucalyptus fibrosa* and/or *Corymbia xanthope* woodlands or open forests (TSSC 2008h).	Species has been recorded within desktop search extent. Given the species' preference for serpentine soils on stony hillsides it is considered unlikely that there are naturally sustainable populations present within impoundment areas. Incidental plants may occur but nil found during field searches (Appendix H, Nangura 2007).	Low
King blue-grass	Vulnerable	King blue-grass is endemic to Queensland occurring mostly on black clay soils supporting blue-grass communities. It is uncommon across its natural distribution but has been found in a broad range of soils across Queensland.	A historic record exists from the greater district outside of the Project footprint and it is considered unlikely to occur naturally within close proximity to the Project footprints as habitat is limited.	Low
Mt Larcom silk pod	Vulnerable	The species is found in the Rockhampton-Mount Perry (south of Rockhampton and south-west of Bundaberg) area in open heathland and shrubland at or near the summits of mountain peaks in shallow loamy soils on cliffs or among outcrops of acid volcanic rocks and serpentinites (DoE 2014i).	The species is known from sites at Mount Larcom (amongst others) (approximately 70 km south of the city of Rockhampton) and outside of the Project footprints. It is unlikely that there are any naturally sustainable populations of this species within the proposed impoundments due to absence of suitable habitat, and species has not previously been recorded within the Project footprint.	Low

Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Reptiles				
Fitzroy River turtle	Vulnerable	The Fitzroy River turtle is endemic to the Fitzroy Basin catchment with the species' distribution extending along the Fitzroy River from the Fitzroy Barrage to the upper reaches of the Dawson, Nogoa and Connors rivers. Important habitat areas relevant to the Project footprints (Legler and Cann 1980, Cann 1998, Limpus et al. 2011) are described in Appendix L, shown on Figure 10-8 and include: • Glenroy Crossing (essential habitat and type locality) • Redbank Crossing (type locality) • Marlborough Creek (essential habitat) • Between Boolburra rail crossing and the Capricorn Highway on the Dawson River (essential habitat) • Alligator Creek (known nesting habitat).	The Fitzroy River turtle is known from sites within the Project footprint. The ability to respire aquatically allows the species to inhabit fast-flowing riffle zones (Gordos 2004). While riffle zones are considered particularly important the species also inhabits pools, runs and creeks. The Fitzroy River turtle is also known to inhabit modified habitats associated with in-stream infrastructure, such as impoundments. While the species largely avoid the deep water areas immediately upstream of the weir wall, suitable habitat occurs within the shallow littoral habitats along the perimeter of the impoundment, within the shallower upstream margins and within pools immediately downstream. The species is not known to occur in off-stream habitats such as farm dams, billabongs or flood plains (Limpus et al. 2011). Appendix L provides a detailed species overview.	High
Collared delma	Vulnerable	This species normally inhabits eucalypt dominated woodland and open forest where it is associated with suitable micro-habitats (exposed rocky outcrops) (DoE 2014j).	Suitable habitat occurs in woodland however the species has not previously been recorded and was not recorded during surveys.	Moderate
Ornamental snake	Vulnerable	This nocturnal species is known only from the Brigalow Belt region of Queensland, within the drainage system of the Fitzroy and Dawson rivers. It occurs in Brigalow woodland growing on clay and sandy soils, riverside woodland, and open forest growing on natural levees (DoE 2014k).	Brigalow woodland communities (RE 11.3.1) occurring in small remnant patches may provide suitable habitat however the species has not previously been recorded and was not recorded during surveys.	Moderate

Common name	EPBC Act status	Habitat characteristics	Suitable habitat in Project footprint and evidence of occurrence	Likelihood of occurrence
Yakka skink	Vulnerable	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. Such habitat and resources are present within the Project footprints, particularly in less disturbed remnant mature woodland. However the species has not previously been recorded from the area and was not recorded during surveys.	Moderate
Dunmall's snake	Vulnerable	This species occurs in Brigalow 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 (DoE 2014l).	Suitable habitat occurs in open forest and woodland on deep cracking clay soils (within RE 11.3.1, 11.3.2 and 11.3.25) however the species has not previously been recorded and was not recorded during surveys.	Moderate



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0 2 4 6 8 10

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
- Waterway
- Highway
- Major Road
- Secondary Roads
- Waterway
- Impoundment area
- Potential squatter (southern) pigeon habitat
- Squatter pigeon (southern) recorded location
- Essential Habitat squatter pigeon

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Job Number 41-20736
Revision A
Date 06 May 2014

Squatter pigeon (southern) recorded locations and potential habitat

Sheet 1 of 2
Figure 10-4

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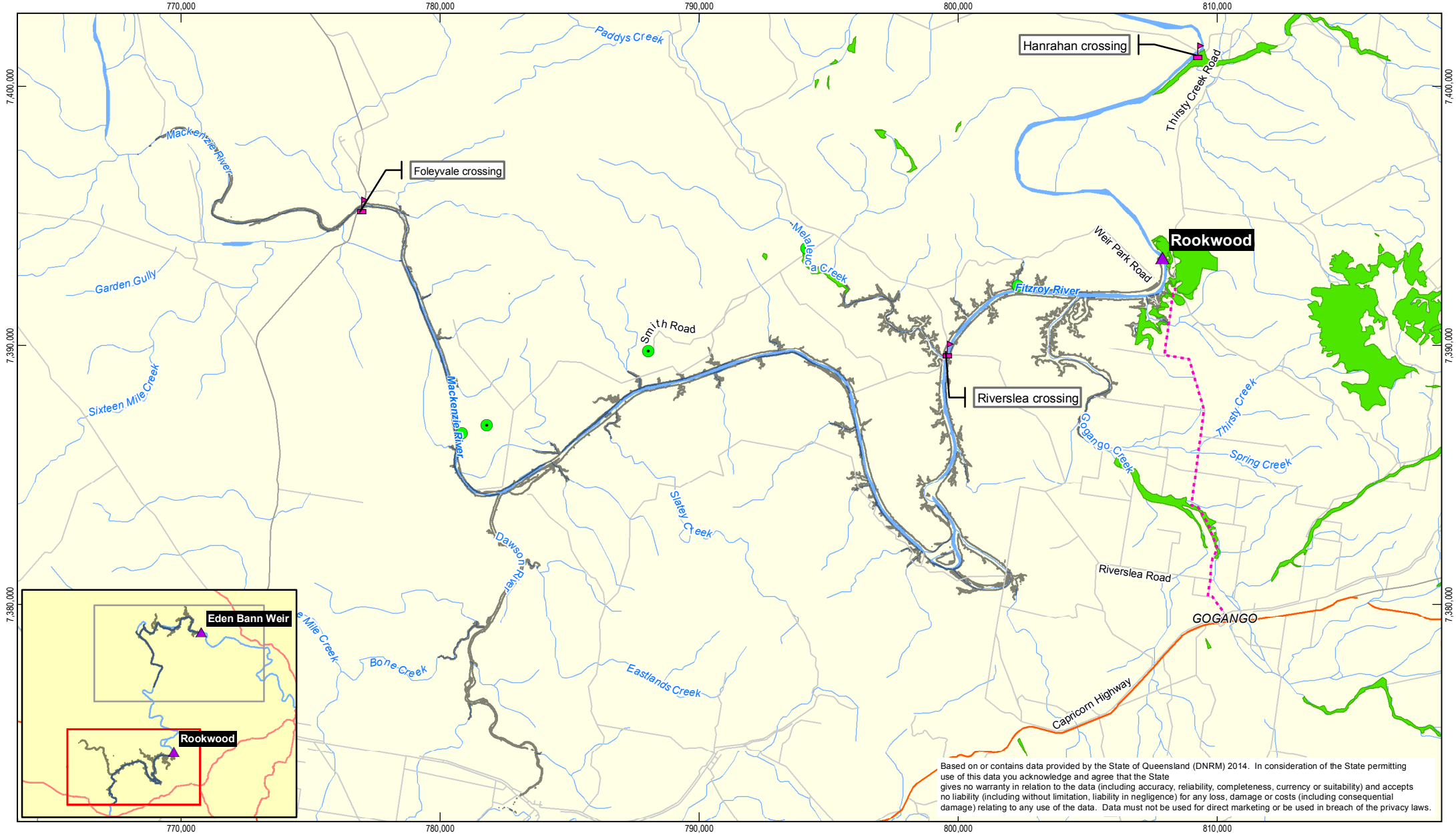

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0 2 4 6 8

Kilometres

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

N

LEGEND

- Weir Location
- River Crossing
- Waterway
- Highway
- Major Road
- Secondary Roads
- Waterway
- Impoundment area
- Squatter pigeon (southern) recorded location
- Potential squatter (southern) pigeon habitat

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Squatter pigeon (southern) recorded locations and potential habitat

Sheet 2 of 2
Figure 10-4

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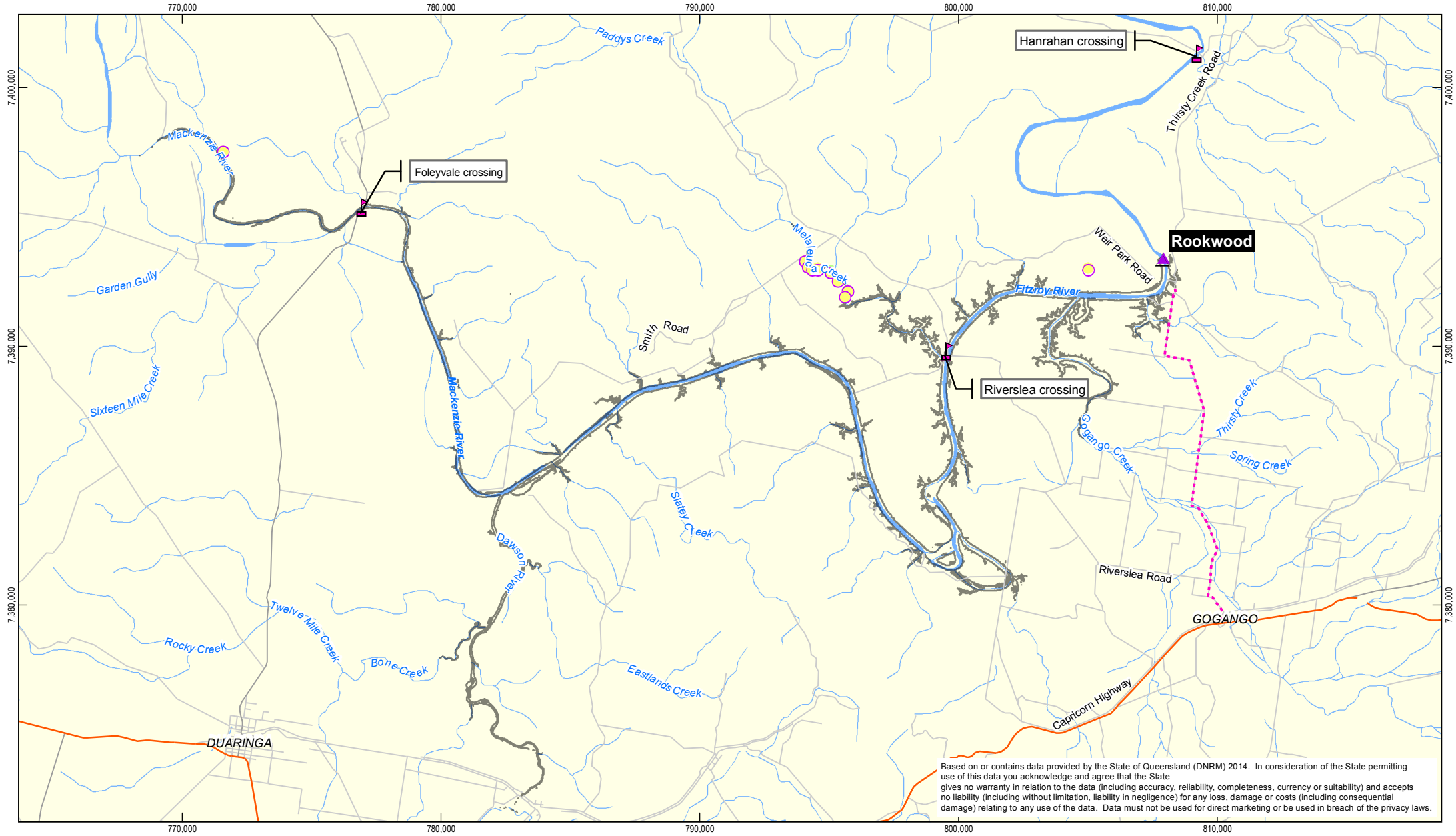
Figure 10-5 Black ironbox

Blackironbox riparian woodland (RE 11.3.25a) along Melaleuca Creek (Source: Nangura 2007).

Blackiron box riparian woodland (11.3.25a) along Melaleuca Creek with rubber vine infestation (Source: Nangura 2007).

Blackironbox along Melaleuca Creek (fringing woodland of *Melaleuca trichostachya* and blackironbox +/- *Eucalyptus camaldulensis/tereticornis* emergent and a spreading growth of noxious rubber vine) upstream of the Project footprint (Source: Nangura 2007).



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0 2 4 6 8

Kilometres

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

N

LEGEND

- Weir Location
- River Crossing
- Waterway
- Access Road
- Highway
- Major Road
- Secondary Roads
- Waterway
- Impoundment area
- Black ironbox recorded location

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Black ironbox (Rookwood Weir Project footprint)

Figure 10-6

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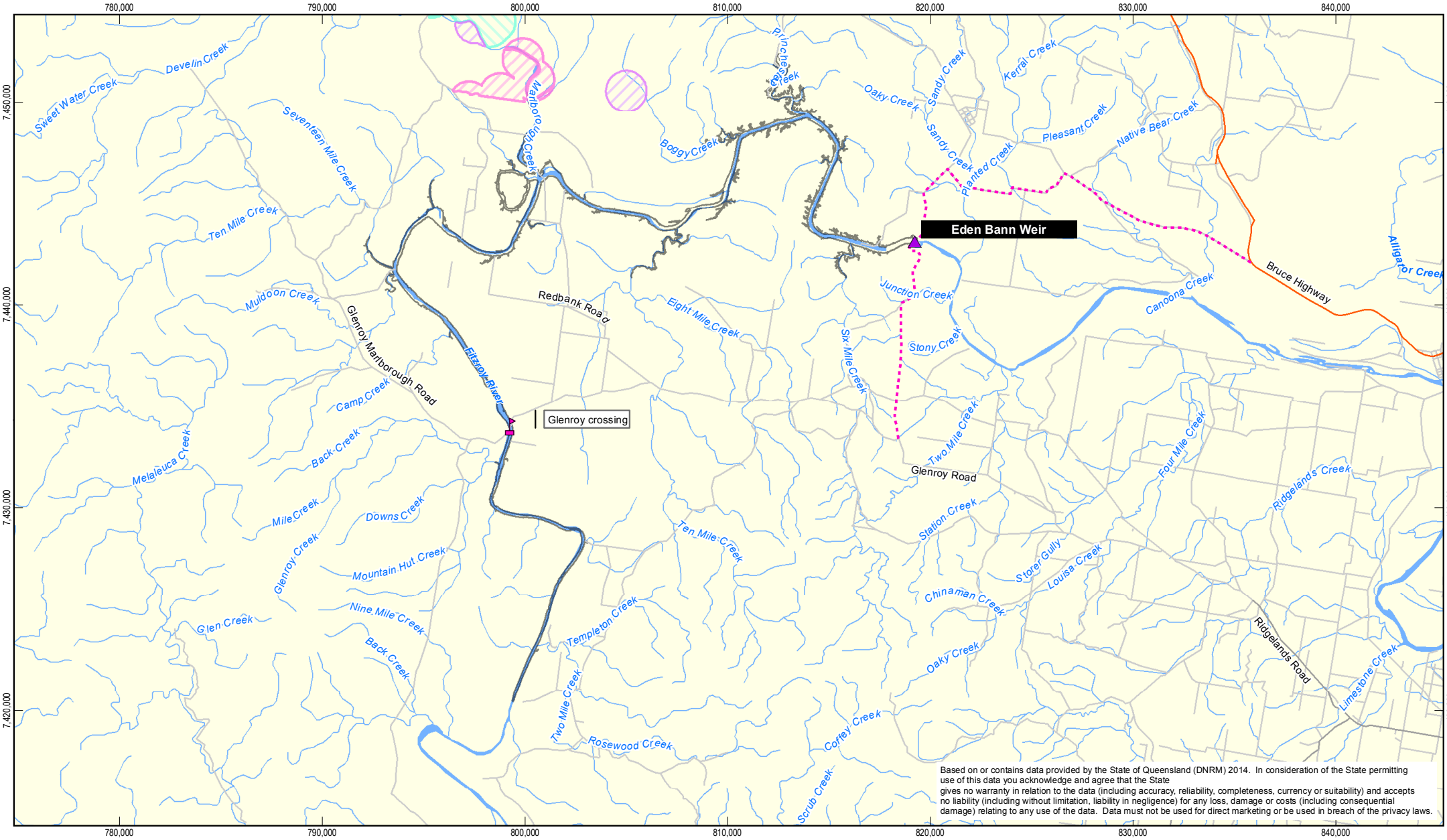

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1:250,000 (at A4)

0 2 4 6 8 10

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
- Waterway
- Highway
- Major Road
- Secondary Roads
- Waterway
- Access Road
- Impoundment area
- Essential Habitat *Neoroepera buxifolia*
- Essential Habitat *Capparis thozetiana*
- Essential Habitat *Capparis thozetiana* and Essential Habitat *Neoroepera buxifolia*

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Essential habitat for serpentine endemics on hills and colluvials (Eden Bann Weir)

Figure 10-7

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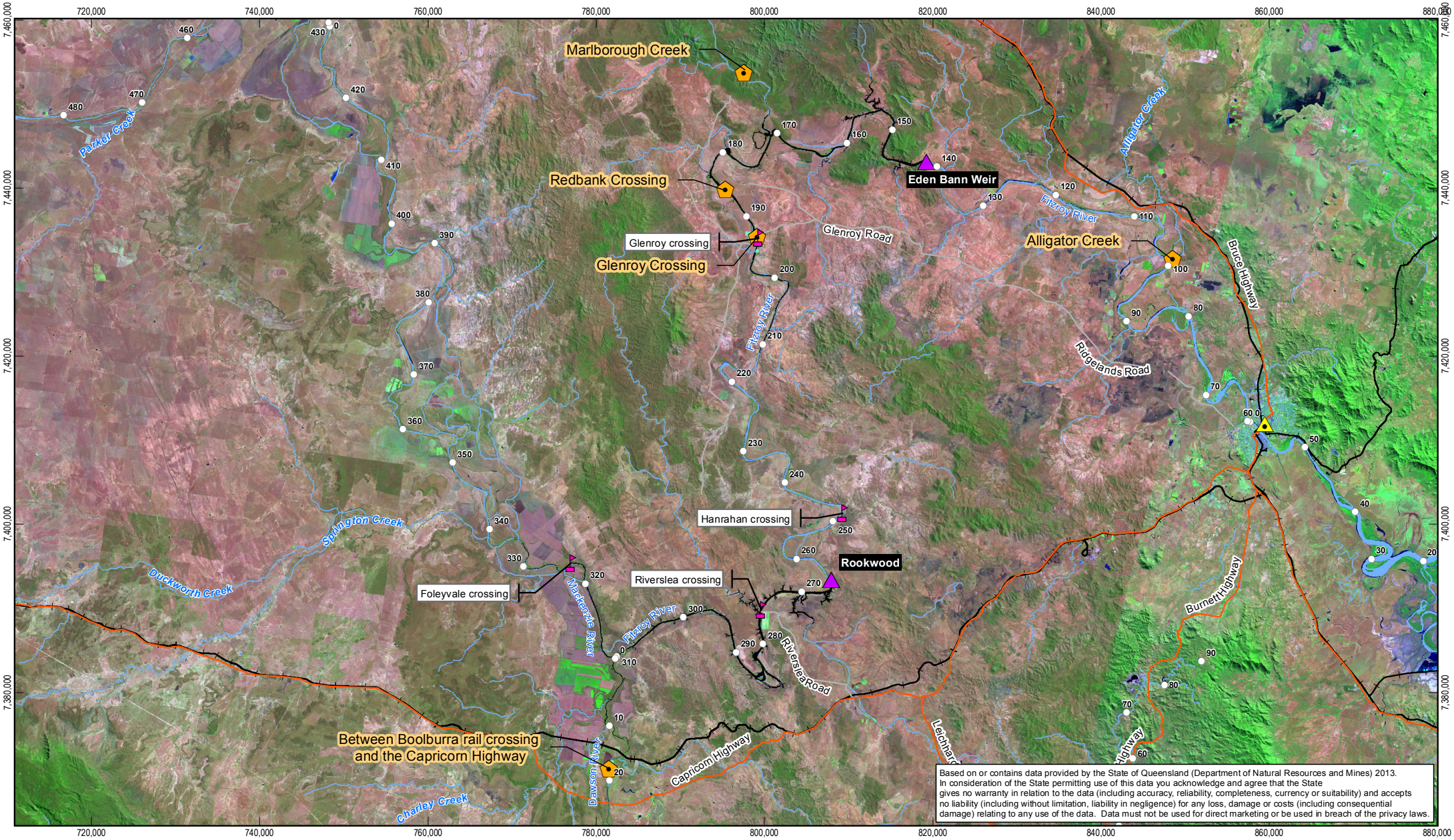

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0 10 20

Kilometres

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

N

LEGEND

- AMTD (km)
- Weir Location
- Fitzroy Barrage
- River Crossing
- Highway
- Minor Road
- Waterway
- Railway
- Impoundment Area
- Fitzroy river turtle important habitat areas
- Essential Habitat fitzroy river turtle

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Revision C
Date 05 Sep 2014

Fitzroy River turtle important habitat areas

Figure 10-8

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10.5.3 Potential impacts

The likelihood of occurrence assessment presented in Table 10-7 filters listed vulnerable species to focus impact assessment on taxa that have a high potential (are known or considered likely) to occur within the Project footprint. In accordance with Part C of the ToR, potential impacts on the following species known or likely to occur within the Project footprint are assessed:

- Squatter pigeon (southern)
- Black ironbox
- Fitzroy River turtle.

An assessment against the MNES guidelines has been undertaken to determine the significance of residual impacts as applicable.

10.5.3.1 Squatter pigeon (southern)

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 (*Felis catus*) and foxes (*Vulpes vulpes*) (approved conservation advice (TSSC 2008c)).

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 (Figure 10-4).

Access to water is an important determinant of habitat utilisation for this species (DoE 2014g) 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 approved threat abatement plans for predation by feral pigs (DEH 2005), feral cats (DEWHA 2008a) and the European red fox (DEWHA 2008b) as well as existing local and regional programmes.

These mitigation and management measures are incorporated into the EMPs developed for the Project as discussed in Chapter 13 Environmental management systems.

The significance of residual impacts on the squatter pigeon (southern) as assessed in Table 10-9 indicates the Project will not result in a significant impact to the squatter pigeon (southern).

Table 10-9 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 in southern Queensland and northern New South Wales (approved conservation advice (TSSC 2008c)) which lie well 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.

Significance criterion	Assessment
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 already supports a number of 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.

10.5.3.2 Black ironbox

As discussed in Section 10.5.2 and Appendix H, black ironbox is known to occur within the Project footprint and was recorded during field surveys.

The main threat to black ironbox is habitat disturbance and smothering by rubber vine. Other potential threats to the species include timber harvesting and disturbance during timber harvesting, fire frequency and land management practices that increase stream bank erosion (approved conservation advice (TSSC 2008h)).

Two populations of black ironbox were recorded within the wider Eden Bann Weir study area along Glenroy Creek and in the vicinity of Ten Mile and Green creeks. A single specimen was recorded at Glenroy Creek and additional small populations (48 and 40 trees per km, respectively) were recorded at Ten Mile Creek and an unnamed branch of Green Creek (upstream of Eden Bann Weir). Populations at these locations are within disturbed and fragmented or cleared riparian habitats outside of the Project footprint and will not be impacted.

Field observations estimate that approximately 100 black ironbox trees will be impacted by the impoundment associated with Rookwood Weir (at the upper limit of development that is Rookwood Weir Stage 2) along Melaleuca Creek. Marginal impacts (approximately 40 trees) will occur at intermediate development levels (Rookwood Weir Stage 1).

An assessment of impacts on black ironbox against the MNES guidelines is provided in Table 10-10. The population of black ironbox impacted as a result of impoundment associated with Rookwood Weir is considered an important population necessary for the species' long term survival and recovery and the loss of 100 individuals is considered a significant impact. Environmental offsets are proposed in accordance with the EPBC Act Environmental Offset Policy and approved conservation advice for the species as discussed further in Chapter 14 Offsets.

Table 10-10Significance of impact on black ironbox

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	The Project will result in a long term reduction in size of the black ironbox population along the Fitzroy River and its immediate tributaries.
Reduce the area of occupancy of an important population	The Project will result in a reduction in the area of occupancy of an important population. The inundation of alluvial terraces along these watercourses represents a reduction of suitable habitat for this black ironbox population.
Fragment an existing important population into two or more populations	It is not anticipated that the Project will further fragment this population. The Project may result in impacts to the periphery of the population thereby reduce the population size and/or area of habitat but will not dissect the area population into multiple populations.
Adversely affect habitat critical to the survival of a species	Although the Project will reduce the area of occupancy of this population by impinging on important habitat, this habitat cannot be construed as critical to the survival of the species.
Disrupt the breeding cycle of an important population	The Project is expected to result in the loss of all black ironbox individuals below the impoundment level. Saplings will most likely die within a year of inundation, and large mature individuals within five years. During this period all individuals are likely to be too stressed to produce flowers and seed at the usual volume. Therefore, the Project will disrupt the breeding cycle of plants within an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project on its own will not result in alterations to habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	It is not expected that the Project will result in any further invasive species that are harmful to black ironbox. It is likely that the Project will result in a temporary decline in the prevalence of rubber vine in the impoundment, at least until it becomes established again along the new waterline. Weed and pest management measures will be implemented to prevent spreading/promoting rubber vine regrowth.
Introduce disease that may cause the species to decline	It is not expected that the Project will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	It is not expected that the Project will interfere with the recovery of the species. Individuals above the impoundment level are likely to survive and it is anticipated that these individuals will reproduce over time and the population will continue to regenerate.

10.5.3.3 Fitzroy River turtle

The Fitzroy River turtle is endemic to the Fitzroy Basin catchment with the species' distribution extending from the Fitzroy Barrage to the upper reaches of the Dawson, Nogoa and Connors Rivers (Limpus et al. 2011). The distribution of the Fitzroy River turtle encompasses the Project footprints and the species is known to occur within both the Eden Bann Weir and Rookwood Weir Project footprints and in areas upstream and downstream. Important habitat in the form of historically significant type localities and mapped essential habitat is present and the Project footprints support isolated nesting in a number of areas. Due to the proportion of the species' habitat in which the Project is located and the significance of habitats within and downstream, the Project footprint is considered to support an important population of the Fitzroy River turtle. The largest known nesting aggregation for the species occurs approximately 40 km AMTD downstream of Eden Bann Weir in the upper reaches of the Fitzroy Barrage impoundment at Alligator Creek (Figure 10-8).

Existing threatening processes acting on the Fitzroy River turtle are detailed in Appendix L. The biggest threat to the survival of the species is the lack of recruitment into the population (Limpus et al. 2011, DERM 2008). Predation of nests by feral animals in particular and trampling of nests by cattle results in poor survival of egg clutches. The bias in favour of adult turtles within the Fitzroy catchment indicates that low recruitment of hatchlings has been occurring over many decades (Limpus et al. 2011). Limpus et al. (2011) predicts that at current recruitment rates the population within the catchment is not sustainable.

The potential impacts on the Fitzroy River turtle that may arise as a result of the Project are likely to be analogous to those caused by the processes which are currently affecting the species throughout the Fitzroy Basin catchment as summarised in Table 10-11. A detailed assessment of impacts on the Fitzroy River turtle, including mitigation and management actions, is provided in Appendix L. Indirect downstream impacts on the Fitzroy River turtle are addressed in Section 10.6.2.3.

A species management program (SMP) for the Fitzroy River turtle has been developed and included at Appendix M. This SMP has been developed having regard to the approved conservation advice for the Fitzroy River turtle. The SMP considers threat abatement and recovery actions (DoE 2014m) as appropriate and describes measures to be implemented to avoid, and if this is not possible, minimise the potential impacts of the Project on the species. The SMP also details specific design features intended to minimise injury to turtles and to allow turtle movement past the weir walls. The SMP will be implemented together with the Project EMPs (Chapter 13) and provides a framework for the management of the species throughout the life of the Project.

Unavoidable impacts are expected to remain in relation to commissioning and operation (impoundment). An assessment in accordance with the MNES guidelines has been undertaken and presented in Table 10-11.

These residual impacts are considered significant and offsets are proposed (Chapter 14 Offsets). The protection and management of turtle nests is proposed to offset the Project's impacts on this species. The protection and management of nests will target Project specific impacts as well as address the key processes currently threatening the survival of the species throughout the catchment. These actions will reduce nest predation, increase population recruitment and promote the recovery of the species.

Table 10-11Potential impacts on the Fitzroy River turtle

Mechanism	Impact on the Fitzroy River turtle[2]
Construction and commissioning phase	
Clearing of vegetation and excavation within the bed and banks	• Loss of foraging and sheltering resources within and adjacent to construction footprints and river crossing construction areas • Loss of potential nesting habitat within and adjacent to construction footprints and river crossing construction areas • Potential injury and mortality of individuals and eggs located within the construction footprints and river crossing construction areas
Vehicle and plant movement to, from and around the construction site	• Potential injury and mortality of individuals and eggs located within the construction footprints and river crossing construction areas • Degradation of habitat through the introduction and spread of introduced weeds and pests
Storage of potentially hazardous materials	• Degradation of habitat within and downstream of the construction footprints and river crossing construction areas • Potential injury and mortality of individuals and eggs exposed to hazardous materials
Construction within the waterway	• Degradation of habitat as a result of point-source pollution from sedimentation, run-off and dust emission • Degradation of habitat as a result of light, noise and vibration disturbance • Alteration of respiratory physiology and diving behaviour due to a reduction in water quality
Acquisition of materials (aggregate) for use in construction	• Loss of potential nesting habitat at extraction sites • Degradation of habitat within and adjacent to extraction sites
Flow diversion/control	• Restriction of upstream and downstream movement of turtles past the construction footprints and river crossing construction areas • Degradation of habitat within and adjacent to the construction footprints and river crossing construction areas • Alteration of respiratory physiology and diving behaviour due to a reduction in water quality
Commissioning -water capture and storage behind the weir	• Reduction in heterogeneity of aquatic habitats within the impoundments – loss of pool-riffle-run sequences • Reduced/altered availability of foraging and sheltering resources (including microhabitats) • Inundation of confirmed and potential nesting habitat
Operation phase	
In-stream barrier operation	• Restriction of upstream and downstream movement of turtles and fragmentation of the turtle population • Potential injury and mortality of individuals as a result of structural and operational design

[2] In the absence of suitable mitigation measures

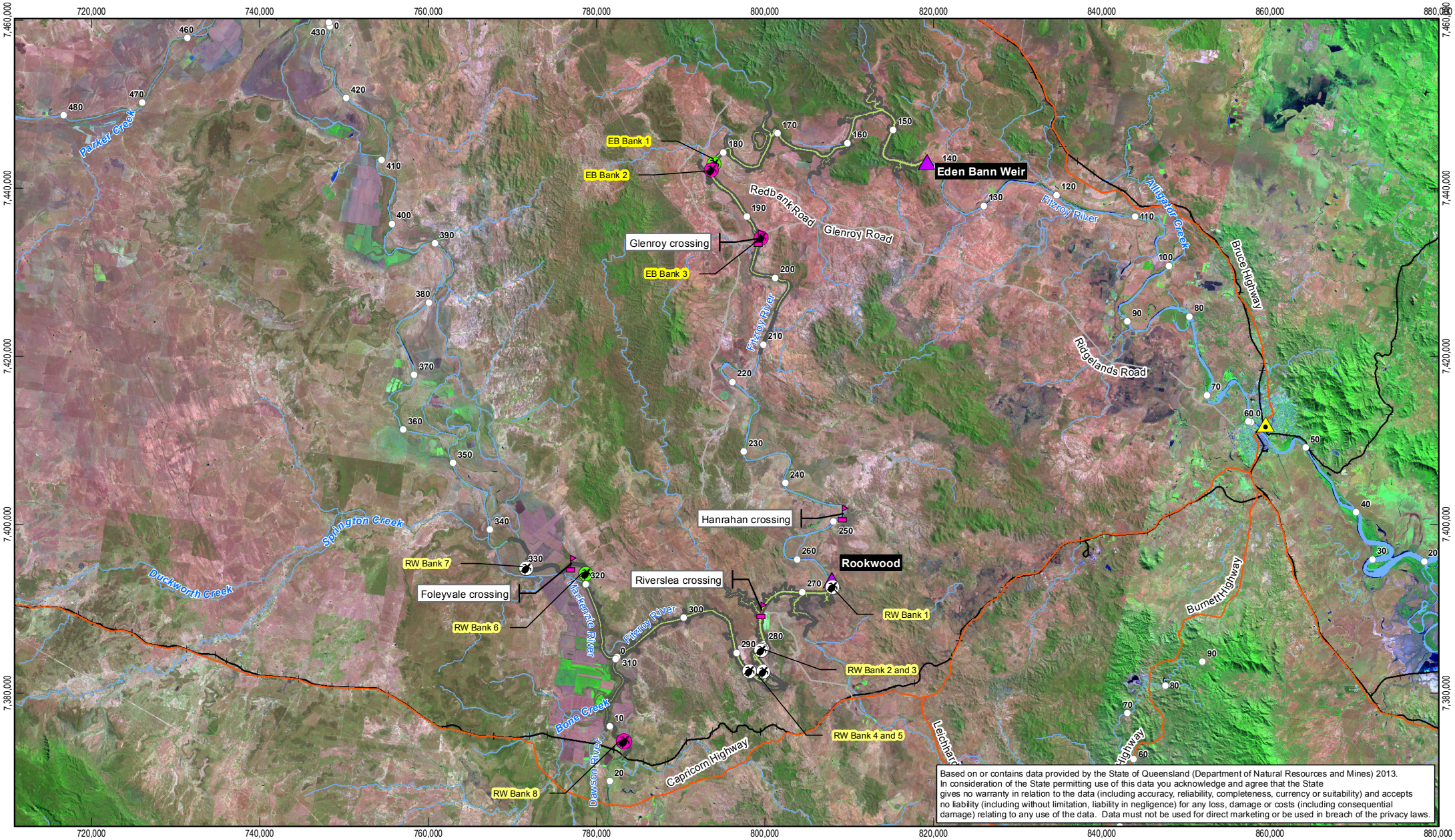
Mechanism	Impact on the Fitzroy River turtle[2]
Altered flow regimes (including management of storage)	• Degradation of habitat as a result of changes to water quality (upstream and downstream of infrastructure) • Alteration of respiratory physiology and diving behaviour due to a reduction in water quality • Potential alteration of downstream nesting habitat due to reduced sediment transport and increased weed abundance • Potential injury and mortality of individuals during recreational activities • Inundation of turtle nests as a result of fluctuations in water levels within and downstream of the impoundment • Increased predation of eggs/hatchlings and trampling of nests by cattle

Table 10-12 Significance of impact on the Fitzroy River turtle

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	The Project has the potential exacerbate the current long-term decrease in the size of an important population of Fitzroy River turtle through the impoundment of 114.5 km of natural river habitat. In general, suitable habitat for the Fitzroy River turtle will be limited to the shallow littoral habitats along the perimeter of the impoundment and within the shallow upstream margins. Due to the overall decrease in habitat resources within the impoundments, the carrying capacity of these habitats is expected to be reduced. This may result in the Project exacerbating the existing long-term decrease in the size of the Fitzroy River turtle population within these areas.
Reduce the area of occupancy of an important population	The Project is expected to reduce the area of habitat suitable for occupancy of the Fitzroy River turtle. The impoundment will result in new and enlarged deep water areas. Deep water areas (areas > 5 m depth) are expected to be largely avoided by the species due to reduced oxygen levels, little or no light penetration and colder temperatures. The open water pelagic zones are likely to provide transient habitat, however, the low abundance of micro-habitats and food resources within these areas will generally limit permanent habitat availability and suitability. In general, suitable habitat for the Fitzroy River turtle will be limited to the shallow littoral habitats along the perimeter of the impoundment and the within the shallow upstream margins.

Significance criterion	Assessment
Fragment an existing important population into two or more populations	The Project has the potential to fragment the existing population of Fitzroy River turtles within the catchment by physically inhibiting upstream and downstream movement of turtles past the weir infrastructure. The home range extent of the Fitzroy River turtle is generally relatively small, however, individuals are thought to make long distance migrations for nesting and courtship, dispersal and reposition following flood displacement. Turtle movement is currently restricted at Eden Bann Weir and at other impoundments throughout the catchment. Turtle passage facilities (turtle ramps) will be constructed at both Eden Bann Weir and Rookwood Weir to facilitate turtle movement and prevent fragmentation of populations.
Adversely affect habitat critical to the survival of a species	The Project will inundate pool-riffle-run sequences and nesting habitats. Although considered preferred habitat, pool-riffle-run sequences are not critical to the survival of the species. The shallow margins and upstream reaches of the impoundment are expected to contain suitable habitat for the Fitzroy River turtle and the presence of this species within existing impoundments substantiates this expectation. In the order of 5.7 ha of nesting habitat will be inundated by the impoundments (Appendix L). Figure 10-9 shows the location of historical and confirmed nesting habitat impacted. Figure 10-9 also identifies nesting habitat considered to be highly suitable impacted by the Project (Appendix L). While only isolated nesting has been recorded in these areas (that is there are no aggregated nest sites) and the Fitzroy River turtle has demonstrated an ability to adapt to new nesting conditions, the loss of this habitat is considered critical to the survival of the species.
Disrupt the breeding cycle of an important population	The inundation of Fitzroy River turtle nesting habitat within the Project footprints is considered a significant impact. Loss of nesting habitat has the potential to disrupt the breeding cycle of the species by restricting nesting to sub-optimal habitats and reducing reproductive success. These impacts have the potential to result in a further reduction in population recruitment, thereby exacerbating the main threatening processes currently impacting the species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will result in the impoundment of 114.5 km of natural river habitat. The quality of habitat within the deep water benthic areas and open water pelagic habitats is likely to be unsuitable for permanent habitation by the species. The Fitzroy River turtle is expected to persist in the shallow littoral margins and upstream reaches, however, due to the overall decrease in habitat resources, the carrying capacity of these habitats is expected to be reduced. Impacts to the availability and quality of habitats downstream of the Project footprints are expected to be suitably managed such that the species is unlikely to decline in these areas.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	An increase in the diversity and abundance of invasive flora and fauna species as a result of Project construction and operation is expected to be suitably managed through mitigation such that impacts to the Fitzroy River turtle are not expected.

Significance criterion	Assessment
Introduce disease that may cause the species to decline	The construction and operation of the Project is not expected to introduce disease that may cause the Fitzroy River turtle to decline.
Interfere substantially with the recovery of the species	The population of Fitzroy River turtle is currently impacted by a number of existing threatening processes, the key factor being extremely high nest predation rates. At the current rate of recruitment, the population of Fitzroy River turtles within the catchment is not considered sustainable. The management actions proposed for the Project (as described in the SMP (Appendix M)), particularly the implementation of a predator control program and provision of turtle passage, will minimise additional impact and promote the recovery of the species. The provision of an offset (Chapter 14 Offsets) to protect nests and promote nesting success will contribute to the recovery of the species in the long-term.



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0 10 20

Kilometres

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

N

LEGEND

- AMTD (km)
- Weir Location
- Fitzroy Barrage
- River Crossing
- Highway
- Minor Road
- Waterway
- Railway
- Historical turtle nesting site
- Confirmed turtle nesting site
- High Potential Turtle Nesting Suitability
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment

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Making Water Work

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision C
Date 05 Sep 2014

Fitzroy River turtle nesting habitat impacted

Figure 10-9

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10.6 Downstream threatened species

10.6.1 Species predicted to occur

Table 10-13 lists threatened species predicted to occur (based on results from the EPBC Protected Matters search) within and/or near:

- The freshwater reaches of the Fitzroy River downstream of Eden Bann Weir, including within the Fitzroy Barrage impoundment and Alligator Creek
- The marine and estuarine reaches of the Fitzroy River estuary into Keppel Bay (downstream of the Fitzroy Barrage and incorporating the Great Barrier Reef World Heritage Area (GBRWHA) and Great Barrier Reef Marine Park (GBRMP)).

Search extents and methodology is provided in Chapter 6 Methodology.

These searches were undertaken to identify threatened species that have the potential to be indirectly impacted as a result of the Project. Table 10-13 excludes species that are also listed as migratory species as impacts on these species are addressed separately in Chapter 11 Migratory species. Downstream Project impacts are discussed in Section 10.6.2.1 in relation to threatened species listed in Table 10-13.

The assessment of direct Project impacts on threatened species within the Project footprint is described in Section 10.4 and Section 10.5, including the Fitzroy River turtle, specifically addressed in Appendix L. In addition to specifically addressing impacts on the Fitzroy River turtle, Part C of the ToR requires an assessment of Project impacts on yellow chat (Dawson), a small insectivorous bird, similar to a finch that is known to occur downstream of the Project footprint in the Fitzroy Delta. Assessment of Project impacts on this species is provided in in Section 10.6.2.2.

Table 10-13 Listed threatened species predicted to occur downstream of the Project footprint

Species	Common name	EPBC Act status[#]	Predicted to occur*	
			Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy River estuary
Birds				
Epthianura crocea macgregori	Yellow chat (Dawson)	Critically endangered	×	✓
Erythrotriorchis radiatus	Red goshawk	Vulnerable	✓	✓
Geophaps scripta scripta	Squatter pigeon (southern)	Vulnerable	✓	✓
Neochmia ruficauda ruficauda	Star finch (eastern), star finch (southern)	Endangered	✓	✓
Pterodroma neglecta neglecta	Kermadec petrel (western)	Vulnerable	×	✓
Rostratula australis	Australian painted snipe	Vulnerable	✓	✓

Species	Common name	EPBC Act status#	Predicted to occur*	
			Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy River estuary
Turnix melanogaster	Black-breasted button-quail	Vulnerable	✓	✓
Mammals				
Chalinolobus dwyeri	Large-eared pied bat, large pied bat	Vulnerable	✓	✓
Dasyurus hallucatus	Northern quoll	Endangered	✓	✓
*Nyctophilus corbeni***	South-eastern long-eared Bat	Vulnerable	✓	✓
Xeromys myoides	Water mouse, false water rat	Vulnerable	×	✓
Plants				
Capparis thozetiana		Vulnerable	✓	×
Corymbia xanthope		Vulnerable	✓	×
Cossinia Australiana	Cossinia	Endangered	✓	×
Cycas megacarpa		Endangered	✓	✓
Cycas ophiolitica		Endangered	✓	✓
Eucalyptus raveretiana	Black ironbox	Vulnerable	✓	✓
Hakea trineura	Three-veined Hakea	Vulnerable	✓	×
Marsdenia brevifolia		Vulnerable	✓	×
Neoroepera buxifolia		Vulnerable	✓	×
Parsonsia larcomensis	Mt Larcom Silk Pod	Vulnerable	✓	×
Pimelea leptospermoides		Vulnerable	✓	×
Pultenaea setulosa		Vulnerable	✓	×
Reptiles				
Denisonia maculata	Ornamental snake	Vulnerable	✓	✓
Egernia rugosa	Yakka skink	Vulnerable	✓	✓
Furina dunmalli	Dunmall's Snake	Vulnerable	✓	×
Rheodytes leukops	Fitzroy River turtle	Vulnerable	✓	✓
Sharks				
Pristis zijsron	Green saw fish	Vulnerable	×	✓

Status as per the EPBC Protected Matters Search reported in EPBC referral 2009/5173.

^ Predicted to occur within proximity of the Project footprint based on EPBC Act Protected Matters Search Tool

✓= record supports presence, x = record does not support presence.

** Previously eastern long-eared bat (*Nyctophilus timoriensis* (south-eastern form). Taxanomic revision as at 17/08/2011.

10.6.2 Potential downstream impacts

10.6.2.1 General

The Project impact on flow regimes and water quality downstream of the Project is discussed in detail in Chapter 8 General impacts.

Flow analysis and subsequent statistical tests have indicated that there is no significant change in the hydrological regime (including the magnitude and frequency of flooding) of the Fitzroy River in the downstream reaches as a result of the Project and environmental flow objectives are maintained. Downstream flows are currently regulated through releases from Eden Bann Weir and the Fitzroy Barrage in accordance with operating rules (including for environmental flows) prescribed in the Fitzroy Basin Resource Operations Plan 2004 (Fitzroy ROP) which implements the Water Resource (Fitzroy Basin) Plan 2011 (Fitzroy WRP). Operating rules (current and future) dictate that flows to the Fitzroy Barrage are to be maintained through releases from Project infrastructure. Flows downstream of the Fitzroy Barrage are and will continue to be made in accordance with the Fitzroy ROP.

Water quality within the Fitzroy Basin, including within the lower reaches of the Fitzroy River, the Fitzroy River estuary and within Keppel Bay (GBRWHA and GBRMP) is largely influenced by large scale land clearing activities to support agricultural production. Point source inputs, regulated flows from Eden Bann Weir and the Fitzroy Barrage as well as natural climatic variability (such as flooding) also impact water quality.

Impacts on water quality as a result of Project construction activities, such as erosion, run-off and sedimentation, are considered to be localised and short-term. It is unlikely that these impacts will influence water quality in the downstream environs and will therefore not impact (directly or indirectly) on threatened species or their habitats.

Water quality within the Fitzroy Basin, including within the lower reaches of the Fitzroy River, the Fitzroy River estuary and within Keppel Bay (GBRWHA and GBRMP) is heavily influenced by anthropogenic factors in the catchment (such as run-off and sedimentation from large scale land clearing to support agricultural production) and these existing impacts on water quality will persist. The Project is not expected to increase the sediment load within the system. Some short-term increases in nutrient levels, as well as increased turbidity and reduced oxygen levels are expected to occur at the weir sites (Chapter 8 General impacts). Wet season in flows, overtopping of the weir spillway, operational releases and releases through fishways and outlet works will dilute and flush nutrients and materials from within the impoundment. It is not therefore expected that water quality in the downstream reaches will be significantly affected.

The Project is therefore not predicted to alter downstream environmental flows or water quality and will not result in downstream loss or fragmentation of habitats, increased predation or the introduction or spread of invasive weeds. No direct or indirect impacts to threatened species predicted to occur downstream of the Project (Table 10-13) are anticipated.

10.6.2.2 Yellow chat (Dawson)

Yellow chat (Dawson) distribution and habitat is shown in Figure 10-10 and an overview of the characteristics of the sub-species is provided in Table 10-14.

The wetland habitat of the yellow chat (Dawson) is dependent on surface / overland flow and is threatened by modifications to hydrological regimes through flow reductions into catchments (Houston and Melzer 2008). Overland flow is defined as water that runs across the land after rainfall, either before it enters a watercourse, after it leaves a watercourse as floodwater, or after it rises to the surface naturally from underground. This flow reduction, as referred to, is associated with overland flow and not flow within the river. As the Project comprises construction and operation of instream infrastructure overland flow patterns will not therefore be impacted. Further maintenance of species habitat within the Fitzroy Delta is largely influenced by localised drainage and surface flows as a result of local rainfall events rather than by large scale events occurring in the greater catchment area and flows within the Fitzroy River (Houston pers. Comm. 2009).

Flow analysis and subsequent statistical tests indicate that the Project is not predicted to significantly alter environmental flows downstream of the Fitzroy Barrage (Appendix P) and will not impact on local drainage channels within yellow chat (Dawson) habitat within the Fitzroy Delta.

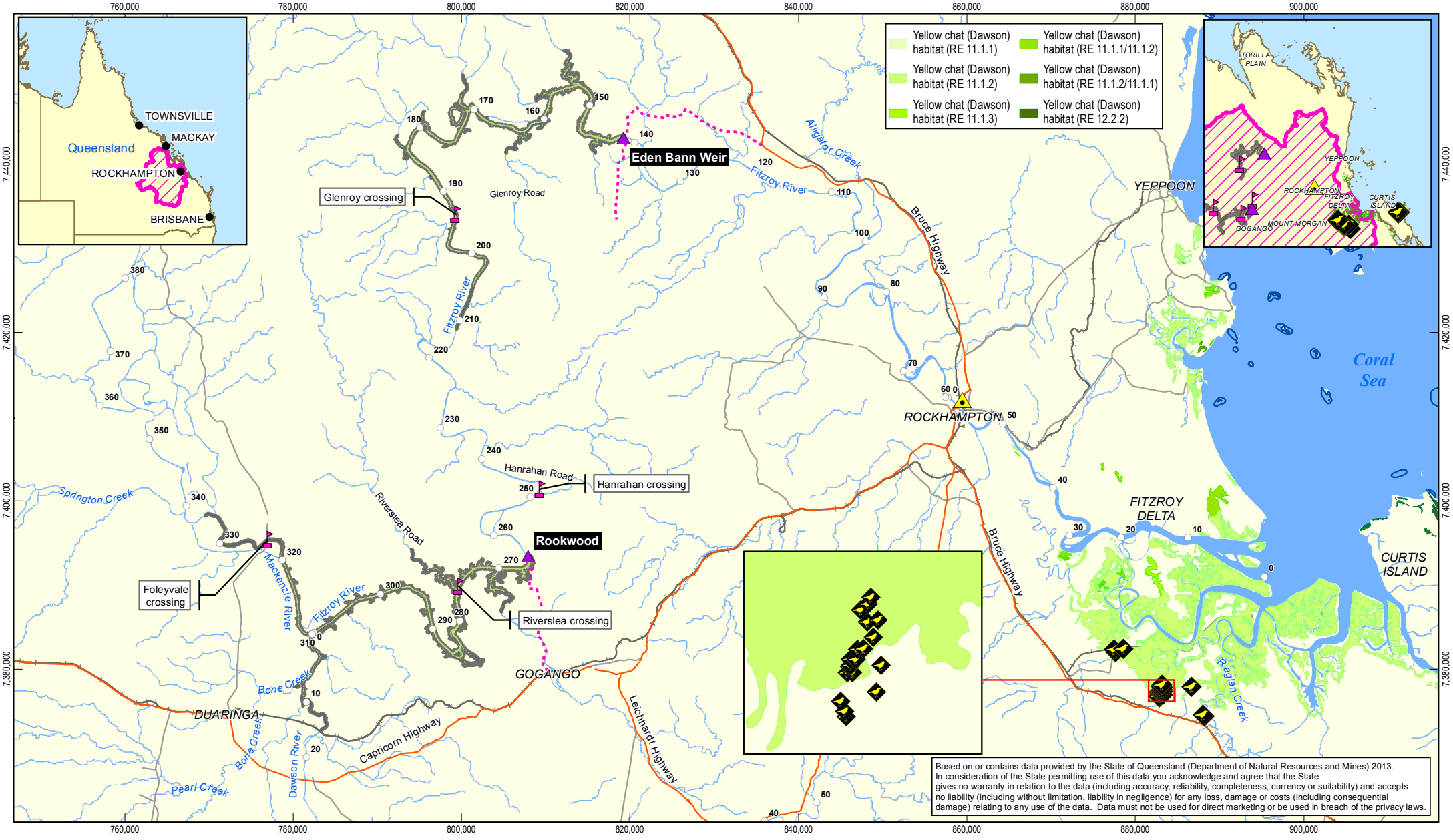
It is considered that the development of the Project and subsequent uses of the downstream storage at the Fitzroy Barrage will not impact negatively on yellow chat (Dawson) habitat.

Table 10-14Yellow chat (Dawson) characteristics

Characteristics	Description
Biology	Species description • Yellow chat (Dawson) is a small, finch-sized insectivorous bird with adult birds standing approximately 11 cm tall and weighing nine grams (Higgins et al. 2001) Life history and ecology • Birds feed within low vegetation in or near channels and basins. Adults forage on the ground at the base of sedges and on bare mud or dry substrates, on low vegetation such as grass tussocks, sedges and samphires and occasionally on shrubs fringing sedge-beds (Houston et al. 2004a, 2004b, 2012; Jaensch et al. 2004a; Jaensch 2004b) • The breeding season is labile which allows the sub-species to breed in any season following substantial rainfall although summer-autumn are dominant corresponding to the wetter months (Houston et al. 2012) • Nesting sites are recorded in sedges and grasses from 0.4 m to 1.5 m high in a variety of vegetation types comprising Daly River club rush (*Schoenoplectus litoralis*), marine couch and water couch • Clutch sizes range from two to three eggs although adults have been observed feeding up to four young (Houston et al. 2004a, 2004b, Jaensch et al. 2004a) • Chats are thought to be opportunistic breeders after rainfall (Williams 1979). Inundation of wetlands that stimulates plant growth and increases insect abundance is thought to trigger breeding in yellow chat (Dawson) (Williams 1979, Houston et al. 2004a)

Characteristics	Description
Distribution	As shown in Figure 10-10 the yellow chat (Dawson) is known from eight sites including: • One at Curtis Island • Four on the Torilla Plain • Three within the Fitzroy Delta. Houston et al. (2004b) indicates that the total adult population is in the order of 300 individuals. Torilla Plain appears to be the most productive site supporting at least 75 per cent of the known population. The Fitzroy Delta sites are of relevance to the Project.
Habitat	Sites from which the sub-species are known are associated with seasonally inundated marine plain wetlands. All sites are dependent on freshwater flows in the wet season but are variably influenced by water salinity. Two important habitat components appear to be: • Areas of moderate to tall rush/sedge or grass vegetation along drainage lines and depressions providing shelter and nesting habitat • Foraging habitat comprising these shelter areas and nearby more open vegetation types (more spare grasslands and samphire (Houston et al. 2004a, Jaensch et al. 2004a) REs corresponding to known habitats are shown in Figure 10-10 and include: • RE 11.1.1 *Sporobolus viginicus* grassland on Quaternary estuarine deposits • RE 11.1.2 Samphire forbland or bare mud-flats on Quaternary estuarine deposits • RE 11.1.3 Sedgelands to grasslands on Quaternary estuarine deposits • RE 12.2.2 Saltpan vegetation comprising *Sporobolus virginicus* grassland and samphire herbland on Quaternary estuarine deposits RE 11.1.3 most adequately describes the sub-species' habitat. Habitat critical to the survival of the sub-species is considered to comprise wetlands and associated grasslands on seasonally inundated marine plains. These wetlands have shallow braided channels and depressions with a mosaic of dense sedge beds, grasslands, tall samphire and areas of mud and/or shallow water.
Threatening processes	The wetland habitat of the sub-species is dependent on surface flow. Upstream land-uses (dams, ponded pasture banks, levees) can reduce overland flow. Further sub-species wetland habitat is threatened by land management practices that: • Reduce habitat and hydrological complexity, for example levee banks cause discontinuity between upper and lower marine plains resulting in freshwater pooling and a reduction in the complex braided drainage systems utilised by the sub-species • Directly damage sedges or grasses that provide shelter and nesting habitat, for example by cattle trampling and increased grazing intensity • Cause habitat loss, for example industrial expansion associated with saltfields and port infrastructure • Alter the marine plain wetland habitat structure through the replacement of native sedges and grasses with introduced wet pasture grasses. Other threats may include increased groundwater salinisation, siltation of channels, unmanaged public access, prolonged floods, consequential impacts associated with climate change and predation by feral animals but these are currently ill-defined.

Source: adapted from Houston and Melzer 2008.



1:600,000 (at A4)

0 5 10 15 20

Kilometres

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

N

LEGEND

- AMTD (km)
- Weir Location
- Fitzroy Barrage
- River Crossing
- Highway
- Major Road
- Streets (Local)
- Fitzroy Basin
- Rookwood Weir Stage 1 impoundment
- Rookwood Weir Stage 2 impoundment
- Eden Bann Weir Stage 2 impoundment
- Eden Bann Weir Stage 3 impoundment
- Access Road
- Yellow chat

Gladstone Area Water Board, SunWater
Lower Fitzroy River Infrastructure Project

Job Number 41-20736
Revision C
Date 05 Sep 2014

Yellow chat (Dawson) distribution and habitat

Figure 10-10

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Data Source: © Copyright Commonwealth of Australia (Geoscience Australia): Places, Waterways (2007); Sunwater: Waterways, Weir Locations /2008; DNRM: Habitat- RE v6.1/Nangura/2011/2007, Railways, Roads/2010; Wildnet: Wildlife online/2009. Created by: MS *See Appendix for disclaimers and copyrights.

10.6.2.3 Fitzroy River turtle

As presented in Figure 10-8, Alligator Creek (which drains to the Fitzroy River main channel at approximately 100 km AMTD) provides important habitat for the Fitzroy River turtle and comprises one of the largest known nesting aggregations for the species. The Fitzroy Barrage pond extends from the Barrage infrastructure (at 59.6 km AMTD) to an upstream limit at 115.0 km AMTD. Alligator Creek is considered to be within the Fitzroy Barrage's influence.

Flows to the Fitzroy Barrage are (and will continue to be) regulated as a result of releases from upstream infrastructure, namely the existing Eden Bann Weir (and the future Project infrastructure). Releases are made in accordance with operational rules dictated by the Fitzroy ROP, including environmental flow releases (seasonal and base flows) and releases for water users. These operating rules (current and future) facilitate that flows to the Fitzroy Barrage are maintained and thus flows impacting on Alligator Creek are maintained.

Operation of the Fitzroy Barrage storage is (and will continue to be) regulated by the Fitzroy ROP. In the event of insufficient inflows, the Fitzroy ROP imposes restrictions on users to maintain the Barrage at a minimum level in order to reduce environmental harm, such as degraded water quality, as a result of low water levels and the presence of stagnant pools. The storage volume and impoundment area of the Fitzroy Barrage pond will not be permanently increased as a result of the Project. Inflows to the Barrage are balanced by outflows and/or abstraction by users. Similarly, current impoundment levels at Alligator Creek will not be increased and impacts on nesting bank habitat are not expected.

Direct Project impacts on the Fitzroy River turtle and its habitat are discussed in Section 10.5.3.3 and Appendix L.

10.7 Summary

In accordance with Part C of the ToR, potential impacts on threatened species and ecological communities identified as having a high potential (known or likely) to occur within the Project footprint have been assessed. Indirect impacts on threatened species downstream of the Project are also considered.

Conservatively, in the order of 20 ha of Brigalow TEC will be affected as a result of the construction and operation of the Project. The impacted areas of Brigalow TEC are not considered to constitute critical habitat and, taking in to consideration the fragmented and disturbed nature of the Brigalow communities within the Project footprint, the representation of this community within the surrounding landscape and the relatively small proportion potentially impacted, the Project is not considered likely to have a significant impact on this ecological community. However, where loss due to impoundment and clearing is unavoidable, offsets are proposed as discussed in Chapter 14 Offsets.

No critically endangered or endangered species have a high potential to occur in the Project footprint. The yellow chat (Dawson) is known from downstream estuarine sites within the Fitzroy Delta. Hydrological flow analysis indicates that the Project is not expected to influence localised drainage and inflows, or impact on water quality, to these wetland habitats that support the sub-species.

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

- Squatter pigeon (southern) is not uncommon in open woodland and grassland habitats in the region and within the Project footprint as verified through field survey. In the order of 21.5 ha of squatter pigeon (southern) habitat (based on areas of RE 11.3.2 and RE 11.12.2) will be impacted by the Project. Squatter pigeon (southern) within the Project footprint are not considered to be part of an 'important population' and the area does not represent 'habitat critical to the survival of the species'. Suitable habitat for the species persists outside of Project areas in large fragments on low rocky hills and uncleared alluvial plains. Further, access to water is an important determinant of habitat utilisation for the species and the impoundments are likely to therefore provide benefits. Implementation of EMPs during the construction and operation phases of the Project will further avoid, mitigate and manage impacts arising from direct injury, habitat clearing and predation. It is not considered that the Project will have a significant impact on the squatter pigeon (southern)
- An important population of black ironbox (200 trees) is known from within riparian woodland habitat along Melaleuca Creek (associated with the Rookwood Weir impoundment). While this population is not in a rapid state of decline, habitat disruption through infestation of rubber vine is apparent. It is estimated that 100 trees will be impacted by impoundment associated with Rookwood Weir Stage 2 and approximately 40 trees will be impacted by impoundment associated with Rookwood Weir Stage 1 at this location. An offset is proposed to mitigate the unavoidable loss of these trees as a result of impoundment (Chapter 14 Offsets)
- The Fitzroy River turtle is endemic to the Fitzroy Basin catchment with the species distribution extending downstream to the Fitzroy Barrage (most notably at Alligator Creek) and upstream into the Dawson, Nogoa and Connors rivers. The Fitzroy River turtle is known from sites within the Project footprint. Appendix L provides a detailed species and habitat overview. Important habitats comprising type localities and essential habitat are present and the Project footprints support isolated nesting in a number of areas. Lack of recruitment into the population is reported by Limpus et al. 2011 as being the greatest threat to survival of the species, with nest predation by feral animals and trampling by cattle being the primary factor in poor survival of egg clutches. Unmitigated impacts on the Fitzroy River turtle arising as a result of the Project are likely to be analogous to those caused by current threatening processes, namely the loss of riffle zone habitat, loss of nesting habitat, reduced water quality, the creation of movement barriers, increased injury and mortality and increased predation. A SMP for the Fitzroy River turtle has been developed (Appendix M) to provide a framework for the management of impacts on the species throughout the life of the Project. Significant residual impacts are considered likely to remain in relation to operation of the Project and offsets are proposed (Chapter 14 Offsets). Hydrological flow analysis indicates that the Project will maintain flows to the Fitzroy River Barrage but will not increase impoundment levels thus the Project is not expected to impact on Fitzroy River turtle habitat located 40 km downstream of the Project at Alligator Creek.

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