11. Migratory and marine species

Table of contents

Table index

11.1 Overview

This chapter provides an assessment of impacts on listed migratory and marine species as a result of the Lower Fitzroy River Infrastructure Project (Project). Migratory species listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) include species listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA) and the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). Marine species listed under the EPBC Act occur naturally in the Commonwealth marine area and although they may not occur within the direct footprint of the Project, these species are included in this impact assessment to take account of potential indirect impacts which may affect the long-term conservation of the species.

EPBC Act Protected Matters searches were undertaken for the Project to identify listed migratory and marine species potentially present within the Project footprint (directly impacted) and downstream of the Project footprint (indirectly impacted). Impacts on identified migratory and marine species are assessed in the following sections.

A summary of survey methodologies is provided in Chapter 6 and detailed survey methods are included within Appendix N and Appendix O.

11.2 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, available in the public domain. Field studies were conducted to obtain ecological information relevant to the Project and to ground truth results from desktop assessments. For conservation significant migratory and marine species, a likelihood of occurrence assessment (Table 11-1) was undertaken to focus assessment on those taxa that are known or likely to occur within the Project footprint. Migratory species listed under the EPBC Act include species listed under the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the China-Australia Migratory Bird Agreement, the Japan-Australia Migratory Bird Agreement and the Republic of Korea – Australia Migratory Bird Agreement.

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 11-1 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

Likelihood	Category	Definition supporting information
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

11.3 Listed migratory species within the Project footprint

11.3.1 Species predicted to occur

EPBC Act Protected Matters searches undertaken for the Project identified 20 migratory species that are potentially present within or near the Project footprint as shown in Table 11-2. This includes six species of marine turtles which breed and forage exclusively in estuary/marine habitat. 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 as discussed in Section 11.4.

Table 11-2 Listed migratory species potentially present within or near to the Project footprint

Species	Common name	EPBC Act status	Predicted to occur^		Previously recorded*		Recorded in Project area	
			Eden Bann Weir to Rookwood Weir	Rookwood Weir inundation	Eden Bann	Rookwood	Eden Bann	Rookwood
Migratory marine birds								
Apus pacificus	Fork-tailed swift	Marine, migratory (CAMBA, JAMBA, ROKAMBA)	✓	✓	×	×	×	×
Migratory marine species								
Crocodylus porosus	Salt-water/ estuarine crocodile	Marine, migratory (Bonn)	✓	✓	✓	×	✓	×
Migratory terrestrial species								
Haliaeetus leucogaster	White-bellied sea-eagle	Marine, migratory (CAMBA)	✓	✓	✓	✓	✓	✓
Merops ornatus	Rainbow bee-eater	Marine, migratory (JAMBA)	✓	✓	✓	✓	✓	✓
Hirundapus caudacutus	White-throated needletail	Marine, migratory (CAMBA, JAMBA, ROKAMBA)	✓	×	×	×	×	×
Hirundo rustica	Barn swallow	Marine, migratory (CAMBA, JAMBA, ROKAMBA)	✓	✓	×	×	×	×

Species	Common name	EPBC Act status	Predicted to occur^		Previously recorded*		Recorded in Project area	
			Eden Bann Weir to Rookwood Weir	Rookwood Weir inundation	Eden Bann	Rookwood	Eden Bann	Rookwood
Monarcha melanopsis	Black-faced monarch	Marine, migratory (Bonn)	✓	✓	x	x	x	x
Monarcha trivirgatus	Spectacled monarch	Marine, migratory (Bonn)	✓	x	x	x	x	x
Myiagra cyanoleuca	Satin flycatcher	Marine, migratory (Bonn)	✓	✓	x	x	x	x
Rhipidura rufifrons	Rufous fantail	Marine, migratory (Bonn)	✓	✓	x	x	x	x
Migratory wetland species								
Ardea alba	Great egret, white egret	Marine, migratory (CAMBA, JAMBA)	✓	✓	x	x	✓	x
Ardea ibis	Cattle egret	Marine, migratory (CAMBA, JAMBA)	✓	✓	x	x	x	x
Gallinago hardwickii	Latham's / Japanese snipe	Marine, migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	✓	✓	x	x	x	x
Rostratula benghalensis	Painted snipe	Vulnerable, marine, migratory (CAMBA)	✓	✓	x	x	x	x

✓ = record supports presence, x = record does not support presence
^ Predicted to occur within proximity to the Project area based on EPBC Act Protected Matters Search Tool
* Previously recorded within proximity to the Project area based on desktop searches

11.3.2 Likelihood of occurrence

Table 11-3 assesses the likelihood of occurrence of migratory species identified as potentially occurring within or near to the Project footprint. Assessment took account of species habitat preferences, distribution, previous records from the region and the presence of suitable habitat within the Project footprint. The likelihood of occurrence assessment criteria is provided in Chapter 6 Methodology. The likelihood of occurrence assessment filters listed species to focus impact assessment on taxa that have a high potential (known or likely) to occur within the Project footprint (Section 11.3.3).

Table 11-3 Commonwealth listed migratory species predicted to occur within and surrounding the Project footprint – likelihood of occurrence

Species	Common name	Suitable habitat in Project footprint	Likelihood of occurrence
Migratory marine birds			
Apus pacificus	Fork-tailed swift	May be a transient visitor to the Project footprint. However unlikely to constitute critical breeding, foraging, roosting or shelter habitat. The fragmented and disturbed landscape matrix within and adjacent to the project footprint exacerbates this.	Moderate
Migratory marine species			
Crocodylus porosus	Salt-water / estuarine crocodile	The Fitzroy River represents marginal habitat for the estuarine crocodile, and is at the southern extreme of the species' range in eastern Queensland.	High
Migratory terrestrial species			
Haliaeetus leucogaster	White-bellied sea-eagle	The species has been previously recorded and was recorded during survey, however the Project footprint is unlikely to constitute critical breeding, foraging, roosting or shelter habitat. The fragmented and disturbed landscape matrix within and adjacent to the Project footprint exacerbates this.	High
Merops ornatus	Rainbow bee-eater	Known to occur in the Project footprint, with riparian and floodplain woodlands providing sufficient nesting, shelter and foraging resources.	High
Hirundapus caudacutus	White-throated needletail	May be a transient visitor to the Project footprint. However unlikely to constitute critical breeding, foraging, roosting or shelter habitat. The fragmented and disturbed landscape matrix within and adjacent to the Project footprint exacerbates this.	Moderate
Hirundo rustica	Barn swallow	May be a transient visitor to the Project footprint. However unlikely to constitute critical breeding, foraging, roosting or shelter habitat. The fragmented and disturbed landscape matrix within and adjacent to the Project footprint exacerbates this.	Moderate
Monarcha melanopsis	Black-faced monarch	The woodland and forest communities within the Project footprint are fragmented and there is a lack of suitable habitat for the black-faced monarch. This species may occur in low numbers within the Project footprint.	Moderate

Species	Common name	Suitable habitat in Project footprint	Likelihood of occurrence
Monarcha trivirgatus	Spectacled monarch	May be a transient visitor to the Project footprint. However the Project footprint is unlikely to constitute critical breeding, foraging, roosting or shelter habitat. This species has not previously been recorded and was not recorded during surveys.	Moderate
Myiagra cyanoleuca	Satin flycatcher	The woodland and forest communities within the Project footprint are fragmented and there is a lack of suitable habitat for the satin flycatcher. This species may occur in low numbers within the Project footprint.	Moderate
Rhipidura rufifrons	Rufous fantail	The woodland and forest communities within the Project footprint are fragmented and there is a lack of suitable habitat for the rufous fantail. This species may occur in low numbers within the Project footprint.	Moderate
Migratory wetland species			
Ardea alba	Great egret, white egret	Wetland birds including *Ardea alba* were encountered in the Project footprint during surveys.	High
Ardea ibis	Cattle egret	May be transient visitor to the Project footprint. However unlikely to constitute critical breeding, foraging, roosting or shelter habitat. The fragmented and disturbed landscape matrix within and adjacent to the Project footprint exacerbates this.	Moderate
Gallinago hardwickii	Latham's snipe, Japanese snipe	The Project footprint is unlikely to constitute critical breeding, foraging, roosting or shelter habitat. The fragmented and disturbed landscape matrix within and adjacent to the Project footprint exacerbates this.	Moderate
Rostratula benghalensis	Painted snipe	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 this species has not previously been recorded and was not recorded during surveys.	Moderate

11.3.3 Potential impacts on listed migratory species within the Project footprint

11.3.3.1 Overview

The Matters of National Environmental Significance Significant impact guidelines 1.1 (DoE 2013) indicate that an action will require approval if the action has, will have, or is likely to have a significant impact on a listed migratory species. An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of 'important habitat' for a migratory species is considered to be one or more of the following:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat utilised by a migratory species which is at the limit of the species range
- Habitat within an area where the species is declining.

11.3.3.2 Migratory birds

The Project footprint is inhabited by a diversity of common woodland, wetland and forest bird species listed as migratory under the EPBC Act. Common terrestrial species such as the white-bellied sea-eagle (*Haliaeetus leucogaster*) and the rainbow bee-eater (*Merops ornatus*) occur in the Project footprint, with riparian and floodplain woodlands providing nesting, shelter and foraging resources. Wetland birds including the great egret (*Ardea alba*) were observed within the Project footprint during surveys.

A number of migratory species predicted to occur in the Project footprint based on bioclimatic modelling were not recorded during field surveys, and have not been previously recorded in the desktop search area. As the woodland and forest communities relevant to these species are fragmented within the Project footprint, and given the lack of suitable habitat for some species (such as black-faced monarch (*Monarcha melanopsis*), satin flycatcher (*Myiagra cyanoleuca*) and rufous fantail (*Rhipidura rufifrons*)), these species may only occur at low densities or not at all within the Project footprint. Other species such as the fork-tailed swift (*Apus pacificus*) and white-throated needletail (*Hirundapus caudacutus*) may be transient visitors to the Project footprint, however due to their predominantly aerial lifestyle, are difficult to record.

While utilised by a number of common migratory species, the Project footprint is unlikely to constitute critical breeding, foraging, roosting or shelter habitat for these species (Appendix J Eden Bann Weir Baseline Terrestrial Fauna Report and Appendix K Rookwood Weir Baseline Terrestrial Fauna Report). Loss of riparian vegetation upstream of the proposed weir sites is considered unlikely to impact on these species. The fragmented and disturbed landscape matrix

within and adjacent to the Project footprint exacerbates this. As such, the woodland, forest and aquatic habitats within the Project footprint are not considered critical habitat for the migratory species known to occur within or near to the Project footprint.

11.3.3.3 Migratory marine species

The Fitzroy River represents marginal habitat for the estuarine crocodile (*Crocodylus porosus*), and is at the southern extreme of the species' range in eastern Queensland. While present in low numbers, survey results indicate that the existing Eden Bann Weir impoundment supports a greater density of estuarine crocodiles than upstream and downstream reaches of the Fitzroy River (Britton 2007). The availability of permanent, deep water and shelter and foraging resources has been cited as explanations for the observed higher density of crocodiles within the Eden Bann Weir impoundment (Britton 2007).

Due to the fact that this estuarine crocodile population is at the limit of the species' range and is a breeding population, the Fitzroy River should be considered 'important habitat' for the species as defined in the Matters of National Environmental Significance Significant impact guidelines 1.1 (DoE 2013). While habitat modification as a result of the Project is likely to have short-term impacts on the species it is unlikely to result in long-term negative impacts to the population, and in fact may serve to benefit the population through the provision of more deep water habitat and linear shoreline (Britton 2007).

Poor nesting success has been identified as the primary factor limiting population growth in the Fitzroy River estuarine crocodile population (Britton 2007). This is as a result of limited suitable nesting habitat, flooding of nest sites and nest predation. The inundation of vegetated islands and riparian fringes upstream of the proposed Eden Bann and Rookwood developments may further reduce nesting habitat resources in the short-term. However, inundation of terrestrial environments is likely to create new islands which are likely to support crocodile nesting when suitable habitat (i.e. vegetation) establishes. In particular, permanent inundation of depressions in the riparian zone and adjacent to creeks may represent suitable crocodile nesting habitat with the establishment of dense vegetation within 10 m to 20 m of the water body. Due to the longevity of estuarine crocodiles, it is not anticipated that a short-term loss of some potential nesting habitat will detrimentally impact the viability of the population upstream of Eden Bann Weir, with several years of little or no recruitment unlikely to result in a notable decline in the population.

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

11.4 Downstream migratory species

11.4.1 Species predicted to occur

Table 11-4 outlines the listed migratory species that were predicted to occur downstream of Eden Bann Weir based on the results of the EPBC Act Protected Matters Search Tool. These searches were undertaken to take account of potential indirect impacts on migratory species downstream of

the Project footprint. The two searches conducted included from Eden Bann Weir to the Fitzroy Barrage (including Alligator Creek) and from the Fitzroy Barrage to the Fitzroy River estuary. While predicted to occur based on the EPBC Act Protected Matters Search Tool, many of the migratory marine species identified in Table 11-4 would not occur in the freshwater area between Eden Bann Weir and the Fitzroy Barrage (such as sea turtles). Similarly, a number of the migratory marine species predicted to occur downstream of the Fitzroy Barrage are unlikely to use habitats within the Fitzroy River estuary and, if present, are likely to be only transient visitors (Section 11.4.2).

Table 11-4 Listed migratory species downstream of the Project footprint

Species	Common name	EPBC Act listing status	Predicted to occur*	
			Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy Estuary
Migratory marine birds				
Apus pacificus	Fork-tailed swift	Marine, migratory (CAMBA, JAMBA, ROKAMBA)	✓	✓
Macronectes giganteus	Southern giant-petrel	Endangered, marine, migratory (Bonn)	×	✓
Puffinus carneipes	Flesh-footed shearwater, fleshy-footed shearwater	Marine, migratory (JAMBA, ROKAMBA)	×	✓
Sterna albifrons	Little tern	Marine, migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	×	✓
Migratory marine species				
Crocodylus porosus	Salt-water crocodile, estuarine crocodile	Marine, migratory (Bonn)	✓	✓
Caretta caretta	Loggerhead turtle	Endangered, marine, migratory (Bonn)	✓	✓
Chelonia mydas	Green turtle	Vulnerable, marine, migratory (Bonn)	✓	✓
Dermochelys coriacea	Leatherback turtle, leathery turtle	Endangered, marine, migratory (Bonn)	✓	✓
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable, marine, migratory (Bonn)	✓	✓
Lepidochelys olivacea	Olive Ridley turtle, Pacific Ridley turtle	Endangered, marine, migratory (Bonn)	✓	✓
Natador depressus	Flatback turtle	Vulnerable, marine, migratory (Bonn)	✓^	✓
Lamna nasus	Porbeagle, mackerel shark	Migratory (Bonn)	×	✓
Dugong dugon	Dugong	Marine, migratory (Bonn)	×	✓
Balaenoptera edeni	Bryde's whale	Cetacean, migratory (Bonn)	×	✓

Species	Common name	EPBC Act listing status	Predicted to occur*	
			Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy Estuary
Megaptera novaeangliae	Humpback whale	Vulnerable, cetacean, migratory (Bonn)	×	✓
Orcaella heinsohni (previously *Orcaella brevirostris*)	Australian snubfin dolphin	Cetacean, migratory (Bonn)	×	✓
Orcinus orca	Killer whale, orca	Cetacean, migratory (Bonn)	×	✓
Rhincodon typus	Whale shark	Vulnerable, migratory (Bonn)	×	✓
Sousa chinensis	Indo-Pacific humpback dolphin	Cetacean, migratory (Bonn)	✓	✓
Migratory terrestrial species				
Haliaeetus leucogaster	White-bellied sea-eagle	Marine, migratory (CAMBA)	✓	✓
Hirundapus caudacutus	White-throated needletail	Marine, migratory (CAMBA, JAMBA, ROKAMBA)	✓	✓
Hirundo rustica	Barn swallow	Marine, migratory (CAMBA, JAMBA, ROKAMBA)	✓	✓
Merops ornatus	Rainbow bee-eater	Marine, migratory (JAMBA)	✓	✓
Monarcha melanopsis	Black-faced monarch	Marine, migratory (Bonn)	✓	✓
Monarcha trivirgatus	Spectacled monarch	Marine, migratory (Bonn)	✓	✓
Myiagra cyanoleuca	Satin flycatcher	Marine, migratory (Bonn)	✓	✓
Rhipidura rufifrons	Rufous fantail	Marine, migratory (Bonn)	✓	✓
Migratory wetland species				
Ardea alba	Great egret, white egret	Marine, migratory (CAMBA, JAMBA)	✓	✓
Ardea ibis	Cattle egret	Marine, migratory (CAMBA, JAMBA)	✓	✓
Gallinago hardwickii	Latham's snipe, Japanese snipe	Marine, migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	✓	✓
Rostratula benghalensis	Painted snipe	Vulnerable, marine, migratory (CAMBA)	✓	✓

✓ = record supports presence, x = record does not support presence
* Predicted to occur downstream of the Project area based on EPBC Act Protected Matters Search Tool

11.4.2 Potential impacts on downstream migratory species

Downstream impacts relating to changes in flow regimes, erosion, sedimentation and water quality are discussed in Chapter 8 General impacts. Downstream impacts on the Great Barrier Reef World Heritage Area are discussed in Chapter 9 World Heritage properties and National Heritage places. The Fitzroy River system is representative of a modified environment where no significant changes to downstream environments are anticipated.

The Project will not significantly alter environmental flows and will not result in loss or fragmentation of habitats, increased predation or the introduction or spread of invasive weeds downstream (Chapter 8 General impacts). No change in existing conditions will be achieved through appropriate weir design and the implementation of mitigation and management measures (Volume 1, Chapter 13 Environmental management system).

As shown in Table 11-5, migratory marine birds are predicted to occur within the Fitzroy River area. These species are transient visitors and as such, the area does not contain habitats of unique ecological value to these species. No impacts on migratory marine birds are predicted.

No significant impacts on migratory marine species are anticipated as a result of the Project (Table 11-5). The Fitzroy River area does not contain habitat critical to the survival of loggerhead turtle (*Caretta caretta)*, green turtle (*Chelonia mydas)*, leatherback turtle (*Dermochelys coriacea)*, hawksbill turtle *(Eretmochelys imbricate)* or olive Ridley turtle (*Lepidochelys olivacea)*. Nesting habitat for the flatback turtle (*Natador depressus)* exists on Curtis Island and Peak Island adjacent to the Fitzroy River estuary. The Project will not significantly alter existing conditions downstream of the Project, therefore the nesting habitats on Curtis Island and Peak Island will not be impacted by the Project.

It is unlikely that porbeagles (*Lamna nasus)*, whale sharks (*Rhincodon typus)* or killer whales (*Orcinus orca)* would use habitats downstream of the Project footprint. Bryde's whales *(Balaenoptera edeni)* and humpback whales (*Megaptera novaeangliae)*, if present, are likely to be only transient visitors.

The Fitzroy River estuary region is a habitat of relatively important conservation value for the Australian snubfin dolphin (*Orcaella heinsohni*) and is home to the southernmost resident population of this species in Australian waters (Cagnazzi 2013). Similarly, suitable habitat for Indo-Pacific humpback dolphin (*Sousa chinensis*) exists in the Fitzroy River estuary. The Project will not alter downstream flows or impact habitat within the Fitzroy River estuary and no long term changes to water quality are anticipated. Accordingly no significant indirect impacts on these species are predicted.

The Fitzroy River estuary has not been observed to support high numbers of dugong (*Dugong dugon*) consistent with the absence of seagrass for the area. The waters do, however, provide habitat observed to support low density dugong populations (Marsh et al. 2005; Grech and Marsh 2007). As for protected dolphin species, no downstream impacts to flows or water quality are predicted which could potentially affect habitat dugong are dependent upon. Accordingly, no significant impacts on dugongs are predicted.

As discussed in Section 11.2.3.3, the Project will not alter downstream flows or suitable habitat for the estuarine crocodile within the Fitzroy Barrage or the Fitzroy River estuary.

Table 11-5 Commonwealth listed migratory marine species downstream of the Project footprint – potential indirect impacts

Species	Common name	Distribution and abundance	Suitable habitat downstream of Project footprint	Potential indirect impacts
Migratory marine birds				
Apus pacificus	Fork-tailed swift	The fork-tailed swift has a wide distribution centred within the Indo-West Pacific. Within Queensland it is known from Cape York Peninsula south to Brisbane (DoE 2013a). They are common west of the Great Diving Range.	They are found predominantly over inland plains but are known to occur above foothills and coastal areas. There is no known record of the species breeding within Australia.	The fork-tailed swift is likely to only use the downstream habitats of the Project area as a transient visitor, particularly for foraging. As such, the area does not contain habitats of unique ecological value to the species. No significant impact is predicted.
Macronectes giganteus	Southern giant-petrel	The southern giant-petrel has a circumpolar distribution in the Southern Ocean. The species (predominantly juveniles) occur in subtropical and sometimes tropical waters during winter months (Walbridge 2012). The species is rare in Queensland.	The southern giant petrel occurs in coastal and oceanic waters. However, in recent years the species has become extremely rare in Queensland waters (Walbridge 2012).	The southern giant-petrel is likely to only use the downstream habitats of the Project area as a transient visitor. As such, the area does not contain habitats of unique ecological value to the species. No significant impact is predicted.
Puffinus carneipes	Flesh-footed shearwater, fleshy-footed shearwater	The flesh-footed shearwater is an Indo-West Pacific species found in southern Indian Ocean and south-western Pacific ocean habitats. Locally, it is a common transient visitor to waters off the continental shelf of south-west Western Australia and southern Queensland (DoE 2013b).	As this species is predominantly found in offshore islands such as Norfolk Island and Lord Howe Island, habitats downstream of the Project are unlikely to house this species in high numbers.	The flesh-footed shearwater is likely to only use the downstream habitats of the Project area as a transient visitor. As such, the area does not contain habitats of unique ecological value to the species. No significant impact is predicted.
Sterna albifrons	Little tern	The little tern has a widespread distribution throughout Europe, Africa, Asia and Australia. In Queensland, there is a southern and northern population, with the northern population breeding from Mackay and into the Gulf of Carpentaria (Homes 2012).	Little terns inhabit sheltered coastal environments in Australia. Downstream of the Project area this may include the estuary, river mouth, harbours and inlets, especially those with exposed sandbanks or sand-spits. Little terns are widespread on islands off the	The little tern is likely to only use the downstream habitats of the Project area as a transient visitor. Therefore, the area does not contain habitats of unique ecological value to the little tern. No significant impact is predicted.

Species	Common name	Distribution and abundance	Suitable habitat downstream of Project footprint	Potential indirect impacts
			Northern Territory coast and appear less often on offshore continental islands or coral cays off Queensland (DoE 2013c). The little tern may be a transient visitor downstream of the Project.	
Migratory marine species				
Balaenoptera edeni	Bryde's whale	Bryde's Whale is a pelagic species found in tropical and warm temperate waters (Kato 2002). There are two forms of the species, with the coastal form limited to waters 200 m or shallower. The offshore form is found in deeper water (Best et al. 1984).	No specific feeding or breeding grounds have been discovered off Australia and therefore insufficient information exists as to how Australian Bryde's Whales use their habitat (DoE 2013d). There is an inshore and offshore form of the whale. The inshore form is more likely to use habitat downstream of the Project area if suitable prey stock is available. The Bryde's whale may pass through downstream of the Project area.	Bryde's whale, if present, is likely to only be a transient visitor within downstream habitats of the Project footprint. The area does not represent habitats of unique ecological value to the whale. No significant impact on this species is predicted.
Caretta caretta	Loggerhead turtle	The loggerhead turtle has a circumglobal distribution throughout tropical to temperate waters. It is found in a range of habitats along the entire Queensland coastline, including coral and rocky reefs, sea grass meadows and soft bottom sand and mud expanses (Miller and Limpus 2012a). There are three known breeding aggregations in Queensland water (Miller and Limpus 2012a).	It is unlikely that any breeding behaviour including migrations to breeding sites, nesting, and hatchling survivorship will be affected by the Project. This is due to the known breeding aggregations occurring at Mon Repos, the Capricorn Bunker group within the Great Barrier Reef and from Swains Reef off Mackay. The species may be a transient visitor for foraging, as it was observed in near shore waters in Gladstone (GHD 2009).	The Fitzroy River estuary area does not contain habitats that provide a unique ecological service for the loggerhead turtle. Therefore, no significant impacts are predicted.
Chelonia mydas	Green turtle	The green turtle has a circumglobal distribution in all tropical and subtropical oceans. It is distributed throughout Queensland and occurs in shallow coastal areas such as coral and rocky reefs, sea	As with the loggerhead turtle, no known nesting aggregations occur downstream of the Project, with the nearest breeding aggregation within the Capricorn Bunker	The Fitzroy River estuary area does not contain habitats that provide a unique ecological service for the green turtle. Therefore, no significant impacts are

Species	Common name	Distribution and abundance	Suitable habitat downstream of Project footprint	Potential indirect impacts
		grass areas and intertidal and subtidal sand and mud expanses (Miller and Limpus 2012b).	group of the Great Barrier Reef. The loggerhead turtle is likely to be a transient visitor for foraging within areas downstream of the Project.	predicted.
Crocodylus porosus	Salt-water crocodile, estuarine crocodile	The estuarine crocodile is found throughout Northern Australia and southern Papua New Guinea. Within Queensland waters it is found from Gladstone north, throughout tropical regions and the Gulf of Carpentaria (Read, 2012). It is relatively abundant throughout tropical Queensland, particularly north of Cairns, where nesting habitats are more favourable (Read 2012).	The species has been found 130 km upstream within the Fitzroy River, and is known to occur throughout the estuaries of the lower Fitzroy River and surrounds.	The Project will not alter downstream flows or the suitability of habitat for this species within the Fitzroy Barrage or the Fitzroy River estuary area. This species is known to persist upstream and downstream of existing movement barriers. No significant impacts are predicted.
Dermochelys coriacea	Leatherback turtle, leathery turtle	The leatherback turtle is the most widely distributed marine turtle, occurring in circumglobal tropical, sub-tropical and temperate waters (Miller and Limpus 2012c). Within Australian waters, the species is known from all states, with a higher abundance in southern states.	The species occurs from coastal waters into the offshore pelagic zone. Although nesting attempts have been witnessed in southern Queensland (Miller and Limpus 2012c), the species is thought to occur in Australia largely for foraging.	The Fitzroy River estuary area does not contain habitats that provide a unique ecological service for the leatherback turtle. Therefore, no significant impacts are predicted.
Dugong dugon	Dugong	The dugong is distributed throughout the tropical and subtropical Indo-West Pacific. The majority of the world's remaining dugong occur in Northern Australia, from Moreton Bay in Queensland through to Shark Bay in Western Australia (Marsh et al. 2012).	Dugongs are found in coastal waters, as well as estuarine creeks and streams and have been tracked travelling within creeks upstream for several kilometres (DoE 2013e). The Fitzroy River estuary has not been observed to support high numbers of dugong consistent with the absence of seagrass for the area (GHD 2009; Grech and Marsh 2007).	The Fitzroy River estuary area does not represent habitat that provides a unique ecological service for the dugong. The waters provide a habitat observed to support low density dugong populations (Marsh et al. 2005; Grech and Marsh 2007). No significant impacts are predicted.
Eretmochelys imbricata	Hawksbill Turtle	The hawksbill turtle has a circumglobal distribution and is found from tropical to temperate waters. The species occurs predominantly on coral and rocky reefs. There are 72 known hawksbill turtle	As the species is heavily reliant on rocky and coral reefs, they are uncommon in other coastal areas. Additionally, their nesting grounds within Queensland waters occur in	The hawksbill turtle is likely to only be a transient visitor within downstream habitats of the Project area. Therefore, the area does not contain habitats of

Species	Common name	Distribution and abundance	Suitable habitat downstream of Project footprint	Potential indirect impacts
		nesting locations in Queensland waters, with all occurring in the northern Great Barrier Reef and into the Gulf of Carpentaria and Torres Strait (Miller and Limpus 2012d).	the northern Great Barrier Reef (Miller and Limpus 2012d). However, they may be transient visitors to the region downstream of the Project.	unique ecological value to the species. No significant impact is predicted.
Lamna nasus	Porbeagle, mackerel shark	The porbeagle has a circumglobal distribution in the subtropical and temperate waters of the southern hemisphere. Given its occurrence in cooler waters, it is known only from southern Queensland, most likely during winter months (Kyne and Curtis 2012).	The porbeagle shark occurs mainly on continental shelves and oceanic regions (Last and Stevens 2009). As such, the species is unlikely to be found in shallow coastal waters of southern Queensland.	It is unlikely that the porbeagle would use habitats downstream of the Project area. Therefore, no significant impacts are predicted to occur.
Lepidochelys olivacea	Olive Ridley turtle, Pacific Ridley turtle	The olive Ridley turtle has a circumglobal distribution, predominantly in tropical and subtropical waters. Along eastern Australia, the species occurs predominantly in the Great Barrier Reef (Miller and Limpus 2012e).	The olive Ridley turtle is found within the waters of the Great Barrier Reef. Although the downstream area of the Project footprint may form foraging habitat, it is unlikely to be a major component of the species life history. Within Queensland waters, nesting sites are only known from the western Cape York Peninsula.	The olive Ridley turtle is likely to be only a transient visitor within downstream habitats of the Project area. As such, the area does not contain habitats of unique ecological value to the species. No significant impact is predicted.
Megaptera novaeangliae	Humpback whale	The humpback whale has a circumglobal distribution in two separate southern and northern hemisphere populations. They are found in Queensland water during late autumn to spring months, following a migration pathway from Antarctica (Bannister 2012). Calving is likely to occur within the Great Barrier Reef.	The humpback whale is a transient visitor to Queensland waters, following northern migrations from Antarctica. They largely occur within 100 m depths until Hervey Bay, where they are assumed to spread out across the Great Barrier Reef and central and northern Queensland waters (Bannister 2012).	Preferred habitat for the humpback whale is not within the Fitzroy River estuary and this species is unlikely to be present in the downstream area except as a transient visitor during peak migration. No significant impacts are predicted to the GBRWHA (Chapter 9). No significant impact on this species is predicted.
Natador depressus	Flatback turtle	The flatback turtle is an Indo-West pacific species known from tropical waters of Papua New Guinea and Indonesia and tropical and subtropical waters of Australia. The only reported nesting sites for	In Queensland, the flatback turtle is relatively widespread, with major nesting sites occurring in Cape York, central and southern Queensland, including Curtis Island and	The flatback turtle is likely to be a transient visitor within downstream habitats. While nesting occurs on nearby Curtis Island and Peak Island

Species	Common name	Distribution and abundance	Suitable habitat downstream of Project footprint	Potential indirect impacts
		this species occur in Australia, located on inshore continental islands (Curtis 2012).	Peak Island adjacent to the Fitzroy River estuary.	the Project will not impact these habitats. No significant impact on this species is predicted.
Orcaella heinsohni	Australian snubfin dolphin	The Australian snubfin dolphin is endemic to northern Australian waters and Papua New Guinea. In Australia, this species occurs in shallow coastal areas often near estuaries and river mouths from southern Queensland to mid north Western Australia (Van Dyck and Strahan 2008). As they are a recently described species, little is known of their ecology or population size.	The Fitzroy River estuary is a habitat of relatively important conservation value for the Australian snubfin dolphin and is home to the southernmost resident population of this species in Australian waters (Cagnazzi 2013).	The Project will not alter downstream flows or impact on habitat within the Fitzroy River estuary. No significant indirect impacts on this species as a result of changes to water quality are anticipated.
Orcinus orca	Killer whale, orca	The killer whale is a circumglobal species, found in all oceans. Within Australia, the killer whale is typically distributed in temperate and subtropical waters, with transient specimens found in tropical waters (DoE 2013e).	In Australia, Killer Whales are usually found along the continental slope and on the shelf, particularly near seal colonies (DoE 2013e).	It is unlikely the killer whale would use habitat downstream of the Project area and therefore no significant impacts are predicted to occur.
Rhincodon typus	Whale shark	Whale sharks have a circum-global distribution within tropical, sub-tropical and warm temperate waters (Last and Stevens 2009). Found along the entire Queensland coast as transient individuals. Known to occur within the Great Barrier Reef and Osprey Reef (Meekan and Speed et al. 2012). Uncommon in other regions.	Although whale sharks occur in coastal and pelagic environments, they are uncommon in coastal waters of Queensland. Rather their known aggregations are from the outer Great Barrier Reef and offshore reefs such as Osprey Reef (Meekan and Speed et al. 2012).	It is unlikely that whale sharks would use habitats downstream of the Project area. Therefore, no significant impacts are predicted to occur.
Sousa chinensis	Indo-Pacific humpback dolphin	Indo-Pacific humpback dolphins are found throughout coastal waters of Queensland, Northern Territory and Western Australia. Off the east and northern coast of Queensland the distribution of this species appears to be continuous (DoE 2013f).	As with the snub fin dolphin, suitable habitat for this species exists in the Fitzroy River estuary.	The Project will not alter downstream flows or impact on habitat within the Fitzroy River estuary. No significant indirect impacts on this species as a result of changes to water quality are anticipated.

11.5 Marine species

11.5.1 Species predicted to occur

Table 11-6 outlines the listed marine species that were predicted to occur within and downstream of the Project footprint based on the results of the EPBC Act Protected Matters Search Tool. Marine species that are also listed as migratory are addressed in Section 11.4 and are not repeated here. Only two listed marine bird species, the magpie goose (*Anseranas semipalmata*) and the osprey (*Pandion haliaetus*), were predicted to occur within the Project footprint and downstream to the Fitzroy Barrage. All other listed marine species comprising marine fish and marine reptiles were predicted to occur downstream of the Fitzroy Barrage, however, it is unlikely that these species utilise habitat within the Fitzroy River estuary.

Table 11-6 Listed marine species predicted to occur

Species	Common name	Predicted to occur^			
		Rookwood Weir inundation	Eden Bann Weir to Rookwood Weir	Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy Estuary
Marine birds					
Anseranas semipalmata	Magpie goose	✓	✓	✓	✓
Pandion haliaetus	Osprey	✓	✓	✓	✓
Marine fish					
Acentronura tentaculata	Shortpouch pygmy pipehorse	×	×	×	✓
Campichthys tryoni	Tryon's pipefish	×	×	×	✓
Choeroichthys brachysoma	Pacific short-bodied pipefish, short-bodied pipefish	×	×	×	✓
Corythoichthys amplexus	Fijian banded pipefish, brown-banded pipefish	×	×	×	✓
Corythoichthys flavofasciatus	Reticulate pipefish, yellow-banded pipefish, network pipefish	×	×	×	✓
Corythoichthys haematopterus	Reef-top pipefish	×	×	×	✓
Corythoichthys intestinalis	Australian messmate pipefish, banded pipefish	×	×	×	✓
Corythoichthys ocellatus	Orange-spotted pipefish, ocellated pipefish	×	×	×	✓
Corythoichthys paxtoni	Paxton's pipefish	×	×	×	✓
Corythoichthys schultzi	Schultz's pipefish	×	×	×	✓
Doryrhamphus excisus	Bluestripe pipefish, Indian blue-stripe pipefish, Pacific blue-stripe pipefish	×	×	×	✓

Species	Common name	Predicted to occur^			
		Rookwood Weir inundation	Eden Bann Weir to Rookwood Weir	Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy Estuary
Festucalex cinctus	Girdled pipefish	×	×	×	✓
Filicampus tigris	Tiger pipefish	×	×	×	✓
Halicampus dunckeri	Red-hair pipefish, Duncker's pipefish	×	×	×	✓
Halicampus grayi	Mud pipefish, Gray's pipefish	×	×	×	✓
Halicampus nitidus	Glittering pipefish	×	×	×	✓
Halicampus spinirostris	Spiny-snout pipefish	×	×	×	✓
Hippichthys cyanospilos	Blue-speckled pipefish, blue-spotted pipefish	×	×	×	✓
Hippichthys heptagonus	Madura pipefish, reticulated freshwater pipefish	×	×	×	✓
Hippichthys penicillus	Beady pipefish, steep-nosed pipefish	×	×	×	✓
Hippocampus bargibanti	Pygmy seahorse	×	×	×	✓
Hippocampus kuda	Spotted seahorse, yellow seahorse	×	×	×	✓
Hippocampus planifrons	Flat-face seahorse	×	×	×	✓
Hippocampus zebra	Zebra seahorse	×	×	×	✓
Lissocampus runa	Javelin pipefish	×	×	×	✓
Micrognathus andersonii	Anderson's pipefish, shortnose pipefish	×	×	×	✓
Micrognathus brevirostris	Thorntail pipefish, thorn-tailed pipefish	×	×	×	✓
Nannocampus pictus	Painted pipefish, reef pipefish	×	×	×	✓
Solegnathus hardwickii	Pallid pipehorse, Hardwick's pipehorse	×	×	×	✓
Solenostomus cyanopterus	Robust ghostpipefish, blue-finned ghost pipefish,	×	×	×	✓
Solenostomus paegnius	Rough-snout ghost pipefish	×	×	×	✓
Solenostomus paradoxus	Ornate ghostpipefish, harlequin ghost pipefish, ornate ghost pipefish	×	×	×	✓
Syngnathoides biaculeatus	Double-end pipehorse, double-ended pipehorse, alligator pipefish	×	×	×	✓

Species	Common name	Predicted to occur^			
		Rookwood Weir inundation	Eden Bann Weir to Rookwood Weir	Eden Bann Weir to Fitzroy Barrage	Fitzroy Barrage to Fitzroy Estuary
Trachyrhamphus bicoarctatus	Bentstick pipefish, bend stick pipefish, shorttailed pipefish	×	×	×	✓
Marine reptiles					
Acalyptophis peronii	Horned seasnake	×	×	×	✓
Aipysurus duboisii	Dubois' seasnake	×	×	×	✓
Aipysurus eydouxii	Spine-tailed seasnake	×	×	×	✓
Aipysurus laevis	Olive seasnake	×	×	×	✓
Astrotia stokesii	Stokes' seasnake	×	×	×	✓
Disteira kingii	Spectacled seasnake	×	×	×	✓
Disteira major	Olive-headed seasnake	×	×	×	✓
Emydocephalus annulatus	Turtle-headed seasnake	×	×	×	✓
Hydrophis elegans	Elegant seasnake	×	×	×	✓
Lapemis hardwickii	Spine-bellied seasnake	×	×	×	✓
Laticauda colubrina	A sea krait	×	×	×	✓
Laticauda laticaudata	A sea krait	×	×	×	✓
Pelamis platurus	Yellow-bellied seasnake	×	×	×	✓

✓ = record supports presence, x = record does not support presence
^ Predicted to occur within proximity to the Project area based on EPBC Act Protected Matters Search Tool

11.5.2 Potential impacts on marine species

The magpie goose has been previously recorded in desktop searches and was recorded during surveys, however the Project footprint is unlikely to constitute critical breeding, foraging, roosting or shelter habitat for this species. The osprey may be a transient visitor to the Project footprint however this species has not previously been recorded in desktop searches and was not recorded during surveys.

The Fitzroy River estuary is representative of a modified environment and no significant change to downstream environments is anticipated as a result of the Project. The Project is not predicted to have long-term effects on or alter downstream flows, water quality or impact on habitat within the Fitzroy River estuary. Accordingly no significant indirect impacts on marine fish and marine reptiles listed in Table 11-6 are anticipated. Any short term impacts to water quality as a result of construction works will be managed in accordance with project specific management plans to avoid impact.

11.6 Summary

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

- Estuarine crocodile
- White-bellied sea-eagle
- Rainbow bee-eater
- Great egret, white egret.

Of the 49 marines species identified through the EPBC Act Protected Matters searches, only two listed marine bird species, the magpie goose and the osprey, were predicted to occur within the Project footprint.

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

While utilised by a number of common migratory and marine bird species, the landscape matrix within and adjacent to the Project footprint is fragmented and disturbed. As such, the woodland, forest and aquatic habitats within the Project footprint are not considered critical breeding, foraging, roosting or shelter habitat for the migratory species known to occur within or near to the Project footprint.

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

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