8. Coastal and Estuarine Flora and Fauna

8.1 Existing Environment

8.1.1 Study Area

Within this section, the terrestrial coastal and estuarine floral and faunal communities of Boathaven Bay and the wetlands associated with Campbell Creek (to the east of the proposed development) are described. Existing impacts in these communities are also noted.

Discussion of the Whitsunday region includes the area between Gloucester Island (20km east of Bowen) in the north to Cape Hillsborough (30km north-west of Mackay) in the south.

8.1.2 Overview of Impact Area

The area that will be impacted through reclamation, dredging, the placement of structures and the operation of the facility as shown in **Figure 2-2**. Mangrove communities in the marina area will largely be removed, although some mangroves will remain behind the vessel maintenance and repair facilities. Intertidal areas in the marina area will be dredged to create the marina basin. Mangroves in the dredge spoil area will largely remain intact although some sedimentation is expected to occur there through release of dredge spoil discharge water over time. Intertidal flats in the dredge spoil area will be covered by dredge spoil.

8.1.3 Flora

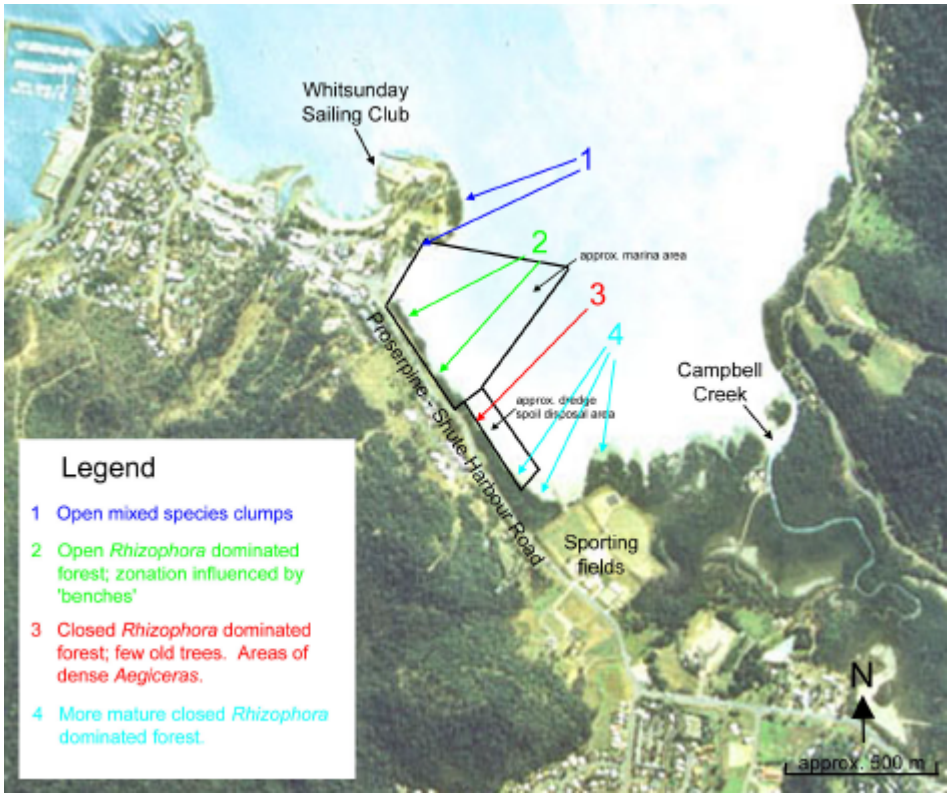
General mangrove communities in Boathaven Bay

Boathaven Bay and the wetlands associated with Campbell Creek (to the east of the proposed development) support a number of mangrove species and mangrove associations, in total comprising approximately 60 ha of mangrove forest (WBM 1998). Within this area several community types have been identified (pers obs.; WBM 1998; Kinhill Cameron McNamara 1990).

a) Mixed open to closed forest (adjacent to Shute Harbour Road and environs) dominated by *Rhizophora stylosa* and *Avicennia marina*, with *Aegiceras corniculatum*, *Bruguiera gymnorrhiza*, *Excoecaria agallocha*, *Lumnitzera* sp. and *Osbornia octodonta*, up to 9 m high;
b) Tall *Rhizophora* closed forest (adjoining Campbell Creek) – dominated by *Rhizophora stylosa*, associated species include *Bruguiera gymnorrhiza*, *Xylocarpus granatum*, *Excoecaria agallocha* and *Heritiera littoralis*;
c) Low *Rhizophora* open fringing forest, dominated by *Rhizophora stylosa* 8 – 15 m high, associated species include *Ceriops tagal*;
d) Low *Ceriops* forest (landward margins of Campbell Creek associations), *Ceriops tagal* up to 6 – 7 m high;
e) *Ceriops* scrub mangroves between 0.5 – 2.0 m high, associated mangroves include *Lumnitzera racemosa* and *Excoecaria agallocha*; and
f) Mixed mangrove closed forest, dominated by *Xylocarpus granatum*, *Heritiera littoralis*, *Excoecaria agallocha* and *Bruguiera gymnorrhiza*.

Mangrove and saltmarsh communities in the area of disturbance

The general distribution of communities in the disturbance area is shown in **Figure 8-1**. The mangrove community that will be directly impacted by the proposed development (**Figure 8-1**) is a fringing mixed-species open to closed forest dominated by *Rhizophora stylosa*. Along the landward edge of the mangroves there are some patches of saltmarsh vegetation, including *Sesuvium portulacastrum* (ruby saltbush) and *Sporobolus virginicus* (saltcouch). There is also some mangrove lily, *Crinum pedunculatum*, at the landward margins of the fringing mangrove communities. Much of this community has been previously disturbed by the construction of the Proserpine – Shute Harbour Road.



■ **Figure 8-1 Mangrove Communities in the Footprint of the Development**

There are few mangroves between the Whitsunday Sailing Club southwards to the bight of Boathaven Bay (**Area 1 in Figure 8-1**). Sediments in the upper intertidal area are silty sands with shingles (**Figure 8-2**), which become increasingly silty towards the bight. The isolated clumps of mangroves comprise mixed mangrove species with little zonation (**Figure 8-3**). *Avicennia marina* subsp. *eucalyptifolia* and *Rhizophora stylosa* are common, with *Aegiceras corniculatum, Osbornia octodonta, Bruguiera gymnorrhiza, Excoecaria agallocha, Ceriops tagal* and *Lumnitzera* sp. also present. The coastal trees *Hibiscus tiliaceus* and *Vitex* sp. are common at the landward margin of these clumps. The saltcouch *Sporobolus virginicus*, the succulent *Sesuvium portulacastrum* and the mangrove lily *Crinum pedunculatum* form a groundcover on the landward margin. Trees within these clumps reach approximately 6 m in height, with trunk diameters typically between 70 and 150 mm. That is the trees are mature, but are unlikely to be more than a decade or so old.

■ **Figure 8-2 Scattered Clumps of Mangroves to the South of the Whitsunday Sailing Club**

■ **Figure 8-3 Mixed Mangrove Species Communities with Little Zonation to the South of the Whitsunday Sailing Club**

On the western side of the bight there are a series of engineered benches that extend seaward of Proserpine-Shute Harbour road (**Area 2 in Figure 8-1**) (**Figure 8-4**). The road and benches have truncated the landward progression of mangroves across the bight. The road is up to 10 m above Highest Astronomical Tide (HAT). *Rhizophora stylosa* is the most common fringing species, with *Avicennia marina* subsp. *eucalyptifolia*. *Excoecaria agallocha* is the dominant species of the benches, with *Aegiceras corniculatum*, *Vitex* sp., *Pandanus* sp. and *Sesuvium portulacastrum* also present. The forest here is relatively open. Trees are up to 6 m, with most having trunks less than 70 mm in diameter. Seedlings of both *Aegiceras corniculatum* and *Rhizophora stylosa* are abundant.

■ **Figure 8-4 Where the Western Shore meets the Bight there are Common Mangrove Species**

■ **Figure 8-5 Rocky Outcrops South-East of the Bight**

Further south-east, as the Proserpine-Shute Harbour Road descends, natural rocky outcrops extend seaward from the engineered benches (**Area 3 in Figure 8-1**) (**Figure 8-5**). The sediments here are pockets of clean sands (**Figure 8-6**) grading to silty sands. The mangrove fringe is approximately 15 m wide and comprised of established *Avicennia marina*, *Bruguiera gymnorrhiza* and *Rhizophora stylosa* up to nine metres high and with trunks up to 250 mm in diameter. Stormwater pipes discharge directly to the mangroves at intervals of approximately 100 m along the road (**Figure 8-7**).

■ **Figure 8-6 Pockets of Clean Sands Grade into Silty Sands South-East of the Bight of Boathaven Bay**

■ **Figure 8-7 Stormwater Discharges into the Nangroves at 100 m intervals along the Proserpine – Shute Harbour Road**

Where the Proserpine-Shuteharbour Road is within a metre or so of HAT, at the approximate apex of the bight, there is a mixed closed forest of *Rhizophora stylosa*, *Avicennia marina* subsp. *eucalyptifolia* and *Bruguiera gymnorrhiza* up to 6 – 7 m high (**Area 4 in Figure 8-1**) (**Figure 8-8**). Occasional dense patches of *Aegiceras corniculatum* break up the landward margin of this forest (**Figure 8-9**), and there are occasional individual trees of *Excoecaria agallocha*, *Xylocarpus granatum* and *Heritiera littoralis* at the landward margin. Here the sediment is soft sandy silt, supporting abundant benthic fauna. Between the mangroves and the base of the road *Sporobolus virginicus*, *Sesuvium portulacastrum* are common with occasional patches of the creeper *Ipomoea pes-caprae* and 'Singapore daisy' (*Wedelia trilobata*, an introduced weed) (**Figure 8-10**).

■ **Figure 8-8 Mixed Mangrove Community Closed Forest at the Apex of the Bight**

■ **Figure 8-9 Landward of Closed Mangrove Communities at the Apex of the Bight, there are occasional dense patches of *Aegiceras corniculatum***

■ **Figure 8-10 Between Mangrove Communities and the Road, Saltmarsh Species and Weeds such as 'Singapore daisy' are common**

Mangrove and saltmarsh communities adjacent to the area of disturbance

Further south-east again, extending beyond the proposed development footprint, the dense closed forest continues, with a slight increase in average tree height and trunk diameter.

Several hundred metres to the south-east of the development footprint, a series of sporting fields have been developed on reclaimed land. *Rhizophora stylosa* is the dominant species on the seaward side of the fields, most trees are saplings with trunk diameters less than 80 mm. There are also occasionally larger trees, possibly remnants of the community prior to the adjacent reclamation (**Figure 8-11** and **Figure 8-12**). In the forest there are abundant *Avicennia marina* seedlings. The mistletoe *Amyema* sp. is common within the *Rhizophora* community (**Figure 8-13**). Common woody weeds and litter characterise the steep scarp from the sporting fields.

The total area of mangroves in the disturbance zone and adjacent to it is approximately 4 ha, and varies from 10 – 110 m in width (generally widening to the south).

■ **Figure 8-11 *Rhizophora stylosa* Saplings Dominate Mangrove Communities fringing the Foreshore adjacent to the sporting fields. There are occasional larger trees**

■ **Figure 8-12 The foreshore adjacent to the sporting fields**

■ **Figure 8-13 The mistletoe *Amyema* sp. is common amongst *Rhizophora* forests adjacent to the sporting fields**

Mangroves within the Region

Species of mangrove recorded from the region are listed in **Table 8-1**. The distribution of mangroves within the region is shown in **Figure 9.2,** which also shows other important coastal and marine communities in the region. Compared to other areas, such as Repulse Bay to the south, there is a relatively small area of mangroves in Pioneer Bay (including Boathaven Bay).

The mangrove species recorded from Boathaven Bay are typical of, and common within the region. No mangroves are listed as threatened under Queensland or Commonwealth legislation.

■ **Table 8-1 Mangrove and associated species recorded within the region and in Boathaven Bay**

Species	Common Name	Recorded in Region	Recorded at Site
Acanthus ilicifolius	Holly mangrove	KCM	
Aegialitis annulata	Club mangrove	KCM, Sailport, EMG	
Aegiceras corniculatum	River mangrove	Sailport, EMG, FRC	WBM, FRC
Avicennia marina subsp. eucalyptifolia	Smooth - barked grey mangrove	Sailport, EMG, KCM, FRC	WBM, FRC
Bruguiera exaristata	Rib-fruited mangrove	KCM, FRC	
Bruguiera gymnorrhiza	Orange mangrove	Sailport, EMG, FRC	WBM, FRC
Ceriops tagal	Yellow mangrove	KCM, Sailport, EMG, FRC	WBM, FRC
Excoecaria agallocha	Milky mangrove	KCM, Sailport, EMG, FRC	WBM, FRC
Heritiera littoralis	Looking-glass mangrove	KCM, Sailport, EMG	WBM, FRC
Hibiscus tiliaceus	Cotton tree	KCM, FRC	FRC
Lumnitzera racemosa	White-flowered black mangrove	KCM, Sailport, EMG, FRC	WBM, FRC
Osbornia octodonta	Myrtle mangrove	FRC	FRC
Rhizophora apiculata	Tall-stilted red mangrove	KCM, Sailport, EMG	
Rhizophora stylosa	Red mangrove	KCM, Sailport, EMG, FRC	WBM, FRC
Xylocarpus granatum	Cannonball mangrove	KCM	WBM, FRC
Sonneratia sp.	Mangrove apple	FRC	
Crinum pedunculatum	Mangrove lily	FRC	FRC

KCM – Kinhill Cameron McNamara (1990)
EMG – E M Grant Pty Ltd (1988)
Sailport Pty Ltd (1988)
WBM – WBM (in Burchill 1998)
FRC - FRC Environmental (present study)

8.1.4 Conservation Significance

Species of conservation significance

Environment Australia has identified two plant species of conservation significance that may occur in the Boathaven Bay area (**Table 8-2**).

■ **Table 8-2 Flora species of conservation significance**

Scientific Name	Common Name	Conservation Status	
		Commonwealth[1]	Queensland[2]
Leucopogon cuspidatus	-	-	Vulnerable
Ozothamnus eriocephalus	-	Vulnerable	Vulnerable

1: *Environment Protection and Conservation Regulation 2000*
2: *Nature Conservation (Wildlife) Regulation 1994*

These species were not observed in the mangrove survey for the proposed marina development site.

Regional Ecosystems

Regional Ecosystem mapping provided by the Queensland Herbarium does not list any ecosystems directly adjacent to the proposed development (**Figure 8-14**) (**Table 8-3**). Vegetation from the majority of land on site or adjacent to the site has been listed as cleared. Regional ecosystems proximal to the site are as follows:

■ **Table 8-3 Regional Ecosystems Descriptions**

RE	Description	Status
8.1.1	Mangrove low closed forest and saltpan vegetation associated with Quaternary estuarine deposites. Major species include *Sporobolus vriginicus*, *Sesuvium portulacastrum*, *Sarcoconia quinquenervia*, *Ceriops tagal* and *Avicennia marina*	No concern at present
8.3.1a	Complex semi-deciduous notophyll.mesophyll rainforests fringing watercourses on Cainozoic alluvial plains. Characteristic species are *Terminalia scericocarya, Acmeosperma claviflorum, Alstonia scholaris, Cryptocarya hypospodia, Myristica muelleri, Ficus racemosa*. Riverine fringing communities include *Nauclea orientalis, Melaleuca spp., Eucalyptus spp.,* and *Lophostermon suaveolens*.	Endangered
8.12.18a	Rainforest (incomplete description) includes areas in subregions 1-3 dominated by *Argyrodendron sp.* and *Dissillaria indistincta*. Common species include *Argyrodendron polyandrum*, *Dysoxylon mollissimum*, *Mallotis sp*, *Archontophoenix cunninghamiana* and emergent eucalypts. Medium sized ranges and hilltops of islands and headlands.	No concern at present
8.12.19	Rainforest (incomplete description) *Argyrodendron actinophyllum* prominent. mopist sheltered areas and higher parts of near coastal ranges. Notophyl (feather palm) vine forest with *Argyrodendron polyandrum subsp. diversifolium* prominent.	Of Concern
8.12.28b	Dry vine thicket with emergent *Acacia dasciculifera* and/or *Araucaria cunninghamii* (incomplete description). *Eucalyptus tereticornins* occassional as emergent. Hillslopes of low hills, islands and headlands	Of Concern

Endangered Ecological Communities

There are no listed Endangered Ecological Communities in the vicinity of the proposed marina development according to Environment Australia (on-line database search 17 October 2002). No endangered ecological communities were observed during the field survey. Endangered Ecological Communities in Queensland occur in inland areas, not on the coast.

Important Wetlands

There are no Ramsar wetlands in the vicinity of the proposed marina development according to Environment Australia (on-line database search 17 October 2002). The nearest Ramsar Wetland is Bowling Green Bay near Townsville, about 300 km to the north-west.

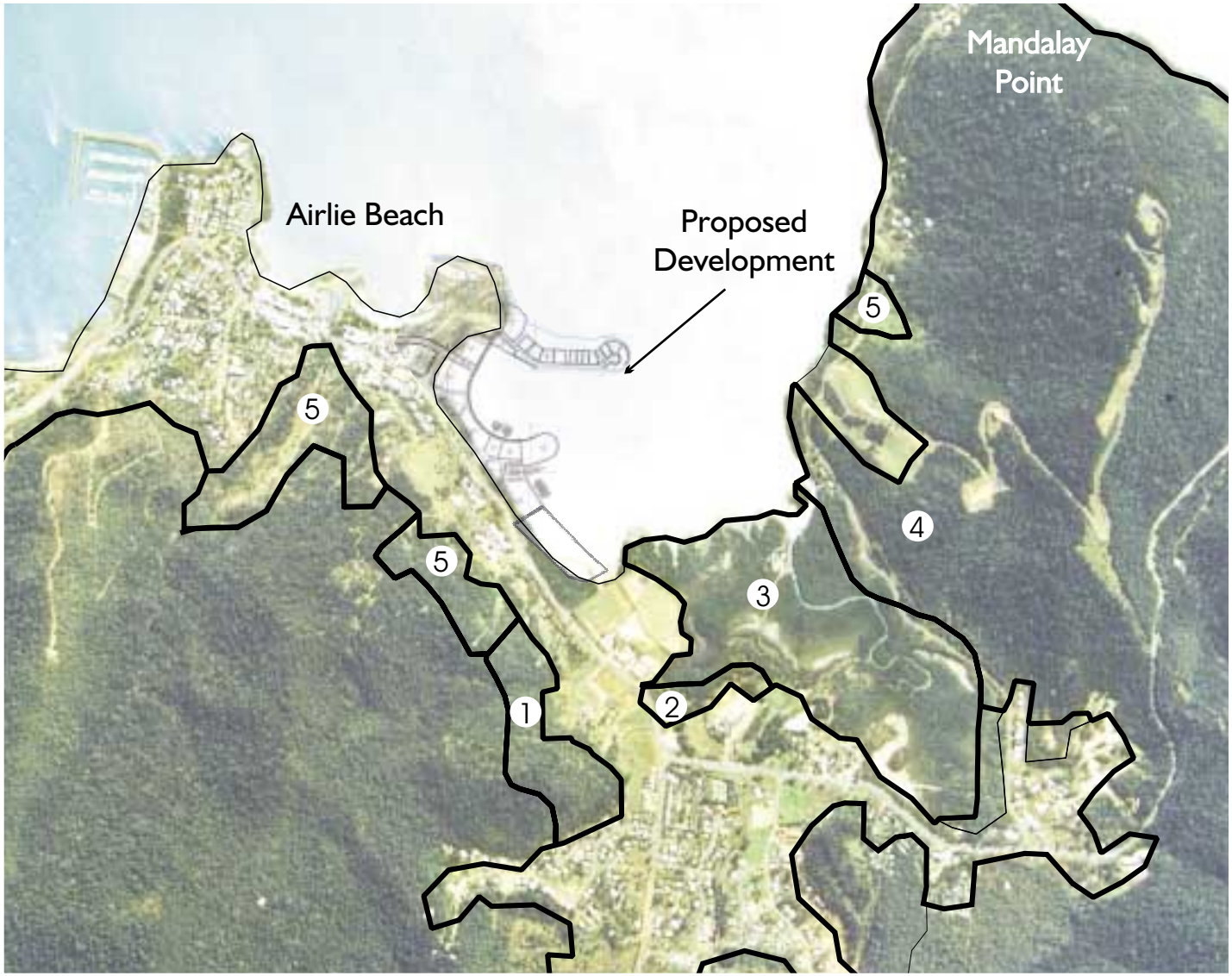
The nearest Nationally Important Wetlands are Edgecumbe Bay to the north and Proserpine-Goorganga Plain near Repulse Bay. Both these wetlands are approximately 20 km from the proposed marina development.

8.1.5 Fauna

This section describes terrestrial vertebrate fauna found in the mangrove and intertidal areas in the study area.

Birds

Birds were the most commonly observed and recorded fauna in the field surveys for the IAS and Supplementary EIS. Sixty-two species of bird have been recorded in total during these surveys. These species are listed in **Appendix G**. Forty-four species were recorded in the IAS and forty-three were recorded for the Supplementary EIS.



KEY

N

① 8.12.28b
② 8.3.1a
③ 8.1.1
④ 8.12.18a / 8.12.19
⑤ Disturbed

Refer to table 8-3
"Regional Ecosystems"

SINCLAIR KNIGHT MERZ

PORT OF AIRLIE MARINA

PORT OF Airlie

Regional Ecosytems

Figure 8-14

Four of the species recorded are regarded as mangrove specialists. These are the Striated Heron (*Butorides striatus*), Mangrove Gerygone (*Gerygone levigaster*), Mangrove Honeyeater (*Lichenostomus fasciogularis*) and Collared Kingfisher (*Todiramphus chloris*).

One threatened species, the Eastern curlew (*Numenius madagascariensis*), was recorded from the intertidal zone during the surveys for the IAS and Supplementary EIS. This species is listed as rare under the *Nature Conservation (Wildlife) Regulation 1994* and the *Environment Protection and Biodiversity Conservation Regulation 2000*.

Another significant species, the Beach Stone-curlew (*Esacus neglectus*) may occur in the region. The Beach Stone-curlew is listed as vulnerable in the *Nature Conservation (Wildlife) Regulation 1994*.

Mammals

Three species of native mammal were recorded in the vicinity of the proposed marina development during the IAS and Supplementary EIS surveys. These species are listed in **Appendix G**. None of these species are threatened under State or Commonwealth legislation.

A targeted survey was conducted in September 2002 for the Water mouse (previously False water rat, *Xeromys myoides*), a species listed as vulnerable under State and Commonwealth legislation, in the marina development area and adjacent to it (refer to specialist report in **Appendix H**). According to the specialist report (**Appendix H**), no specimens were caught during the survey. Examination of the habitat in the vicinity revealed that it is not preferred by the Water mouse and that it is unlikely to occur there.

It should be noted that the Proserpine Rock-wallaby (*Petrogale persephone*) is not present at or close to the study area.

Migratory Species

Seven species of bird recorded during the IAS and Supplementary EIS surveys are migratory birds, and are significant under the migratory provisions of the *Environment Protection and Biodiversity Conservation Act*. A search of the Environment Australia's EPBC Act database recorded several more species that may occur in the area (in the EPBC On-line on-line database search, 17 October 2002). These species are listed in **Table 8-4**.

■ **Table 8-4 Species covered by migratory provisions of the *EPBC Act***

Class	Scientific Name	Common Name	Sighted in EIS/ Supp. EIS
Aves	*Haliaeetus leucogaster*	White-bellied sea-eagle	Yes
Aves	*Hirundapus caudacutus*	White-throated needletail	No
Aves	*Hirundo rustica*	Barn swallow	No
Aves	*Monarcha melanopsis*	Black-faced monarch	No
Aves	*Monarcha trivirgatus*	Spectacled monarch	No
Aves	*Myiagra cyanoleuca*	Satin flycatcher	No
Aves	*Ardea alba*	Great egret	Yes
Aves	*Numenius madagascariensis*	Eastern curlew	Yes
Aves	*Limosa lapponica*	Bar-tailed godwit	Yes
Aves	Gallinago hardwickii	Latham's Snipe, Japanese Snipe	No
Aves	*Rostratula benghalensis*	Painted snipe	No
Aves	*Numenius minutus*	Little curlew, Little whimbrel	Yes
Aves	*Numernius phaeopus*	Whimbrel	Yes
Aves	*Anseranas semipalmata*	Magpie goose	No
Aves	*Nettapus coromandelianus albipennis*	Australian cotton pygmy-goose	No
Aves	*Riphidura rufrifrons*	Rufous fantail	Yes

The distribution and habitat preferences for these migratory species are described below. Habitat descriptions are from Pizzey and Knight (1997). A number of species identified in the EPBC Act on-line database clearly do not have a habitat preference for coastal mangrove and intertidal ecosystems which occur in the proposed marina development area.

Haliaeetus leucogaster - White-bellied sea eagle
The White-bellied sea eagle is found across coastal and inland eastern Australia and around the coastline in other parts, including Tasmania. It is found around rivers, dams, inland rivers and coastal areas. It nests in large nests in tall live trees, usually near water. It was observed in the IAS and Supplementary EIS.

Hirundapus caudacutus - White-throated needle-tail
This species is a regular summer visitor to Australia. It inhabits airspace over forests, woodlands, farmlands, plains, lakes, coasts and towns. It was not recorded in the surveys of the area of the proposed marina development and is not likely to inhabit the mangrove or intertidal areas due to a lack of preferred habitat.

Hirundo rustica - Barn swallow
The Barn swallow is found in a variety of open country areas, agricultural lands and towns. It is a summer visitor to northwest Australia and the Queensland coast. This is a very widespread and common house-swallow in the northern hemisphere. The mangrove and intertidal habitat in the area of the proposed marina does not represent preferred habitat.

Monarcha melanopsis - Black-faced monarch
The Black-faced monarch is found along the east coast between the Great Dividing Range and the coast. It frequents rainforests and vine-forest, eucalypt forests and woodlands. The mangrove and intertidal habitat in the area of the proposed marina does not represent preferred habitat.

Monarcha trivirgatus - Spectacled monarch
The Spectacled monarch is found in a similar area to the Black-faced monarch, however its range is more restricted. It prefers the understorey of rainforests, wooded gullies and riparian vegetation. The mangrove and intertidal habitat in the area of the proposed marina would not represent suitable habitat.

Myiagra cyanoleuca - Satin flycatcher
The Satin flycatcher is found in heavily vegetated gullies in forests and taller woodlands. It is found across wide areas of coastal and inland eastern Australia. The mangrove and intertidal habitat in the area of the proposed marina would not represent suitable habitat.

Ardea alba – Great egret
The Great egret is distributed widely across Australia and can be found in a variety of environments including river shallows, estuaries, tidal mudflats, freshwater wetlands, sewage ponds, irrigation areas and larger dams. It was recorded from the proposed marina development area during surveys for the IAS.

Numenius madagascariensis - Eastern curlew
The Eastern curlew inhabits mud and sand flats, particularly where seagrass grows. Eastern curlews have been recorded from the intertidal zone in both the IAS and Supplementary EIS surveys.

Limosa lapponica – Bar-tailed godwit
The Bar-tailed godwit has a wide distribution across most of Australia, excluding only inland areas of Western Australia. It can occupy a variety of wetland habitats, including pasture fields and sewage ponds. It is most common on the coasts.

Gallinago hardwickii – Latham's snipe
Latham's snipe inhabits wet, boggy areas, such as seepage areas in fields or below dams and in saltmarshes or mangrove fringes. This species may visit saltmarsh or mangrove fringe areas near the proposed marina development. It is generally an uncommon species, but does have a wide distribution along eastern and northwestern Australia. It was not recorded during surveys for the IAS or Supplementary EIS.

Rostratula benghalensis - Painted snipe
The Painted snipe has a wide distribution along eastern and northern Australia, mainly on the coast and inhabits a variety of well-vegetated shallow marshy areas that may be part of wetlands, dams, pastures, or irrigation systems. It is relatively rare over its range. It was not recorded during surveys for the IAS or Supplementary EIS.

Numenius minutus - Little curlew
The Little curlew has a wide distribution northern Australia and can occur in very large numbers and inhibits a variety of habitats, such as tidal mudflats, grasslands, sewage ponds, playing fields and numerous others (Pizzey & Knight, 1997). It has been recorded from the proposed marina development site.

Numenius phaeopus – Whimbrel
The Whimbrel forages along tidal sand and mudflats in estuaries, bays and mangroves. It has been recorded from the intertidal zone in the proposed marina development area.

Anseranas semipalmata - Magpie goose
The Magpie goose inhabits open, shallow, wet freshwater grasslands and floodplains. The mangrove and intertidal areas do not provide this preferred habitat, so the Magpie goose is unlikely to occur near the proposed marina development.

Nettapus coromandelianus albipennis - Australian cotton pygmy-goose
The Australian cotton pygmy goose inhabits freshwater swamps, lagoons, dams, with water lilies and other submerged plants. The proposed marina site does not represent preferred habitat for this species.

Rhipidura rufifrons - Rufous fantail
The Rufous fantail is found in the undergrowth of rainforests and wet eucalypt forests, inland and coastal scrub communities as well as parks and gardens in town areas. It occurs across eastern Australia from inland to coastal areas. This species was recorded from the mangroves in the Supplementary EIS survey.

8.1.6 Conservation Significance

Species of conservation significance

Environment Australia has identified seven significant species of fauna that may be located in the vicinity of the proposed marina development. Three others are significant under Queensland legislation. These species are listed in **Table 8-5** below. A discussion on the potential for these species to be found within the impact area of the marina development follows.

■ **Table 8-5 Fauna species of conservation significance**

Class	*Species*	Common Name	Conservation Status		Sighted in IAS/Supp. EIS
			Commonwealth[1]	Queensland[2]	
Aves	*Erythrotriorchis radiatus*	Red goshawk	Vulnerable	Endangered	No
Aves	*Geophaps scripta scripta*	Squatter pigeon (southern)	Vulnerable	Vulnerable	No
Aves	*Pterodroma neglecta neglecta*	Kermadec petrel (western)	Vulnerable	-	No
Aves	*Numenius madagascariensis*	Eastern curlew	-	Rare	Both
Aves	*Esacus neglectus*	Beach stone thick-knee	-	Vulnerable	No
Aves	*Nettapus coromandelianus*	Australian cotton pygmy goose	-	Rare	No
Aves	*Rostratula benghalensis*	Painted snipe	-	Rare	No
Reptilia	*Egernia rugosa*	Yakka skink	Vulnerable	Vulnerable	No
Mammalia	*Petrogale persephone*	Proserpine rock wallaby	Endangered	Endangered	No
Mammalia	*Pteropus conspicillatus*	Spectacled flying-fox	Vulnerable		No
Mammalia	*Xeromys myoides*	Water mouse	Vulnerable	Vulnerable	No

1: *Environment Protection and Conservation Regulation 2000*
2: *Nature Conservation (Wildlife) Regulation 1994*

Erythrotriorchis radiatus - Red goshawk
The Red goshawk is found in coastal and near coastal eucalypt forests and woodlands, as well as savannah grasslands, with rivers and the edges of rainforest communities. Recent sightings in south-eastern Queensland are rare. They have a home range of around 200 km^2 and nest in the tallest trees, which are vulnerable to storm damage. The area of potential impact from the marina development is mangrove strands, which are not preferred habitat of the red goshawk.

Geophaps scripta scripta - Squatter pigeon (southern variety)
The Squatter pigeon inhabits woodlands with grassy understorey. It suffers from predation by foxes and cats. The mangrove strands in the area of the proposed marina development do not represent preferred habitat for the squatter pigeon.

Pterodroma neglecta neglecta - Kermadec petrel (western)
The Western Kermadec petrel breeds on high oceanic islands among rocks and vegetation, and forages far out to sea. Their nests are generally built on the ground, so are particularly vulnerable to predation. They are found on small islands off Lord Howe Island and Norfolk Island, but can have an oceanic distribution. The proposed marina development area does not represent suitable habitat for the Kermadec petrel, as they prefer more oceanic environs.

Numenius madagascariensis – Eastern curlew
Curlews are a migratory bird, which arrive around August and leaves around April. They inhabit mud and sand flats, particularly where seagrass grows. Eastern curlew have been recorded from the intertidal zone in both the IAS and Supplementary EIS surveys.

Esacus neglectus - Beach stone thick-knee
The Beach stone thick-knee is a sedentary, solitary wader, sparsely distributed within coastal habitats of the northern and eastern Australian coastline. The species occurs in a wide range of beach habitats (corraline sand, surf or sheltered, muddy, sandy, stony or rocky) with a particular preference for intertidal flats or beaches associated with or near mangroves (WBM, 1998). The occurrence of Beach Stone Thick-knees have been reported to the Airlie Beach office of the National Parks and Wildlife Service, though it is unclear as to whether such reports are of the Beach Stone-curlew, or its similar looking co-gener, the Bush Stone Thick-knees, which is more common and known to occur within a both intertidal and terrestrial habitats within the Boathaven Bay.

Egernia rugosa - Yakka skink
The Yakka skink inhabits dense ground vegetation and fallen timber in open dry eucalypt forest and woodland. The mangrove forests in the vicinity of the proposed marina development do not offer preferred habitat for the Yakka skink.

Petrogale persephone - Proserpine rock wallaby
The Proserpine rock wallaby inhabits rocky piles, rocky outcrops and cliffs within a preferred microphyll/notophyll semi-deciduous dry vine forest. According to the mapping in the Recovery Plan for the Proserpine rock-wallaby (Nolan & Johnson, 2001), habitat for the species is not recorded from the site of the marina development, although critical habitat has been recorded close-by, where the quarry for the original marina concept was to be located along Jubilee-Pocket Road. This area is several kilometres from the site and is not contiguous with the proposed marina development area. It is unlikely that the site of the proposed marina development would be preferred habitat especially given the moderate disturbance in the area (e.g. roads and sporting grounds).

Pteropus conspicillatus – Spectacled flying fox
The spectacled flying fox primarily inhabits rainforest, wet sclerophyll margins, coastal swamps, monsoon vine thickets and mangrove areas. Roosts are always found within six km of rainforest. Their range in Queensland primarily extends from Cape York to Cardwell, well north of the marina development area. Given the range of the spectacled flying fox and the moderately disturbed nature of the marina development area, it is highly unlikely that they would occur in the marina development area.

Xeromys myoides – Water mouse (previously False water rat)
The water mouse inhabits sedgeland zones adjacent to mangrove forests as well as freshwater swamps and reedy lakes close to foredunes. A specialist survey was conducted in September 2002 in the proposed marina development site to establish the presence of the water rat or its preferred habitat (refer to **Appendix H**).

No Water mice were trapped during 400 trap nights (100 traps per night for 4 consecutive nights). From an examination of the habitats in the proposed marina development site and the surrounds it was concluded that Water mice are unlikely to inhabit the area surveyed. Primary habitat for water mice/false water rats in the Proserpine area appears to be *Bruguiera* / *Ceriops* mangrove ecotones (T. Ball, pers. comm. 2002). Areas of salt couch, *Sporobolus virginicus*

are also inhabited. *Rhizophora stylosa* forests are generally not primary habitat for water mice, probably being too frequently inundated by high tides (T. Ball, pers. comm. 2002). *Bruguiera* and *Ceriops* mangroves are present, but are not the dominant species within the communities of the study area; and salt couch is not abundant within the proposed development area.

8.2 Construction Impacts

The main construction activities will occur over a nine-month period during the dry season. Potential impacts from construction may be direct (e.g. removal of habitat) or indirect (e.g. through influences on water quality).

Potential impacts to terrestrial coastal flora and fauna during construction are described below. The potential impacts of development are clearly related to the sensitivities of floral and faunal communities within the area influenced by the proposed development. **Appendix J** provides a discussion of the various environmental factors influencing the distribution and abundance of key floral and faunal communities.

8.2.1 Flora

Mangroves

Development of the proposed marina-complex will result in the direct loss of approximately 1.2 ha of fringing mangrove forest. That is, approximately 2% of the remaining mangroves in Boathaven Bay would be lost, or <0.1% of the mangroves in the Whitsunday region. A permit is required under the *Fisheries Act 1994* to remove, damage or destroy marine plants, including mangroves.

Mangrove elements will be maintained behind the vessel maintenance and repair facilities and inshore from the bunded dredge disposal area. Measures will be implemented to minimise disturbance to these mangroves during construction, such as clearly identifying them on construction plans and cordoning these mangroves off.

Increased turbidity is unlikely to have a significant effect on the mangroves adjacent to the proposed marina construction area. While large increases in sediment deposition can result in smothering of some aerial roots and the consequent morbidity and/or mortality of some trees, sedimentation in excess of levels already experienced by these mangroves from land run-off is not expected.

Nutrient enrichment from the disturbance of intertidal sediments may potentially alter the community composition (habit and species composition) and distribution of the mangrove and saltmarsh communities (Adam 1990; Adam 1995). In the short to medium term the production of mangroves, and to a lesser extent the more shallow rooted saltmarsh flora, may increase, however in the longer term this may lead to degeneration of these communities if nutrient levels are able to maintain saturation levels. Sustained saturation levels are unlikely to occur since activities that disturb sediments (e.g. dredging) will be short-term and not persistent and in any case, nutrient levels in sediment in Boathaven Bay are not excessive (See **Section 6**).

8.2.2 Fauna

The construction of the marina development has the potential to impact on the coastal faunal communities associated with Boathaven Bay through the following:

- clearing of fringing mangrove habitat;
- reclamation of intertidal feeding areas;
- flow-on effects from acid sulphate soils; and
- construction activity and noise effects.

The extent of these impacts will be minimised through various mitigation measures and environmental management plans, which are described in **Section 8.4** and **Section 21**.

Clearing of foreshore mangroves

The removal of 1.2 ha of fringing mangroves within the proposed marina development site will represent a loss of potential habitat for terrestrial species, particularly for several wader species and birds that are mangrove specialists (Striated heron, Mangrove gerygone, Mangrove honeyeater and Collared kingfisher).

The area of mangroves for removal provides habitat for a very limited range of bird fauna. This loss is not expected to result in any significant impact on these mangrove and intertidal bird fauna as it is subject to road traffic noise and activity, and represents less favourable habitat than remaining expanses of undisturbed mangroves in Boathaven Bay.

Reclamation of intertidal feeding areas

Construction activities will result in the loss of the following intertidal and shallow subtidal areas:

- Eight hectares of intertidal and shallow subtidal seagrass meadows (discussed in more detail in **Section 9.3**);
- approximately 6.5 ha of unvegetated soft sediment intertidal and shallow subtidal lands; and
- another loss of a further 2 ha (approximately) of unvegetated soft sediment intertidal lands from placement of the dredge spoil.

This loss represents less than 0.1% of the intertidal and subtidal, unvegetated soft sediment in the region. The loss of these habitats is likely to have minor local impact on associated flora and fauna and will have negligible impact in a regional context.

This localised impact is likely to be greatest on several migratory wader bird species, (e.g. Bar-tailed godwit, Whimbrel, Eastern curlew, Little curlew), which have a preference for this type of habitat. These birds forage in the intertidal habitat, so the construction of the marina will result in the localised loss of feeding opportunities Overall, the construction of the marina is not expected to have a significant impact on birds dependent on intertidal feeding area, as the proportional loss of feeding habitat is not significant and birds are able to utilise other intertidal areas.

Flow-on effects from acid sulphate soils

In the event that acid sulphate soils (ASS) are generated during excavation, these will be managed through the implementation of an Acid Sulphate Soils Management Plan (ASSMP) such that there will be no change in the pH of receiving waters. Hence, impacts on flora and fauna species resulting from acid sulphate soils are not expected.

Management measures for ASS are provided in **Section 6**.

Without management measures as indicated in **Section 6**, the release of acidic water may impact on fish and invertebrates in the receiving waters of Boathaven Bay, potentially resulting in a localised loss of food for a range of terrestrial vertebrates Bay including wader birds and the Water mouse.

Construction activity and noise

A small proportion of the mangrove and intertidal area utilised by birds for foraging will be reclaimed during construction of the Port of Airlie Marina. Significant areas on the eastern side of Boathaven Bay will remain available for foraging. These areas, however, will be influenced by noise associated with construction activities, which are short-term in nature and limited to the construction phase.

Construction activities associated with the proposed works that would generate noise include:

- pile driving during the construction of a steel sheet pile wall around the entire marina basin;
- excavation of the top layer of marine muds and transport to the containment site;
- importation and spreading of fill material within the marina basin to provide a suitable base for the proposed residential and commercial facilities;
- installation of sheet coffer dams during the land reclamation phase;
- dredging of the proposed marina entrance channel using a cutter suction dredge; and
- installation of services and construction of buildings using cranes, concrete trucks, hand tools, mobile generators and the like.

It is likely that construction activities and the associated noise emissions will disturb waders when they arrive around August, however the extent of this is not certain. Initially at least, it is likely that the areas immediately surrounding the construction activities will become less than favourable for foraging due to the disturbance. Over subsequent months, it is waders will likely become acclimatised to noise if the noises are regular in nature.

8.3 Operation

Impacts to terrestrial flora and fauna during the operation of the marina relate to the loss of intertidal habitat and the potential for hydrocarbon contamination of adjacent mangrove and intertidal areas, which provide habitat for a range of fauna.

8.3.1 Impacts to birds using remaining intertidal areas

As noted above, a small proportion (about 17 ha) of the intertidal and mangrove area will be removed from the western part of Boathaven Bay. Over 150 ha of intertidal area will remain in the eastern part of the bay. These areas will be available for utilisation by those species currently using Boathaven Bay once the development is complete.

While the flats and intertidal area will be available for utilisation, it is possible that noise and lighting effects from the marina may decrease the suitability of the area for some species of bird. The extent of impact will depend on the extent to which the birds become accustomed to noise and the illumination of the marina. Many examples exist of migratory birds foraging and roosting in close proximity to marina developments (e.g. Wynnum Marina, Moreton Bay), and the overall impact of noise on wader species at Port of Airlie will not be significant.

8.3.2 Hydrocarbon Contamination

In large quantities, such as from major oil spills, petroleum and petroleum by-products are harmful to mangroves (Odum and Johaness 1975) causing mechanical damage by blocking the pores in the pneumatophores and effecting respiration, photosynthesis and translocation (Mackey and Smail 1995). Acute (or at least a 'one off") contamination may result in severe ecological consequences although recovery is in most cases inevitable. The potential for major spills in the marina will be minimised since the fuels will be stored and handled in accordance with AS1940 (Storage and Handling of Flammable and Combustible Material).

The chronic presence of hydrocarbons has the potential to cause locally significant impacts. Low levels of petroleum hydrocarbons in the aquatic environment are adsorbed onto, or incorporated into, the sediments, where they may persist for years (Pelletier *et al*. 1991; Voudrias and Smith 1986). A large number of small-scale oil spills may lead to a significant increase in hydrocarbons over time, in effect resulting in a 'permanent' impact. It can result in the 'permanent' (or at least for the duration of contamination) morbidity or localised extinction of flora and fauna.

In order to minimise the potential for acute or chronic presence of hydrocarbons to enter the water, fuel storage and handling activities will be undertaken in accordance with AS1940 (Storage and Handling of Flammable and Combustible Material) will encompass spill containment and response. Additionally, the high degree of flushing expected in the marina (refer **Section 7**) will result in dispersion and dilution of any hydrocarbons that do enter the water.

8.3.3 Creation of New Habitat

The breakwater rock wall may increase feeding and roosting opportunities for some relatively disturbance tolerant species, such as seagulls. Others, such as cormorants, may utilise the aquatic habitats around the rock walls, attracted by small fish, which are expected to utilise such habitats.

It is expected that mangroves will regenerate in areas that are not persistently disturbed following construction and will extend seaward as a result from moderate sedimentation around the dredge spoil area. This will partially offset losses due to mangrove removal during construction.

8.3.4 Conservation Significance

Only one species of conservation significance, the Eastern curlew (*Numenius madagascariensis*), has been recorded from the marina development area. Two other species, the Beach thick knee (*Esacus neglectus*) and Water mouse (*Xeromys myoides*) may potentially occur nearby.

These species will not be significantly impacted by the construction and operation of the Port of Airlie marina on a regional scale as the loss of habitat is minute at that scale. However, they may experience some minor local impact through the loss of a small proportion of foraging or nesting area within Boathaven Bay, although the majority of Boathaven Bay will remain available as preferred habitat.

Within the study area only the seagrass meadows (discussed in **Section 9**) are likely to be considered of regional significance. The mangrove communities and other ecosystems whilst likely to be of local significance are unlikely to be of regional significance.

8.3.5 Impacts on Native Mammals

Surveys undertaken of the site have not identified the presence of water mice or any other native mammals. In any case, retention of the mangroves behind the spoil disposal area will continue to provide foraging habitat for water mice, in the event that there are any living in mangrove areas at Cambpells Creek or elsewhere in Boathaven Bay.

It is noted that pet cats may have an impact on native mammals. It is proposed to ban pet cats from the development.

8.4 Recommendations

A range of measures are proposed to mitigate against potential impacts to coastal flora and fauna during construction and operation of the Port of Airlie Marina.

8.4.1 Construction

The following mitigation strategies are proposed to mitigate potential construction impacts:

- Protect remaining mangroves in the marina development area (behind vessel maintenance and repair facilities and inland of the bunded dredge spoil disposal area) from unnecessary damage and ensure adequate tidal flushing
- Undertake water quality protection measures discussed in **Section 7**
- Monitor the health of mangroves during and after construction
- relocate any threatened species from the construction area if they are found.

To minimise potential impacts on wader birds which may arise as a result of the construction of the proposed marina, implementation of the water quality management program, as described in **Section 7**, is recommended.

Similarly, to manage the potential impact on shorebirds from acid sulphate soils, implementation of the Acid Sulphate Soils Management Plan as described in **Section 6** is recommended.

Discussion of matters relating to loss of fish habitat are discussed in more detail in **Section 9.3.4**. More information on environmental monitoring is provided in **Section 21.5.1**.

8.4.2 Operation

The following mitigation strategies are proposed to mitigate potential operational impacts:

- Minimise illumination to the intertidal area to the east of the marina by orienting principal lighting away from there. This will reduce light disturbance to migratory waders which may forage at night.
- Undertaking water quality protection measures outlined in **Section 7**.

Discussion of matters relating to loss of fish habitat are discussed in more detail in **Section 9.3.4**. More information on environmental monitoring is provided in **Section 21.5.1**.

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