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6. Nature conservation



6. Nature conservation

This chapter describes the existing environment, potential impacts and mitigation measures within the proposed Jilalan Rail Yard project area and surrounds in terms of biodiversity and significance of the ecological values. The assessment has been based on a review of existing information and the outcomes of supporting field investigations.

6.1 Project area

The project area is located in the coastal environs of Sarina Shire Local Government Area (LGA). Previous land use activities within the area have had a negative impact on the area's biodiversity and habitat values.

Extensive clearing for the purposes of grazing and cropping (primarily sugar cane) has fragmented the landscape and reduced connectivity. Scattered patches of eucalypt woodland and thin strips of paperbark open forest are restricted to the riparian zones of watercourses intersecting the area and areas not suitable for agriculture. The fact that many of these existing habitats/corridors are generally long, thin strips of vegetation has resulted in severe edge effects at many sites.

A significant part of the project area (approximately 101 ha) has been cleared and replanted for agricultural purposes, predominantly sugar cane with some minor areas of tree cropping.

There is some east-west connectivity between the coastal plain to the east of the project area and Connors Range to the west. This connectivity is associated with the watercourses traversing the area, including Plane, Elizabeth, Willy and Freddy Creeks. However, linear disturbances have impacted on the east-west connectivity, including the Bruce Highway and North Coast Line and Goonyella Branch Line. North-south connectivity within the area is limited and is mainly associated with the coastal environs to the east of the project area (aligning Sarina Inlet and Llewellyn Bay) and road and rail reserves.

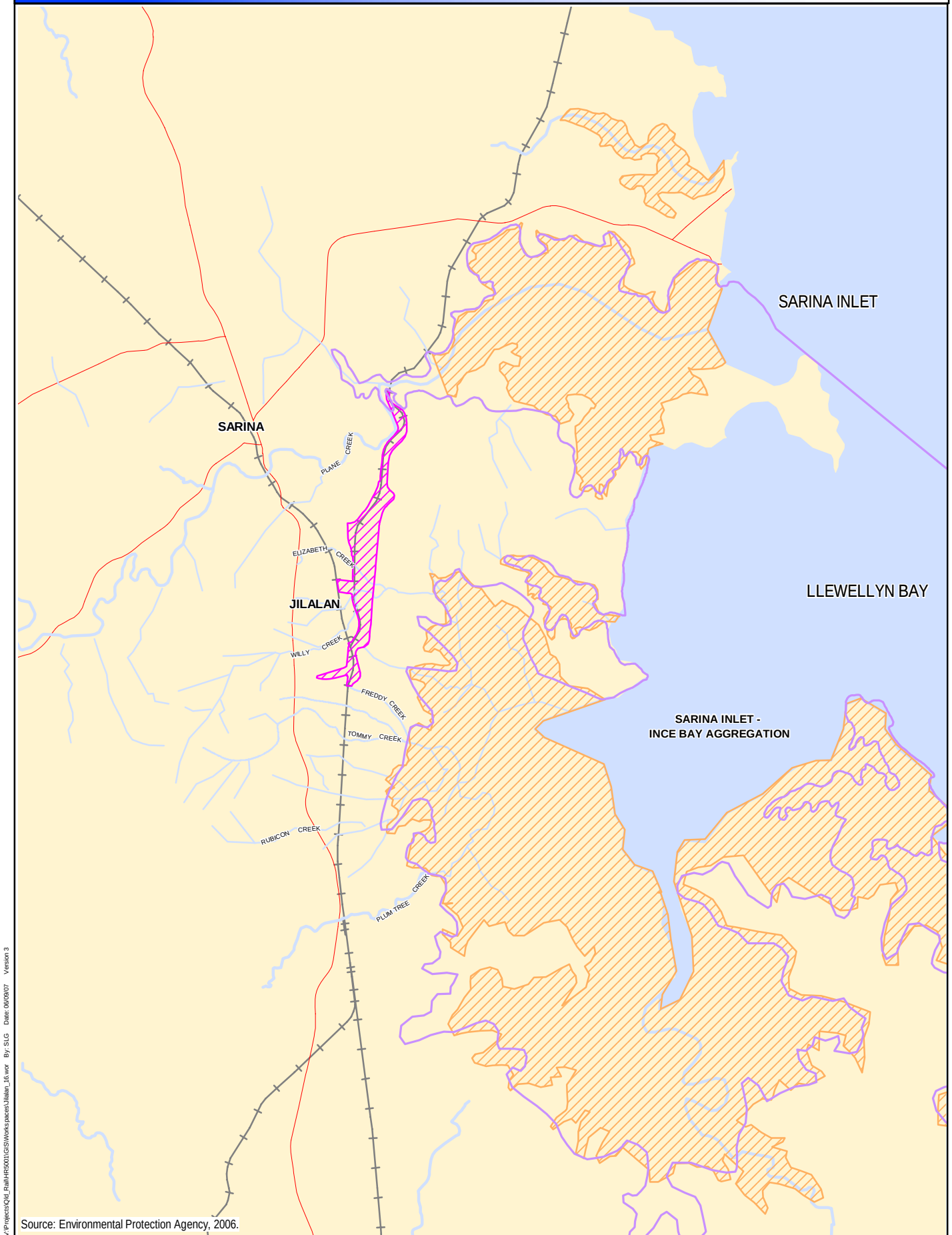
Further to the south of the project area is Tommy and Plumtree Creeks. The riparian zone along these watercourses is also important in maintaining the region's biodiversity and connectivity.

The watercourses intersecting the project area discharge into Sarina Inlet and Llewellyn Bay approximately 5 km downstream of the project area. The intertidal wetlands in conjunction with the marine environs of Sarina Inlet and Llewellyn Bay are listed on the Directory of Important Wetlands in Australia (refer Figure 6.1). The intertidal wetlands of Sarina Inlet and Llewellyn Bay comprise an area of approximately 28,000 ha and are dominated by mangrove communities.

This area is recognised as a nationally important area for shorebirds, with many EPBC Act and NC Act listed birds recorded in this area, such as the Sooty oystercatcher (*Haematopus fuliginosus*) and the Terek sandpiper (*Xenus cinereus*) as well as marine fauna, such as dugongs (*Dugong dugon*) and Flatback turtles (*Natator depressus*) (Australian Wetlands Database).

As well as being recognised as a nationally significant wetland, Sarina Inlet and Llewellyn Bay area are part of the Great Barrier Reef World Heritage Area (GBRWHA), the Great Barrier Reef Marine Park and Great Barrier Reef Coastal Marine Park (refer Figure 6.2). The project area traverses freshwater and estuarine systems. The water courses and their catchments are outside the boundaries of the Great Barrier Reef Marine Park (GBRMP) and the GBRWHA.

The GBRWHA encompasses an area of approximately 348,000 km², extending from the low water mark of the mainland and includes all islands, internal Queensland Waters and *Sea and Submerged Lands Act 1973* exclusions.



LEGEND

Intertidal Wetlands

Directory of Important Wetlands

Project Area

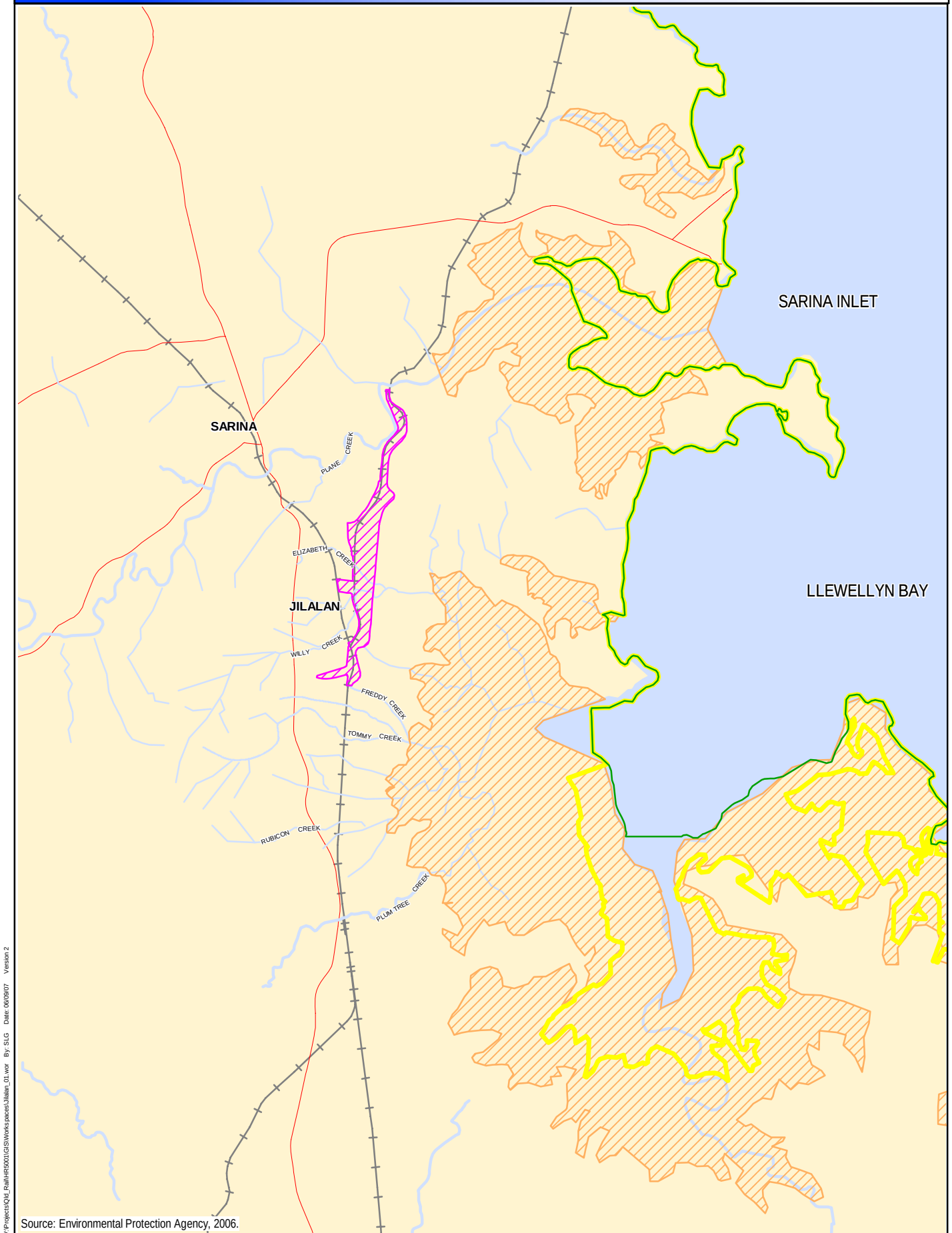
Watercourse

Major Road

Rail

INTERTIDAL WETLANDS

FIGURE 6.1



LEGEND

- Project Area
- World Heritage Area
- Intertidal Wetlands

- Great Barrier Reef Marine Park (State and Commonwealth)
- Watercourse
- Major Road
- Rail

DOWNSTREAM ENVIRONMENTS

FIGURE 6.2

The Great Barrier Reef Marine Park (Marine Park) was declared in 1975 and is legislated primarily by the *Great Barrier Reef Marine Park Act 1975*. The Act provides for the establishment, control, care and development of the Marine Park. The Marine Park comprises 33 sections as per the Proclamations, but excludes Queensland owned islands, internal waters of Queensland and exclusions under the *Seas and Submerged Lands Act 1973*. This area extends from the mean low water mark out toward the 200 nautical mile Economic Exclusion Zone.

The Marine Park was established with the purpose of preserving the area's outstanding biodiversity whilst providing for reasonable use and access. This was achieved through the establishment of the Great Barrier Reef Marine Park Zoning Plan in 2003. Under the plan, eight zones, ranging from General Use to Preservation, have been created which regulate access protocols and restrict activities within the different zones. The Great Barrier Reef Marine Park Authority (GBRMPA) is responsible for the management of the Marine Park.

The Great Barrier Reef Coast Marine Park is legislated by the Queensland Government under the *Marine Parks Act 2004*, *Marine Parks Regulation 2006* and *Marine Parks (Great Barrier Reef Coast) Zoning Plan 2004*.

The Great Barrier Reef Coast Marine Park extends from Baffle Creek (north of Bundaberg) to Cape York and encompasses tidal waters and tidal lands from the Highest Astronomical Tide (HAT) to 3 nautical miles. The zoning and provision generally complement the Commonwealth Marine Park, however there are some Queensland specific provisions that may apply.

The significance of the downstream environs must be taken into account when ensuring strict mitigation measures limit the impact of the Project on water quality within the area. Wetland and waterbird species are also at risk to negative impacts due to reduction in habitat quality if water quality is reduced upstream within the project area as a result of the upgrade.

6.2 Flora existing environment

6.2.1 Methodology

A number of existing studies and databases were reviewed for the ecological assessment to provide information relevant to the project area. Database searches included:

- The Department of Environment and Water Resources (DEWR) EPBC Act Protected Matters Report (EPBC Report)
- The Queensland Environmental Protection Agency (EPA) WildNet database
- The Queensland EPA Wildlife Online database
- The Queensland EPA Regional Ecosystem (RE) Online Mapping
- The Queensland Herbarium HERBRECS database
- The Queensland Museum Database

Additional information reviewed included the Regional Vegetation Management Code for Coastal Bioregions (NRW 2006), aerial photography, a species list provided by CSR Sarina Distillery and other anecdotal data gathered from local landholders.

In addition to existing information, the project area was surveyed by Connell Wagner staff during November 2006, May 2007 and June 2007.

During November 2006 an initial site inspection of the project area was undertaken for the Preliminary Ecological Assessment as part of the IAS phase of the Project.

A gap analysis was then carried out which led to further more detailed inspections being undertaken during May and June 2007 by two qualified ecologists.

Vegetation communities within the project area were traversed to gather information such as plant identification to genus and/or species level and dominant plant species. Two 50 m x 10 m temporary survey plots were established within mapped REs within the project area to record basal counts, tree heights (using a clinometer) and tree diameter at breast heights (DBH). This information as well as vegetation structures of the vegetation communities were recorded using methods described by Neldner *et al* (2005) in the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.1. The structural compositions of the vegetation communities were classified as per Specht (1970).

The majority of species observed were identified using appropriate field guides and taxonomic keys. Samples for specimens not readily identifiable were obtained during the survey and forwarded to Queensland Herbarium for identification and/or verification. Botanic and common names used in the report to describe flora were obtained from Stanley & Ross (1983, 1986 and 1989), Harden *et al* (2006), Anderson (2003), Stephens *et al* (2002) and Johns (2006). Where there is no accepted common name only the botanical name is used.

It is important to note that due to seasonal limitations, all flora species within the project area may not have been recorded. This could be attributed to the extent of the area, plants being unidentifiable due to lack of fertile material, or plants lying dormant (eg terrestrial orchids) at the time of the survey. However, it is unlikely that any significant species identified in the desktop searches would be dormant in the survey area at that time.

6.2.2 Background searches

Regional ecosystem mapping

REs are significant remnant vegetation communities gazetted under the VM Act. This ensures appropriate protection measures are undertaken when development of a site occurs. In most instances, prior to clearing vegetation within an RE a vegetation clearing permit (issued by DNRW) is required.

A RE code is an abbreviation used by the EPA to describe a vegetation community according to its bio-region classification, its land zone classification and species composition.

Table 6.1 summaries the characteristics of the RE classification.

Table 6.1 Regional Ecosystems Classifications

RE Classification	Characteristics of Classification
Endangered	less than 10% of the pre-clearing extent remains, or 10-30% of the pre-clearing extent remains (but the area of remnant vegetation is less than 10,000 ha) or if the community is considered rare (ie less than 10,000 ha in Queensland) and subject to threatening processes
Of Concern	10% to 30% of the RE type left undisturbed or more than 30% of the pre-clearing extent remains (but the area of remnant vegetation is less than 10,000 ha)
Not of Concern	30% of the pre-clearing extent remains and the area of remnant vegetation is more than 10,000 ha

Source: EPA/QPWS 2006

To qualify as remnant vegetation it must have the following characteristics:

- 50% of the predominant canopy cover that would exist if the vegetation community were undisturbed
- 70% of the height of the predominant canopy that would exist if the vegetation community were undisturbed
- Composed of the same floristic species that would exist if the vegetation community were undisturbed

The EPA's RE mapping indicated there to be six REs within and adjacent the project area (refer Appendix H1). Table 6.2 summarises the vegetation types, their status and their location with Figure 6.3 displaying their approximate locations.

Table 6.2 Regional Ecosystems within and adjoining the project area

Regional Ecosystem	Description	VMA Status ¹	Location
8.1.1	Mangrove vegetation of marine clay plains, estuaries and estuarine wetlands	Not of Concern	North-eastern boundary of project area around Plane Creek
8.3.3a ² /8.3.5 ³	<i>Melaleuca leucadendra</i> or <i>M. fluviatilis</i> ± <i>Casuarina cunninghamiana</i> open forest to woodland, fringing watercourses/ <i>Corymbia clarksoniana</i> + <i>Lophostemon sauveolens</i> + <i>Eucalyptus platyphylla</i> woodland, or <i>E. platyphylla</i> woodland on alluvial plains	Of Concern	North-eastern boundary of project area adjacent to Smyths Road
8.3.5 ³ /8.3.3a ²	<i>Corymbia clarksoniana</i> + <i>Lophostemon sauveolens</i> + <i>Eucalyptus platyphylla</i> woodland, or <i>E. platyphylla</i> woodland on alluvial plains/ <i>Melaleuca leucadendra</i> or <i>M. fluviatilis</i> ± <i>Casuarina cunninghamiana</i> open forest to woodland, fringing watercourses	Of Concern	North-western boundary of project area between Plane Creek and Arron Road
8.3.1a ³	Semi-deciduous notophyll/mesophyll vine forest fringing watercourses on alluvial plains	Of Concern	North-western boundary of project area south of Plane Creek
8.12.12a	Variable mixed open-forest to woodland consisting of <i>Corymbia</i> spp. ± <i>Eucalyptus tereticornis</i> ± <i>E. platyphylla</i> ± <i>E. drepanophylla</i> ± <i>E. portuensis</i> on lower and mid-slopes of ranges on Mesozoic to Proterozoic igneous rocks	Not of Concern	South-eastern boundary of the project area north of Onnooie Road
8.12.22	Variable woodland to open-forest usually dominated by <i>Eucalyptus drepanophylla</i> ± <i>E. platyphylla</i> ± <i>Corymbia clarksoniana</i> ± <i>E. exserta</i> ± <i>C. trachyphloia</i> , <i>E. portuensis</i> and <i>C. intermedia</i> and <i>E. melanophloia</i> on hills and ranges at low to moderate altitudes, in drier areas	Not of Concern	East of the project area adjacent Armstrong Beach Road

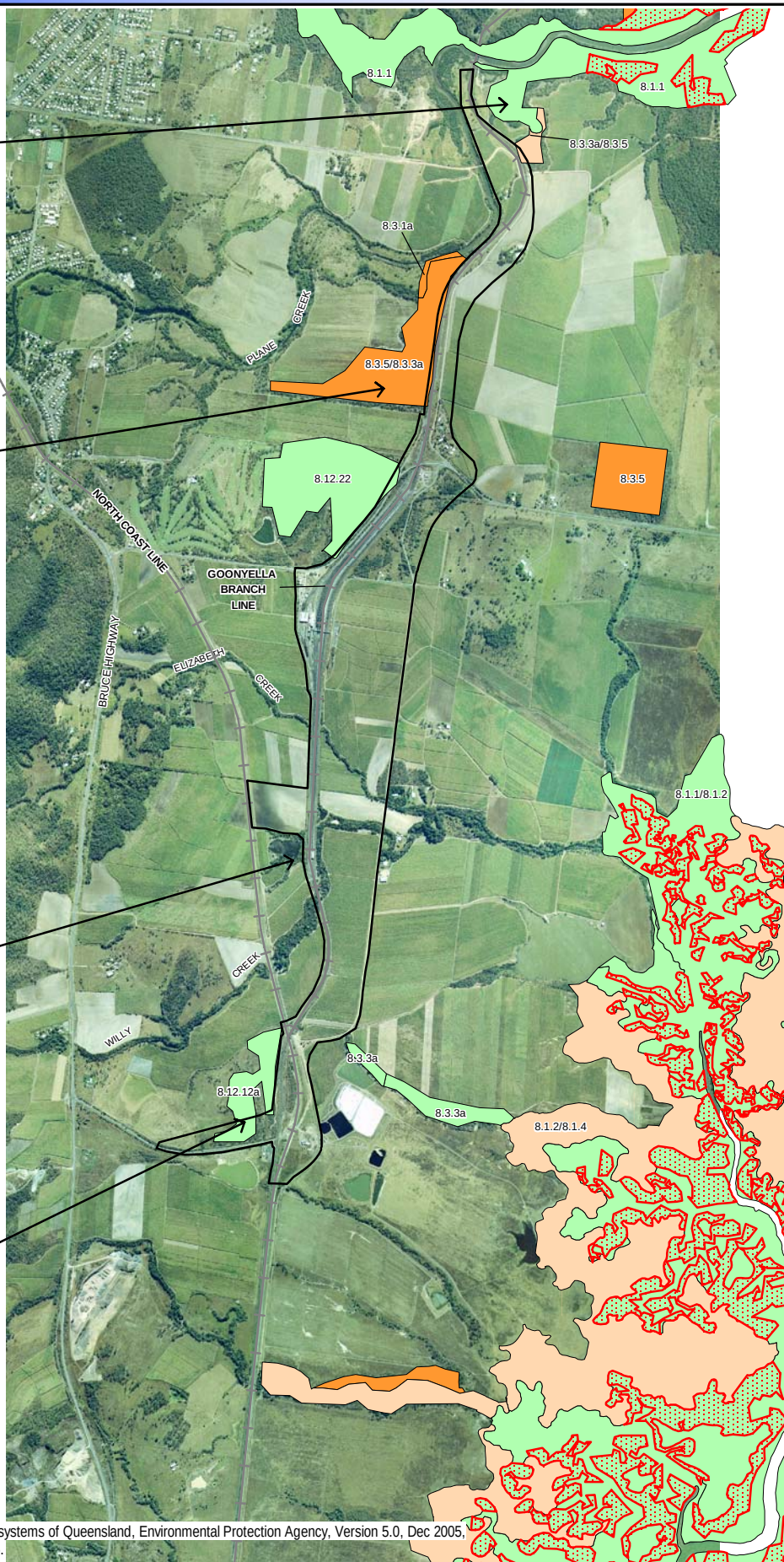
Source: NRW 2006b

Table Notes:

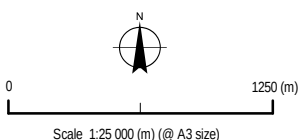
¹ Vegetation Management Act 1999

² Biodiversity status considered to be "Of Concern" by the EPA if further clearing is carried out within this RE type.

³ Biodiversity status considered to be "Endangered" by the EPA if further clearing is carried out within this RE type.



Source: 2003 Remnant Vegetation Communities and Regional Ecosystems of Queensland, Environmental Protection Agency, Version 5.0, Dec 2005.
Essential Habitats, Environmental Protection Agency, 2006.



LEGEND

Regional Ecosystem Status

- Of Concern - Dominant
- Of Concern - Sub dominant
- Not of Concern

Essential Habitat

Project Area

REGIONAL ECOSYSTEMS AND ESSENTIAL HABITATS

FIGURE 6.3

Threatened flora species

The EPBC Report identified two threatened (ie critically endangered, near threatened, endangered, vulnerable, rare under EPBC Act and/or NC Act) species as potentially inhabiting the project area with HERBRECS confirming the presence of one significant species within the project area (refer Appendix H1). Both species identified from these searches are listed as vulnerable under the EPBC Act and the NC Act. It is also important to note that REs within and adjacent to the project area are also considered to contain suitable habitat for rare and threatened flora species. All significant species potentially inhabiting the project area have been outlined in Table 6.3.

Table 6.3 EPBC Act Protected Matters Report – Threatened plants

Species	Status		Habitat	Likely Occurrence
	EPBC Act	NC Act		
<i>Eucalyptus raveretiana</i> (Black ironbox)	V	V	A tree to 21 m occurring in riparian woodlands on alluvial flats along river banks on sandy and/or alluvial soils. This species is usually found with <i>Melaleuca</i> and <i>Casuarina</i> spp. as well as <i>E. tereticornis</i> (Calvert <i>et al</i> 2005)	High This species is likely to occur within the project area with HERBRECS records recording it within the area Suitable habitat occurs along watercourses and <i>Melaleuca</i> wetland communities within the project area. Field surveys confirm its presence within the project area
<i>Leucopogon cuspidatus</i>	V	-	Small dense shrub to 1.2 m mainly associated with poor skeletal soils and rocky slopes in montane environs including granite or serpentine outcrops Commonly associated with woodlands or open woodlands and sometimes in heath or shrubland communities (M. Edginton <i>pers comm</i> cited in REA 2005)	Low Suitable habitat within the area is limited and the species has not been identified from Sarina Shire LGA
<i>Acacia jackesiana</i> (Betsy's wattle)	-	R	A shrub rarely exceeding 50cm and usually found in open eucalypt woodlands on hill slopes in skeletal soils. This species is generally associated with Ironbarks and Mallee box vegetation communities (Calvert <i>et al</i> 2005)	Low Although likely occurrence is low, suitable habitat exists north of Oonooie Road and within RE 8.12.22 (adjacent to the project area)

Table Notes:

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*NC Act = *Nature Conservation Act 1992*

V = Vulnerable

R = Rare

E = Endangered

NCN = No Common Name

Species	Status		Habitat	Likely Occurrence
	EPBC Act	NC Act		
<i>Cycas ophiolitica</i>	E	E	A small to medium sized cycad rarely exceeding 4 m in height. This species is known to occur on hill tops and steep slopes at altitudes between 80-620 m it is commonly associated with eucalypt open forest/woodland communities (DNRW 1999) Distribution for this species is generally restricted to between Marlborough and Rockhampton North	Low Known recorded distribution approximately 260 km south of project area Field surveys confirm presence of a <i>Cycad</i> sp. within the project area. Insufficient material available to make a definite identification. However more likely to be <i>Cycas media</i> subsp <i>media</i> listed as not of concern under the NC Act.
<i>Rhamphicarpa australiense</i>	-	R	A small herb to 30cm occurring annually in poorly drained open eucalypt and <i>Melaleuca</i> woodlands or wetlands (Calvert <i>et al</i> 2005)	Low The project area and surrounding region is outside the species known distribution
<i>Eulophia bicallosa</i>	-	R	A terrestrial orchid often occurring on sandy soils in a range of habitats from open woodlands to rainforests and flowers in spring and (Stanley and Ross 1989, Jones 2006)	Moderate HERBRECS data indicates the species has been recorded in the Mackay area. Suitable habitat is present throughout the project area
<i>Grevillea venusta</i> (Byfield spider flower)	V	V	A shrub to 5 m found along creekbanks or ridges and usually associated with mixed sclerophyll forest/woodland and rainforest environments (DNRW 1999)	Moderate Suitable habitat for this species exists along watercourses within the project area
<i>Persoonia amaliae</i>	-	R	A shrub or small tree to 8 m generally occurring in dry sclerophyll forest, dry rainforest, gallery or fringing forest, casuarina open forest/woodland and disturbed environments (DNRW 1999)	Moderate Due to the wide habitat tolerance of this species, suitable habitat exists within the project area, particularly within REs and along watercourses
<i>Pratia podenzanae</i>	-	R	A small creeping herb occurring in a range of habitats including hilly terrain on creek bans and alluvial flats. This species is thought to grow in open forest communities with <i>E.tereticornis</i> , <i>C.intermedia</i> , <i>Lophostemon sauveolens</i> and <i>Casuarina cunninghamiana</i> at altitudes between 80-120 m (DNRW 1999)	Low Suitable habitat occurs along watercourses within the project area

Table Notes:

EPBC Act = Environment Protection and Biodiversity Conservation Act 1999

NC Act = Nature Conservation Act 1992

V = Vulnerable

R = Rare

E = Endangered

NCN = No Common Name

Species	Status		Habitat	Likely Occurrence
	EPBC Act	NC Act		
<i>Paspalidium scabrifolium</i>	-	R	A grass species reaching 100cm in height occurring in a range of habitats including eucalypt woodlands and forests	Moderate Suitable habitat for this species occurs within RE 8.12.12 at the southern extent of the project area
<i>Sarcotoechia heterophylla</i>	-	R	A small tree to 12m usually occurring on ridges in simple/mixed notophyll vine forests at altitudes between 200 to 900 m (DNRW 1999)	Low Suitable habitat for this species may exist within RE 8.3.1 (south of Plane Creek)
<i>Solanum sporadotrichum</i>	-	R	Small shrub to 2.5 m occurring on slopes in association with vine thicket vegetation. This species is usually found on igneous coastal ranges (Calvert <i>et al</i> 2005)	Low Suitable habitat for this species may exist within RE 8.3.1 (south of Plane Creek)
<i>Trigonostemon inopinatus</i>	V	V	Very little is known about this species however, Herbarium records indicate species presence within araucarian microphyll vine forest on alluvium soils along rocky creek banks.	Low Suitable habitat for this species may exist within RE 8.3.1 (south of Plane Creek)

Table Notes:

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*NC Act = *Nature Conservation Act 1992*

V = Vulnerable

R = Rare

E = Endangered

NCN = No Common Name

6.2.3 Field results

During the field investigations approximately 190 plant species were identified from 12 sites (refer Figure 6.4). A comprehensive species list from each site has been included in Appendix H2. A detailed breakdown of the vegetation communities within each site is outlined below.

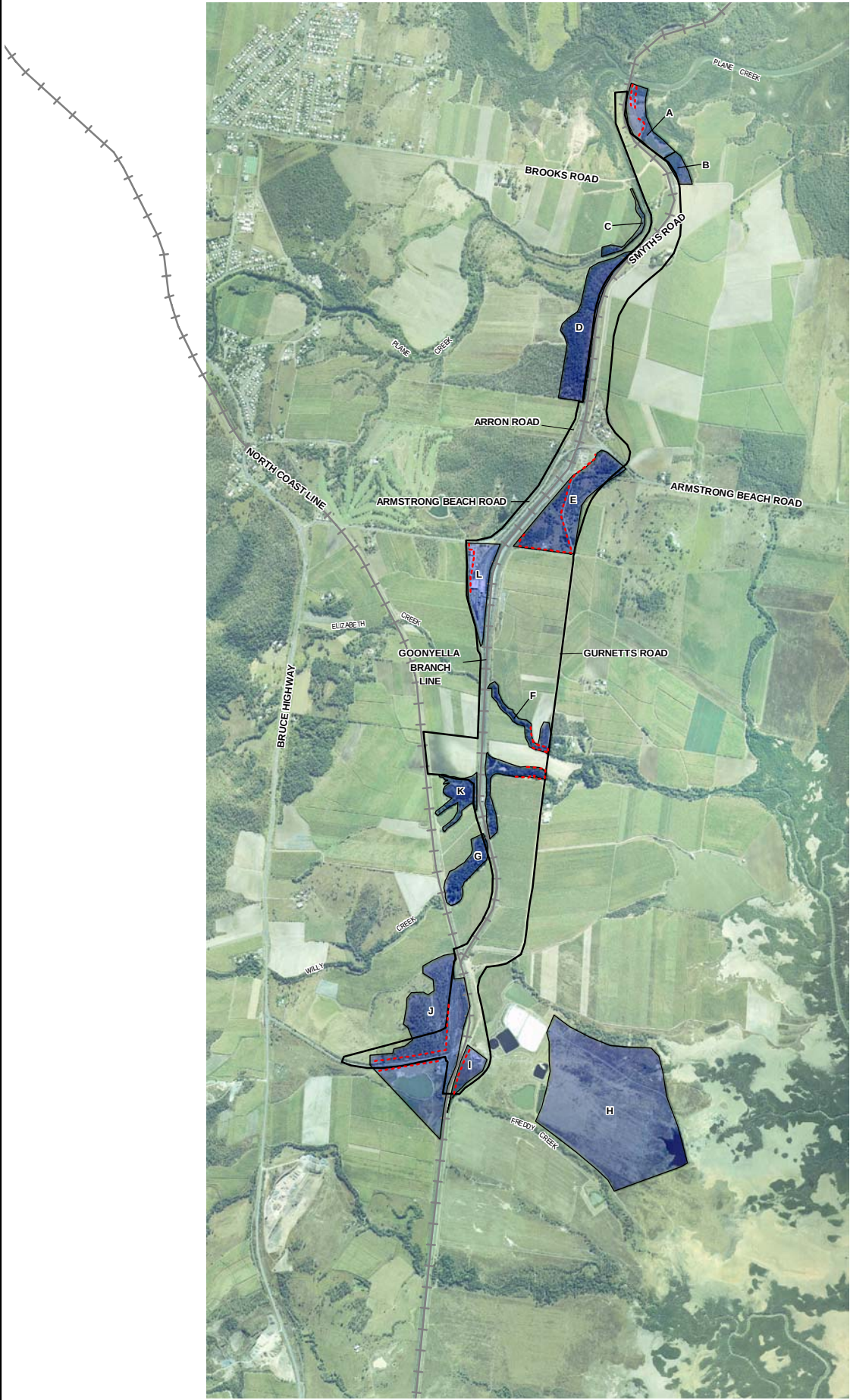
Site A (Plane Creek)

The vegetation communities along the northern and southern banks of Plane Creek are mapped as RE 8.1.1 (refer Figure 6.3). The community on the southern bank encompasses an area of 40 ha and extends downstream approximately 0.75 km from the Goonyella Branch Line Bridge to an area which has been cleared for agriculture. The community on northern bank extends upstream and downstream from the project area and is contiguous with the intertidal wetlands of Sarina Inlet covering an area of approximately 400 ha.

Other intertidal wetland communities are also present within the area, including saline grasslands and saltmarsh communities. However, the existing railway embankments and a thin strip adjacent to the marine plants were dominated by introduced shrubs and grasses.

This site did not appear to contain suitable habitat for rare and threatened flora species listed in Table 6.3 nor were any located during field surveys.

Marine plants (including mangroves) observed within this site are protected under Section 123 of the *Fisheries Act 1994*. A permit from the Department of Primary Industries and Fisheries (DPIF) is required to remove or damage marine plants.



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LEGEND

- Project Area
- Flora Survey Traverse (May 2007)

- Survey Site
- Rail

SURVEY SITES

FIGURE 6.4

Site B (RE 8.3.3a/8.35)

To the east of the project area adjoining the intertidal wetlands is approximately 2.5 ha of vegetation, classified as RE 8.3.3a/8.3.5 (refer Figure 6.3). The vegetation community within this area consists of *Corymbia clarksoniana* / *Lophostemon sauevolens* / *Eucalyptus platyphylla* woodland regrowth which is consistent with RE 8.3.5.

Whilst this vegetation community exhibits the characteristics associated with RE 8.3.3a/8.3.5 its overall integrity is considered to be low because of edge effects and fragmentation due to current land use activities. Evidence of a recent controlled burn was also observed.

This site was not surveyed for rare and threatened flora species, however suitable habitat may be present for Black ironbox (*Eucalyptus raveretiana*), *Rhamphicarpa australiensis*, *Eulophia bicallosa*, Byfield spider flower (*Grevillea venusta*), *Persoonia amaliae* and *Pratia podenzanae* (refer Table 6.3).

Declared pest species Lantana (*Lantana camara*) was observed within this area. Management requirements under the LP Act are discussed later in this section.

Site C (Plane Creek)

Located north-west of the project area (south of Brooks Road) the thin strip of vegetation between Plane Creek and agricultural crops includes mature *Melaleuca* spp. with heights to approximately 24 m and Diameter at Breast Height (DBH) of approximately 146 cm (refer Figure 6.4 and Photo 6.1). These trees are amongst other vegetation, including Mangrove communities along the banks of Plane Creek and disturbance tolerant species such as Blush Macaranga (*Macaranga tanarius*), Guinea grass (*Megathursus maximus*) and Castor oil plant (*Ricinus communis*).



Photo 6.1 Remnant *Melaleuca* specimen in Site C

The overall integrity of this area is considered to be low due to edge effects and fragmentation that has resulted from past and current land use activities. In addition to these factors, the presence of a dense cover of weeds has significantly reduced the presence of suitable habitat for rare and threatened flora species listed in Table 6.3.

Marine plants (including mangroves) present at this site are protected under Section 123 of the *Fisheries Act 1994*. A permit from DPIF is required to remove or disturb marine plants.

Site D (RE)

Located on the western side of the Goonyella Branch Line between Plane Creek and Arron Road is approximately 27 ha containing three vegetation communities mapped RE 8.3.5/8.3.3a and RE 8.3.1a (refer Table 6.2). Within this area, a class 1 unnamed creek traverses these REs which provides habitat for rainforest species in the upper reaches and mangrove thickets in the lower reaches where it feeds into Plane Creek.

RE 8.3.5/8.3.3a

The geology and vegetation within this site appears consistent with RE 8.3.5. It contains species such as Poplar gum (*Eucalyptus platyphylla*), Grey ironbark (*E.drepanophylla*) and Swamp box (*Lophostemon suaveolens*) to an estimated height of 17 m. *Livistona* sp. was also observed towards the edges of the large embankment (facing Plane Creek) and along the unnamed creek within this area. The species composition and geology is consistent with RE 8.3.3a (refer Photo 6.2). Many epiphytic orchids were also observed on the trunks of mature trees along the watercourse.



Photo 6.2 Vegetation structure within RE 8.3.5/8.3.3a

The mid stratum within RE 8.3.5 was sparse to mid-dense containing species such as Cocky apple (*Planchonia careya*) and Lantana (refer Photo 6.3), whilst along the creek line this stratum contained predominantly rainforest species in the upper reaches and mangrove species such as Holy mangrove (*Acanthus ilicifolius*) towards Plane Creek.



Photo 6.3 Mangrove vine forest along the unnamed creek

Grazing pressures within the lower stratum of these REs along with controlled burns and slashing has changed the species composition of this site and encouraged the growth of introduced species in the lower stratum. Scorch marks on *Livistona* spp. indicate recent medium intensity fires along the edge of the riparian zone (refer Photo 6.4).



Photo 6.4 Scorch marks on a dead *Livistona* in RE 8.3.3

The declared pest species, Lantana was recorded within this area.

A targeted search for rare and threatened species within these REs was restricted to areas along the creek line. Although no rare and threatened species were located at this time, suitable habitat exists for Black ironbox, *Rhamphicarpa australiensis*, *Eulophia bicallosa*, Byfield spider flower, *Persoonia amaliae*, *Pratia podenzanae*, *Sarcotoechia heterophylla*, *Solanum sporadotrichum* and *Trigonostemon inopinatus* (refer Table 6.3).

Site E

Site E is located in the middle section of the project area between Armstrong Beach Road and Soto Road and encompasses an area of approximately 15 ha (refer Figure 6.4).

Vegetation communities within this site include *Corymbia clarksoniana*/*Lophostemon suaveolens*/*Eucalyptus platyphylla* woodland with an average canopy height to approximately 10 m along the road verges and *Eucalyptus platyphylla* and *Melaleuca* spp. open forest with an average canopy height to approximately 16 m in less disturbed areas. The mid stratum of the less disturbed areas includes species such as Screw pine (*Pandanus tectorius*) and Lantana with *Melaleuca* sp and *E. platyphylla* regrowth. Scorch marks were observed high up dead remnant trees within this area indicating their demise may have been a result of past high intensity fires.

The ground layer in the majority of the area appears to have been highly modified by grazing and is dominated by exotic grasses, herbs and small shrubs (refer Photo 6.5). A small community (20 individual specimens) of Pink nodding orchid (*Geodorum densiflorum*), a terrestrial orchid, was also recorded.



Photo 6.5 *Cynodon* sp. dominating an intermittently waterlogged area

In addition, there is a dam on the western side of Gurnetts Road surrounded by trees. Adjacent to this is an intermittently waterlogged area dominated by Couch (*Cynodon* sp.). An orchard containing Mango (*Mangifera indica*) and Fig trees (*Ficus* sp.) was also located within this area.

Along a small watercourse on the eastern side of Gurnetts Lane two remnant species, a Swamp box with a DBH of 34 cm and a Broad-leaf paperbark (*Melaleuca viridiflora*) approximately 10 m tall with a DBH of 45 cm was observed.

The vegetation in this site is not mapped as a RE which may be due to past and present agricultural activities that have caused significant modification to it. However, this site is considered to contain suitable habitat for Black ironbox, *Rhamphicarpa australiensis* and *Eulophia bicallosa* (refer Table 6.3).

Declared pest species observed within this area included Lantana, African tulip tree (*Spathodea campanulata*) and Parramatta grass (*Sporobolus fertilis*).

Site F (Elizabeth Creek)

The section of Elizabeth Creek traversed during field surveys is located upstream of Willy Creek/Elizabeth Creek junction between Gurnetts Road and the Goonyella Branch Line (refer Figure 6.4).

The riparian vegetation within Elizabeth Creek consists of a very narrow band (to 3 m each side) of Weeping teatree (*Melaleuca leucadendra*) (to 18 m high) and River oak (*Casuarina cunninghamiana*) open forest with Screw pine and Blush macaranga present in the upper mid stratum. A sparse rainforest understorey was present in the lower strata, however this area is highly disturbed on both banks and is dominated by weed species (refer Photo 6.6). Epiphytic orchids are also present on the trunks of large *Melaleuca* trees on the northern bank of Elizabeth Creek.



Photo 6.6 Weeds along the edge of riparian vegetation along Elizabeth Creek

The integrity of the riparian vegetation along Elizabeth Creek varies between Gurnetts Road and the Goonyella Branch Line with large areas of weed infestation evident and few intact areas.

The species mix and geology along this area of Elizabeth Creek is consistent with RE 8.3.3, however due to the extent of the vegetation community and the degree of disturbance the vegetation is not mapped as remnant vegetation. Scorch marks were also observed on riparian vegetation along the edge of the creek line which is likely to be associated with controlled sugarcane fires within this area.

Targeted searches for rare and threatened species within a patch of vegetation north of Elizabeth Creek revealed the presence of *Cycas* sp. This could potentially be *Cycas ophiolitica*, an endangered cycad listed under both the NC Act and the EPBC Act (refer Figure 6.5 and Photo 6.7) but is more likely to be *Cycas media* subsp *media*, a species not listed as a threatened species under the NC Act. Although no other rare and threatened species were located at this time, suitable habitat exists for Black ironbox, *Eulophia bicallosa*, Byfield spider flower, *Persoonia amaliae* and *Pratia podenzanae* (refer Table 6.3).



Photo 6.7 *Cycas* sp. vegetation north of Elizabeth Creek

Declared pest flora recorded within this area included Lantana and Parramatta grass.

Site G (Willy Creek)

The section of Willy Creek traversed during field surveys is located between the Gurnetts Road and the North Coast Line (refer Figure 6.4).

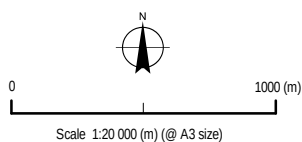
The dominant open forest vegetation within the riparian zone of Willy Creek consists of species such as Weeping teatree and River oak in the upper stratum and rainforest species such as Glossy acronychia (*Acronychia laevis*), Northern olive (*Chionanthus ramiflora*) and Buttonwood (*Glochidion lobocarpum*) in the mid stratum. Lower stratum species include Matrush (*Lomandra* spp.) and *Cyperus* spp. and the seedlings of various rainforest species (refer Photo 6.8). Scorch marks were also observed on riparian vegetation along the edge of the creek line, which are likely to be associated with controlled sugarcane fires within this area.

Although very large specimens of *Melaleuca* were observed along Willy Creek (some with a DBH of over 90 cm) a basal count conducted within a 50 m x 10 m plot adjacent the creek line found that the average height of canopy species to be 13 m with an average DBH of 19 cm (refer Figure 6.5 for location of plot).

Due to the average width of the riparian vegetation along Willy Creek (20 m each side) its structural integrity and species composition is considered greater than that found along Elizabeth Creek. There is also less weed infiltration due to the canopy closure in denser areas towards the creek itself. The species composition and geology in this site is consistent with RE 8.3.3, however the vegetation along Willy Creek is not currently classified as a RE which may be attributed to its limited extent and width.



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LEGEND

- Rail
- Project Area
- + Transect Start/End

Significant Species

- *Cycas ophiolitica*
- *Eucalyptus raveretiana*

SIGNIFICANT SPECIES AND TRANSECT LOCATIONS

FIGURE 6.5



Photo 6.8 Riparian zone along Willy Creek

Targeted searches for rare and threatened species along Willy Creek revealed the presence of what appears to be Black ironbox, a eucalypt species listed as vulnerable under both the NC Act and the EPBC Act (refer Figure 6.5). Due to the height of the specimens and density of weed species surrounding their base, it was not possible to collect sufficient material to confirm identification.

Although no other rare and threatened species were recorded at the site, suitable habitat also exists for *Eulophia bicallosa*, Byfield spider flower, *Persoonia amaliae*, *Pratia podenzanae* and *Sarcotoechia heterophylla* (refer Table 6.3).

Declared pest flora observed within this area included Lantana and Parramatta grass.

Site H (Oonooie Salt Flat)

This site was traversed during May 2007 and is located east of the Goonyella Branch Line to the south east of the project area (refer Figure 6.4)

The vegetation within this site appears consistent with RE 8.1.2 containing saltpan and grassland vegetation adjacent to mangroves (refer Photo 6.9). Currently these salt pans, owned by CSR, are being rehabilitated through tree planting and weed eradication programmes in order to improve the integrity of the area and the intertidal wetlands.



Photo 6.9 Mangroves present amongst grassland vegetation at Site H

Site I (CSR Sarina Distillery to Freddy Creek)

Around the CSR Sarina Distillery the vegetation consists of a mown grassy understorey with Long-fruited bloodwood (*Eucalyptus polycarpa*) and Spotted gum (*Corymbia citriodora*) regrowth. The height of the regrowth within the area was up to 15 m tall with an average DBH of 21 cm.

From the southern edge of the mown area through to the Freddy Creek, a patch of regrowth vegetation containing species such as Broad-leaf paperbark and Poplar gum to 4 m was present with an understorey dominated by Ditch millet (*Paspalum scrobiculatum*). The vegetation along Freddy Creek itself consisted of a thin strip of *Melaleuca leucadendra*/ *Casuarina cunninghamiana* open forest with a rainforest understorey on both banks. Scattered remnant trees are also present.

In addition, there are a number of sedge and small native herb species along existing access tracks adjacent to the North Coast Line.

Due to the extent of the vegetation community and the degree of disturbance the vegetation is not mapped as remnant vegetation.

This area was not surveyed for rare and threatened species, however suitable habitat may exist for Black ironbox, *Acacia jackesiana*, *Eulophia bicallosa*, Byfield spider flower, *Persoonia amaliae* and *Pratia podenzanae* (refer Table 6.3).

Site J

The western side of the North Coast Line and south of Oonooie Road has been cleared for agriculture. It is dominated by grasses and herbaceous species and a farm dam (refer Photo 6.10). To the north of Oonooie Road is approximately 10 ha of RE 8.12.12a (refer Table 6.2 and Figure 6.3).



Photo 6.10 Farm Dam south of Oonooie Road

The woodland vegetation on the upper slopes of this area consists of species such as Grey ironbark, Poplar gum and White mahogany (*E.portuensis*) in the upper stratum (refer Photo 6.11) with a low shrub layer of *Xanthorrhoea latifolia* (grass tree) and *Acacia* spp. along the disturbed edges. The lower stratum consists of grasses and herbaceous species such as Kangaroo grass (*Themeda triandra*), *Aristida utilis*, Gambia pea (*Crotalaria goreensis*), Gomphrena weed (*Gomphrena celosiodides*) and Sensitive weed (*Mimosa pudica*).

A basal count conducted within a 50 m x 10 m plot on the upper slope found that the average height of the Ironbark species to be 14 m with an average DBH of 31 cm (refer Figure 6.5 for location of plot).



Photo 6.11 Upper slopes of RE 8.12.12a *Eucalyptus platyphylla* and *E. drepanophylla*

The average canopy height on the lower slopes (directly adjacent to the North Coast Line) is approximately 10 m with denser vegetation dominated by *Melaleuca* spp. and Poplar gum in the upper stratum (refer Photo 6.12). Lantana, Cocky apple and Cedar (*Paraserianthes toona*) is scattered throughout the middle stratum. Common grass and herbaceous species such as Snakeweed (*Stachytarpheta jamaicensis*), Sensitive weed (*Mimosa pudica*) and Spear grass (*Heteropogon contortus*) occur in the lower stratum.



Photo 6.12 *Melaleuca/Eucalyptus* vegetation on lower slopes of Site J

Grazing pressures within the lower stratum of these areas, in addition to controlled burns and slashing, has modified the species diversity of this site and encouraged the growth of introduced species in the lower stratum.

Although rare and threatened species have not been located at this time, suitable habitat within this RE and its adjoining vegetation exists for Black ironbox, *Acacia jackesiana*, *Cycas ophiolitica*, *Rhamphicarpa australiensis*, *Persoonia amaliae* and *Paspalidium scabrifolium* (refer Table 6.3).

Declared pest flora recorded within this area included Lantana and Paramatta grass.

Site K (Wetland)

The state significant wetland area is located on a tributary of Willy Creek between the North Coast Line and the Goonyella Branch Line and encompasses an area of approximately 4 ha (refer Figure 6.4).

The vegetation within this area is dominated by mature stands of *Melaleuca* and *Eucalyptus* spp. with *Livistona* sp. also present in the upper and mid strata. There is a grassy understorey consisting of species such as Black speargrass and *Cyperus* spp. and semi-aquatic species such as Smartweed (*Persicaria attenuata*) and Hymenachne (*Hymenachne amplexicaulis*).

Limited searches for rare and threatened species of the wetland revealed the presence of what appears to be Black ironbox, a eucalypt species listed as vulnerable under both the NC Act and the EPBC Act (refer Figure 6.5). Due to a lack of fertile material it has not been possible to adequately identify this specimen at this time. Suitable material is not likely to be available from these species until their flowering period between December and February.

In addition, suitable habitat within this site also exists for *Rhamphicarpa australiensis* and *Pratia podonanae* (refer Table 6.3).

Declared pest species *Hymenachne* was observed within this site.

Site L

The vegetation within the existing Jilalan Rail Yard is dominated by exotic grasses and herbs (many which were dying at the time of survey) with a few scattered ornamental, native and exotic trees and shrubs.

Targeted searches for rare and threatened species within this area were not considered necessary due to the low likelihood of these species occurring in this area.

Declared pest plants

A number of flora species observed within the project area are declared pest plants under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) and listed in the *Land Protection (Pest and Stock Route Management) Regulation 2003* (LP Regulation). Declared species observed during site investigations are listed in Table 6.4 with their general locations shown in Figure 6.6.

Table 6.4 Declared pest flora within the project area

Botanical Name	Common Name	Category	Site						
			B	D	E	F	G	J	K
<i>Hymenachne amplexicaulis</i>	Hymenachne	C2							✓
<i>Lantana camara</i>	Lantana	C2	✓	✓	✓	✓	✓	✓	
<i>Spathodea campanulata</i>	African tulip tree	C3			✓				
<i>Sporobolus fertilis</i>	Parramatta grass	C2			✓	✓	✓	✓	✓

Reasonable steps to keep the land free of Class 2 and Class 3 declared species is required under the LP Act as listed in the LP Regulation.

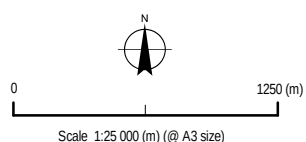
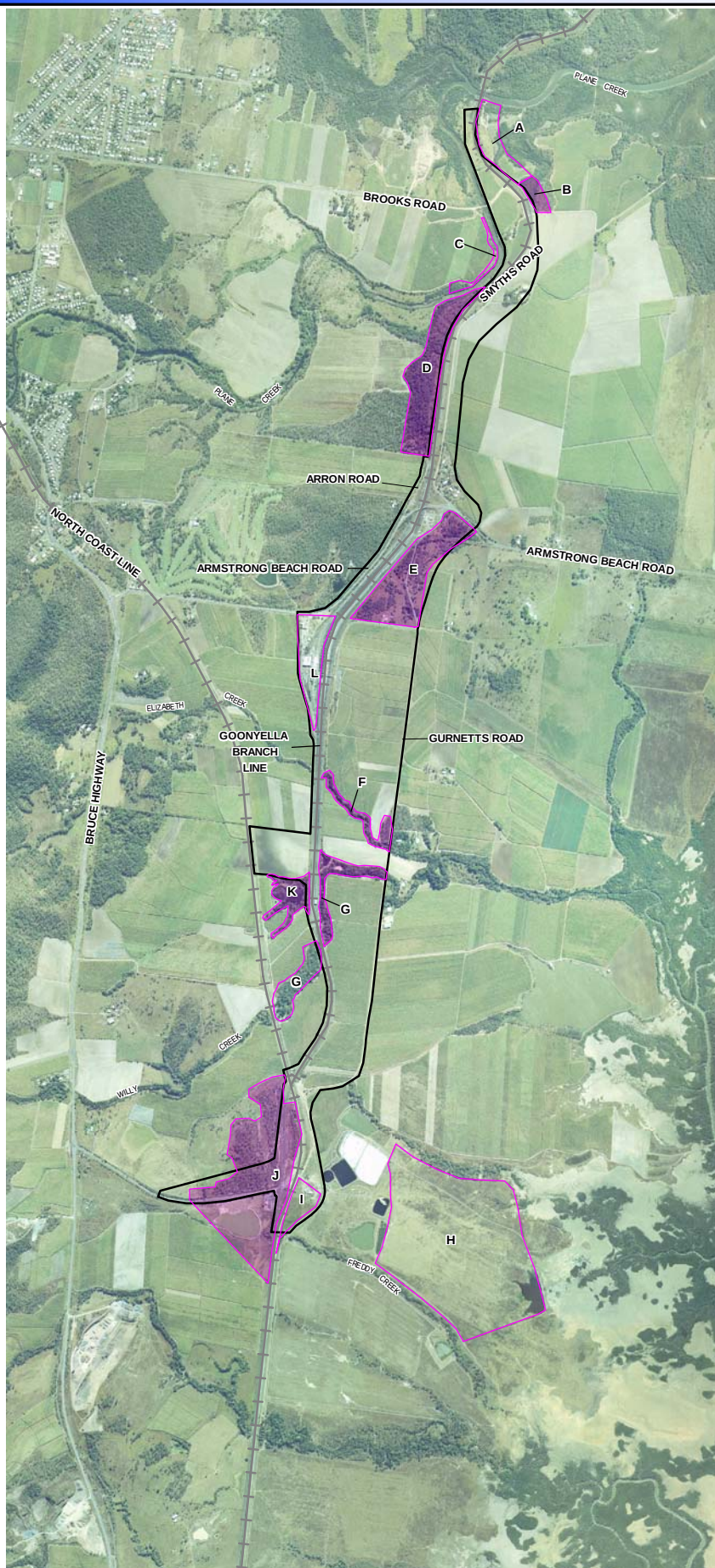
A person must not, without reasonable excuse, introduce a declared pest to any of the following areas unless a declared pest permit has been obtained:

- The owner's land
- Unfenced land comprising part of a road or stock route that adjoins or is within the owner's land
- Other land that is fenced within the owner's land
- The bed, banks and water of a watercourse on the owner's land, or
- The bed, banks and water to the centre-line of a watercourse forming a boundary, or part of a boundary, of the owner's land

Due to the high level of disturbance throughout the project area Parramatta grass was particularly abundant. To control this species CSR currently have a weed management plan in place with the aim of eradicating this species from the CSR Distillery site.

Lantana was also prevalent throughout the entire project area, whilst *Hymenachne* was only recorded from Site K. Mature specimens of African tulip tree were observed throughout the project area particularly along the creek lines.

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LEGEND

- Project Area
- Rail

- Survey Site with Declared Pest Species
- All Other Survey Sites

DECLARED PEST SPECIES

FIGURE 6.6

6.3 Terrestrial fauna existing environment

6.3.1 Methodology

The methodology adopted to identify the fauna of the area during the field inspections included:

- Bird survey – targeted survey at each site to identify birds inhabiting the project area, incidental sighting were also recorded during the survey. Early morning bird surveys conducted until 2 hours after dawn were carried out at each site and incidental sightings during trap checking and further site investigations.
- Diurnal search – targeted search of microhabitats (eg rocky outcrops, leaf litter, fallen logs, exfoliating bark etc) to identify the fauna inhabiting the project area.
- Trapping – conducted in targeted areas to identify the mammals inhabiting the area and to confirm wildlife corridors in the project area. Elliott traps and some cage traps were used and these were checked and cleared daily for any fauna caught and re-baited where necessary. Bait used was a mixture of rolled oats, vegetable oil and peanut butter.
- Spotlighting – conducted at specific sites to identify nocturnal species within the project area.
- Anabat II detector – used whilst spotlighting to identify the bats inhabiting/utilising the area.

The survey techniques are based on the Flora and Fauna Survey Guidelines (EPA 1999) and the National Parks and Wildlife Service Comprehensive Regional Assessment Systematic Fauna Survey Guidelines (Carlton 1997). The survey was conducted in accordance with Connell Wagner's scientific purposes permit (WISP01649604) and animal ethics permit (0099).

6.3.2 Background searches

Table 6.5 shows the three bird species that are listed as vulnerable under the EPBC Act and were identified from the EPBC Report as potentially occurring within the project area on the Protected Matters database (refer Table 6.5 and Appendix H1).

Table 6.5 Potential EPBC Act Listed Species

Species	Conservation Status	Habitat Association	Likely Occurrence
Red Goshawk <i>Erythrotriorchis radiatus</i>	Vulnerable (EPBC Act) Endangered (NC Act)	Open forests and woodlands especially near rivers and wetlands (Pizzey and Knight 2003) The species home range encompasses an area between 50 and 220 km ² (EPA 2007)	Low - Moderate Suitable habitat occurs within the region, however species has not been recorded from the Sarina Shire LGA
Squatter pigeon (southern) <i>Geophaps scripta scripta</i>	Vulnerable (NC Act, EPBC Act)	Mainly inhabits grassy woodlands and open forests that are dominated by eucalypts and also disturbed areas such as pastoral land (DEW 2007) The species is commonly observed in habitats that are located close to bodies of water. The species has also been observed foraging along roads and railway lines (DEW 2007)	Low Suitable habitat is limited within the project area (ie majority of the area is dominated by sugar cane and not open pastoral lands)

Species	Conservation Status	Habitat Association	Likely Occurrence
Australian painted snipe <i>Rostratula australis</i>	Vulnerable (EPBC Act NC Act Migratory)	Associated with a diverse array of wetland habitats including freshwater and intertidal areas. Habitats are generally shallow with well vegetated margins (Garnett and Crowley 2000). Not identified from the project area or Sarina Shire LGA	Low Suitable habitat is limited within the project area Suitable habitat occurs downstream of the Project area in association with the intertidal wetlands of Sarina Inlet and Llewellyn Bay

Table Notes:

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)NC Act = *Nature Conservation Act 1992* (Queensland)

None of these species were recorded during the bird surveys conducted, nor are they recorded on the EPA databases. The absence of these species may be attributed to a lack of preferred habitat within the project area or seasonal variation, cryptic nature, resource availability, vagrancy and climatic patterns.

There is potential for the Rufous owl (*Ninox rufa queenslandica*), listed as rare under the NC Act and Grey goshawk (*Accipiter novaehollandiae*), listed as vulnerable under the NC Act, to inhabit and/or utilise the project area. These species are associated with RE 8.3.3 (refer Table 6.2) which occurs within the region (refer Figure 6.3) and in association with Willy and Elizabeth Creeks (refer Figure 6.4). The project area is within the known distribution of both species, however it is important to note that the species were not identified from the ecological database searches for the project area and that only the Rufous owl has been recorded from Sarina Shire LGA (Wildlife Online – Sarina Shire).

6.3.3 Field results

A total of 116 fauna species were recorded from the project area either through sightings during field investigations or through anecdotal information obtained from local landholders.

This included, 98 bird, two amphibian, five reptile and 11 mammal species (refer species list Appendix H2). The majority of the 116 species are listed under the NC Act as least concern and were expected to be in the area given the results of the desktop searches carried out prior to the survey and the known habitat features of the area.

Three threatened species listed under the NC Act, the Radjah shelduck (*Tadorna radjah*) which is listed as rare, the Black-necked stork (*Ephippiorhynchus asiaticus*) listed as rare and the Estuarine crocodile (*Crocodylus porosus*), listed as vulnerable, have been identified inhabiting the wetland and riparian ecosystems within the area (ie survey and anecdotal information).

It is important to note that not all significant species listed as potentially inhabiting the area were identified during the survey. Factors include the intensity of the survey, cryptic nature and behaviour of some species, resource availability (food, habitat and water), breeding patterns, migration, vagrancy as well as seasonal and spatial variation may result in certain species not being identified. At the time of the survey, conditions were wet and temperatures low which is likely to have resulted in a lower number of species being active at the time.

Birds

During the survey, 98 bird species were recorded from the project area and the immediate surrounds. Most of these species are listed as least concern under the NC Act, however the Radjah shelduck, listed as rare, was identified from the intertidal wetlands associated with the salt flats at the CSR Sarina Distillery and the Black-necked stork also listed as rare under the NC Act, is also recorded from this area also and was observed feeding along a drainage line on Gurnetts Road during the survey. In addition, six migratory species listed under the EPBC Act were recorded from the area (refer Table 6.6).

Table 6.6 Migratory EPBC listed birds identified during survey

Species Name	Common Name	Agreement	Habitat ¹	Area Observed
<i>Ardea alba</i>	Great egret	JAMBA, CAMBA	Shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, sewage ponds, irrigation areas, larger dams	Salt flats at CSR Sarina Distillery (Site H) and Oonooie Road (Site J).
<i>Ardea ibis</i>	Cattle egret	JAMBA, CAMBA	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains	Salt flats at CSR Sarina Distillery (Site H) and Oonooie Road (Site J) and habitats to the south
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	CAMBA	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs	Salt flats at CSR Sarina Distillery (Site H) and intertidal wetlands of Llewellyn Bay
<i>Merops ornatus</i>	Rainbow bee-eater (refer Photo 6.14)	JAMBA	Open woodlands with sandy, loamy soil, sandridges, sandpits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses	Throughout project area and surrounds
<i>Monarcha trivirgatus</i>	Spectacled monarch	Bonn	Understorey of mountain/lowland rainforests, thickly wooded gullies, waterside vegetation, mostly well below canopy	Elizabeth Creek (Site F). It is important to note that this species is a resident of north Queensland and is a summer breeding migrant to SEQ
<i>Rhipidura rufifrons</i>	Rufous fantail	Bonn	Undergrowth of rainforest/ wetter eucalypt forest/gullies, monsoon forests, gardens. On migration, farms, streets, buildings	Willy Creek 1 (Site G). Summer breeding migrant to south-eastern Australia

Table Note:

1. Pizzey and Knight, 2003.

JAMBA Japan-Australia Migratory Bird Agreement

CAMBA China-Australia Migratory Bird Agreement

Bonn Bonn Convention on Migratory Species

The EPBC Report for the area identified an additional nine bird species (excluding the Painted Snipe) as potentially inhabiting or with suitable habitat within the area (refer Appendix H1).

The Sarina Inlet is an important area for waterbirds and wetland birds and these species may also utilise the mangrove areas around Plane Creek and the wetland within the project area for roosting and feeding. Monitoring of bird distributions and populations during the migration cycle is still in its infancy. Therefore population sizes and trends of many species remain unknown. This limits the understanding of the value of areas such as Sarina Inlet and even smaller wetlands such as that found within the project area and also the impacts associated with development and construction.

Raptor species such as Pacific baza (*aviceda subcristata*), Brahminy kite (*Haliastur indus*), Whistling kite (*Haliastur sphrenus*) and Black kite (*Milvus migrans*) were observed throughout the project area, with Pacific bazas and Black kites abundant throughout the project area (refer Photo 6.13). It is likely that the raptor species occurring within the area exploit resources especially during cane harvesting.



Photo 6.13 Black kites within project area

Significant bird species

The Radjah shelduck is listed as rare under the NC Act and is listed as marine under the EPBC Act. This species was recorded from the salt flats to the east of the CSR Sarina Distillery, downstream of the project area. As the area is downstream of the project area there is the potential that the health of the environs may be impacted by the rail yard upgrade.

According to employees of CSR, these birds commonly visit the salt flats. When breeding, males take up and defend wetland feeding territories, with nesting occurring in tree hollows in or near water. Pairs often gather annually on particular wetlands where the young may be protected in crèche-like groups. Once breeding is finished, the flight feathers are moulted causing the birds to become flightless where they gather on traditional, large waters (Pizzey and Knight 2003). Very few bird species breed within this kind of habitat, this area is more likely to be utilised as a feeding site.

The Jabiru, or Black-necked stork (*Epipppiorhynchus asiaticus*), listed as rare under the NC Act was also observed during the survey and is noted to occur regularly within the project area by local landholders. This species occupies wetlands and nearby open environs feeding upon fish, frogs, eels, turtles, small crabs and snakes. Although still relatively common across coastal Northern Australia, they are becoming increasingly scarce southwards on the eastern and western coasts (Morcombe 2000). This species is recorded within the salt flats and was observed off Gurnetts Road north of the distillery during the survey. As with the Radjah shelduck, this species is unlikely to nest within the immediate project area and is more likely a transient within the area utilising resources depending on availability.

The Australian Government is actively involved in the conservation of migratory species and habitats through its involvement with a number of international agreements. They include the Ramsar Convention and the Convention on Migratory Species (CMS/Bonn Convention), the China-Australia Migratory Bird Agreement (CAMBA) and the Japan-Australia Migratory Bird Agreement (JAMBA) throughout the East Asian-Australasian Flyway.

During the survey five migratory bird species listed under the EPBC Act were recorded within or near the project area (refer Table 6.6 and Photo 6.14).



Photo 6.14 EPBC listed migratory species – Rainbow bee-eater

The presence of a wetland situated to the north of Willy Creek and immediately west of the existing Jilalan Rail Yard gives a strong indication that wetland and migratory species would utilise this as a roosting and feeding habitat, particularly during summer. A large number of species were identified during the site survey despite the time of year, cooler temperatures and wet weather. Suitable habitat also occurs within the area for the Latham's snipe (*Gallinago hardwickii*) and the Eastern curlew (*Numenius madagascariensis*) mainly in association with intertidal wetlands of Sarina Inlet and Llewellyn Bay. The Eastern curlew has been recorded within the Sarina LGA according to the EPA Wildlife Online records.

Other species identified from the EPBC Report are associated with forest/woodland habitats such as those that occur within and adjacent the project area (eg Rufous fantail and Spectacled monarch which were observed within the project area and are residents within north Queensland). However, the high degree of disturbance within the area is likely to limit the species local distribution and abundance. The majority of the species are also summer breeding migrants to southeast Queensland and southeast Australia.

Amphibians

During the nocturnal searches and site surveys two amphibian species were recorded including the Striped marsh frog (*Limnodynastes peronii*) and the introduced Cane toad (*Bufo marinus*). There was an unusually low range and abundance of amphibian species present during the survey given the large amount of rain that the local area had received in the past couple of weeks and the high rainfall that occurred during the survey. It was expected that a large number of species would be heard calling particularly during the nocturnal searches, however only the Striped marsh frog was heard. It is expected that during the summer months which is the breeding season for most species, more species are likely to be active and calling within the area.

The EPA Wildlife Online database search lists 12 amphibian species recorded within the Sarina Shire, all of which are listed as least concern under the NC Act with the exception of the Cane toad (*Bufo marinus*) which is considered a non-declared pest under the LP Act. No amphibian species listed under the EPBC Act were identified from the area (refer Appendix H2).

Reptiles

Two reptile species were recorded during the survey through targeted searches of suitable habitats (eg woody debris, leaf litter and rocky outcrops). These species are listed as least concern (NC Act) were Small eyed snake (*Rhinocephalus nigrescens*) and an unidentified diurnal skink species.

Anecdotal information from adjacent landowners and employees of the nearby CSR Sarina Distillery reported common sightings of Carpet python (*Morelia spilota*), Taipan (*Oxyuranus scutellatus*) and Eastern brown snake (*Pseudonaja textilis*) all of which are listed as least concern under the NC Act.

Estuarine crocodiles have been sighted from watercourses and wetlands within the region, including Elizabeth and Willy Creeks and at the intertidal wetlands downstream of the project area to the east of the CSR Sarina Distillery. It is reported that a breeding female is known to regularly frequent a dam downstream of Elizabeth Creek. This suggests a resident population within the area, however none were observed during the survey.

Estuarine crocodiles are listed as vulnerable under the NC Act and are also listed under the Bonn Convention and thus are recognised as a migratory species under the EPBC Act.

The Yakka skink (*Egernia rugosa*), listed as vulnerable under the EPBC Act and NC Act, potentially inhabits, or suitable habitat occurs, within the area (refer Appendix H1). The habitat association includes open dry sclerophyll forest or woodland such as that identified within region with distribution extending near the coast and in the sub-humid to semi-arid eastern interior of Queensland, from the St George area in the south to Cape York Peninsula. However, the species was not identified from the area or from Sarina Shire LGA.

There is the potential that the Rusty monitor (*Varanus semiremex*) listed rare under the NC Act inhabits the areas surrounding Plane Creek (Sites A and B) and downstream habitats. However, this species was not identified from database searches for the project area or Sarina Shire LGA. The biology and habits of the Rusty monitor are poorly known. However, it is known to inhabit margins of waterways, including coastlines and estuaries from Gladstone to Cape York Peninsula. It has been discovered recently that in the southern extent of the Rusty monitor's range (ie the project area) the animal depends on the Grey mangrove (*Avicennia marina*), which was present within the Plane Creek area and may provide habitat for this species, with the hollows of limbs and completely dead trees used for shelter. These mangrove trees may be up to 100 years old at the time of death. These trees are believed to be what is considered 'home trees' which the monitor displays site fidelity to and can be recognised by shed monitor skin in the hollows and crab remains at the base of the tree. The range of these animals is becoming increasingly restricted because of direct habitat loss due to clearing of mangroves as well as adjacent habitat loss which can have an indirect impact on this species. Cane toads may also contribute to the decline in numbers (Jackson 2005).

The EPA Wildlife Online database records for the Sarina Shire also lists the Flatback turtle (*Natator depressor*) as a species found within the region. It is known to occupy the Sarina Inlet and utilise the area for nesting. Other marine turtle species may utilise the Sarina Inlet for feeding resources, the Green turtle (*Chelonia mydas*) is known to occasionally nest in this area also (Australian Wetlands Database).

Although no examples of the Yakka skink or Rusty monitor were recorded during the survey, the absence of sightings may be attributed to reduced and/or fragmented preferred habitat and disturbed resident populations. Other factors influencing species distribution include seasonal variation, cryptic nature, resource availability, vagrancy and climatic patterns.

Mammals

Seven native and four introduced mammalian species were recorded from the project area. All native species are considered of least concern (NC Act). Six of these native species were physically observed during the survey either through trapping, spotlighting or Anabat II detection. These species include Gould's wattled bat (*Chalinolobus gouldii*), Northern brown bandicoot (*Isodon macrourus*), Eastern grey kangaroo (*Macropus giganteus*), Grassland melomys (*Melomys burtoni*), Sugar glider (*Petaurus breviceps*) and Yellow-bellied sheathtail bat (*Saccolaimus flaviventrus*). The Grassland melomys appeared to be very abundant within the project area with a significant number caught during the survey (refer Photo 6.15).



Photo 6.15 Grassland melomys caught during the survey

Two arboreal mammal species, the Koala (*Phascolarctos cinereus*) and the Common brushtail possum (*Trichosurus vulpecula*) have been recorded from the area. Both species are listed as least concern under the NC Act for this region.

In 2006, the Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016 (the Koala Plan) came into effect. A key focus of the Koala Plan is to address development and land use in Koala Habitat Areas within the SEQ region (EPA 2006). The project area is within an area mapped as District C, in which koalas are of least concern under the NC Act due in part to the generally lower perceived threat to their survival (EPA 2006).

The Common brushtail possum is common and widespread within eastern Queensland due in part to the species tolerance and adaptation to urbanisation. There are anecdotal reports of Sugar gliders and Squirrel gliders (*Petaurus norfolcensis*) inhabiting or utilising feeding resources within the area.

Land use activities within the area are likely to limit species' distribution with habitat trees (ie hollow bearing trees and feeding trees) cleared or highly fragmented. The high degree of fragmentation that has occurred within the project area has also isolated pockets of remnant vegetation potentially reducing the abundance of the species within the area.

Two species of flying-fox, the Black flying-fox (*Pteropus alecto*) and the Little red flying-fox (*Pteropus scapulatus*) have been identified from the area. It is likely that these species overfly the area from adjacent roosting sites (eg mangrove communities of Sarina Inlet and/or Llewellyn Bay predominantly the Black flying-fox) or exploits feeding resources within the area (eg feed mainly on nectar from flowering melaleucas and eucalypts). The Black flying-fox is likely to be predominant and may travel up to 50 km each night in search of flowering or fruiting trees.

The EPBC Report for the project area lists three mammalian species as potentially occurring or having habitat potentially occurring within the project area. These species include the Northern quoll (*Dasyurus hallucatus*), Spectacled flying-fox (*Pteropus conspicillatus*) and the False water rat (*Xeromys myoides*).

The Northern quoll is listed as endangered under the EPBC Act. However, this species is listed as of least concern under the NC Act. The Northern quoll lives in a range of open woodland and open forest types preferring rocky areas. Suitable habitat exists adjacent to the project area to the north of the Jilalan Rail Yard. The upgrade may have an impact on any individuals that potentially inhabit the region. Within Queensland a number of fragmented populations exist, including dense populations within Mackay-Whitsunday areas. This species has not been recorded from the project area or Sarina Shire LGA (Wildlife Online 2007).

The Spectacled flying-fox is listed as vulnerable under the EPBC Act, however its presence within or nearby the project area is unlikely due to lack of suitable habitat and the project area being situated to the south of the species' known distribution range (ie Tully to Cape York).

It is unlikely that the False water rat inhabits the project area. However, it is probable that this native rodent is found within the intertidal wetlands downstream of the project area. The area is mapped as essential habitat for the species, however the essential habitat mapping is based on habitat modelling and not species records. The Wildlife Online records for the area lists numerous records of this species within the Sarina LGA and it is likely that some of these sightings would have occurred within the intertidal wetlands downstream of the project area.

The False water rat inhabits coastal wetlands such as lagoons, swamps and sedged lakes close to foredunes. It forages amongst the mangroves at night when the tide is low, and when the tide rises it returns to the adjacent sedgeland for shelter. The species builds large mud nests like termite mounds, up to 60 cm high and usually in areas where they can escape the highest of tides. They often use exposed tree roots to form the foundation for the mounds (Department of Environment and Water Resources).

Any negative impacts to the downstream environs could impact on any local populations of the False water rat potentially inhabiting the intertidal wetlands. Implementation of appropriate mitigation measures during construction will minimise the potential impact on this species (refer Chapter 17).

Pest species

Of the 116 fauna species (excluding birds) recorded from the survey, approximately four per cent are introduced and/or pest species. Pest species can impact on the biodiversity of an area through increased competition for resources, habitat destruction, weed distribution, increase risk of diseases and predation.

There was strong evidence (tracks and scats) that feral dogs/dingos are also common throughout the area. Some of this evidence is likely to be due to domesticated dogs frequenting the area as several were encountered whilst conducting the survey. Cats (both domesticated and feral) are also likely inhabitants of the area. Local residents have reported that the Dingo (*Canis familiaris dingo*) and European fox (*Vulpes vulpes*) are commonly observed. Due to the large expanses of cane fields within the area, it is also likely that the House mouse (*Mus musculus*) and Black rat (*Rattus rattus*) are present. Cattle (*Bos* spp.) are grazed within the salt flat area to the east of the CSR Sarina Distillery as well as in the Regional Ecosystem associated with Site D.

Cane toads (*Bufo marinus*) were observed during the survey, although in relatively low numbers which was surprising given the favourable weather conditions for amphibians at the time of the survey. Cane toads have contributed to the decline of many native Australian animals due to their diet ranging from insects to small mammals, competition with native species for food and shelter resources as well as the toads toxicity to other species when ingested (EPA website, August 2006).

All of the pest species recorded from the survey are listed under the LP Act as 'declared' species. Species listed as Class 2 declared pest species are European foxes, European rabbits, feral pigs, feral dogs and dingoes. These animals are targeted for control as they represent a threat to primary industries, natural resources and the environment. Domestic dogs and cattle are non-declared pest animals under the LP Act. Animals such as birds, fish and some insects (such as Fire ants) are not covered by the LP Act. Landowners must take reasonable steps to keep land free of Class 2 pests (http://www.nrm.qld.gov.au/pests/pest_animals/declared/index.html).

The impacts from the introduction of feral cats, foxes, feral pigs, rabbits and the cane toad are listed under the EPBC Act as key threatening processes. A key threatening process is one that threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community (<http://www.deh.gov.au/biodiversity/threatened/ktp/index.html>). As a result a number of corresponding threat abatement plans has been compiled to mitigate and reduce potential impacts.

6.3.4 Habitat values

In order to easily facilitate a detailed description of the area, the project area has been divided into 12 sites. These are detailed in Figure 6.4 and described in detail below.

Site A (Plane Creek – Southern Bank)

The southern bank of Plane Creek consists predominantly of mangroves along the banks with some regrowth further to the south, inland from the creek. Few species were observed within this area with mostly least concern bird species present and evidence that birds of prey which are most likely a species of Kite based upon the high occurrence of these in the area. These birds seem to be feeding on fish within the creek because a large number of fish carcasses were found on the creek banks. As previously mentioned, it is likely that Estuarine crocodiles also frequent this area.

The mangroves provide substantial habitat value in the area because they provide essential nursery, feeding and breeding areas for many species of fish and invertebrates. The area may also be important roosting and feeding habitat for migratory wetland birds, shorebirds and birds of prey such as goshawks. As mentioned previously, this area may also provide habitat for the Rusty monitor (*Varanus semiremex*) given the species of mangroves found in this area are known to provide a favoured habitat for this species. Further south, the area of regrowth vegetation provides some habitat value, however this value is lower with fewer feeding and shelter resources. Towards the east and west of this area the mangroves continue and appear to provide a corridor along Plane Creek. More mobile species such as birds and large mammals are likely to be transients within the project area and exploit resources when available.

The most abundant species observed within this area were the Clamorous reed warbler (*Acrocephalus stentoreus*), Torresian crow and Welcome swallows. No significant or threatened species were observed within this area during the survey.

Site B (RE 8.3.3a/8.3.5)

This area is described as supporting habitat suitable for the Red-cheeked dunnart (*Sminthopsis virginiae*), Rufous owl (*Ninox rufa*) and Grey goshawk. The small size of the area and fragmentation from other similar habitats limits the likelihood of these species inhabiting the area. The exception to this is the Rufous owl which may exploit the area as well as the mangroves in the wider area surrounding this site.

Site C (Plane Creek)

Site C consists of a thin strip of vegetation along Plane Creek that provides little habitat value due to the long and narrow shape of the area and the extent of cane farming that occurs in adjacent areas. As mentioned in the Site A description, it would be expected that Estuarine crocodiles would utilise resources from Plane Creek and associated banks. Numerous Black kites were observed within this area, possibly searching for food within the cane fields. Raptor species were also observed in this area highlighting the richness in food resources that the surrounding cane fields and riparian areas offer the birds of prey within the area.

Site D (RE 8.3.5/8.3.3a)

Despite being mapped as a RE, this area is highly disturbed due to the heavy cattle grazing that occurs within the property and the high level of weed infestation which is likely to be attributed to the cattle destroying native vegetation and spreading the exotic species. Evidence of pigs (*Sus scrofa*) was also observed within the area. Very few species were observed within this area due to the poor weather conditions on each occasion when this area was surveyed. Heavy rain and cold temperatures resulted in a limited species list from this area, however a thorough survey of the area allowed for a detailed investigation into the habitat integrity of this site. Whilst most of the higher ground within Site D is highly disturbed and has relatively poor habitat value, the lower, riparian area that follows a tributary of Plane Creek highlights a much more intact habitat, with rainforest flora species, a dense tree canopy and a large amount of leaf litter. Due to the very steep slopes leading down to the tributary, cattle is restricted in these areas and has managed to preserve the integrity.

Habitat value within this riparian area was quite high, and when considered in conjunction with the adjoining, disturbed vegetation community, the habitat value of the latter is raised considerably due to the resources that the riparian corridor provides (different vegetation species/food resources, water source). Some habitat trees were observed within the disturbed areas of the site and it would be likely that many arboreal species utilise this area despite its disturbed nature. A significant amount of Lantana has invaded the higher areas and although this species is considered a Class 2 pest, it does provide habitat for birds such as fairy wrens and mannikins as do other weed species (refer Photo 6.16).



Photo 6.16 Nest constructed in exotic plant at Site D

The survey found Grassland melomys (*Melomys burtoni*) utilising the area and according to the area's RE description there is the potential for Grey goshawk and Rufous owl habitat to occur. With the vegetation along Plane Creek providing a substantial wildlife corridor, this area is likely to provide feeding and habitat resources for species utilising the corridor to move to other areas as well as for the resident populations living on the site.

The most abundant fauna species that appeared to inhabit this area was domestic cattle, fairy wrens, Spangled drongo (*Dicrurus bracteatus*) and Black kites.

Site E (Armstrong Beach Road to Soto Road)

This area has moderate habitat value despite being highly disturbed. Connectivity between this area and nearby vegetation is limited with cane fields to the east and south, and the rail yard serving as a barrier to dispersal on the western side although there may still be some fauna movement between this site and the RE 8.12.12 to the west of the rail yard. Despite the limited connectivity, this area represents a reasonably well inhabited woodland fragment providing food and shelter resources for many bird, mammal and reptile species. Little is documented about the use of cane fields by fauna, however it is unlikely that many species utilise them as corridors. Some reptile species may exploit the cane fields for food resources for rodent species (native and introduced) that are also likely to inhabit these areas as do the many raptors such as Black kites and Pacific bazas (*Aviceda subcristata*) observed within the area.

Most of this area is an open woodland with a thick grassy groundcover and limited shrub/mid-storey which has been considerably altered due to grazing and other anthropogenic influences such as dumping of waste (refer Photo 6.17). Some species may use anthropogenic waste such as corrugated iron and car bodies as habitats in the absence of natural debris.



Photo 6.17 Example of dumped waste providing artificial habitat value for some fauna species at Site E

Very few of the trees within this area are old enough to have formed hollows, therefore further limiting the habitat value of the area. A drainage line runs through the south-western section of this area. This may provide important habitat (local scale), however it is likely that water flows are intermittent through this drainage line. A small dam towards the south-eastern corner of this site contained water during the survey.

Many of the bird species observed within this area were granivorous, nectivorous and insectivorous species typical of open woodlands such as fairy wrens, finches, fantails and honeyeaters. Despite the disturbed nature of this area, suitable habitat exists for many typical woodland birds. Clearing is the single greatest threat to woodland avian species within Australia and retaining suitable woodland habitat where possible, regardless of how small, is paramount to the survival of many of the species that rely on this habitat (McIntyre *et al* 2002). Current studies suggest that a mix of land use comprising approximately 30-35% native vegetation and 65-70% agricultural land use has a high likelihood of retaining a diverse and resilient woodland community (Radford *et al* 2005). The current ratio of native vegetation to agricultural production within the Jilalan area is less than this ratio. The current ratio therefore places higher importance on these remaining woodlands at a local scale despite their disturbed nature, emphasising the need to retain them wherever possible no matter how small they may be.

Sugar gliders have also been reported from the area and one was observed whilst spotlighting in this area despite the apparent lack habitat trees. At the time of the survey however, many individuals may have entered torpor due to the cold temperatures and rain during the survey period.

The most common species observed during the survey within this area included the Black-faced cuckoo shrike (*Coracina novaehollandiae*), Spangled drongo, lorikeets and the Grassland melomys.

Site F (Elizabeth Creek)

The Elizabeth Creek area provides limited habitat value but provides connectivity to vegetation to the west of the rail yard as well as east to the intertidal wetlands of Llewellyn Bay. The narrow shape of the area, and the extent of disturbance (vegetation is cleared right up to high bank on southern side, slightly wider on northern side) limits the areas resident population; with species more likely to exploit resources when they are available (refer Photo 6.18). As the area is neighboured either side by cane fields, the only movement likely by most species is east to west and vice versa.

On the northern bank substantial remnant *Melaleucas* with hollows provide good habitat for arboreal species such as gliders and possums as well as hollow nesting birds within the area. Scratch marks could be seen around many of the hollows, however no animals were observed.

During the survey, few species were observed in the area, with the exception of some bird species, including the Spectacled monarch which is listed as migratory under the EPBC Act. This species is a resident of coastal environs of north Queensland during the winter months (ie summer breeding migrant to southeast Queensland). Other species within this area included White-throated gerygone (*Gerygone olivacea*), Dusky honeyeater (*Myzomela obscura*), Red-browed finch (*Neochima temporalis*) and Rainbow bee-eater (*Merops ornatus*).



Photo 6.18 Elizabeth Creek highlighting narrow strips of vegetation on both sides of creek

Site F (Willy Creek)

Willy Creek has high habitat value, with dense vegetation both in the canopy, mid and ground storeys. As well as providing good connectivity to the habitats east and west of the project area. The habitat in many sections of the creek are wide and structurally diverse enough to provide suitable habitat for resident fauna (refer Photo 6.19). As with Elizabeth Creek, Willy Creek also provides good connectivity to the vegetation and habitats to the east and west. Studies have revealed that birds are generally 12% more diverse in broad strips of native vegetation when compared with narrow strips that are less than 50 m wide and that riparian strips of vegetation provide essential movement corridors (Barrett 2000).

To the western side of the Goonyella Branch Line the vegetation changes along Willy Creek and becomes more like a rainforest with respect to the flora species present, high tree canopy and large amount of leaf litter. Disturbance in this area has led to the influx of grasses on the western side of the creek in what appears to be a drainage line. The habitat value within this area is not as high as that on the eastern side, however on a whole the value would be considered to be quite high.

Species within this area included Mistletoebird (*Dicaeum hirundinaceum*), Common koel (*Eudynamys scolopacea*), Rufous fantail (*Rhipidura rufifrons*) and Leaden flycatcher (*Myiagra rubecula*).

Within this area, Grassland melomys (*Melomys burtoni*) and Northern brown bandicoots (*Isodon macrourus*) were caught. It is likely due to the habitat within this area that species of Antechinus, Planigale and other rodents (both native and introduced) utilise this area as permanent habitat and as a corridor to the east and west. It would also be anticipated that arboreal species such as gliders and possums would inhabit the area as many of the remnant Melaleucas along the creek have formed hollows. Feeding resources for these species would be readily available but may need to move along the creek in order to exploit these. Due to the reliable water source, ground debris such as logs and litter and obvious abundance of small mammals it is also likely that several snake species would inhabit this area as well as the neighbouring cane fields. It is likely that species of dragons and other lizards such as skinks inhabit the area as well as irregular use of the creek by crocodiles.



Photo 6.19 Dense vegetation providing wildlife corridor at Willy Creek

Site H (Salt Flats)

The salt flats adjoining the CSR Sarina Distillery form part of Llewellyn Bay, currently the salt pans and associated property owned by CSR are being rehabilitated through tree planting and weed eradication programmes in order to improve the integrity of the area and the intertidal wetlands. It appears that wildlife diversity and abundance is high within the area despite the recent rehabilitation efforts being relatively recent. This area may potentially be an important wetland and shorebird roosting and feeding area (refer Photo 6.20).



Photo 6.20 Salt flats behind CSR Sarina Distillery

The majority of the fauna species inhabiting saltmarsh/salt pans are common in adjoining habitats. However, significant species, which occur within these habitats include the Dawson race of the Yellow chat (*Epthianura crocea macgregori*) and the Water mouse (*Xeromys myoides*). The Black-necked stork (*Ephippiorhynchus asiaticus*) listed as rare under the NC Act, has been recorded foraging within the saltmarsh/salt pan communities.

Regional studies often report a paucity of flora and fauna in saltflat habitat, but offer little detail about their ecology, importance or status. However, these areas are important primary production areas and contribute significantly to the surrounding environments (ie the saltmarsh/salt pan areas are an important nutrient source for near shore environments).

The distribution of fish on saltmarshes was found to be most strongly influenced by proximity to intertidal, mangrove-lined feeder creeks, with more species and more individuals close to creeks than further away (Connolly *et al* 2006). Anthropogenic activities within the area have resulted in changes to the drainage regimes, which reduces the area of viable habitat and may limit fauna movement.

Saltmarsh communities also support a diverse invertebrate fauna, including crustaceans, molluscs and insects. These are important food sources for a number of species, including species of commercial and recreational value.

A fauna list has been kept by employees at the CSR Sarina Distillery and was provided as a supplement to the fauna that was observed during the site survey for the EIS (refer Appendix H2). In addition to the wild animals that utilise this area, cattle are also kept on this property. As has been mentioned previously in this chapter, essential habitat for the False water rat, or Water mouse is mapped for a large part of the area encompassing these salt flats. Due to accessibility issues and poor weather conditions, no trapping was conducted within this area to determine the abundance of this species, however Wildlife Online has several records of the species within the Sarina Shire.

Site I (CSR Sarina Distillery and Freddy Creek)

The habitat value in the area around the CSR Sarina Distillery towards Freddy Creek (excluding the salt flats) is low, with very young regrowth providing little value to fauna. The area immediately surrounding the distillery consists predominantly of maintained grass and some remnant Eucalypts. Freddy Creek itself is considerably overgrown with introduced grasses with little water observed in the creek at the time of survey. According to employees from CSR, Freddy and Willy Creeks had been sprayed and stripped of vegetation up until roughly 13 years ago when the rehabilitation programmes began. Some mature trees still exist along the creek line. Few fauna species were observed within this area during the survey.

Site J (Oonooie Road)

The vegetation within this area provides substantial habitat value with the area to the west of Oonooie Road consisting of quite dense regrowth. Although most of these trees are not yet hollow bearing habitat trees, those not bearing hollows still provide other important resources. Despite being regrowth, this area represents a pocket of vegetation that is likely to provide food and shelter resources for many fauna species. This area contains grassy woodland that is grazed in rotation with other paddocks. The understorey is predominantly grassy with some Lantana and no mid-storey. Habitat value within this area is high despite being regrowth and disturbance due to grazing. During the survey, many bird species were observed. The area contains a very large amount of logs and rocks creating ideal reptile habitat. One snake, a Small-eyed snake was observed, however due to the cold conditions, no other reptile species were observed during the survey despite the diurnal searches and spotlighting.

A drainage channel runs through this area and according to the land owner there is also a dam on the property providing a water source for wildlife and cattle.

This area is classified as RE12.12.12a which is considered habitat for the Northern quoll and the Koala. It is possible that the Koala may inhabit this area, however due to the severe fragmentation that has occurred within the area and a lack of rocky outcrops, it is possible but unlikely that the Northern quoll would be found at this site. Suitable habitat to the west of the project area is more likely to contain this species. Scratch marks on some of the Eucalypts indicate that arboreal mammals inhabit the area although none were observed during spotlighting (refer Photo 6.21).



Photo 6.21 Scratch marks surrounding tree hollow

Species observed during the survey at this site included Pacific baza, Black kite, Red-backed fairy wren (*Malurus melanocephalus*), Tawny frogmouth (*Podargus strigoides*), Brown quail (*Coturnix ypsilophora*) and Little friarbird (*Philemon citreogularis*). All of these species were abundant at the time of observation.

A dam at the north-eastern section of Oonooie Road just south of the substation is likely to be utilised by waterbirds in the area as well as amphibians and reptiles such as dragons. Most of the species observed in this area consisted of Rainbow bee-eaters, Black kites, Cattle egrets (*Ardea ibis*) and Bush stone-curlews (*Burhinus grallarius*).

Site K (Wetland)

The wetland, although surrounded by land uses such as cane farming and the adjacent rail yard that is just north of where the North Coast Line and Goonyella Branch Line intersect, provides very good habitat for many wetland bird species which were observed during the survey. It is also highly likely to be an important summer roosting and feeding site for migratory birds as well as being sound habitat for frogs and reptiles (refer Photo 6.22). This area has some connectivity to Willy Creek which increases the habitat value of both this wetland as well as Willy Creek and is therefore a locally significant area of habitat within the region.



Photo 6.22 Wetland providing habitat for amphibians, reptiles and birds

Remnant Melaleucas border the wetland in many areas, with some occurring in the centre of the wetland with a large number of nests constructed in them. These are most likely to be Darter (*Anhinga melanogaster*) or Cormorant (*Phalacrocorax* sp.) nests (refer Photo 6.23).



Photo 6.23 Melaleucas within wetland housing birds nests

The main value for this area lies with its importance for bird species utilising the area. Further disturbance to this area may result in seasonal visitors to the area not returning to the area, forcing them to seek out new roosting and breeding sites. As many of these species may be included in international agreements such as JAMBA, CAMBA or the Bonn Convention, limited disturbance to this site should occur.

Site L (Existing Jilalan Rail Yard)

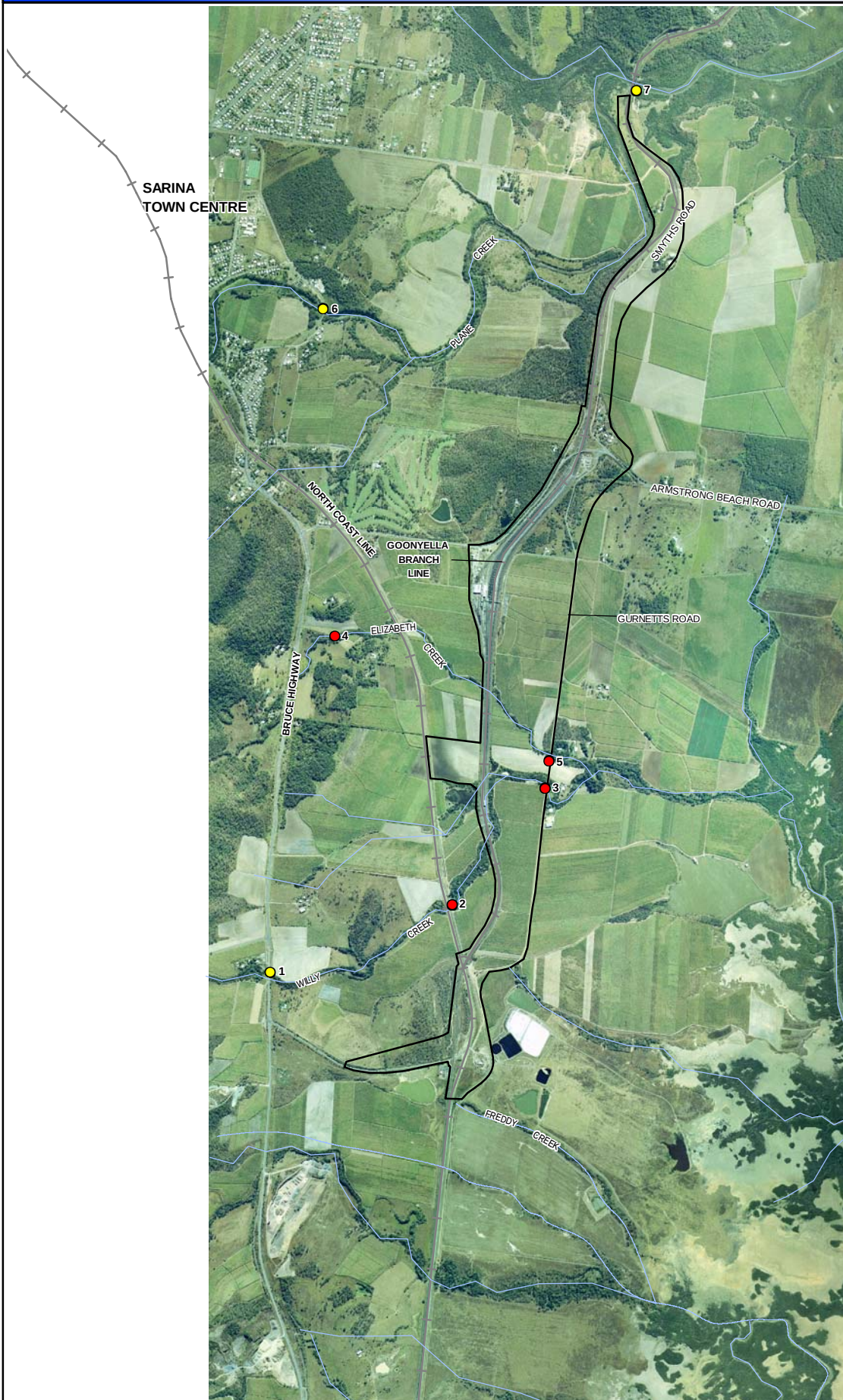
This area is highly modified and disturbed with most of the area consisting of built structures such as sheds, workshops and coal wagons. Vegetation within and surrounding the rail yard consists primarily of landscape areas and cane fields. Habitat value is very low and provides little in terms of food resources or shelter for most fauna species. A creek that flows adjacent to the yard provides some riparian habitat, however it is more likely to be a wildlife corridor than permanent habitat for most species. Species that utilise this area include those that have adapted to urbanisation/industrialisation such as Torresian crow, Welcome swallows (*Hirundo neoxena*) and Willie wagtails (*Rhipidura leucophrys*).

6.4 Aquatic ecology existing environment

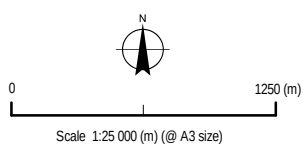
6.4.1 Methodology

The project area encompasses freshwater and brackish water environments. A review of existing information and a site assessment of the aquatic biodiversity was undertaken targeting ecological significant aquatic species, communities and habitats that may be impacted upon by the Project.

The study area encompassed four creek systems within the project area and their downstream environments. A total of nine sites were selected within the project area for surveys of aquatic habitat, macrophytes, macroinvertebrates and fish. Sites were selected to provide a 'snap shot' of the aquatic ecological communities in the upstream and downstream reaches of the project area in freshwater and estuarine waterways. The sampling and analysis was undertaken in accordance with QLD Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual (August 2001). The methodology and results for the aquatic ecological assessment is illustrated in Appendix H3. The locations of the monitoring sites are illustrated in Figure 6.7.



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LEGEND

- Rail
- Project Area
- Watercourse
- Bioassessment Site
- Fish Monitoring Site

AQUATIC ECOLOGY MONITORING LOCATIONS

FIGURE 6.7

Existing data was obtained through Queensland Museum, Mackay Whitsunday Natural Resource Management Group, Queensland Department of Primary Industries and Fisheries (DPIF) to gain an appreciation of the aquatic ecology within and adjacent the project area. Limited information exists specifically relating to aquatic species and their abundance within the waterways, specific to the project area.

The aquatic ecology assessment was undertaken during May 2007. Given the time constraints of the Project, a seasonal comparison has not been reported in the EIS. However, further water quality monitoring will be undertaken prior to construction (refer Chapter 7).

The water quality assessment (refer Chapter 7) and terrestrial flora and fauna assessments (Sections 6.2 and 6.3) provided additional environmental information applicable to the aquatic ecology assessment. The water quality of the creek systems is described in detail in Chapter 7 of the EIS together with a description of the catchment areas.

6.4.2 Background searches

There is limited information on aquatic ecology communities and health within Plane, Elizabeth and Willy Creeks. A study on fish communities within the Plane Creek catchment and Rocky Creek Dam compiled by DPIF was not available for use at the time of writing this assessment.

Wetlands

A search of the Australian Wetland Database (<http://www.environment.gov.au>) found there are no listed Ramsar wetlands within close proximity to the project area. The closest Ramsar wetlands to the project area are within the Shoalwater and Corio Bays Area.

Ramsar wetlands are wetlands that are internationally recognised under the Convention on Wetlands of International Importance (Ramsar Convention) as being internationally significant in terms of ecology, botany, zoology, limnology or hydrology.

Nationally Important Wetland Sites relevant to the project area, which are listed on the Directory of Important Wetlands in Australia (DIWA) are Sarina Inlet – Ince Bay Aggregation and the Great Barrier Reef Marine Park. These sites are not within the project area, however they are within 5 km downstream of the Project area (refer Figure 6.2).

To be considered nationally important, a wetland must meet at least one of the six nationally agreed criteria. The criteria covers the following areas: biogeographic representativeness, important ecological or hydrological functions; provision of animal habitat during times of vulnerability or adverse conditions, support for more than 1% of the national population of any taxa, support for threatened taxa communities, and historical or cultural significance (<http://www.environment.gov.au>).

The QLD EPA Wetland Mapping for the Mackay region identifies a lacustrine (lake) wetland on the tributary of Willy Creek (refer Photos 6.24 and 6.25), which is situated west of the existing rail and south of the proposed turning angle for Jilalan (refer Appendix E). This wetland has local ecological significance supporting local, regional and migratory species. Additional lacustrine wetland systems are also present south west of the Project which link into the estuarine system of Llewellyn Bay. A palustrine (marsh or swamp) wetland system exists downstream of Willy Creek and also links to the estuarine system of Llewellyn Bay.



Photo 6.24 Lacustrine wetland



Photo 6.25 Melaleuca community within wetland

6.4.3 Field results

Plane Creek

The project area intercepts the middle reaches of the Plane Creek Catchment, specifically the lower reaches of the creek within the tidal zone. Plane Creek enters the sea at Sarina Inlet just north of Llewellyn Bay. Plane Creek is macro tidal having tidal ranges of less than 4 m. The creek has naturally high turbidity due to its tidal influences which results in moderate sediment trapping occurring thus affecting the instream fauna that inhabits the creek.

Plane Creek is highly regulated, with one dam (Middle Creek Dam) and four weirs (Rhode *et al* 2006). Plane Creek lies within a Coastal Management District (refer Figure 6.8).

Anthropogenic influences are evident within the lower reaches of Plane Creek. Within the project area Plane Creek has been heavily disturbed through infrastructure development and adjoining agricultural uses. Plane Creek catchment has a sugarcane cultivation area of more than 20% and has the highest rate of fertiliser application of all Great Barrier Reef catchments (Schaffelke *et al* 2001).

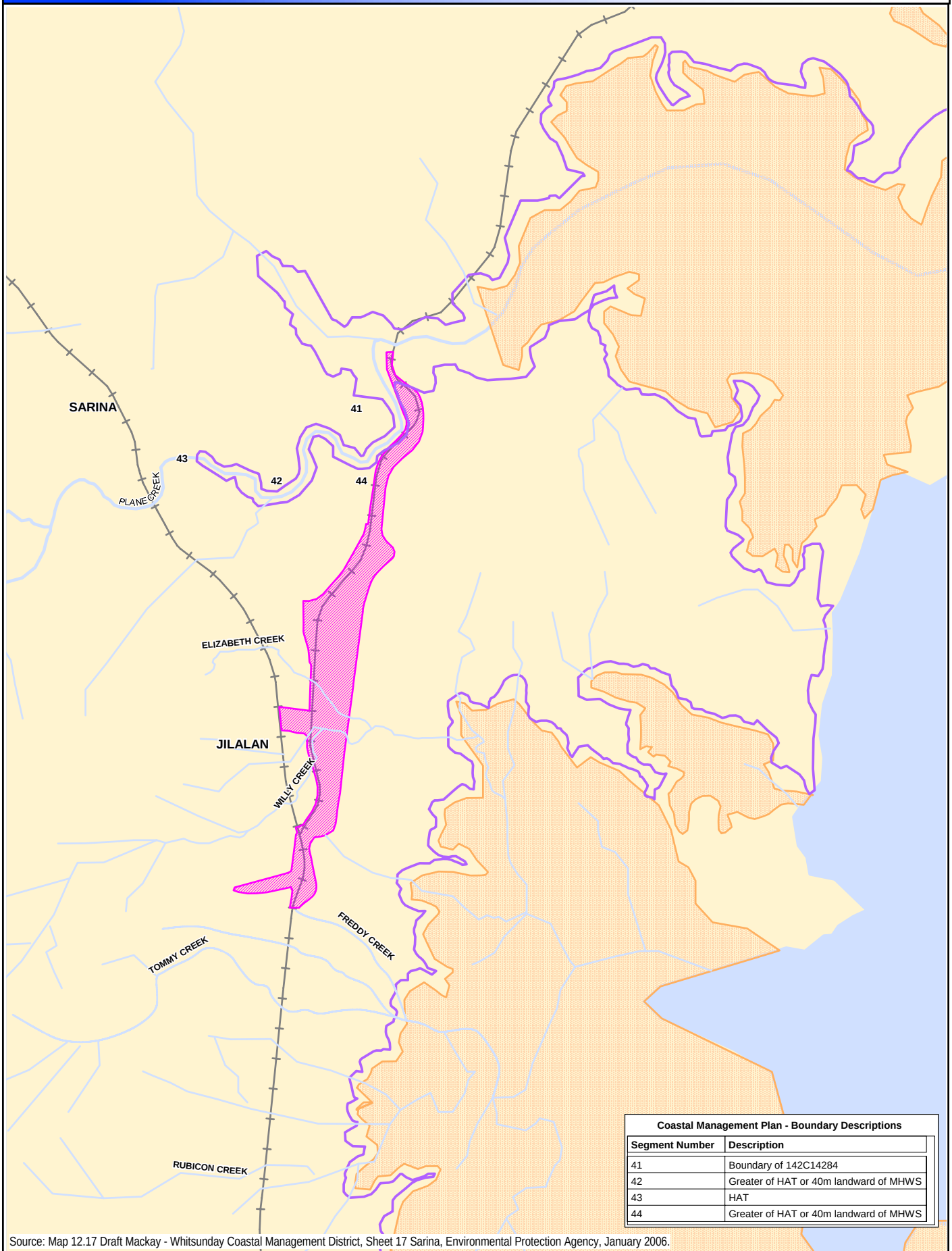
Elizabeth, Willy and Freddy Creeks

Elizabeth, Willy and Freddy Creeks lie within the Llewellyn Bay catchment, discharging directly into Llewellyn Bay and drain from the Connors Ranges. Extensive cane production occurs in the lower catchment areas.

Intertidal wetlands

The Project has the potential to impact on intertidal wetlands of Plane Creek, Sarina Inlet and Llewellyn Bay. These wetlands are recognised as significant under the EPA Coastal Planning Mapping and also nationally through the Directory of Important Wetlands and the Marine Park.

Estuary Assessment 2000 assessed the condition of 979 estuaries, including estuaries within the Plane Creek Basin (Land and Water Australia 2004). Information from this assessment for Sarina Inlet (including Plane Creek) and Rocky Dam Creek (including Llewellyn Bay and Elizabeth Creek) has been used to describe the intertidal wetlands of the downstream receiving environments (Bucher and Saenger 1989).



LEGEND

- Project Area
- Intertidal Wetlands
- Coastal Management District Boundary
- Watercourse

COASTAL MANAGEMENT DISTRICTS

FIGURE 6.8

General zonation patterns within the region are exposed mud and sandbanks with or without seagrass occurring on the seaward side of the mangroves. On the seaward side mangroves were generally closed *Rhizophora* communities with closed *Ceriops* community on the landward side. Adjoining the *Ceriops* communities were areas of saltpan and where conditions are favourable samphires and saline grassland communities occur. This zonation is characteristic of Sarina Inlet and Llewellyn Bay. Within Queensland 37 species of mangrove occur, with species richness inversely related to latitude south. For example, species diversity within the Cape York is 36 species, while in South East Queensland there are nine species (Duke 1992). On a local scale species distribution and zonation is influenced by wave energy, salinity, nutrients and/or soil oxygen levels.

Mangroves recorded from Sarina Inlet include *Aegialitis annulata*, *Aegiceras corniculatum*, *Avicennia marina*, *Bruguiera gymnorhiza*, *Ceriops tagal* var. *australis*, *Excoecaria agallocha*, *Lumnitzera racemosa*, *Osbornia octodonta*, *Rhizophora stylosa* and *Sonneratia alba* (Land and Water Australia 2004). A study on Plane Creek in 1996 identified an additional seven species of mangroves, including *Acanthus ilicifolius*, *Bruguiera exaristata*, *B. parviflora*, *Cynometra ramiflora* (southern limit of known distribution), *Heritiera littoralis*, *Rhizophora apicalata* and *R. mucronata* (Doran et al 1996).

Mangrove communities within Sarina Inlet encompass an area of approximately 5,400 ha. The dominant species are the Red mangrove (*Rhizophora stylosa*), Yellow mangrove (*Ceriops tagal*) and Grey mangrove (*Avicennia marina*). Within Llewellyn Bay the mangrove communities encompass an area of approximately 29,000 ha. This area is dominated by extensive *Rhizophora*, *Ceriops* and *Avicennia* communities.

Saltmarsh/saltpan encompasses an area of approximately 5,200 ha within Sarina Inlet and 15,000 ha within Llewellyn Bay (Land and Water Australia 2004). Saltmarsh/salt pans may be unvegetated or vegetated and are generally found in simple zonation or complex mosaics. Compared with other wetland types biodiversity within these communities is generally low. This community is a dominant feature of lower reaches of Elizabeth Creek/Llewellyn Bay area.

Along Plane Creek and Elizabeth Creek upstream of Sarina Inlet and Llewellyn Bay where freshwater input and intermittent inundation closed *Ceriops* and *Avicennia* communities occur.

The intertidal wetlands of Plane Creek adjoining the project area (southern bank) east of the Goonyella Branch Line is dominated by a closed *Ceriops* community. The closed *Ceriops* community encompasses approximately 17 ha. Other communities such as closed *Avicennia* and *Rhizophora* were also present within this area. This area has been fragmented as a result of anthropogenic activities within the region.

Avicennia was prominent along the waterline upstream of the Goonyella Branch Line. The geomorphology of the Plane Creek restricts the distribution of this species (ie the steep bank and change in morphology of channel limits the inundation area).

On the northern bank the intertidal wetlands are generally contiguous with the intertidal wetlands of Sarina Inlet. As the communities within this area are intermittently inundated closed *Ceriops* and *Avicennia* (upstream of the project area) are dominant along the Plane Creek. Downstream of the project area where inundation is more frequent closed *Rhizophora* is dominant with closed *Ceriops* communities on the landward side.

The lower reaches of Elizabeth Creek are dominated by closed *Ceriops* communities with saltmarsh/saltpan communities on the landward side. Mixed intertidal communities, closed *Rhizophora* communities and saline grasslands are interspersed within this area.

Saltmarshes were dominated by salt-tolerant vegetation such as *Suaeda* spp., *Sarcocornia quinqueflora* (samphire communities) and/or *Sporobolus virginicus* (saline grasslands). Both vegetation types have adapted to high salinity and infrequent inundation by tides and/or freshwater. Diversity and complexity within these communities is directly proportional to latitude.

There are approximately 1.6 ha of marine plants within the Project area (refer Figure 6.9).

There are no seagrass communities within the project area, however important communities exist downstream of the site within Llewellyn Bay and Ince Bay. The meadows in these areas are considered the most important meadows for dugong feeding to the north of Shoalwater Bay.

Aquatic macrophytes

Aquatic and semi-aquatic macrophytes are important to the health of freshwater ecosystems. These communities provide important habitat for aquatic biota, stabilise substrates and banks, and have an important role in the physio-chemical characteristics of the waterbody.

Macrophyte diversity was generally limited within the project area with a low species diversity in the riverine sites with the greatest diversity recorded from the wetland habitats.

Free floating species such as Duck weed (*Spirodella oligorrhiza*) and Water fern (*Azolla pinnata*) were dominant in the pool habitats of Willy and Elizabeth Creeks. The abundance of these species is generally associated with a decrease in flows and an increase in water temperature.

Other macrophyte species recorded from the riverine habitats included submerged species such as *Myriophyllum* spp. with the fringing vegetation dominated by Paragrass (*Brachiaria mutica*). Willow primrose (*Ludwigia octovalis*) and *Bacopa monnieri* were also recorded from Elizabeth Creek catchment.

Fringing vegetation was primarily terrestrial and semi-aquatic species. Section 6.2.3 discusses the riparian vegetation along Elizabeth and Willy Creeks. Semi-aquatic species such as grasses, sedges and rushes (eg *Cyperus* spp., *Juncus* spp., *Eleocharis* spp.) are prevalent throughout the project area.

Species richness within the farm dams was generally poor due to grazing pressures and maintenance activities (ie scouring out of sediment). Other impacts may include fluctuating water levels, clearing activities and limited dispersal mechanisms. Paragrass and *Hymenachne* dominated the fringing vegetation of the farm dams and the wetland on Willy Creek.

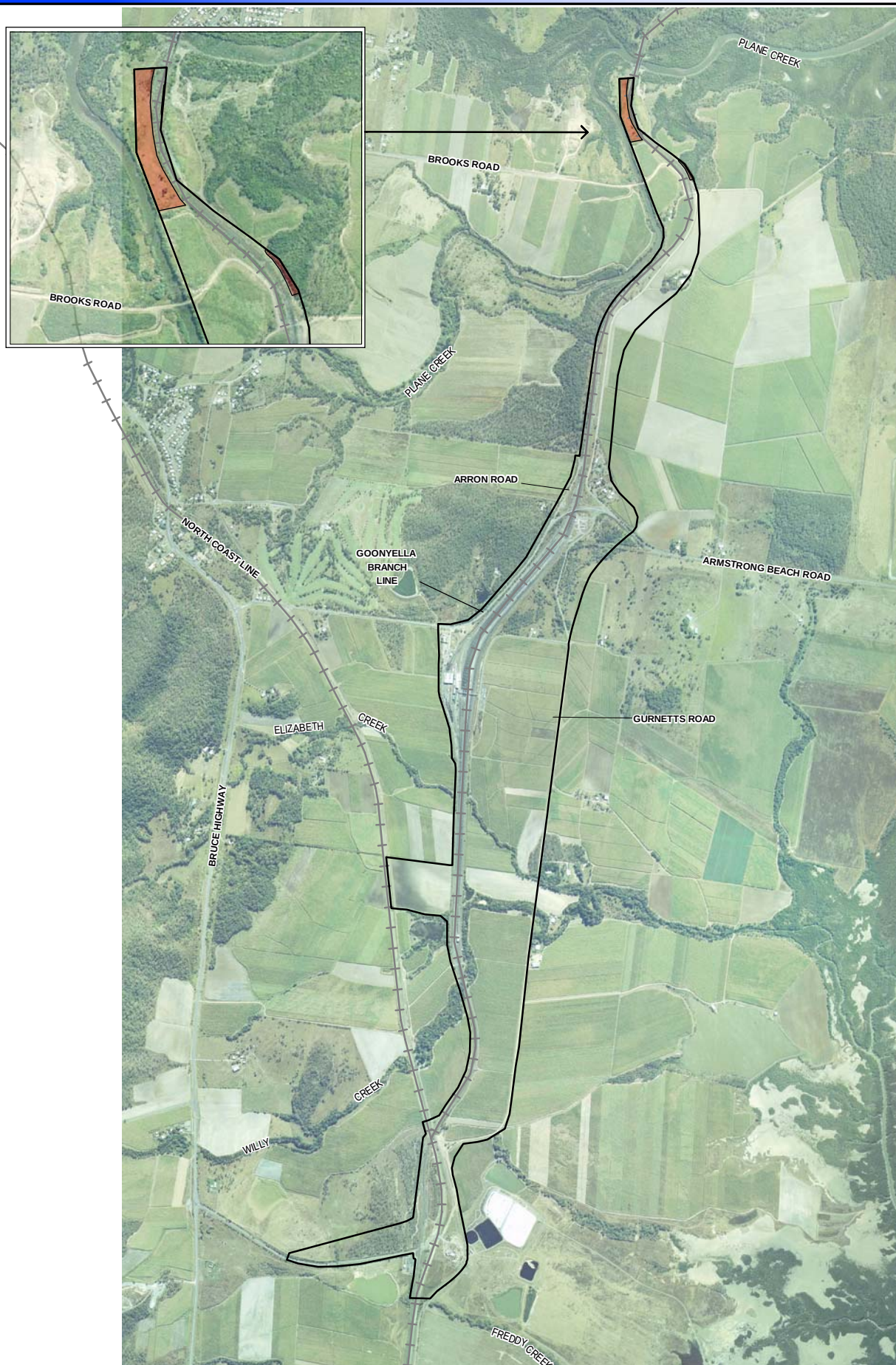
Zonation was evident at the freshwater wetland on Willy Creek. *Persicaria attenuata* an emergent species dominate the edge environment of the waterbody. Other species identified from the area include *Hymenachne*, *Cyperus digitatus*, *Paspalum distichum*, *Spirodella* spp. and *Typha* spp. The vegetation community fringing the wetland has been discussed in Section 6.2.3.

The macrophyte species recorded from the project area were generally common and widespread within the region. A number of exotic or introduced species were identified, including *Hymenachne* and Paragrass. *Hymenachne* is a declared pest under the LP Act.

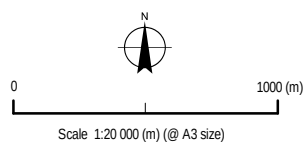
The freshwater reaches of Plane Creek often has large infestations of exotic aquatic plants, particularly Water lettuce (*Pistia stratiotes*) proliferating especially in the weir pools. Water lettuce affects pH and dissolved oxygen levels resulting in a decline in overall water quality and can often lead to fish kills. One of the main issues in Plane Creek is the high levels Filterable Reactive Phosphate, which is increasing the aquatic weed population (Healthy Waterways 2006).

Fish species

Within the Mackay Whitsunday Region 45 freshwater fish species have been recorded. Around 24 of the species found in the region are able to live in both freshwater and saltwater, while 19 species are wholly dependant on freshwater.



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LEGEND

- Project Area
- Marine Plants
- Rail

EXTENT OF
MARINE PLANTS

FIGURE 6.9

Of these species the following species have been predominantly recorded (DPIF 2007) from freshwater habitats within the vicinity of the project area:

- Eastern rainbowfish (*Melanotaenia splendida splendida*)
- Empire gudgeon (*Hypseleotris compressa*)
- Fly-specked hardhead (*Craterocephalus stercusmuscarum fulvus*)
- Pacific blue-eye (*Pseudomugil signifer*)
- Southern purple-spotted gudgeon (*Mogurnda adspersa*)

These species are potamodromous in which species migrations occur wholly within freshwater for breeding and other purposes. The project area is within the geographical limits of these species and hence these species may inhabit the freshwater ecosystems of the project area. However, during the field investigations only the Southern purple-spotted gudgeon was recorded from Elizabeth and Willy Creeks. Species richness within Elizabeth and Willy Creeks will be limited due to the geomorphology and ephemeral nature of the systems (ie pooling is intermittent and instream complexity is limited).

Species richness within the freshwater wetlands will be dependent on their proximity to potential pathways (eg Elizabeth and Willy Creeks) and instream habitat.

Fish habitat within Plane Creek has been reported as poor as it is highly regulated. The regulation of the creek would impact fish assemblages by reducing fish movement/migration, reducing environmental triggers for breeding, and habitat complexity. However, the freshwater fish communities inhabiting the creek are of moderate condition (Marsden *et al* 2006). The project area is located within Plane Creek catchment above the limit of tidal influence.

The Mackay Area Fish Stocking Association Incorporated has been stocking four central weirs within Plane Creek in Sarina, with Barramundi since 2003. The four weirs are Power Alcohol, Mill, Jacksons and Council weirs. The primary aims of restocking multiple rivers and creeks within the local Mackay/Sarina area is to protect, preserve and enhance fisheries habitat; replenish angling fish stocks in depleted streams and rivers; and to promote responsible recreational fishing and wise use of the resources and to educate others (<http://www.mafsa.org>)

The regulated nature of the Plane Creek is likely to impact on commercial and recreational fish species such as Barramundi (*Lates calcarifer*) and the Sea mullet (*Mugil cephalus*) which are catadromonous (ie migratory fishes which spend most of their lives in fresh water, and which migrate to sea to breed).

There is limited information on the fish assemblage inhabiting the estuarine reach of Plane Creek. However, the area is used by recreational anglers who target species such as whiting, bream and flathead. In 1997 the estimated total catch (total numbers of fish harvested plus released) for the Sarina Inlet and Castrades Inlet was 26,936 fish. The main species captured are whiting, Wire netting cod, Sweetlip, Grunter bream and Flathead (Land and Water Australia 2004). Other species include barramundi, blue threadfin blue salmon and mud crabs.

Commercial fishing operations also occur within Sarina Inlet with a total catch of 18.51 tonnes in 1999. The effort involved a wide arrange of techniques including line, net, pot and trawl.

Directly downstream of the project area, Llewellyn Bay supports a productive commercial fin fish fishery, including shark, barramundi, mackerel, mullet, blue salmon and to a lesser extent queen fish, king salmon and whiting (cited Roder & Roelofs undated). Other fisheries values include bream, estuary cod, flathead, grey mackerel, grunter, mangrove jack, queenfish, school mackerel and whiting.

The most important commercial operation is the prawn industry which targets king, banana and tiger prawns. Aquaculture also occurs within the region, however this is along Rocky Creek Dam and not downstream of the project area. No updated information was available on the Coastal Habitat Resources Information System (CHRIS).

Sarina Inlet and Llewellyn Bay are not declared Fish Habitat Areas (FHA) (ie give protection to inshore and estuarine fish habitats that are important for sustaining local and regional fisheries) as listed under the provisions of the *Fisheries Act 1994*. However, Rocky Dam FHA is situated at the mouth of Elizabeth Creek in Ince Bay (southern Llewellyn Bay), encompassing 2,935 ha and is classed as a management level 'B'. Cape Palmerston FHA encompasses 8,791 ha and is classed as a management level 'A'. This FHA is also situated in Ince Bay.

Other vertebrates

A number of fauna species inhabit and/or frequent the freshwater, estuarine and marine ecosystems within and downstream of the project area (refer Section 6.3.3). This includes a number of significant species under State and Commonwealth legislation such as the Saltwater crocodile which is known to inhabit the Plane Creek catchment.

The EPA Coastal Planning Mapping (2006) for Significant Marine Wetland Habitat identifies Llewellyn Bay and upstream reaches as significant saltwater crocodile habitat. The intertidal wetlands are also recognised under the EPA Coastal Planning Mapping and the VM Act as essential habitat for the Water mouse.

Other aquatic/marine species which habitat the region includes turtles (marine and freshwater), dugongs and other marine mammals.

Marine turtles have been frequently sighted in localities where seagrass is present in downstream areas of the project area (eg Sarina Inlet and Llewellyn Bay). Marine turtles are listed as threatened species under State and Commonwealth legislation.

Green (*Chelonia mydas*) and flat back turtles (*Natator depressus*) are known to nest on Armstrong Beach. *C. mydas* and *N depressus* are listed as vulnerable under the EPBC Act and NC Act. The Project is unlikely to affect turtle nesting behaviours, however there is the potential for the works to impact the water quality and ecosystem health of Sarina Inlet and Llewellyn Bay.

Dugong populations and habitats occur in the downstream of the project area. Surveys of dugong population of Llewellyn Bay and Ince Bay have shown a decline from 542 $\pm$ 293 to 82 $\pm$ 60 between 1987 to 1994 (Marsh *et al* 1996). The seagrass resources in Llewellyn Bay do not appear to be favoured for feeding by dugong or turtles. However, deepwater seagrass patches may provide suitable habitat for dugong feeding, and should be considered potentially important for dugong (Marsh *et al* 1996).

To protect these areas Llewellyn Bay and Ince Bay were declared as a Dugong Protection Area (DPA) in January 1998. Both areas are located downstream of Elizabeth Creek with the Llewellyn Bay DPA Zone 'B' encompassing 12, 652 ha and the Ince Bay DPA Zone 'A' encompassing 6,951 ha.

DPAs give protection to known dugong habitat, breeding, feeding grounds within the Great Barrier Reef Marine Park. DPAs were subsequently declared in legislation under the NC Act, and as Special Management Areas under the *Great Barrier Reef Marine Park Regulations 1983* and the *Great Barrier Reef Marine Park Zoning Plan 2003*.

The Project is unlikely to directly impact species behaviour, however there is the potential for the works to impact the water quality and ecosystem health of Sarina Inlet and Llewellyn Bay.

Aquatic invertebrates

Macroinvertebrates are important biological indicators of ecosystem health due to the sedentary nature of the species, relatively immobile, they are widespread and most importantly, they reflect the aggregate of impacts of environmental change on the stream ecosystem.

There is limited existing information on the aquatic macroinvertebrates within the creek systems potentially affected by the Project. Overall taxa richness at the sites ranged between eight and 22 taxa. This is low compare to similar studies within the lowland streams of Central/North Queensland.

In terms of general composition of the aquatic invertebrates, the major insect orders (Odonata, Ephemeroptera, Hemiptera, Diptera, Coleoptera and Trichoptera) were recorded. Gastropoda and Decapoda were also well represented within the habitats. There is no significant difference in taxa richness between the edge and riffle habitats (refer Figure 6.10). However, in the pool habitats the gastropods, odonatans and dipterans were the dominant taxa, while in the riffle habitats dipteran, coleopteran and trichopteran were the dominant taxa.

Due to the absence or rarity of Plecoptera the PET index is based on the presence of ephemeropterans and trichopterans. The PET index ranged between three and seven with ephemeropterans and trichopterans present at all the sites. This indicates that the water quality at the sites is generally good.

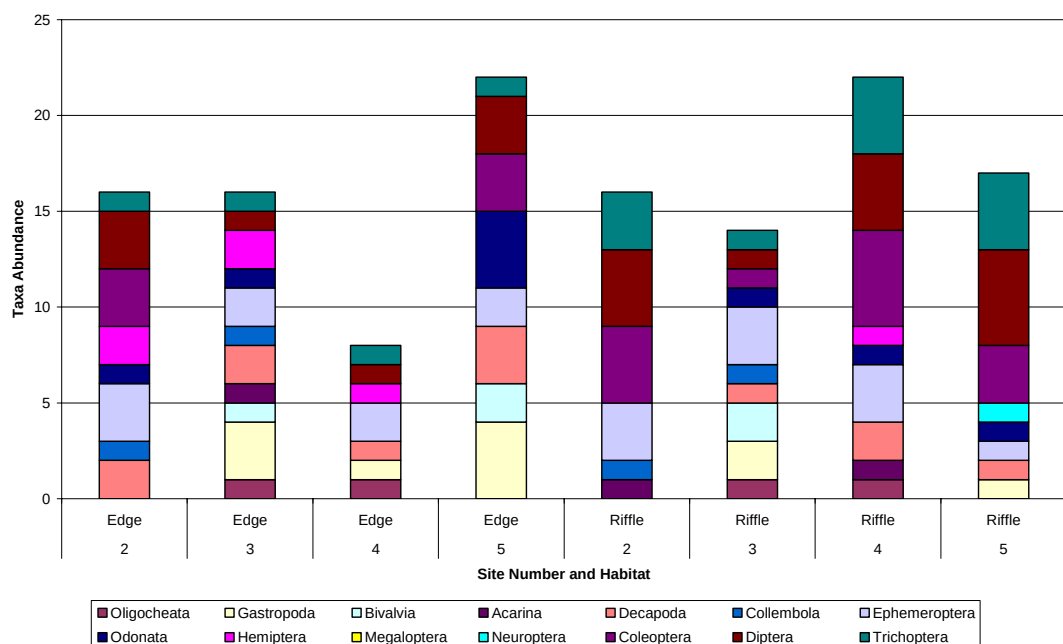


Figure 6.10 Sampling results of riffle and edge habitats

Abundance at the sites ranged between 560 and 3,170 individuals. Overall abundance was dominated by dipterans and ephemeropterans at the sites. There is no significant difference in taxa (ie Odonata, Acarina and Gastropoda) abundance between the edge and riffle habitats.

Abundance was generally higher in the riffle habitats than the edge habitats of the sites, with ephemeroptera and dipterans the dominant taxa. This is likely to reflect the habitat complexity within this habitat compared to the edge habitats. In addition, recent flow events are more likely to impact the edge habitats through the removal of detrital material and fluctuating water levels.

The edge habitats were dominated by more tolerant taxa such as chironomids, oligochaetes and certain gastropods. This is likely to reflect the disturbed nature of the watercourses within the area.

The abundance of individuals within PET taxa shows a marked decline with anthropogenic disturbance and is thus useful as an early warning indicator of a decline in stream health. The PET abundance ranged between 50 and 1,480. The low score within the edge habitats of Sites 2 and 3 reflects the disturbed nature of the site and also the potential impact of recent flows on the populations (ie sampling was conducted during a flow event which removed niches and resources and limits the time for recruitment).

Upstream and downstream of the project area were sampled whereby riffle and edge habitats of each reach were sampled and assessed in terms of habitat condition. Photos 6.26 and 6.27 illustrate sampling at the two different habitat types.



Photo 6.26 Riffle sample upstream of Willy Creek



Photo 6.27 Edge sample downstream of Elizabeth Creek

Water birds

The species of waterbirds and shorebirds inhabiting and/or frequenting the regions is detailed in Section 6.3.3.

It is important to note that species diversity was mainly associated with wetland ecosystems, including the freshwater wetland within the Willy Creek catchment and intertidal wetlands (eg saltpan/samphire communities) of Sarina Inlet and Llewellyn Bay. These areas are important feedings and roosting sites for resident and migratory bird species.

6.5 Potential construction impacts

6.5.1 Flora

Vegetation clearing

Vegetation clearing has the capacity to reduce biodiversity levels, habitat values and connectivity whilst increasing the risk of environmental harm through erosion and sedimentation. Vegetation is important in sustaining soil stability, especially along creek lines and around the wetland in the project area. It is important in buffering the results of anthropogenic activities such as land clearing, including reducing velocities of overland stormwater flows, filtering out sediments, nutrients and pesticides. The disturbance and/or removal of riparian and wetland vegetation may lead to the destabilisation of banks alongside increasing erosion, sedimentation and increased concentrations of nutrients and pesticides in the creeks and wetlands within the project area and downstream.

The clearing of populations of insect and bird pollinated plants can reduce density and numbers of such plants to a level where their ability to reproduce successfully is reduced (Morgan and Scacco 2006). This can be particularly important for small isolated populations of rare and threatened species such as the populations of *Cycas ophiolitica* and *Eucalyptus raveretiana* within the project area.

An ecological corridor may be defined as a “linear feature of vegetation, which differs from the surrounding vegetation and connects at least two patches (of remnant vegetation), which were connected in historical time” (Saunders and Hobbs 1991). These may be naturally existing, such as the vegetation along Elizabeth and Willy Creeks, a restored piece of linear habitat or an artificial construct (such as a hedge). They serve as a conduit for the movement of individual animals and a means for genetic interchange between populations of fauna. Such movements enable patches to be recolonised in the event of a catastrophic event and enable genetic interchange to occur. They may also function as habitat. Such corridors may not need to be continuous to be effective depending on the mobility and tolerance to disturbance of the species utilising them. Clearing will also result in the severing of the wildlife corridor in the study area formed by the riparian vegetation along Elizabeth and Willy Creeks.

Where the existing rail corridor and associated easements occur, the loss of native vegetation during the construction phase of the Project is expected to be minimal. The majority of flora species occurring within these areas are species that commonly occupy woodlands and open forest communities both locally and regionally and have adapted to modified or disturbed ecosystems.

Table 6.7 sets out the approximate areas of significant non-remnant vegetation and REs that will be cleared within the project area.

Table 6.7 Approximate areas of vegetation/RE to be cleared

Regional Ecosystem/vegetation type	VMA Status	Location	Approximate area to be cleared
RE 8.1.1	Not of Concern	North-eastern boundary of project area around Plane Creek	-
RE 8.3.3a/8.3.5	Of Concern	North-eastern boundary of project area adjacent to Smyths Road	-
RE 8.3.5/8.3.3a	Of Concern	North-western boundary of project area between Plane Creek and Arron Road	-
RE 8.3.1a	Of Concern	North-western boundary of project area south of Plane Creek	-
RE 8.12.12a	Not of Concern	South-eastern boundary of the project area north of Oonooie Road	2.2 ha
RE 8.12.22	Not of Concern	East of the project area adjacent Armstrong Beach Road	-
Marine vegetation	protected under the <i>Fisheries Act 1994</i>	Northern part of the project area	0.2 ha
Riparian vegetation		Elizabeth Creek	3.2 ha
Riparian vegetation		Willy Creek	4.5 ha
Wetland vegetation	State significant wetland	West of Goonyella Branch Line	0.2 ha
Sugar Cane	Not Applicable	Throughout project area	101 ha

Weed proliferation

Weed proliferation is exacerbated by clearing activities that disturb and expose the soil. The activities of personnel and vehicles within the project area increases the potential for the movement and introduction of weed species into other locations within the project area where they do not currently occur. Such activities include importing fill, slashing and soil disturbance from earth works and grading. Weed propagules may also be introduced on footwear, machinery, vehicles and equipment moving into the project area from other locations as well as translocating them within the project area. Weeds may out-compete less disturbance-tolerant native species and may alter the species composition of the vegetation community they encroach upon.

The removal of the invasive weeds species, particularly along creek lines if not done carefully may also increase the risk of seeds or spores entering the waterway and being translocated downstream. Chemical treatment of weed and other pest species is currently carried out on cultivated crops within the project area which minimises their spread to the riparian zone.

Increasing edge effects

Edge effects can penetrate from 15 to 50 m into an area of remnant vegetation depending on the topography, physical processes and vegetation type involved (Catterall *et al* 1991; Big Scrub Conservation Strategy 1987). Further clearing of remnant vegetation generally results in the migration of the edge with a subsequent reduction in interior habitat. The migration of this edge is likely to occur in all areas where disturbance occurs within riparian vegetation and the REs within the project area.

Edge effects have the potential to create changes to species composition of remnant vegetation within the project area and increase the presence of introduced and disturbance dependant native species in the area. Previously intact areas will be opened up through fragmentation. This will create edge effects and attenuate areas of significance such as the riparian and wetland vegetation and the REs within the project area. When this occurs, the integrity of the floristic structure within the vegetation communities is likely to be compromised.

Clearing will create a new edge on the remaining area of RE 8.3.3a/8.3.5 further reducing the area of intact vegetation. It will also create a new edge on the remaining area of RE 8.12.12a north of Oonooie Road further reducing the area of intact vegetation in this RE.

If the REs, in particular the area north of Oonooie Road, become too attenuated any remaining core habitat may reduce along with the flora and fauna species that depend on it.

Bushfire

Bushfires may be the result of natural and/or anthropogenic processes. The impact of bushfire on a given ecosystem will vary depending upon its intensity, the season, the time since the last fire, the vegetation structure as well as the species composition involved. Many plant species have developed specific mechanisms to survive periodic bushfire, while some species depend on fire regimes to stimulate flowering, seed release or to provide optimal conditions for seed germination (eg *Eucalyptus raveretiana*).

Whilst bushfire is an important factor in shaping the dynamics and health of an ecosystem too frequent fire can alter the species composition of vegetation communities and facilitate weed infestation. This is particularly so for RE 8.3.1 and RE 8.3.3 which are both fire sensitive and will be degraded by too frequent bushfire. Activities which may increase the risk and frequency of bushfires occurring within the project area include the careless discarding of matches and cigarette butts, littering and the operation of equipment (eg sparks associated from heavy machinery).

The effects of dust

Dust deposition from construction activities or from passing coal laden wagons has the potential to impact upon vegetation generally if excessive quantities are sustained over extended periods of time. Excessive dust deposition on foliage reduces photosynthetic processes which in turn stunts floral growth rates and reduces the overall health of vegetation and the REs. Excessive dust deposition on foliage may reduce growth rates and overall health of the remaining areas of RE within and adjacent to the project area.

Dust levels from the project are predicted to be below air quality guideline levels (refer Chapter 9).

Threatened species

The two threatened species listed under the EPBC Act and the NC Act (*Cycas ophiolitica* and *Eucalyptus raveretiana*) may be removed directly as a result of construction activities within the project area. Even if they are not removed the clearing of vegetation in their vicinity may lead to a reduction in suitable local habitat available for their progeny to occupy. It may also further isolate these local populations from pollinating birds and insects further reducing their ability to successfully reproduce. It may also bring about changes to microclimate and soil conditions that could threaten their continued survival in the area. Increase competition from weeds caused by construction activities may directly threaten the existing individuals and prevent successful recruitment of their offspring in the area.

The generation of dust may also threaten the long term survival of the *Cycas ophiolitica* by settling on the foliage and decreasing their ability to photosynthesise and impeding gaseous exchange.

6.5.2 Fauna

Significant areas

The proposed project area is situated in close proximity to two areas of national significance, including:

- The Great Barrier Reef World Heritage Area
- GBRMP

Neither of the two areas mentioned above are directly impacted by the proposed upgrade, however both are within 15 km downstream of the project area (refer Chapter 7). As a result of this, any reduction in water quality flowing into the Sarina Inlet or Great Barrier Reef may have a negative impact on the flora and fauna that inhabit these areas.

An Essential Habitat has been identified in close proximity downstream of the project area. Essential Habitats are based on actual recordings and/or habitat modelling for threatened species (ie endangered, vulnerable or rare) pursuant to the NC Act. This Essential Habitat falls within RE 8.1.1 and is for the False water rat or Water mouse, which is listed as vulnerable under the NC Act and the EPBC Act.

With the implementation of an appropriate Erosion and Sediment Control Plan during construction the impact on downstream areas and habitat will be minimised.

Fauna populations

In total 116 species were recorded during the survey as inhabiting/frequenting/utilising the project area. Due to the already fragmented landscape in the area, very few wildlife corridors remain. Only three corridors occur within the project area. As a result of this, the proposed Project is likely to have an impact on the fauna within the area, with the degree of impact dependent on the final design and construction staging.

The main impacts will involve fragmentation of current wildlife corridors/habitats as well as loss of habitat, particularly within the Willy Creek, wetland and Oonooie Road areas. Although the existing environment is highly disturbed, the remaining habitats are significant to the area's biodiversity and sustainability.

The main impacts on local fauna populations will be through the:

- Translocation and/or displacement of species
- Loss/disturbance of habitat
- Removal of hollow bearing trees
- Loss of microhabitats (rocky outcrops, hollow logs)
- Increased edge environment

- Soil composition
- Increased pressure for resources, and
- Linear disturbances

Bird populations within Site E (Armstrong Beach/Soto Road) and Oonooie Road are likely to be impacted on if both of these areas are cleared of vegetation. There is a limited amount of woodland remaining within this local area and removal of these two sites will result in further strain on the local populations that will need to recolonise in another area. This subsequently results in a strain on the resources of the new habitat where there is likely to be existing populations already inhabiting the area and utilising the resources.

Removal of vegetation from Willy and Elizabeth Creeks will impact on the local fauna populations that currently use these areas as wildlife corridors. Connectivity within this area is already reduced and further removal of any corridors will have impacts on the movement of wildlife. This in turn has impacts on animals sourcing food, finding a mate (limited mating choice can result in localised reduction in genetic diversity and inbreeding) and the dispersal of young and sub-adults. However, it is important to note that most of the species recorded within the project area are of Least Concern under the NC Act and are common and locally abundant within the Mackay/Central Queensland region.

Staging of works may assist in reducing the impact to individuals within the area, however the benefit of this may be limited given the already scarce amount of existing suitable habitat. Other pressures associated with the works include the translocation and/or displacement of species, change in microclimates, change in soil composition and increased pressure for resources.

Microbial and invertebrate assemblages will also be affected by the proposed development. This could impact on the dynamics, biodiversity and health of the ecosystem (ie loss of a particular group within the food web, which would impact on higher trophic species).

The implementation of mitigation measures will reduce the potential construction impacts on fauna that utilise the area (refer Section 6.7).

Threatened species

Although several threatened or significant species were identified during the survey and there is potential for more threatened species to occur within the project area, it is unlikely that the upgrade will have a significant impact on fauna populations. Any indirect impacts as a result of the Project, such as increased light and noise may impact negatively on local populations, is likely to be minimal as implementation of mitigation measures will reduce potential impacts (refer Section 6.7).

Of the significant species observed during the survey, one was observed within the proposed project area (Black-necked stork) and another species was identified downstream, just outside the project area (Radjah shelduck).

No significant species pursuant to the EPBC Act were observed during the survey, however there is the potential that other species may inhabit/frequent/utilise the area (refer Appendix H1). Construction activities may impact on the ecosystem health, which may in turn have an impact on fauna assemblages.

The loss/degradation of mangrove communities may impact on species behaviour (ie roosting sites, foraging behaviour) due to the direct loss of these communities or the associated construction activities, including the potential increases in lighting, noise and dust.

Under the conditions of the EPBC Act, however, it is unlikely that the proposed project will have a significant impact on the ecological values of the area.

Radjah Shelduck

This species was observed whilst inspecting the salt flats downstream of the project area. This species is often observed within this area according to employees of the CSR Sarina Distillery. The proposed Project is unlikely to have a direct impact on this species, however any reduction in water quality from the Project may impact on the downstream environment and subsequently negatively impact on the feeding resources for this species. There may be some indirect impacts on this species, including increased noise, light and dust as a result of construction activities (refer Chapter 7 for a detailed description of the potential impacts on water quality).

Black-necked Stork

This species is found in wetlands, mangroves and tidal mudflats and has been observed within the salt flats of the CSR Sarina Distillery and also within the project area along Gurnetts Road. Impacts on this species are dependent on the amount of disturbance that occurs to the wetland and dams within the project area.

If disturbance to these areas is minimal, it is likely that the Project will not have a significant effect on this species. This is assuming that no indirect effects occur in terms of reduction of downstream habitat quality as a result of the Project as mentioned above.

Potential construction impacts may result in a cumulative impact which reduces the recovery period of the area (ie prolonged construction activities may drive out the localised population). The recovery of the species within the area will depend on the time period associated with the disturbance and species tolerance.

False water rat

As mentioned previously this species is listed as vulnerable under the NC Act and the EPBC Act. With Essential Habitat lying outside the project area, this species may be indirectly impacted by the Project if reduction to water quality occurs as a result of the construction works. If mitigation measures are strictly adhered to, negative impacts to this species are not anticipated.

Other species potentially inhabiting the area

The Rufous owl is recorded for the Sarina Shire (Wildlife Online). This species is listed as rare under the NC Act and was not identified during the survey, however suitable habitat does exist within the area. The main threat to this species is the loss of nesting habitat through clearing of hollow bearing trees. If there are individuals of this species within the project area, construction is likely to have a negative impact, particularly if hollow trees are being cleared. Increased light and noise as a result of construction is also likely to impact any species within the area as well as reducing available food resources.

The Grey goshawk is listed as vulnerable under the NC Act and may inhabit and/or utilise the project area. Suitable habitat does exist within the project area and it is likely that habitat removal and construction activities will impact on species inhabiting the area and will also impact the behaviour of those that exploit the area for resources due to the loss of suitable foraging habitat and the potential noise/light/dust generation.

The Yakka skink is listed as vulnerable under the NC Act and the EPBC Act and may potentially inhabit the project area. Little is known about this species, however it would be expected that if there are individuals of this species inhabiting the area, there would be significant direct impacts on the local population through the clearing of vegetation.

The Rusty monitor may potentially inhabit the project area in the mangrove communities surrounding Plane Creek. This species is listed as rare under the NC Act, loss of hollow bearing mangroves has historically been a large contributing factor in their decline in numbers. Vegetation clearing as a result of the Project may reduce habitat within the area and construction activities may impact on any individuals inhabiting adjacent mangrove communities due to impacts from light, noise and dust.

The intertidal wetlands of the Sarina Inlet and Llewellyn Bay are important habitats for a number of species of migratory waterbirds and shorebirds. These species may also utilise the resources and habitats within the project area, such as the mangrove communities of Plane Creek and the wetland. Monitoring of bird distributions and populations during the migration cycle is still in its infancy. Therefore population sizes and trends of many species remain unknown. This limits the understanding of the value of areas such as the Sarina Inlet and Llewellyn Bay and even smaller wetlands such as that found within the project area and also the impacts associated with development and construction.

The main threat is the loss/degradation of habitat within and adjacent the project area. There is the potential that the Project could impact on the health of adjoining ecosystems such as those downstream which are recognised as important feeding and roosting habitats for a diverse number of migratory species.

Direct impacts from the upgrade surrounding the wetland are also a concern, with dust, light and noise generating activities likely to disturb the natural behaviour of the species that inhabit or frequent the area.

Other impacts such as contamination and reduction in the buffering capacity (ie removal of mangroves and/or other native vegetation can directly and/or indirectly impact of species behaviour).

Changes to the water quality of the downstream environment as a result of overland runoff, contamination and removal of wetlands can impact on fauna assemblages (eg turbidity as a result of overland runoff and substrate disturbance will potentially impact on primary productivity, which may impact on higher trophic organisms). These activities may also affect colonisation and recruitment.

Due to the comparatively small size of the wetland and holding capacity in terms of the amount of species that it could support, any major disturbances to the area could have a significant impact on local populations and seasonal visitors that utilise this area. It is therefore recommended that disturbances within and around this area are kept to a minimum, particularly during the summer migratory season.

Under the EPBC Act, a migratory species is significantly impacted on if a proposal will or is likely to:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles of altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- Result in invasive species that may impact the migratory species, or
- Seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

No significant impact is anticipated on the migratory bird species as a result of the Project. Any potential impacts will be mitigated if the mitigation measures outlined in Section 6.7 are implemented.

Vegetation clearing

Vegetation is one of the principal impacts of the Project and is likely to have an impact on the biodiversity of the area. Vegetation clearing activities may impact on fauna through:

- Loss of important habitats and habitat complexity
- Increase fragmentation and linear disturbances

- Reduction and loss of wildlife corridors
- Increase the potential risk of edge effects
- Disturb significant species behaviour
- Increased pressure from exotic and/or pest species
- Change in the fauna assemblages – the displacement /loss of some species as a result of the activities and/or a species occupying the 'vacant' ecological niche. Such changes may potentially impact on the dynamics of the ecosystem (potential collapse of a local population).
- Loss of stands of vegetation are also important buffer systems (noise and visual)

The proposed Project encompasses a range of habitats, including mangroves, riparian rainforest, woodland, open woodland, wetland and cane fields. The size and complexity of the habitats, limited wildlife corridors and anthropogenic disturbances (eg fragmentation and linear disturbances) limit the biodiversity and ecological value of the area. The proposed Project will further reduce the ecological value of the area if connectivity is not retained to some extent.

Loss of tree hollows

The removal of hollow trees in the project area will result in the decrease of roosting or nesting sites for a number of species of hollow dependant fauna found in the project area - Gould's wattled bat (*Chalinolobus gouldii*) (in Site F), Yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*) (in Sites E and J) and Sugar glider (*Petaurus breviceps*) (in Site E). This may result in an overall reduction in numbers of these species locally. This may be ameliorated to some extent by the placement of artificial nest and roost boxes in and around the project area. It should be noted however, that of these three species only Gould's wattled bat (*Chalinolobus gouldii*) and Sugar glider (*Petaurus breviceps*) have been showed to use these. It is therefore a better option to retain hollow trees in situ where possible.

Introduced species

Approximately four and a half per cent of the fauna species identified inhabiting the area are introduced species which is a small percentage given the large amount of disturbance within the area. Introduced species can impact on the biodiversity of an area through increased competition for resources, habitat destruction, weed distribution, increased risk of disease and predation. During the construction activities, there is the potential for the translocation and/or introduction of introduced species. The rail yard upgrade may also create higher competition between introduced and native species for the more limited resources, once the footprint has been cleared.

Bushfire

Bushfires are an important factor in shaping the dynamics and health of an ecosystem. Many species have developed specific mechanisms to survive periodic fire, while some species depend on fire regimes for critical life stages. Fires may be the result of natural and/or anthropogenic processes.

The impact of fire on a given ecosystem will vary depending upon its intensity, season and the time since the last fire, as well as the species involved. Activities within the area may increase the risk and frequency of fires occurring. Potential sources of concern are human activity (eg smoking and littering) and the operation of equipment (eg sparks associated with trains and heavy machinery).

Fuel load will affect the fire intensity and the speed with which a fire spreads. The activities associated with the Project are likely to have an impact on the fuel loads present within the project area. A large area of habitat is likely to be disturbed, which is likely to result in the loss of mosaic structure and the introduction and subsequent dominance of grass species.

This risk in conjunction with isolated/fragmented communities can have a detrimental impact on the survival of a population. Changes in bushfire regimes can also have an impact on the dynamics of the ecosystem, which may ultimately impact on the biodiversity and ecosystem health.

Acid sulfate soils

Acid sulfate soils are discussed in Chapter 5.

6.5.3 Aquatic ecology

Riparian zone

The riparian habitats adjoining Plane, Elizabeth, Willy Creeks and the wetland north of Willy Creek protects the soils and substrate from scouring and erosion and also acts as a filter for sediment and nutrient input into the receiving waters. Removal of riparian vegetation will lead to increased erosion of banks causing alterations in channel structure and flow. Loss of fish habitat will also occur through erosion and loss of riparian vegetation and macrophytes, which provide refuge and feeding grounds for fish and other aquatic species.

Removing riparian vegetation will also result in increased sedimentation which can smother instream habitats such as riffles and pools and potentially impacting upon instream species.

Loss of wetland habitat, specifically the northern section of the wetland north of Willy Creek may impact on local and migratory species.

Water quality

Removal of overhanging macrophytes or riparian vegetation will lead to an increase in water temperatures, specifically in Willy and Elizabeth Creeks where these areas are heavily shaded with medium canopy cover affecting the dissolved oxygen levels.

Loss of riparian vegetation will also reduce the natural filtration system into the receiving waterbody, resulting in an increase in the levels of nutrients, particularly nitrogen, phosphates and fertilisers from adjoining cane farming uses. Increase in nutrient levels may also lead to algal blooms which can smother native aquatic vegetation and potentially choke narrow waterways like Elizabeth and Willy Creeks.

Increase in water turbidity during waterway construction works in all creek systems will disrupt the natural behaviour of instream fauna, particularly fish.

Construction works may result in direct sediment loads to all creeks within the project area and also downstream waterbodies, Sarina Inlet and Llewellyn Bay, leading to smothering of fish habitat and loss of niche availability, smothering of adult juvenile and eggs of aquatic species.

Limiting the amount of nutrients entering Plane Creek would reduce the amount of water lettuce present and improve dissolved oxygen levels.

The impacts of changing water quality on aquatic communities may be direct through the creation of instream barriers or indirect through the release of contaminants or nutrients to the environment.

Changes to the water quality of the downstream environment as a result of overland runoff, contamination and removal of wetlands can impact on fauna (eg turbidity as a result of overland runoff and substrate disturbance will potentially impact on primary productivity, which may impact on higher trophic organisms). These activities may also affect colonisation and recruitment.

Chapter 7 discusses the potential impacts on existing water quality in further detail.

Instream habitat

Riparian vegetation is an important source of woody debris. The loss of woody debris in the instream habitat will reduce the structural complexity and habitat diversity available for the establishment of aquatic flora and fauna populations.

The impact of impoundments on fish habitats and aquatic communities will affect natural water flow, volume, substrate and profile, water quality and fish passages and connectivity. The presence of a physical barrier in Plane, Elizabeth and Willy Creeks can have an impact on fish populations by preventing their migration patterns and disrupting normal daily and seasonal cycles.

Within Elizabeth and Willy Creeks, the alterations in flow, thermal regime, bottom substrate will cause the instream habitat to be less suitable for native species and more attractive to more adaptable species, which may include introduced or noxious flora and fauna species.

By constructing culverts or stream crossing this may create a barrier for fish movements as the increase in the current velocity through the culvert may be too great, discouraging or preventing the passage of some fish species.

Biodiversity

Smothering of native and instream vegetation, including macrophytes will reduce their ability to photosynthesis. Native plant populations may then decrease with subsequent effects on native fish species, including reduced habitat complexity and availability, loss of refuge sites from potential predators, decrease in food resources for herbivorous fish and sources of primary productivity.

Loss of protective vegetation will leave fish species more vulnerable to predation from terrestrial predators.

Acid sulfate soils

There is the potential that the construction activities will disturb acid sulfate soils (ASS). The risk area is largely within the vicinity of the tidal influences of Plane Creek. Adverse impacts of ASS in areas of tidal influence are discussed in Chapter 5. An ASS investigation will be undertaken in August and September 2007, which will result in an ASS management plan to be implemented during construction.

Sedimentation

Fish have the ability to move out of areas subject to high sedimentation (ie instream construction works), however they may still be impacted through the reduction of habitat loss and impacts to breeding or spawning sites. The geomorphic attributes of the sediment (whether the sediment is derived from acid or alkaline soils) can affect the impacts of the sediment on the receiving habitat, altering the pH balance of the water.

Sediments entering the waterway with high organic loads can lead to severe reproductions in the dissolved oxygen content. The impacts on many fish species will include respiratory stress, increased susceptibility to disease and, in severe cases, death.

Fine particulate sediments may remain suspended within the water column creating a highly turbid environment, which will interfere with the abilities of fish species to navigate, locate food sources and avoid predation. Remaining sediments may also cover breeding and spawning sites and smother eggs and reduce their survival.

Wetland (Site K)

Due to the comparatively small size of the wetland and holding capacity in terms of the amount of species that it could support, any major disturbances to the area could have a significant impact on local populations and seasonal visitors that utilise this area. Due to the fact that the existing rail corridor lies less than 500 m to the east of the wetland indicates that many species would be tolerant of a certain level of noise and activity, however introducing additional infrastructure within the direct area of the wetland would significantly reduce its habitat value.

The implementation of appropriate mitigation measures during the construction phase will minimise the impact on downstream and adjacent aquatic ecological values (refer Chapters 7 and 17).

6.6 Potential operational impacts

6.6.1 Flora

Weed control

Injudicious use of herbicides to control weeds around the railway lines may inadvertently cause the death of *Cycas ophiolitica* and *Eucalyptus raveretiana* and other non-target native species.

The effects of dust

The coal dust from passing coal wagons may threaten the long term survival of the *Cycas ophiolitica* by settling on the foliage and decreasing their ability to photosynthesise and impeding gaseous exchange.

Coal dust deposition from passing coal wagons on foliage may reduce growth rates and overall health of the remaining REs and other non-remnant vegetation in and adjacent to the project area.

Weed and bushfire control measures will be implemented during the construction phase to minimise the impact on downstream and adjacent aquatic ecological values.

6.6.2 Fauna

Fauna populations

Impacts directly related to the operational phase of the Project related to increased noise and lighting from the upgrade which may impact on species remaining in the area. Birds in particular that utilise the wetland area may be impacted by the Project depending on the location and proximity of rail infrastructure to the wetland. Most native fauna species will have dispersed during the construction phase, however any species resilient to noise and urbanisation are likely to recolonise the area once the disturbance has settled.

The main threat is the loss/degradation of habitat within and adjacent to the project area. There is the potential that the project could impact on the health of adjoining ecosystems such as those downstream which are recognised as important feeding and roosting habitats for a diverse number of migratory species.

Direct impacts (dust, light and noise generating activities) from the Project on the wetland have the potential to disturb the natural behaviour of the species that inhabit or frequent the area.

Other impacts such as contamination and reduction in the buffering capacity (ie removal of mangroves and/or other native vegetation) can directly and/or indirectly impact of species behaviour.

Threatened species

Radjah Shelduck

Increased dust and noise levels as well as increased lighting and movement (ie of the trains and personnel) may also have indirect impacts on this species during the operational phase.

Black-necked Stork

If disturbance to these areas is minimal, it is likely that the Project will not have a significant effect on this species. This is assuming that no indirect effects occur in terms of reduction of downstream habitat quality as a result of the Project.

Bushfire

An increased frequency of bushfire may adversely affect some fauna species. The impact of fire on a given ecosystem will vary depending upon its intensity, season and the time since the last fire, as well as the species involved. Activities within the area may increase the risk and frequency of fires occurring. Potential sources of concern are human activity (eg smoking and littering) and the operation of equipment (eg sparks associated with trains and heavy machinery).

Fuel load will affect the fire intensity and the speed with which a fire spreads. The activities associated with the Project are likely to have an impact on the fuel loads present within the project area. A large area of habitat is likely to be disturbed, which is likely to result in the loss of mosaic structure and the introduction and subsequent dominance of grass species.

This risk in conjunction with isolated/fragmented communities can have a detrimental impact on the survival of a population. Changes in bushfire regimes can also have an impact on the dynamics of the ecosystem, which may ultimately impact on the biodiversity and ecosystem health.

Increased train and road traffic noise and movement

Roads and the associated verges can act as a substantial barrier to fauna movement. Road construction results in the alteration of habitat due to clearing, mowing, spraying, grading or burning (Goosem 2001). Traffic noise and the visual disturbance by the movement and headlights of vehicles, as well as the associated pollutants, may cause some species of fauna to avoid the road and add to their affects as barriers once they are constructed (AMBS January 2001). The upgrade of Gurnetts Road is likely to increase road traffic and increase the barrier affect of the existing road.

Though there is no specific data on the effects of train traffic on fauna its effects are likely to be similar to that of road transport though less pronounced due to the intermittent nature of train traffic. There will be a substantial increase in rail traffic as a result of the proposed works and a concomitant increase on the current level of impact on fauna. In addition, the steep rail embankments are also likely to act as a substantial barrier to some native fauna.

Increased artificial lighting

The increased level of artificial lighting is likely to have minimal impact on local fauna. These have been discussed in detail in Chapter 14.

The development of appropriate mitigation measures during the design phase will minimise the impact on fauna species that utilise the area (refer Section 6.7).

6.6.3 Aquatic ecology

Noise and vibration

Noise and vibration impacts associated with the increased train operation are expected to be minimal in relation to the aquatic ecology of Plane, Elizabeth and Willy Creeks. Vibrations from rail activity may influence the behaviour of fish and other aquatic fauna through local disturbances, however impacts are likely to be negligible.

Water quality

Although impacts to existing water quality will be minor compared to construction impacts, the increase or accumulation in pollutant loads may occur if operational and maintenance activities are not managed effectively.

Coal

Coal is evident directly under the existing rail line within the aquatic zone, particularly where the line traverses Plane Creek. This is likely to continue if not managed appropriately. Additionally, runoff from the railway tracks may cause localised build up of inert coal particles.

Oil and chemical spills

Oil, chemical or other contaminants resulting from maintenance activities may enter the waterways if not managed appropriately. Depending upon the contaminant and its bioavailability, water quality degradation will eventually affect aquatic biota.

Chapter 7 discusses the potential operational impacts to water quality in further detail.

Air quality and dust

Dust levels will be more elevated during construction of the Project than during the operational phase. However, air quality may be affected by an increase in train movement, train ballast, unsealed stockpiles and roads adjacent to the rail line.

Dust deposition, including coal material can have long term impacts on riparian foliage by reducing photosynthetic processes that may cause effects to plant growth and reduce overall health of riparian communities. The issue of dust and its management are further discussed in Chapter 9.

6.7 Mitigation measures

The following mitigation measures will be incorporated where practicable to minimise the potential ecological impacts of the Project:

6.7.1 Design phase

Measures to be developed and implemented during the design include:

Vegetation clearing and earthworks

- Maximise the width of the buffer between the railway lines and associated earthworks and *Cycas ophiolitica* and *Eucalyptus raveretiana* (Black ironbox).
- Where railway lines cross Elizabeth and Willy Creeks explore opportunities to use bridges rather than culverts to minimise the clearing of riparian vegetation and minimise disruption to the creek channel.

- Minimise rail corridor footprint through innovative design techniques to limit disturbance to vegetation and waterways, where possible.
- Where possible, minimise the disturbance to marine plants within the Plane Creek area and wetland vegetation in order to retain their ecological value and their buffering abilities.

Conservation and protection measures

- Utilise a high flow bypass channel across previously cleared land rather than straightening Elizabeth Creek.
- Locate the locomotive turnaround facility to avoid the significant wetland (Site K) and adjacent vegetation. Any works proposed within 1 km to the north or south of this area should be carefully considered due to the negative impacts that it will have on habitat values in this area.
- In consultation with the EPA and DNRW find opportunities for offsetting removal of the area of RE 8.12.12a and riparian vegetation along Elizabeth and Willy Creeks in the areas adjacent to the project area and remnant vegetation.
- Maximise and retain wildlife corridors within the project area – these are primarily the riparian zones associated with Plane Creek, Elizabeth Creek and Willy Creek. Limit the disturbance and reduced function of these corridors as these serve as the last viable wildlife corridors in the local area.
- Where practical include opportunities to widen the remaining riparian vegetation within the project area to a minimum of 20 m on each bank using pioneer species with dense canopies to close the edge (in order to minimise weed invasion and other edge effects).
- Design structures to minimise risk to fauna (ie prevent bird nesting and/or roosting).
- Design bridges to minimise impact on riparian zones.
- Where culverts must be installed rather than bridges, culverts shall be fitted with raised ledges (of 100 mm) on at least one side of the culvert; where multiple culverts are to be used set the invert level of the outer culverts so that they provide dry access for small ground dwelling fauna. Explore best practice fish friendly culvert design (ie culvert inverts).
- Adequate lighting shall be provided within culverts (eg skylights) where continuous crossings are longer than 30 m.
- Define areas to be rehabilitated and/or revegetated as part of the design to address loss of connectivity between existing habitat areas (ie improve wildlife corridor function).
- Additional lighting shall be designed in such a way that the structures and lights have a minimal impact on surrounding habitats and fauna (refer Chapter 14).

Pollution control systems

- Any fuel and chemical storage facilities should be designed in order to provide sufficient buffer zone and limited pathway to aquatic environments.
- Any waste storage facilities being incorporated into the design of the Project shall be located and designed in such a way that it will be protected from fauna.

Management system measures

- Prepare a Construction Environment Management Plan (EMP(C)) supported by drawings showing spatially where the various management measures are to be implemented.

6.7.2 Construction phase

Measures to be developed and implemented during construction include:

Vegetation clearing and earthworks

- Install erosion and sediment control measures, prior to construction.
- Ensure dust suppression mechanisms are in place throughout the construction period.

- Minimise clearance of remnant vegetation to that necessary for construction. Ensure all necessary permits and approvals are in place prior to commencing such works.
- Minimise disturbance to riparian and instream vegetation to prevent bank erosion and excess sedimentation.
- No filling, draining or alteration of any waterway is to occur unless absolutely necessary for construction. Ensure all necessary permits and approvals are in place prior to commencing such works.
- There shall be no additional clearing of native vegetation to accommodate temporary facilities such as site offices, stockpiles and plant and equipment storage.
- Where practical access tracks will be constructed clear of waterways.
- Mulching of cleared vegetation should occur as soon as practicable after clearing to avoid resident fauna populations moving into the stockpiles of felled trees. If stockpiles are not mulched immediately after clearing, it is recommended that a spotter/catcher be present whilst plant machinery disturbs the stockpile prior to mulching to attempt to move any fauna that may be within the stockpile prior to mulching.
- Culverts and other infrastructure should be installed so that they do not impede water and fauna movement within existing creeks and do not exacerbate scouring and sedimentation.

Conservation and protection measures

- If the *Cycas ophiolitica* and *Eucalyptus raveretiana* (Black ironbox) are to be retained collect seed from them for propagation and planting in suitable locations nearby to increase numbers and density to aid in their long term survival in the area (to be negotiated with the EPA).
- If the *Cycas ophiolitica* cannot be retained in their current location relocate them to another suitable area outside the project area (to be negotiated with the EPA).
- If the *Eucalyptus raveretiana* (Black ironbox) cannot be retained collect seed from them for propagation and planting in suitable locations outside the project area (to be negotiated with the EPA).
- Minimise operation of heavy equipment within the riparian zone or adjacent to waterways and ensure that construction vehicles and machinery remain on designated roadways.
- Disturbances within and around the wetland area shall be kept to a minimum, particularly during the summer migratory season.
- Protect and clearly define/mark all vegetation for retention which will be clearly communicated to work crews. Vegetation (trees) to be retained shall be protected by exclusion fences. Exact location should be verified on site in consultation with the Environmental Officer.
- Trees and stags containing hollows are to be marked prior to construction and are to be retained unless they present a significant risk to the health and safety of people and property.
- Where hollows are destroyed, bat and habitat boxes suitable for Sugar gliders should be obtained and be placed between 3 and 6 m from the ground for microbats, 4 to 8 m for Sugar gliders on the eastern, southern and western side of the tree.
- Bat boxes should be placed at the rate of 30 per ha of woodland/forest vegetation removed in Sites E, F and J in areas adjacent to the cleared areas. These should be clustered in groups of three or four (one per tree) within a radius of 10 to 15 m.
- Boxes suitable for Sugar gliders should be placed at the rate of 20 per ha of woodland/forest vegetation removed in Site E in areas adjacent to the cleared areas. Glider poles should not be used due to risk of electrocution.
- Implement a procedure if an injured animal is encountered.
- Hollow bearing trees and cleared vegetation may be used in rehabilitation and/or landscaping activities to improve habitat complexity.
- Hollow logs on the ground shall be kept intact and where possible moved to adjoining habitats.
- Exclude parking of vehicles, storage of plant and equipment and stockpiling from the drip zone of trees to be retained.
- Mulch cleared vegetation for reuse in any revegetation works where possible. Do not include seeds and other propagules of environmental and declared weeds.

- Stabilise disturbed areas of soil either by grass seeding or replanting with endemic vegetation (where possible) as soon as practical, to minimise soil erosion and downstream sedimentation.
- Ensure dust suppression measures are implemented throughout the construction process to minimise damage to adjacent REs, significant non remnant vegetation and significant species.
- Revegetate the entrances to culverts to enhance their potential for use as fauna underpasses.

Pollution control systems

- Fuel and chemical storage facilities should be designed in order to provide sufficient buffer zone and limited pathway to aquatic environments.

Management system measures

- Ensure an appropriately qualified Environmental Officer is present on the construction site at all times during construction to address any environmental issues in a timely manner.
- Prepare and implement a Weed Management Sub Plan (including wash down for vehicles prior to entering the project area) to prevent the introduction of additional weed species and the further spread of existing species within the project area. This should operate throughout the construction and maintenance period.
- Prepare and implement an Erosion and Sediment Control Plan to minimise the sedimentation from the project area downstream of Plane, Elizabeth and Willy Creeks.
- Prepare and implement an Erosion and Sediment Control Plan in order to protect all waterways within the project area from reduced water quality as a result of increased sediment and nutrient loads. This is particularly important due to the sensitivity of the downstream environment (Sarina Inlet and Llewellyn Bay and ultimately the Great Barrier Reef).
- Prepare and implement a Dust Monitoring Programme and Water Quality Monitoring Programme (eg visual observation) within the vicinity of the three creeks and their downstream environs and ensure it commences prior to construction works.
- Prepare and implement bushfire management measures (as part of site emergency procedures) to minimise damage to adjacent regional ecosystems, wetland and riparian vegetation.
- Implement a revegetation/rehabilitation plan for the area.
- Prepare and implement a Fauna Management Sub Plan which shall include but not be limited to the following:
 - An EPA certified spotter/catcher must be engaged for the length of clearing works, clearing must not commence until a spotter/catcher has inspected the area and given approval for works to commence.
 - All native fauna is protected, including snakes and any fauna that is discovered onsite must not be harmed, a spotter/catcher will relocate fauna to similar habitat within the area. If the animal is in an area where works are to occur, work must cease until a certified spotter/catcher or EPA representative has removed the animal.
 - Inspection of the area to identify any hollow bearing trees. Trees with significant hollows (ie with a diameter of 10 cm or greater) than will be checked and where necessary relocated or replaced at a 1:1 ratio.
 - Provisions shall be made for tree hollows to be removed from habitat trees and retained to be reattached to other suitable trees outside of the project area. A cherry picker should be used when removing the hollows so that they can be lowered safely to the ground before the tree is felled to avoid any animals being injured.
 - The replacement of any hollows knocked down or damaged during clearing shall be employed (ratio will depend on existing density and consultation with the EPA). Hollows that have been removed from habitat trees should be reattached to a tree of the same species facing in the same aspect, by the spotter/catcher preferably within the same day of the hollow being removed so that the animal inside does not need to be re-located without a hollow.

- Inspect trenches, culverts and other structures daily to ensure that no fauna species are trapped or injured due to site works.
 - Install trench ramps at 15 degree slope every 30 m or place branches or suitable material for fauna to climb and escape from trenches.
- Prepare and implement a Pest Management Sub Plan which shall include but not be limited to the following:
 - During construction, sighting of declared species to be reported to relevant officer in DNRW and further management steps to be advised by government department and/or Sarina Shire Council.
 - Contractors shall not willingly introduce declared pest species as listed under the LP Act.
 - Implement waste management measures to avoid increased numbers of introduced animals and opportunistic native fauna in the project area and adjacent areas during construction activities.
 - Imported material to be checked. No biotic or abiotic contamination is to enter the construction site.
- Prepare and implement a Hazardous Materials Management Sub Plan that includes procedures that will assist in the avoidance of material spills and ensure prompt clean up of any that occur.

6.7.3 Permits and approvals

At the time of compiling this EIS, QR does not have any existing approvals or permits for the preliminary works or construction works for the Project.

A marine plant removal permit will need to be obtained under the *Fisheries Act 1994* to remove approximately 0.2 ha of marine plants within the Plane Creek area.

Figure 6.9 illustrates the extent of the marine plants within proximity to the project area.

An EPBC Referral was submitted to Department of the Environment and Water Resources (DEW) in March 2007, whereby the delegate for the Commonwealth Minister for the Environment and Heritage decided the Project did not constitute a controlled action pursuant to the EPBC Act on 10 April 2007.

If the final project alignment does not significantly differ from the initial alignment provided as part of the EPBC Referral and following discussions with DEW, an additional EPBC Referral will not be required.

The *Nature Conservation Act 1992* provides for interim conservation orders to conserve, protect or manage wildlife, habitat or areas subject to a threatening process likely to have significant detrimental effect.

A water licence will need to be obtained through DNRW under the *Water Act 2000*. Specifically, Section 206 – Applying for a Water Licence, whereby the applicant intends to (b) interfere with the flow of water on, under or adjoining any of the land.

A Stream Diversion Permit, under the *Water Act 2000* may be required for redirecting part of Elizabeth Creek.

Construction of a bridge or culvert within Elizabeth and Willy Creeks may require a waterway barrier works approval. Construction or raising of a waterway barrier is classed as operational works under the IP Act and requires a development approval. Development approvals will also require assessment under the *Fisheries Act 1999* by DPIF. The other key agencies that assess dams, weirs and other waterway barrier works are the DNRW and the EPA.

Tidal works approval may be required if works occur within the Plane Creek Coastal Management District.

A Vegetation Clearing Permit will be required to clear remnant vegetation. Section 6.3 details the specific extent and locations of the areas to be cleared.

A Riverine Protection Permit (RPP) will be required for works within Plane, Elizabeth and Willy Creeks, under the *Water Act 2000* through DNRW. However, under Sections 49-51 of the *Water Regulation 2002* particular activities are permitted (ie do not require a RPP) if they are undertaken in accordance with the Guideline – Activities in a watercourse, lake or spring and carried out by an entity. Under this legislation QR are an 'entity' where they are required to undertake an assessment which addresses this guideline.

Further details on the legislative requirements of the Project are contained in Section 4.11.

6.7.4 Operational phase

The following mitigation measures will be implemented during the operational phase of this Project:

Vegetation clearing and earthworks

- Maintenance works are carried out within designated areas and/or offsite. This should be an area that is currently cleared within the project area.
- Any new access tracks shall be constructed clear of waterways wherever possible.

Conservation and protection measures

- Maintenance contractors are to remain on designated tracks and shall not disturb surrounding vegetation.
- Exclude parking of vehicles, storage of plant and equipment and stockpiling from the drip zone of trees to be retained. These activities should be confined to currently cleared areas only.
- All native fauna is protected and shall not be intentionally harmed as a result of workers or workers actions.

Pollution control systems

- Ensure any chemicals used on the project area are properly contained and disposed of to prevent soil contamination and subsequent damage to native vegetation

Management system measures

- Traffic should be restricted to constructed access tracks.
- Prepare and implement a Weed Management Sub Plan for the project area. Ensure herbicides are applied judiciously to avoid damaging non target flora and vegetation (consider the use of steam weeding technology rather than applying herbicides).
- Prepare and implement a Pest Management Sub Plan. Discourage the feeding of wildlife by personnel throughout the project area.
- Prepare and implement an Emergency Response Plan to address the risk and management of operational activities in relation to fire risks.

6.8 Conclusions

Vegetation types identified within and adjacent to the project area were open forest and woodlands, semi-deciduous motophyll/mesophyll vine forest, mangrove forest and saltmarsh/saltpan communities and freshwater wetland communities. Historic land use activities (growing sugar cane, cattle grazing and infrastructure development) and linear disturbances (roads and rail) within and adjacent to the project area have resulted in fragmentation of the native vegetation and disrupted the ecological processes within the area.

The construction of the rail infrastructure and associated road works will result in the removal of approximately 10.1 ha of terrestrial vegetation and 0.2 ha of marine plants.

While 10.3 ha of native vegetation will be cleared for the Project, this is mitigated by:

- Supplementary planing which may be possible along the remaining riparian vegetation along Elizabeth and Willy Creeks.
- Avoiding areas which may contain rare and threatened flora.

The impacts to native fauna are the severing of two corridors, removal of habitat and increased edge effects. Some fauna species will be forced to relocated and compete for resources in the surrounding areas.

The implementation of mitigation and management measures during the construction and operation of the rail infrastructure will ensure that potential impacts to terrestrial and aquatic flora and fauna within the area is minimised.