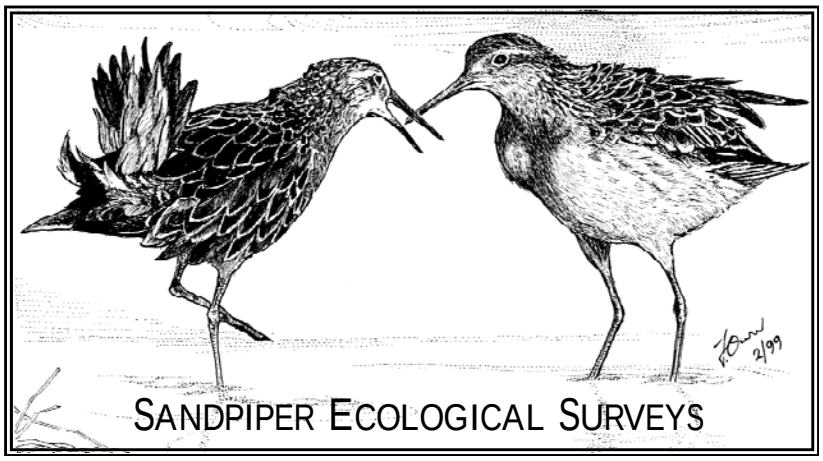
QGC QUEENSLAND CURTIS LNG PROJECT, CURTIS ISLAND

~ SUPPLEMENTARY TARGETED BIRD SURVEY ~

10 MARCH 2009



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1. INTRODUCTION

1.1 Background

Sandpiper Ecological Surveys and Wildsearch Environmental Services were contracted by ERM Australia to conduct supplementary bird surveys for the proposed QGC Liquefied Natural Gas (LNG) facility at Gladstone, Queensland. These surveys compliment the comprehensive bird surveys conducted in spring 2008 (Sandpiper Ecological Surveys and Wildsearch Environmental Services 2008). The supplementary surveys focused on three components of the LNG proposal:

1. The proposed road and pipeline corridors. The island section of these corridors extends from 'Hamilton Point' to Laird Point where they cross Port Curtis to the mainland. On the mainland the pipeline extends to the south west whilst the road follows the shoreline south towards Gladstone.

2. Proposed dredge spoil dump sites to the north and south of the LNG facility; and

3. The extended LNG facility boundary. The extended boundary encompasses an additional 76ha of Dry Open Forest on the northern and eastern sides of the original boundary.

Some data gathered during the previous comprehensive bird surveys has been included in this report to provide contextual information. The objectives of the survey were to:

- Determine the species richness of birds within the subject site and assess the type and quality of bird habitat.

- Determine if the site is utilised or contains suitable habitat for threatened birds listed on the Queensland *Nature Conservation Act 1992* (NC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- Provide advice on the impact of the proposal on birds.

- Provide recommendations to mitigate impacts on birds.

1.2 Subject Site and Study Area

The subject site included the terrestrial and immediately adjacent intertidal habitat within the proposed road and pipeline corridors, dredge spoil sites and the extended LNG facility (Figure 1b and 2b). The study area included all habitats within 500m of the subject site. Whilst most survey effort was concentrated in the subject site, sampling within the broader study area was undertaken to ensure comprehensive survey coverage. The boundary of the subject site and centerline of road and pipeline corridors was determined by down-loading grid coordinates into hand held GPS units (Garmin GPS76), which were used during field surveys.

2. METHODS

2.1 Collation of background data

The following databases were searched to obtain records of avifauna, with potential to occur within the study area and the locality (i.e. within a 10km radius of the study area):

- Commonwealth Department of the Environment Water Heritage and the Arts (DEWHA) online protected matters database; and

- Queensland Environmental Protection Agency (EPA) Wildlife Online and Regional Ecosystems (RE) databases.

The Schedules of threatened fauna listed under the NC Act and EPBC Act were also searched to identify other threatened bird species that may occur within the subject site.

2.2 Site Perusal and Survey Design

Prior to the commencement of the field survey, aerial photographs and Regional Ecosystem (RE) maps were perused to identify major fauna habitats. A foot-based traverse of the subject site was not required as the survey team already had a basic understanding of habitats from the previous survey. Sample sites were allocated to each RE and habitat type. Where possible, to ensure that sample sites did not overlap, sites within a habitat or ecosystem were a minimum of 400m apart. In some cases sample sites were closer, although this does not affect the results due to the qualitative nature of the survey. Field surveys were conducted over 10 days, from 26 to 28 January and 16 to 22 February 2009.

2.3 Bird Surveys

2.3.1 Fauna Features Traverse

The subject site and study area were traversed on foot during each day of the survey. Surveys were undertaken by two staff and included a combination of random meander traverses to search for fauna features and targeted searches for threatened species. Targeted searches focused on roads, ridgelines and intertidal habitat. Traverses of roads and shoreline were conducted on foot and by bicycle (Figure 3a).

2.3.2 Area Searches

Thirty-two 2ha plots were sampled throughout the study area with replicate plots situated in each of the major vegetated habitats (Figure 3b; Table A1, Appendix A). Six plots were sampled on two occasions and the remaining plots were sampled once only. Twenty minutes was spent recording bird species during each survey. All area-searches were conducted between 0530hrs and 1030hrs. Data were recorded on a standard bird survey proforma.

2.3.3 General Species List

Birds within the dredge spoil dump sites were sampled opportunistically during a random meander and habitat assessment. During these surveys all potential bird habitats were sampled and a general bird species list for each was developed.

2.3.4 High and Low Tide Surveys

Intertidal habitat was sampled during high and low tide to assess use of the site by estuarine birds, particularly shorebirds (Order Charadriiformes). Targeted high tide surveys were conducted on four occasions, two spring tides (26 & 27.1.09) and two neap tides (19 & 20.2.09) with opportunistic surveys conducted on two other occasions. One low tide survey was conducted during a spring tide cycle (27.1.09). The time of high and low tide was determined through visual observation of water level on-site and with reference to National Tidal Centre tide predictions and local tide variations.

Six sites were sampled at high tide, with repeated effort focused on known and potential roosting habitat near the mainland road corridor and the bridge (Figure 3a). Roosts were sampled by two

observers during the two-hour period surrounding high tide. During each survey all species were identified and the number of individuals counted. Care was taken to avoid double counting and if birds were flushed during the survey their direction of flight was noted. Low tide surveys occurred in the vicinity of the mainland access road corridor and in dredge spoil dump sites (Figure 3a). The number of species and individuals on each intertidal area was recorded.

2.3.5 Call Broadcast

Nocturnal call broadcast (or playback) was conducted by two personnel on five nights between 1915 and 2130hrs at five sites (Figure 3b). The early evening time period was selected to maximise the opportunity of detecting owls that were roosting on or in close proximity of the site. Calls of five species, Eastern Barn Owl (Tyto javanica), Masked Owl (Tyto novaehollandiae), Barking Owl (Ninox connivens), Powerful Owl (Ninox strenua) and Bush Stone-Curlew (Burhinus grallarius) were broadcast at all sites unless a species was detected during the preceding dusk census (refer to section 2.3.5). Calls were broadcast for five minutes with a 3-5 minute gap between calls. Ten minutes was spent listening for calls prior to and after broadcast and a brief spotlight survey of the playback site was conducted at the completion of the final 10 minute listening period. Call broadcast was conducted at one additional site on the mainland; however this has not been included as the weather conditions were unsuitable.

2.3.6 Dusk Census

Dusk surveys were conducted at six sites (Figure 3b), although one site has been discounted due to poor weather. Surveys were conducted by two observers for between 30 and 60 minutes with all surveys undertaken between 1800 and 1915hrs. During the census all species and, if possible, the number of individuals calling or sighted were recorded.

2.3.7 Chat Survey

Surveys of potential Yellow Chat (Epthianura crocea) habitat were conducted by two observers at two sites with each site sampled once only. Saltmarsh and other shoreline habitats that had some potential to support Chats were quietly traversed on foot by two staff (Figure 3a). During each traverse the shoreline was scanned using binoculars for any fauna.

2.3.8 Habitat Assessment

Habitat was assessed within a 25m by 25m quadrant at 40 sites. A standard habitat assessment proforma was used to collect information on fauna habitat features, including, Disturbance History, Vegetation Structure and Floristics, Density of Arboreal Hollows, Foraging Resources and Ground Layer Attributes.

2.3.9 Threatened Species Targeted

Bird species listed on the Queensland NC Act and/or the Commonwealth EPBC Act were targeted. These species included: Red Goshawk (Erythrotriorchis radiatus) (Endangered), Yellow Chat (Endangered), Beach Stone-curlew (Esacus magnirostris*)* (Vulnerable), Black-breasted Button-quail (Turnix melanogaster) (Vulnerable), Black-throated Finch (Poephila cincta cincta) (Vulnerable), Powerful Owl (Vulnerable), Squatter Pigeon (Geophaps scripta scripta) (Vulnerable), Grey Goshawk (Accipter novaehollandiae) (Rare), Square-tailed Kite (Lophoictinia isura) (Rare), Painted Honeyeater (Grantiella picta) (Rare), Black-chinned Honeyeater (Melithreptus gularis) (Rare), Turquoise Parrot (Neophema pulchella) (Rare), Eastern Curlew (Numenius madagascariensis) (Rare) and Lewin's Rail (Rallus pectoralis) (Rare).

A summary of the survey effort is provided in Table 1 and Table A1, Appendix A and the techniques used to target threatened species are summarised in Table 2.

Table 1: Survey effort expended sampling birds for the proposed QGC Liquefied Natural Gas Facility, Gladstone in January and February 2009.

Date	Person Hours	Tasks
26.1.09	18	2ha search, habitat assessment, shorebird survey, dusk census, call playback
27.1.09	19	2ha search, habitat assessment, shorebird survey, chat survey, dusk census, fauna features traverse
28.1.09	16	2ha search, habitat assessment, chat survey, fauna features traverse
16.2.09	18	Habitat assessment, fauna features traverse, opportunistic survey
17.2.09	17	2ha survey, habitat assessment, fauna features traverse, dusk census, call playback.
18.2.09	10	Fauna features traverse, dusk census, shorebird survey, call playback.
19.2.09	19	2ha search, shorebird survey, habitat assessment, duck census, call playback.
20.2.09	14	Opportunistic survey, fauna features traverse, dusk census, call playback.
21.2.09	14	Shorebird survey, dusk census, 2ha search, call playback, habitat assessment.
22.2.09	14	Fauna features traverse, dusk census, habitat assessment, call playback.

Table 2: Targeted survey techniques employed for threatened species

Species	Area Search	Call Broadcast	Waterhole Watches	Chat and Shorebird Survey	Dusk Census	Habitat Traverse	Owl Roost Search
Red Goshawk	X				X	X	
Grey Goshawk	X				X	X	
Square-tailed Kite	X					X	
Yellow Chat				X		X	
Beach Stone-curlew	X			X		X	
Eastern Curlew				X		X	
Black-breasted Button-quail	X					X	
Black-throated Finch	X		X			X	
Glossy Black-Cockatoo	X		X			X	
Powerful Owl		X			X	X	X
Squatter Pigeon	X		X			X	
Painted Honeyeater	X					X	
Black-chinned Honeyeater	X					X	
Turquoise Parrot	X		X			X	
Lewin's Rail						X	

2.4 Butterflies

Butterflies were recorded opportunistically whilst conducting morning bird surveys and habitat assessments. Particular attention was paid to recording butterflies around flowers in mangrove and woodland habitats where species listed on the NC Act and/or the EPBC Act were most likely to occur.

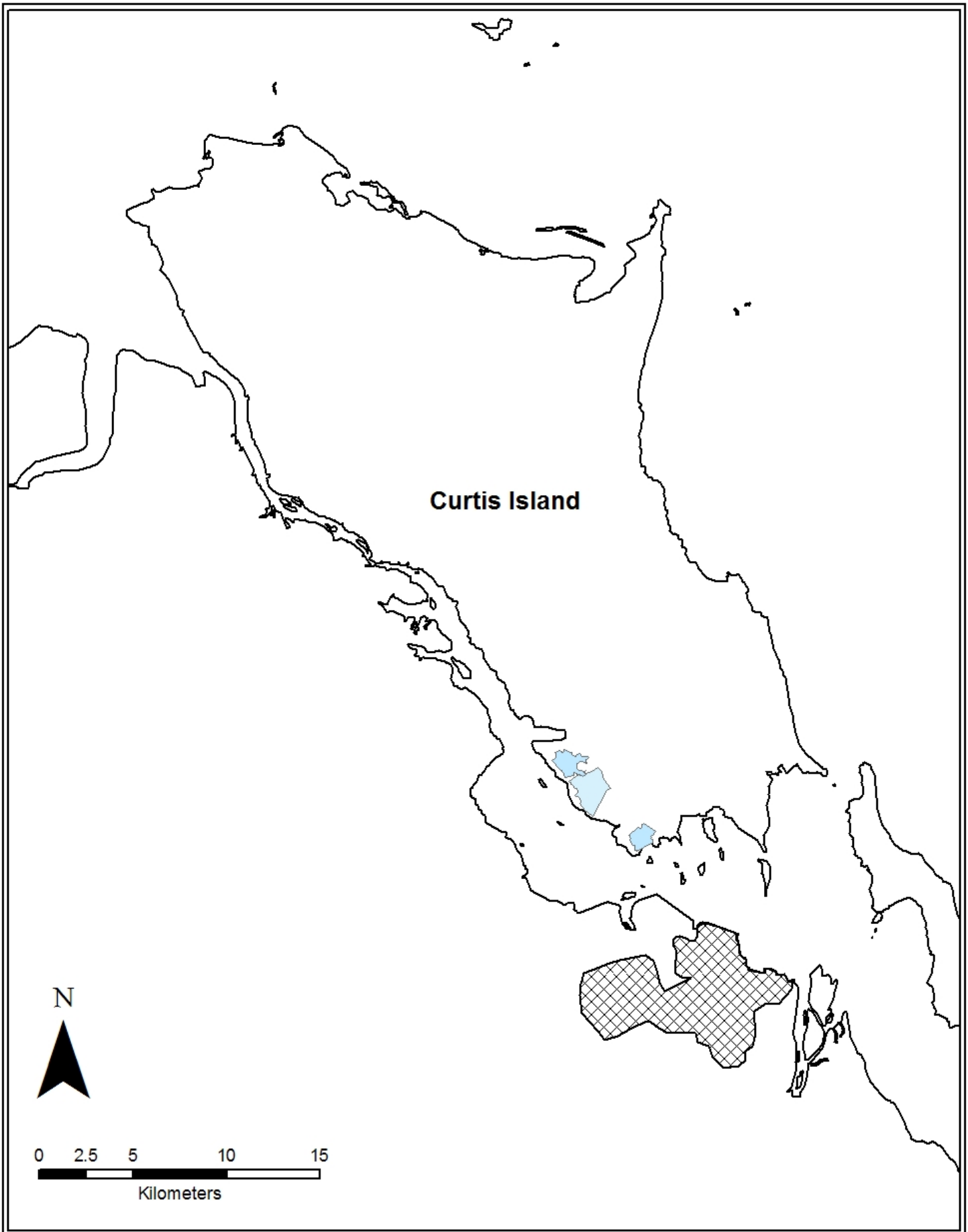

Figure 1b:
Location
Curtis Island Study Area
March 2009

Legend

- dredge_spoil
- Revised_Site_Boundary_Feb09
- Gladstone

Sources: Geoscience Australia
GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services

Figure 2b:
LNG Proposal: Curtis Island Regional Ecosystems March 2009

Legend

- Access Road
- Pipeline_Route
- dredge_spoil
- Revised_Site_Boundary_Feb09

calliope_re03

- <all other values>

VM_POLY

- E-dom
- E-subdom
- NotOfC
- O-dom
- O-subdom
- non-rem

N

0 0.4 0.8 1.6 2.4

Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services. March 2009

3. RESULTS

3.1 Weather Conditions

Weather conditions were variable. Surveys in late January were affected by rain and strong afternoon winds which made conditions unsuitable for dusk census and playback. Rain occurred on the mornings of 17 and 18 February causing dawn surveys on 18 February to be abandoned. Otherwise warm and humid conditions with light or no wind prevailed (Table A2, Appendix A).

3.2 Survey Effort

A total of 159 person hours was spent sampling birds within the subject site during the supplementary surveys (Table 1), with an additional 34 person hours spent traveling to and from the site, during which opportunistic fauna sightings were recorded.

3.3 Limitations

The survey was conducted during reasonable weather conditions. Although rain and wind hampered some surveys these were repeated during better conditions thereby ensuring that all sites were surveyed adequately. There was minimal blossom during the survey which possibly reduced the abundance of nectivorous birds. The survey was conducted during a period when there was abundant fresh water enabling some comparison to surveys in spring 2008 when freshwater was limited to isolated wetlands. The results suggest that the bird community recorded in spring was not affected by the availability of water.

A better indication of species richness could be obtained by incorporating greater temporal variation into the survey. Sampling in different seasons and environmental conditions would be ideal to fully document bird species diversity. Nonetheless, surveys have been conducted during both spring and summer providing some indication of temporal variability in the bird community. The level of survey effort and the attention focused on assessing bird habitat has been satisfactory to obtain a good idea of species richness and to assess the likelihood of occurrence of threatened species.

3.4 Species Richness

A combined total of 140 bird species was recorded during the 2008 and 2009 surveys. Of the ninety-six species recorded during the 2008 survey 13 were not recorded during the 2009 surveys. A total of 125 species were recorded during the 2009 surveys including 34 additional species not recorded during the 2008 survey (Table A3, Appendix A). The majority of these additional species reflect the greater habitat diversity sampled (i.e. areas of vine thicket were included) and the more extensive mudflats and other estuarine habitats present on the mainland that supported a greater diversity of migratory shorebirds.

Bird species richness within the subject site is regarded as typical given the floristic and structural diversity of habitats on the subject site and the distribution of flowering and fruiting plants. The bird community was dominated by medium to large species that are common in woodland and degraded forests in the South East Queensland Bioregion, and can therefore be considered typical of this habitat.

3.4.1 Diurnal Birds

The diurnal species recorded were typical of a summer survey. In 2009 species diversity and abundance were highest in the Endangered RE 12.3.3 / 12.3.7 - Queensland Blue Gum (*Eucalyptus tereticornis*) – Grey Ironbark (*Eucalyptus crebra*) (59 species) and in the RE 12.11.6,

- Lemon-scented Gum (*Corymbia citriodora*) / Grey Ironbark (*Eucalyptus crebra*) / Queensland Peppermint (*Eucalyptus exerta)* (71 species). Bird species diversity in the saltmarsh / claypan and mangrove communities (RE's – 12.1.2 and 12.1.3) was relatively low, 30 and 39 species respectively (Table A3, Appendix A). Despite the limited extent of the semi-evergreen vine thickets (Re 12.11.4) 35 species were recorded. Many of which were more or less dependent upon this habitat type, i.e. Superb Fruit-dove.

The most frequently recorded species were: Rainbow Lorikeet (25 sites), Noisy Friarbird (21), Australian Magpie (22), Pheasant Coucal (20), Rainbow Bee-eater (20), Laughing Kookaburra (17), Striated Pardalote (15), White-naped Honeyeater (15) and Spangled Drongo (12). The majority of these are insectivorous or generalist species found in a wide range of habitats across Australia.

In 2009, the mainland mangrove habitats and associated estuarine wetlands were notable for their higher bird activity and abundance when compared with similar habitats on Curtis Island. Mangrove Honeyeaters, Collared Kingfisher, Mangrove Gerygone and Shining Flycatchers were frequently encountered on the mainland but were relatively rare in similar habitat on Curtis Island.

Noisy and Little Friarbird, White-naped and White-throated Honeyeater and Blue-faced Honeyeaters were relatively common, particularly in the Queensland Blue Gum forest and woodlands where the Queensland Blue Gums, Queensland Peppermint and Grey Ironbarks were flowering. During the 2008 surveys honeyeater numbers were relatively high on the island but declined significantly once flowering had reduced. In January 2009 large numbers of Little Friarbirds, Noisy Friarbirds and Blue-faced Honeyeaters, together with lorikeets, were observed along the mainland road corridor. These numbers had reduced noticeably by the February 2009 survey. White-throated Honeyeaters were observed feeding on nectar and insects in the scattered *Melaleuca* found at the forest margins and on alluvial flats adjacent to creeklines.

Seasonal migrants, such as the Forest Kingfisher and Leaden Flycatcher were common, particularly in the Queensland Blue Gum woodland / open forest and the Lemon-scented Gum / Grey Ironbark open forest. In 2008 and 2009 numerous breeding pairs were observed. Forest Kingfishers were frequently encountered excavating nest hollows in the numerous arboreal termitaria. These termitaria were also used by Laughing Kookaburras. The mangrove habitats of the mainland, and to a lesser extent those of Curtis Island, supported a number of Collared Kingfisher. Preferred habitats were typified by large old-age mangroves or extensive stands of mangroves. Birds were also observed foraging in relatively open mangrove / mudflat habitats adjacent to these dense stands. The Laughing Kookaburra was common and breeding pairs were regularly encountered. Laughing Kookaburras were recorded at 17 of the 32 two-hectare survey plots. Blue-winged Kookaburra were less common and were usually observed in small family groups and appeared to favour the Queensland Blue Gum forests and woodlands.

Other than nocturnal birds, raptors were rare. The Eastern Osprey, White-bellied Sea-eagle and Brahminy Kite were observed patrolling the shorelines of the study area. A number of stick nests were recorded. Some of these may have been raptor nests. The Pacific Baza was observed on a number of occasions. Seasonal changes in small passerine numbers may influence and limit the number of forest-dependent raptors found in study area.

As for the 2008 survey, small passerines such as thornbills, fairy-wrens and finches were rare. Red-backed Fairy-wrens were recorded at eight of the two-hectare survey plots. These were generally recorded from areas of dense Sida (*Sida* spp.), *Acacia* thickets and grasses on alluvial flats adjacent to creeks and other drainage lines. Small parties of Silvereye and Fairy Gerygone were observed in and adjacent to the small semi-evergreen vine thickets in the southern parts of the southern dredge spoil dump site. No thornbills were recorded and only one Weebill was recorded. Double-barred Finches were recorded at two locations.

Squatter Pigeons were observed at four locations on the mainland but were not observed on Curtis Island. All of the mainland observations were within 150m of a dam or creekline containing permanent fresh water. A number of immature birds were observed. Squatter Pigeons were not recorded on Curtis Island. The Curtis Island study area was grazed by cattle and wild horses and in 2008 permanent freshwater was scarce. During dry times, this significantly reduced the quality and extent of the grassy habitats on the island. By way of contrast, the mainland study area was lightly grazed and contained a number of dams or other supplies of permanent freshwater.

The small remnant patches of semi-evergreen vine thickets in the south western parts of the southern dredge spoil dump supported a small number of Superb and Rose-crowned Fruit-doves. These species were observed feeding on the fruits of several rainforest shrubs. Larger vine thickets and vine forest occur immediately to the north of Graham's Creek and could provide a more consistent food resources when compared with similar vegetation types within the study area.

The large cuckoos including the Eastern Koel, Channel-billed Cuckoo and Pheasant Coucal were common in all habitats other than the saltpan and mangrove shrublands. In 2009 the Pheasant Coucal was observed at 20 of the 32 two-hectare survey plots. In 2008 Channel-billed Cuckoos were observed on a number of occasions taking eggs from Noisy Friarbird and Australian Magpie nests. The Brush Cuckoo and Horsfield's Bronze-cuckoo were also recorded in low numbers.

On the 16.2.2009 a large mixed flock of Fork-tailed Swift and White-throated Needletail was observed over the southern dredge spoil dump. At least one Australian Swiftlet was also observed within this flock. This observation was well outside the normal distribution of this species but is not without precedent as these birds have been recorded on an irregular basis as far south as northern NSW (Pizzey & Knight 2007, D. Charley pers obs).

The freshwater dams adjacent to the southern sections of the mainland road route supported a diversity of birds not found elsewhere in the study area. Small parties of Magpie Geese, Wandering Whistling Duck, together with a Brolga, Purple Swamphen and Pacific Black Duck were recorded. The Pacific Black Duck was also recorded in the Curtis Island study area.

Parrots and cockatoos were relatively uncommon in the study area. Rainbow Lorikeets and Scaly-breasted Lorikeets were recorded throughout the study area and were often the most abundant species. Numbers were highest in those areas where Queensland Peppermint and Queensland Blue Gum were flowering. Nesting pairs were observed on a number of occasions, particularly in Queensland Blue Gum woodland / open forest and the Lemon-scented Gum / Grey Ironbark open forest. In 2008, these species were most abundant during the first week of the survey when the Queensland Blue Gum and Grey Ironbark were in flower. Pairs were recorded nesting in branch hollows of Queensland Blue Gum and occasionally Lemon-scented Gum. Their numbers decreased substantially once flowering declined. Little Lorikeets were less common and were recorded infrequently during the 2009 survey.

The Pale-headed Rosella was more commonly encountered during the 2009 surveys than in 2008. Pairs were observed nesting in Queensland Blue Gums on the mainland. A pair of Red-winged Parrots was also observed nesting in a large Queensland Blue Gum within the mainland road easement. The Galah was recorded flying over the area on a number of occasions. Small family groups of Red-tailed Black-cockatoo were observed at four 2ha sites and opportunistically on a number of other occasions. They were observed coming in to drink at a small dam near the site compound on Hamilton Point.

During the 2008 survey Red-backed Button-quail were frequently encountered, particularly under thickets of dense *Acacia* or *Sida* shrubs. Evidence of this species occurring in the study area was not conspicuous during the 2009 surveys. Despite intensive searches very few foraging scrapes were found and only two confirmed sighting of this species were recorded: one on the mainland

and one from an area of Saltmarsh in North China Bay. Painted Button-quail were not recorded in 2009.

No introduced bird species were recorded.

3.4.2 Nocturnal birds

Nocturnal birds appear to be at very high densities within the study area. Seven species of nocturnal bird were recorded, including Barking Owl, Powerful Owl, Eastern Barn Owl, Southern Boobook, White-throated Nightjar, Australian Owlet-nightjar and the Bush Stone-curlew (Figure 4b, Table A3, Appendix A).

The results of this and the 2008 survey suggest that there is at least seven pairs of Barking Owl, one resident pair of Powerful Owl and a number of Southern Boobook pairs within the study area. The Barking Owl was recorded at five locations in 2009 including pairs at three roost sites. These were in addition to the five locations, including a nest site and three roosts, located during the 2008 survey (Figure 4b). The Barking Owl and Southern Boobook were relatively abundant and were recorded in a majority of the major vegetation types (RE's) of the subject site (Figure 4b). Both species were often recorded by unsolicited calls or located during foot traverses of the site.

During the 2009 surveys the Barking Owl was initially recorded opportunistically during diurnal bird surveys, when a bird was disturbed from a roost in mangroves near Hamilton Point in the south western parts of the southern dredge spoil dump (Figure 4b). Another pair together with a juvenile was observed roosting in relatively dense vegetation adjacent to a small dam and creekline on the northern edge of North China Bay (Nocturnal Call Playback Site 1 (Figure 4b). A third pair was observed roosting in the dense canopy of a Swamp Turpentine (*Lophostemon sauveolens*) in the far north eastern section of the pipeline route. A fourth pair was recorded roosting near the eastern end of the Quad Bike track. A pair responded to call broadcast at Nocturnal Call Playback Site 5 (Figure 4b) located in the centre of the northern dredge spoil dump site.

Three pairs of Barking Owl were recorded during the 2008 survey (Figure 4b). A nesting pair was located at the western edge of the proposed LNG plant site (Figure 4b). A pair was also found at a roost in dense Stilt-rooted Mangroves (*Rhizophora stylosa*) on the central western boundary of the subject site. This pair was roosting within the lower canopy of the mangroves approximately 1.6m – 1.8m above ground level. A third pair was recorded roosting in a relatively densely vegetated gully in the south-eastern parts of the subject site. This roost may have been in one of a number of large dead trees found in this area. A large number of crown feathers from a Barking Owl were also found on a ridgeline on the south-western boundary of the site.

Observations made elsewhere in Australia suggest that Barking Owls maintain and defend a small territory around the nest site of <200ha, and often as small as 30ha (Higgins 1999), but will forage up to 5km from the roost site (Higgins 1999). Hollands, in Higgins (1999) reported that near Gin Gin (Central Queensland) pairs were located between 6 and 10 kms apart. More recently M. Stanton (pers comm. 2008) found that in the Piliga Scrub in northern NSW radio-tagged Barking Owls utilized foraging areas of approximately 2000ha.

A single Powerful Owl responded to call broadcast. An adult male was observed at close quarters after it responded to calls broadcast from a location at the eastern edge of the study site (Nocturnal Call Playback Site 4) (Figure 4b). It was observed within three minutes of the calls being broadcast and appeared to have come from a location close to the broadcast site. This observation is consistent with the results obtained during the 2008 surveys when a response to call broadcast was recorded from the same area. During the 2008 survey a number of Sugar Glider (*Petaurus breviceps*) tails (three) were found during fauna feature traverses of the proposed LNG plant site. The tails of this prey-species are typically removed by Powerful Owls following capture and their occurrence suggests that the Powerful Owl forages widely across the

subject site. However, Barking Owls are also known to take Sugar Gliders and these prey remains may be the result of predation by Barking Owl rather than Powerful Owl. The authors are unsure whether or not Barking Owls remove the tails of gliders in the same manner as the Powerful Owl.

The Southern Boobook was widespread throughout the study area with a minimum of four pairs calling each night. They appeared to use all habitat types and moved rapidly from their roost once it was dark. These results were consistent with those obtained during 2008.

The Bush Stone-curlew was recorded at a number of sites. Two pairs responded to call playback at Nocturnal Call Playback Site 1 adjacent to the extensive mudflats of North China Bay and a pair was flushed from woodland habitat on the eastern side of the southern dredge spoil dump (Figure 4b). These were in addition to the birds recorded during the 2008 survey when one bird was observed at 2ha Plot 20, four birds were recorded at nocturnal call broadcast site NCP1 and two birds at dusk census site DC2. During that survey this species was also recorded opportunistically during travel to and from the subject site. This species was not recorded on the mainland despite suitable habitat being present.

The White-throated Nightjar and Australian Owlet-nightjar were recorded at a number of nocturnal call broadcast locations (Figure 4b and Table A3 - Appendix A) and were also recorded opportunistically during foot traverses of the study area.

The Eastern Barn Owl was recorded at one location. One bird responded to calls broadcast from Nocturnal Call Playback Site 2 in the vicinity of Laird Point (Figure 4b). The Masked Owl was not recorded.

3.4.3 Estuarine birds

Six shorebird surveys were conducted on the mainland including three neap-tide surveys; one spring high tide survey; one low tide survey and one survey of the most northerly claypan which is bisected by the proposed pipeline easement (Figure 3b, Table A4 - Appendix A). Species diversity and abundance at these mainland sites was high. A total of 17 (estuarine) species was recorded (Table A3, Appendix A). These were: Bar-tailed Godwit, Whimbrel, Eastern Curlew, Common Greenshank, Grey-tailed Tattler, Terek Sandpiper, Great Knot, Red-necked Stint, Sharp-tailed Sandpiper, Pied Oystercatcher, Red-capped Plover, Pacific Golden Plover, Lesser Sand Plover, Beach Stone-curlew, Caspian Tern, Gull-billed Tern and Little Egret.

A total of 371 shorebirds comprising nine species was recorded during the low tide survey (27.1.2009); 309 shorebirds of 12 species were recorded during the high tide survey (26.1.2009); and 374 shorebirds (10 species) were recorded during the neap tide survey on 19 February 2009, 181 shorebirds (6 species) were recorded during the neap tide survey on 20 February 2009 and 118 shorebirds (6 species) during the neap tide survey of 27 January 2009.

Red-necked Stints dominated the low and high tide counts in the Claypan where 304 and 145 individuals were recorded. Red-necked Stints, Sharp-tailed Sandpipers and Pacific Golden Plovers were not recorded during the neap tide surveys. Whimbrel (299 minimum count), Bar-tailed Godwit (8-74 minimum count) and Eastern Curlew (15 – 56 minimum count) dominated the neap tide results. A majority of the shorebirds recorded at the mainland sites during the neap tide surveys were found at a roost on the southern shoreline near Friend Point (Figure 6b, Table A4 – Appendix A). During a spring high tide a majority of the shorebirds recorded were roosting and/or foraging on the extensive claypan situated between the proposed road corridor and pipeline corridor (Figure 6b, Table A4 – Appendix A). The proposed road corridor bisects spring and neap tide roosting habitat.

Shorebird populations within the Curtis Island study area were significantly lower than on the mainland and included: Bar-tailed Godwit, Whimbrel, Eastern Curlew, Pied Oystercatcher, Red-capped Plover, Beach Stone-curlew, Striated Heron, Masked Lapwing and Little Egret.

Small parties or individual Whimbrel and Eastern Curlew were observed foraging along the shoreline within the study area. Large numbers of Whimbrel (minimum high tide count of 173 individulas on 22 February 2009) and lesser numbers of Bar-tailed Godwit and Eastern Curlew (6 on 19 February 2009) were recorded roosting at Laird Point. Small groups of Red-capped Dotterel (maximum count of 6) and Crested Terns (maximum count of 31) were also recorded using the Laird Point roost.

A large number of Terek Sandpiper (105), 19 Grey-tailed Tattler and 35 Little Egret were recorded roosting in the mangroves and on a small sandspit at the southern end of South Passage Island (Figure 3b). The numbers occupying this roost suggest that this site is of some significance. Two Buff-banded Rails and 2 Striated Herons were also recorded at this site.

The Beach-stone Curlew was recorded at five locations; three mainland sites and two sites on Curtis Island (Figure 5b). Pairs with one fledgling were recorded at the south eastern edge of the southern dredge spoil dump site and also at the shorebird roost south of Friend Point on the mainland.

By way of comparison, high tide counts conducted in Spring 2008 at a roost site immediately to the west of South End on Curtis Island recorded a minimum of 1600 individuals of 16 species, including large flocks of Eastern Curlew, Whimbrel and Grey-tailed Tattler. Smaller flocks of Bar-tailed Godwit and Great Knot were also recorded.

3.5 Bird Habitat

Six broad bird habitats were recorded in the subject site (Figure 2b, Table A7a and A7b, Appendix A). These were; Mangrove shrubland (RE: 12.1.3 and 11.1.4); Claypan/Mudflat (RE: 12.1.2 and 11.1.2); Saltmarsh (RE: 12.1.2); Queensland Blue Gum (*Eucalyptus tereticornis*) woodland / open forest (RE: 12.3.3 / 12.11.14 / 12.3.7 / 12.3.11); Lemon-scented Gum (*Corymbia citriodora*) / Grey Ironbark (*Eucalyptus crebra*) open forest (RE: 12.11.6); and Semi-evergreen vine thicket (RE 12.11.4). The road corridor, particularly the mainland section, included substantial areas mapped as “non-remnant”. These areas consist of regrowth forest that satisfies the definition of both *Lemon-scented Gum / Grey Ironbark open forest* and *Queensland Blue Gum woodland open forest.*

The majority of habitats had been previously cleared or significantly disturbed. Previous land uses include cropping, dairy, grazing and horticultural activities. The structure and development of the vegetation reflects these previous land uses. Habitat characteristics are summarised in Tables A7a and A7b, Appendix A.

3.5.1 Mangrove shrubland (RE: 12.1.3 and 11.1.4)

Mangrove shrubland is associated with all intertidal areas throughout the subject site and occurs within the proposed spoil dump sites and the mainland sections of the pipe and road corridors. Both proposed spoil sites include large areas of mangrove shrubland and a dense and almost continuous fringe of mangrove occurs along the mainland shoreline to the east of the proposed access road. A narrow belt of mangroves also occurs on the northwest side of the proposed mainland access road (Figure 2b). This habitat type is flooded during each high tide, although the depth of inundation varies. Vegetation structure and floristic composition varies throughout the site, although lower elevation sites are typically dominated by Orange Mangrove (Rhizophora stylosa) to a height of four metres with a canopy cover of 70 – 80%. In other areas, Yellow Mangrove (Ceriops tagal), Grey Mangrove (Avicennia marina) and River Mangrove (Aegicerus corniculatum) formed isolated thickets or occurred as scattered individuals. The midstorey and

understorey were generally open with shrubs absent or represented by scattered juveniles of the canopy species. Ground cover was dominated by sticky fine-grained marine mud.

Hollow logs were rare, however, hollow branches and other arboreal shelter sites were present at all sites. Flowering Knee-rooted Mangrove (Brugaria spp) and Orange Mangrove were recorded throughout the site. Epiphytes were rare. As expected, no evidence of fire was recorded, although some evidence of previous disturbance by feral horses and pigs was recorded. Evidence of dieback was recorded at several sites in the study area. The most severe occurring adjacent to the proposed mainland access road.

3.5.2 Saltpan/Mudflat (RE: 12.1.2 and 11.1.2)

Saltpan and mudflat habitat consist of low-lying areas with minimal topographic relief that are either regularly (mudflat) or periodically (saltpan) inundated at high tide. This habitat occurs within both spoil dump sites and the mainland section of the pipe and road corridors. Vegetation is typically absent, although scattered mangroves and saltmarsh vegetation may occur along and adjacent to tidal channels. Extensive Saltpan habitat occurred immediately inland of the mangrove shrubland at both proposed dredge spoil dump sites and on both sides of the proposed mainland access road (Figure 2b). Both Saltpan and Mudflats provide foraging and roosting habitat for shorebirds. Saltpan habitat is particularly important during spring high tides and after rain when the pans become inundated.

3.5.3 Saltmarsh (RE: 12.1.2)

Saltmarsh habitat occurred within the proposed spoil dump sites and within the pipeline and road corridor. Small herblands occurred as isolated patches within the saltpans and linear grassland fringes were found at the ecotone between Saltpans and adjacent woodland habitats. More expansive and complex Saltmarsh habitat occurred on the mainland adjacent to both the proposed pipeline and access road alignments (Figure 2b). Fringing Saltmarsh was dominated by Saltwater Couch (Sporobolus virginicus), whilst more expansive habitat on the mainland included a mix of Samphire (Holosarcia spp.), Jelly-bean Plant (Suaeda spp.) and Couch (Zoysia spp). Saltmarsh had a vegetative cover of 50% with patches of dense vegetation interspersed with shallow pools of open water. Vegetation reached a maximum height of 0.4m on the mainland and 0.15m on Curtis Island. This habitat is subjected to tidal inundation, although major flooding occurs only during the highest tides. No evidence of fire was recorded, although evidence of long-term and heavy grazing by horses and cattle was evident on Curtis Island. Grazing had severely impacted upon this habitat resulting in erosion and simplification of the vegetation structure and floristics. No weeds were recorded in this habitat.

3.5.4 Queensland Blue Gum woodland / open forest (RE: 12.3.3 / 12.11.14 / 12.3.7 / 12.3.11)

The Queensland Blue Gum woodland / open forest includes three Regional Ecosystems, all of which have Queensland Blue Gum as a dominant canopy species and occur on alluvial soils (Figure 2b). The habitat includes the endangered regional ecosystem *Eucalyptus tereticornis woodland to open forest on alluvial plains.* This habitat occurs as linear strips along drainage lines between hills or in more expansive alluvial deposits on the landward side of Slaypans (Figure 2b). The overstorey was dominated by a mix of Queensland Blue Gum and Grey Ironbark with a midstorey of regrowth eucalypts, Moreton Bay Ash and *Acacia* spp. The understorey was dominated by *Acacia* spp., *Sida* spp. with a dense grassy ground cover. The dense thickets of *Acacia* spp. and grasses were the result of fires that had occurred within the past five years. The habitat is dissected by a number of ephemeral creek lines where softwoods such as Cheese Tree (Glochidion ferdinandi), Red Ash (Alphitonia excelsa), *Waterhousia* spp., *Melaleuca* spp. and Burdiken Plum (Pleiogynium timorense) occur. This habitat is of particular significance having a large number of large hollow-bearing trees, arboreal termitaria and seasonally important flowering gums.

Spoil Sites

Canopy height ranged from 15m to 28m with a cover of 20%. Midstorey height ranged from 7-18m and attained a cover of 20-25%, understorey vegetation was dominated by *Acacia* spp. to a height of 2-3m and a cover of 20-30%. The litter layer was sparse ranging from 10-25%. There was recent evidence of fire and grazing and the vegetation had been extensively cleared with very few mature trees present. Fallen logs and arboreal hollows were rare. The most prominent fauna features were thickets of *Acacia* spp., some decorticating bark and occasional *Melaleuca* spp.

Road and Pipeline Corridors

Canopy height ranged from 24m to 28m with a cover of 30%. Midstorey height ranged from 10-15m and attained a cover of 10-15%, understorey vegetation was dominated by *Acacia* spp. to a height of 5-6m and a cover of 20-30%. The ground layer was dominated by grasses to a height of 0.75-1m and a cover of 60-80%. There was a well developed litter layer of 40-50% cover and 2cm depth. Surface rock was absent. There was recent evidence of low intensity fires and grazing and partial clearing. Good quality mature forest was recorded along parts of the road and pipeline corridor. Fallen logs and (small and medium) arboreal hollows were common, although large (>15cm diameter) hollows were rare. Other prominent fauna features included thickets of *Acacia* spp., fleshy fruits, flowers and decorticating bark. A low level of weed infestation was recorded, primarily along the creek lines.

3.5.5 Lemon-scented Gum / Grey Ironbark open forest (RE:12.11.6)

The Lemon-scented Gum / Grey Ironbark open forest habitat dominated the ridges and slopes of the study area and, on the lower slopes, graded into Grey Ironbark / Queensland Blue Gum woodland (RE: 12.11.14) (Figure 2b). Overstorey vegetation was dominated by a mix of Lemon-scented Gum and Grey Ironbark on the higher slopes and Grey Ironbark, Queensland Peppermint, Moreton Bay Ash and Queensland Blue Gum on the lower slopes. The midstorey was open and dominated by Lemon-scented Gum, Grey Ironbark, Queensland Peppermint and *Acacia* spp. The understorey was dominated by *Acacia* spp. and *Sida* spp. thickets. These thickets were most likely associated with past fire events. Ground cover varied between sites and was dependent upon topographic position. Ground cover was sparse on the steeper, higher slopes and was dominated by tussock grasses and surface rock but increased on the mid and lower slopes. Moderate to low levels of weed infestation were recorded at some sites.

The road and pipeline corridors included some good quality dry open forest habitat that appears to have been less disturbed than other areas of similar habitat in the locality. These areas had a well developed vegetation structure a mature canopy and numerous arboreal hollows.

Spoil Sites

Overstorey vegetation was dominated by a mix of Queensland Peppermint, Grey Ironbark and Bloodwood (Corymbia spp). Height ranged from 13-17m and cover from 15-25%. Dominant midstorey species varied between plots and included Foambark (Jagera pseudorus), Swamp Box, Grey Ironbark and *Acacia* spp. Midstorey height ranged from 8-10m and cover from 10 to 25%. Understorey was dominated by a mix of *Acacia* spp., Foambark and Red Ash, with height ranging from 3 to 5m and cover from 10 to 40%. Groundcover consisted of grasses to 1m in height and with a cover of 35 to 70%.

Arboreal hollows were patchily distributed. Some plots had high densities of large, medium and small hollows whilst others had none. Hollows were more abundant within the northern spoil site. Fallen timber was recorded in high densities throughout both spoil sites, although hollow logs were rare. Evidence of fire, clearing and grazing was recorded in all sample plots. Leaf litter cover ranged from 15 to 45% with a depth less than 5cm.

Road and Pipeline Corridors

Overstorey vegetation included a mix of Lemon-scented Gum and Grey Ironbark on the slopes and Queensland Peppermint, Moreton Bay Ash and Queensland Blue Gum on the lower slopes. Canopy height ranged from 16 to 24m and cover from 15 to 40%. The midstorey was dominated by Eucalypt regrowth and *Acacia* spp. to a height of 7-14m and a cover of 5-20%. Understorey was dominated by thickets of *Acacia* spp. and *Sida* spp. with a height of 2-5m and cover of 15-50%. The understorey was dominated by various species of grass, *Sida* spp., and vines. Understorey height ranged from 0.75-1m and cover from 30 to 80%. Ground cover was typically higher on the lower slopes than ridgelines.

Arboreal hollows were patchily distributed but occurred in high densities along the northern sections of corridor on Curtis Island. Large (i.e. >15cm diameter) hollows were uncommon. Fallen timber was common, although the greatest densities were recorded along the northern sections of corridor on Curtis Island. Hollow logs were rare. Evidence of disturbance was recorded at all plots and included moderate intensity fires, moderate to severe clearing and light to moderate grazing. Leaf litter ranged from 10-50% but was typically 30% with a depth of <2cm.

Extension

Vegetation with the extended LNG facility boundary was dominated by Lemon-scented Gum Open Forest on high slopes and ridges. Dominant canopy species were Lemon-scented Gum and Grey Ironbark with a height of 22m and a cover of 20%. Midstorey was dominated by regrowth canopy species with a height of 12m and cover of 10-15%. Understorey vegetation consisted of a mix of *Acacia* spp. and eucalypt regrowth with a cover of 35-45% and height of 3-4m. The understorey consisted of grasses to 1m with cover of 35-75%. Arboreal hollows and fallen timber were rare, and no large hollows were recorded. Other prominent fauna features included dense thickets of *Acacia* spp. There was a well developed litter layer of 20-40%. The habitat showed evidence of moderate disturbance included clearing and fire within the past 1-5 years.

3.5.6 Semi-evergreen vine thicket (RE:12.11.4)

The semi-evergreen vine thicket habitat was restricted to a small linear remnant adjacent to the fringing mangroves in the south western corner of the southern dredge spoil dump. The vine thicket was restricted to a steep northeast facing slope on the inside of Hamilton Point. The slope and aspect protect the area from severe fires. The Vine Thicket is characterised by a mix of mature rainforest trees and shrubs with a canopy height of 8m and a cover of 50%, a midstorey height of 4m and cover of 25% and an understorey height of 2m and a cover of 15%. Ground vegetation was sparse (3% cover). Fleshy fruit and flowers were present and there was a well developed litter layer. Fallen logs were abundant but no hollow logs or arboreal hollows were recorded.

3.5 Threatened and Migratory Species

Four species listed on the Queensland NC Act were recorded during the survey (Figure 5b, Table A5 – Appendix A). These were: Squatter Pigeon, Powerful Owl and Beach Stone-curlew, all listed as vulnerable; and Eastern Curlew, which is listed as Rare. The Squatter Pigeon is also listed as either endangered or vulnerable on the EPBC Act. Twenty-eight migratory species, listed on the EPBC Act were also recorded.

The Beach Stone-curlew was observed at a number of locations (Figure 5b): on the shoreline near the south western end of the mainland road corridor; on the shoreline approximately midway along the proposed mainland road corridor; in the vicinity of Friend Point; near Laird Point at the mouth of Graham's Creek on Curtis Island; and on the shoreline in the south eastern corner of the southern dredge spoil dump. These observations were in addition to those recorded during

the October 2008 survey when birds were observed near the village of South End and on the extensive tidal flats that occur along the south-eastern and southern shores of Curtis Island.

The Squatter Pigeon was observed on four occasions. All observations of this species were made in the vicinity of the mainland road corridor (Figure 5b). The habitat at these locations was typically open grassy woodland in close proximity to a number of permanent freshwater dams and lagoons. The Squatter Pigeon was not recorded on Curtis Island during this survey or during the October 2008 survey.

As for the October 2008 survey targeted searches for the endangered Yellow Chat were undertaken and focused on the saltpan habitats at the subject site, particularly the Saltwater Couch vegetation. No Yellow Chats were recorded. Apart from a small area in the vicinity of Friend Point Saltmarsh was highly degraded and limited in extent. Additional surveys targeted the Black-throated Finch. This species was not recorded.

3.6 Butterflies

Nineteen species of butterfly were recorded within the subject site during the summer survey (Table A6, Appendix A). Most species were recorded within a variety of habitats. The highest abundance and species richness was recorded in Mangrove Shrubland and Queensland Blue Gum Woodland/Open Forest. No species listed as either endangered or vulnerable on the NC Act or the EPBC Act were recorded.

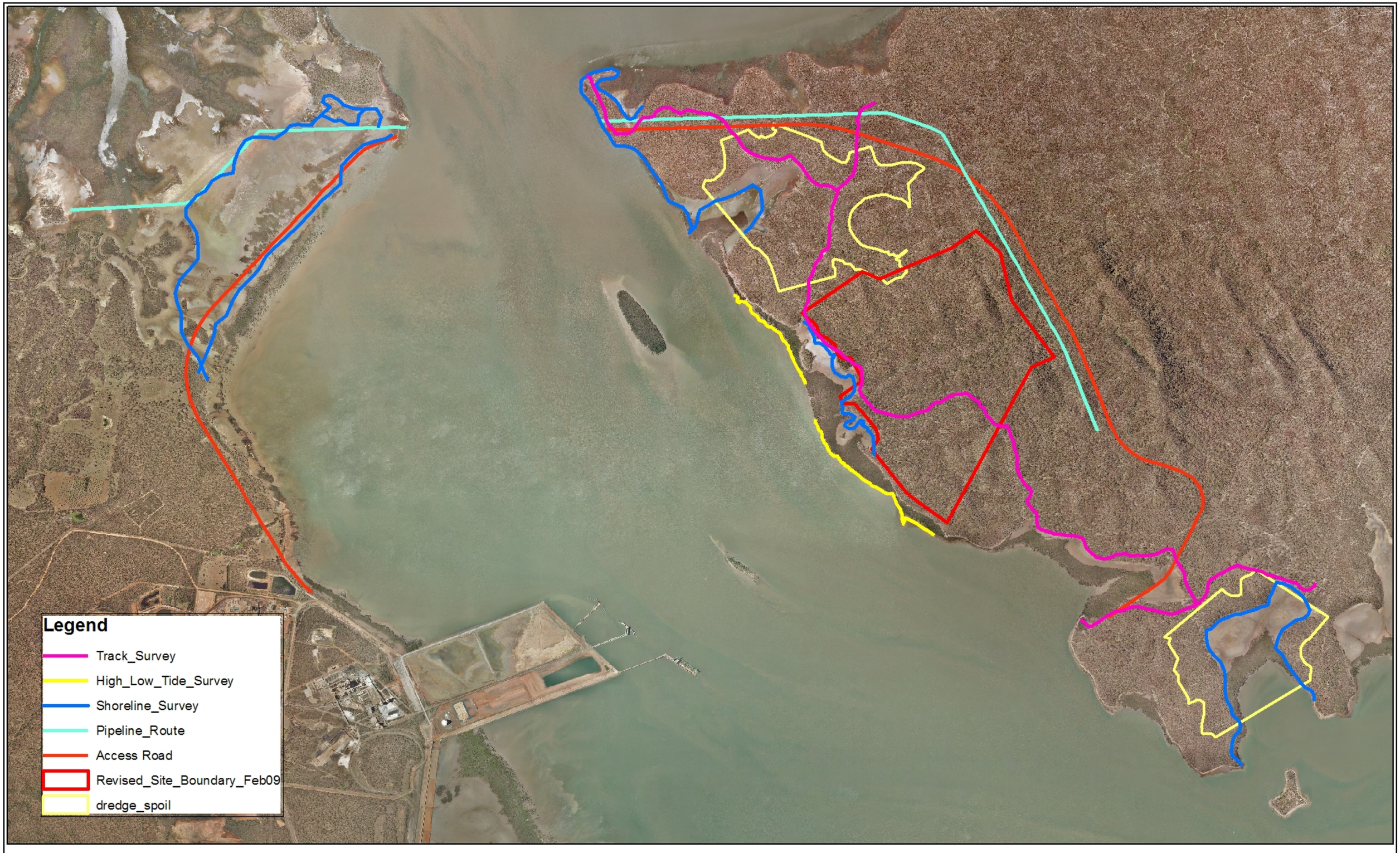

Figure 3a
BG LNG Proposal: Curtis Island
Survey Transect Locations.
March 2009

N

0 0.25 0.5 1 1.5
Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services. March 2009

Legend

Sites_Feb_09	Sites_Oct_08
<all other values>	<all other values>

Type	Method
Bird Census	Bittern Playback
Call Playback	Chat Survey (shoreline)
Habitat	Dusk Census
Shorebird	High Tide Survey
	Low Tide Survey
	Nocturnal Call Playback
	Water Hole Survey
	2ha_Plots
	Pipeline_Route
	Access Road
	Revised_Site_Boundary_Feb09
	dredge_spoil

Figure 3b
Curtis Island Bird Survey Survey Site Locations: March 2009

N

0 0.25 0.5 1 1.5
Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services. March 2009

Figure 4b:
Nocturnal Bird Locations: March 2009
BG LNG Project: Curtis Island

N

0 0.25 0.5 1 1.5
Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services. October 2008

Figure 5b:
BG LNG Proposal: Curtis Island Threatened Species Locations. March 2009

N

0 0.25 0.5 1 1.5
Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services. March 2009

4. IMPACT ASSESSMENT

4.1 Threatened Species Known or Predicted to Occur on the Subject Site

Fifteen threatened species of bird were identified as possibly occurring on the subject site. The likelihood of each species using the subject site was assessed with reference to survey results, published information on habitat preferences and distribution. Four threatened species are known to occur in the subject site and two additional species have a moderate likelihood of occurrence (Table 5b). Square-tailed Kite and Black-chinned Honeyeater are predicted to have a moderate likelihood of occurrence based on habitat type and proximity of records (Marchant & Higgins 1993; Higgins 2001). The impact of the proposal on species that are known to occur or have a moderate likelihood of occurrence is assessed in the following section.

Yellow Chat was specifically targeted during the field survey. Despite targeted searches of Saltmarsh habitat no Yellow Chats were recorded. According to Houston *et al.* (2004a & 2004b) Yellow Chats, on Curtis Island, utilise a mosaic of wetland habitat, including tall (>1.2m) rush-beds, areas of patchy rush and less dense salt couch and chenopod salt flats. Potential habitat (well developed Saltmarsh) was restricted to the mainland and occurred near the proposed pipeline and road corridors (Figure 6b). Although this habitat had some suitable attributes it was limited in area (approximately 13ha), height (<0.4m) and complexity. Similar habitat on Curtis Island was heavily grazed and dominated by vegetation less than 15cm in height. Important refuge habitat in the form of rush-beds was also absent.

4.2 Summary of Impacts

The proposal could affect birds in several ways, including: removal of habitat, barrier effects, edge effects, habitat fragmentation, isolation of habitat and altered hydrology. Impacts would vary between the different components of the project. One important aspect to consider is the cumulative impact of the various components of this report coupled with other nearby proposals.

4.2.1 Dredge Spoil Dump Sites

The type of impacts at the dredge spoil dump sites would be similar to those discussed by SES and WES (2008) for the proposed LNG facility. The spoil sites include some similar habitat components to the proposed LNG facility. Although most of the proposed dredge spoil dump site consists of Saltpan substantial areas of forested habitat would be removed. This is particularly the case at the northern site where a large area of Queensland Blue Gum Open Forest on alluvial flat would be removed. Other affected habitat types include Mangrove Shrubland, Saltpan, fringing Saltmarsh and Ironbark/Lemon-Scented Gum Open Forest. A very small area of lowland vine thicket would be affected at the southern dredge spoil dump.

The deposition of dredge spoil may have some short-term benefits for waterbirds which would be attracted to the site to forage. Any short-term benefits would be outweighed by the destruction of foraging and roosting habitat for waterbirds and forest birds and ongoing edge effects along the interface between dredge spoil and retained vegetation. The proposal would remove potential foraging and roosting habitat for Powerful Owl and known habitat for Eastern Curlew. Barking Owls also occur in high densities in the alluvial forests and pairs of Bush Stone-Curlews occur at both sites. Spoil would also disrupt drainage of adjoining vegetation possibly causing water to pool which may further alter vegetation structure and floristics.

The impact of depositing dredge spoil is exacerbated by the close proximity of the deposition sites to the proposed BG and Santos LNG facilities. The dredge spoil and LNG proposals would have a substantial cumulative impact on Queensland Blue Gum Open Forest and Saltpan habitats including direct impacts on threatened bird habitat.

Table 3: Likelihood of occurrence of threatened species within the subject site.

Species	Likelihood of Occurrence	Reason
Red Goshawk	Low	Habitat lacks permanent water and there is a low abundance of potential prey.
Grey Goshawk	Unlikely	No suitable habitat on the subject site; species prefers moist forests. May occur in Semi-evergreen Vine Thickets / Forests to the north.
Square-tailed Kite	Moderate	Suitable habitat is present on the subject site and the species is known to occur in the Gladstone area; low abundance of passerines may result in large home range; could utilise habitat within the road and pipeline corridors, extension and dredge spoil dump sites.
Yellow Chat	Unlikely	No suitable habitat (Houston *et al.* 2004a & 2004b); suitable saltmarsh habitat is limited in area, whilst the remainder is highly degraded due to grazing by cattle and horses.
Beach Stone-curlew	Known	Recorded at six sites in the study area, including three on the mainland and three on Curtis Island (Figure 5b). Known to occur near the proposed dredge spoil dump sites and access road corridor.
Eastern Curlew	Known	Recorded roosting and/or foraging at seven sites within the study area (Figure 5b); small numbers of individuals (<10) forage and roost on intertidal mudflats and Saltpans at both proposed spoil dump sites, the LNG facility, Hamilton Point and Lairds Point; a larger number of individuals (<60) roost on the mainland within the proposed road corridor. Known to occur near the proposed dredge spoil dump sites and access road corridor.
Black-breasted Button-quail	Unlikely	No potential habitat is present on the subject site.
Glossy Black-Cockatoo	Low	Potential feed trees (i.e. *Allocasuarina* spp) are rare on the subject site; and no evidence (i.e. chewed cones) of foraging was recorded during the survey.
Black-throated Finch	Low	Potential habitat is present but the variability of freshwater reduces the likelihood of occurrence.
Powerful Owl	Known	Predicted to forage over much of the LNG facility and road and pipeline corridors on Curtis Island; May roost within the LNG facility boundary, possibly near the "Quad-bike Track".
Squatter Pigeon	Known	Recorded in small numbers (<3) at four sites near the mainland access road corridor (Figure 5b). Predicted to forage on extant access tracks and nearby areas of open grassland in the southern half of the mainland road corridor; Habitat on Curtis Island less suitable due to the prevalence of long dense grass and absence of permanent water (Higgins & Davies 1996).
Painted Honeyeater	Unlikely	Subject site is outside normal range (Barrett *et al.* 2003; Higgins *et al.* 2001); Mistletoe was very rare on the subject site.
Black-chinned Honeyeater	Moderate	Habitat has some suitable attributes but dominant flowering eucalypts differ to typical habitat (Higgins *et al.* 2001)
Turquoise Parrot	Unlikely	Habitat is unsuitable and site is situated outside normal range (Barrett *et al.* 2003; Higgins 1999).
Lewin's Rail	Unlikely	No suitable habitat occurs on the subject site.

Key: unlikely = the subject site does not contain habitat resources suitable for the subject species; low = the subject site has some attributes (i.e. habitat type) that are suitable for the subject species but key habitat attributes (i.e. nest, shelter and foraging sites) are absent; Medium = the subject site contains potential habitat and habitat attributes but the species is uncommon in the locality; High = the subject site contains potential habitat and habitat attributes and there are records nearby; Known = species recorded using the subject site during the field survey.

Figure 6b:
BG LNG Proposal: Curtis Island Significant Shorebird Locations. March 2009

N

0 0.2 0.4 0.8 1.2
Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

Sandpiper Ecological Surveys and
Wildsearch Environmental Services. March 2009

4.2.2 Road and Pipeline Corridors

Linear developments such as the proposed road and pipeline have a number of impacts on fauna. The proposed road and pipeline corridors would have the following impacts on birds:

- Create edge effects over a large area: Forest edges would be colonised by edge tolerant aggressive species that will compete with species in the adjoining forest thereby altering the composition of the bird community. Edge species that are likely to benefit from the proposal include Pied Currawong, Noisy Miner and Common Myna.

- Fragment and isolate habitat that is situated between the corridors: The habitat situated between the two corridors, in areas where the pipeline and road diverge, would be partially isolated from nearby habitats. These habitat islands would be unsuitable for most species of bird except for edge tolerant and aggressive species such as Pied Currawong, Australian Magpie, Noisy Miner and Common Myna. Although the retention of habitat islands may reduce the total area of clearing these areas are unlikely to function as good quality bird habitat. The northern end of the proposed mainland access road would partially isolate known spring tide and wet weather foraging and roosting habitat in the nearby Saltpan from intertidal foraging and spring tide staging habitat. Whilst shorebirds are likely to fly over the road the proposal may disrupt known movement paths.

- Create a barrier to movement for some birds and prey species: The gap/s created by the road and pipeline would pose a barrier to movement by cover dependent fauna. Although most species of forest bird recorded during the survey are capable of crossing gaps, some species of small passerine and ground birds, such as button-quail would be subject to greater predation risk. Gaps may cause a short-term disruption of movement by birds. Movement by arboreal mammals may also be disrupted, which could affect the foraging behaviour and territory structure of Barking and Powerful Owls. The mainland road would not represent a physical barrier to shorebirds moving from foraging areas and the neap tide roost to the spring tide roost (i.e. Saltpan) but it would represent a visual barrier for birds using the neap tide roost.

- Remove important bird habitat: The proposal would contribute to the cumulative impact of habitat removal between Hamilton and Laird Points on Curtis Island. Although most of the habitat has been previously disturbed through clearing, grazing and fire the road and pipeline corridors contain important habitat resources, such as arboreal hollows and owl roost sites. The northern end of the proposed mainland access road would remove part of an existing neap tide shorebird roost. This roost is used by both threatened and migratory species and is identified as a "*Major Shorebird Roost Site*" by the Environment Protection Agency. In addition to the removal of habitat it is predicted that shorebirds would no longer roost at the site due to the disturbance created by nearby traffic. This may have a flow-on effect and reduce use of the adjoining Saltpan during wet weather and spring tides. Furthermore, the access road on Curtis Island may encourage increased visitation to Lairds Point thereby increasing disturbance of that roost.

- Disrupt tidal movement: The mainland section of the proposed access road and pipeline would disrupt tidal movement into a large area of intertidal habitat. Specific habitats affected include Saltpan/Mudflat, Saltmarsh and Mangrove. It is essential that both the pipeline and road allow for natural tidal exchange to ensure that the above habitats continue to be inundated on the appropriate tidal regime. The effect of tidal disruption may vary between habitats. The most obvious impact is a reduction in the frequency and duration of inundation. This may alter the distribution of Saltmarsh and Mangrove vegetation and reduce the suitability of Saltpans and Mudflat as foraging and roosting habitat for shorebirds.

- Increased risk of road strike: High traffic volumes and high speeds in the early morning and evening would pose a threat of road strike to birds. Many species of bird are susceptible to road strike and given that peaks in traffic volume would coincide with peak bird activity road strike will occur. Traffic intensity at night is unlikely to be sufficient to affect Powerful Owls but it may contribute to local mortality in the long-term. Squatter Pigeons would also be susceptible to road strike during the early stages of operation. Squatter Pigeons are likely to cross the road to access foraging sites during the early stages of operation birds could be subject to road strike. Overtime pigeons may adjust there foraging patterns and exclude the small area of foraging habitat isolated by the road.

4.2.3 LNG Extension

The extended LNG boundary includes 76ha of Dry Open Forest on low ridges and slopes. This habitat tends to be of low value for birds due to previous clearing, regular fires, a low abundance of hollows and floristic composition. It is anticipated that most of the subject area would be cleared and excavated to provide fill for other areas of the LNG facility. The primary value of habitat within the LNG extension is that it provides foraging habitat for owls, including Powerful Owl. Clearing of this habitat contributes to the cumulative impact of the proposal. Cumulatively the proposal would remove a substantial area of potential foraging habitat for Powerful Owls and a possible roost site. SES and WES (2008) discuss further impacts relevant to the boundary extension..

4.3 Impact on Threatened Species Listed on the NC Act

Impact on the Local Population[1] of a Threatened Species

Squatter Pigeon – Small numbers of Squatter Pigeons (i.e. 1-3) were recorded at four sites near the proposed mainland access road (Figure 5b). Squatter Pigeons were associated with existing vehicle tracks (3 sites) or small areas with sparse ground cover (1 site). Understorey vegetation through most of the subject site is unsuitable for Squatter Pigeons as it consists of dense grass cover. The records provide a useful indication of habitat use in the study area and it is predicted that Squatter Pigeons are restricted to foraging along existing tracks or in small areas with sparse ground cover near tracks, areas of recent disturbance or the upper shoreline. No potential Squatter Pigeon habitat was recorded within the subject site on Curtis Island. In addition to several tracks and clearings there are also several sources of permanent freshwater near the mainland access road.

Habitat removed to construct the mainland access road would not have direct impacts on Squatter Pigeons as most of the existing track network would remain unaffected. During operation Squatter Pigeons may even forage in areas disturbed during construction. The proposed road would pose a risk of road strike to pigeons and it is therefore necessary to limit vehicle speeds to 80km or less.

Beach Stone-curlew – Several breeding pairs of Beach Stone-curlews utilise habitat within and immediately adjacent to the subject site (Figure 5b). Two pairs of Stone-curlews are known to utilise habitat within and adjoining the mainland access road, with other pairs at Lairds Point and near the southern spoil dump site. Whilst the available evidence suggests that pairs of Stone-curlews occur in the above areas this species is capable of moving substantial distances including between the mainland and Curtis Island. The number of pairs recorded is regarded as reasonably accurate as the two pairs recorded on the mainland were recorded 2km apart within 30 minutes of each other reducing the chances of movement. The presence of two groups with 2 birds (1 on the mainland and 1 on the island) and two groups of 3 birds (1 on the mainland and 1 on the island) further increases the likelihood that the identified groups are unique.

[1] "Local Population" is the population that occurs within a 10km radius of the subject site.

Although Stone-curlews can co-exist with low levels of development and disturbance it is critical to retain and protect nesting sites and foraging areas and to ensure that human disturbance of nest and foraging areas is minimised. The proposal would have direct impacts on the pair of Beach Stone-curlews that occur near Friend Point. The proposed road is situated near foraging habitat and the bridge would remove a small shingle island that may be used for nesting and shelter. The pair of Stone-curlews at Lairds Point could be affected by increased recreational disturbance which may disrupt breeding success. Habitat use by Beach Stone-curlews that occur near the southern spoil dump site is unknown. These birds (2 adults & a fledgling) were recorded roosting near the edge of the proposed deposition site and they may occasionally forage within the nearby Saltpan. The deposition of dredge spoil is likely to remove an area of foraging habitat.

Of the four pairs known to occur in the study area the proposal would have serious impacts on one pair, cause increased disturbance to a second pair and remove a small area of roosting and foraging habitat for a third pair. Driscoll (1997) estimated that 22 Beach Stone-curlews occur in the Curtis Coast region. This may be an underestimate as Stone-curlews are often difficult to count during standard shorebird surveys. Alternatively, our data may indicate that the Curtis Island/Gladstone area is a hotspot for the species in the region. At least one additional pair of Beach Stone-curlews is known to occur at South End. Given the broad distribution of Stone-curlews and potential habitat in the locality and the localised nature of impacts it is unlikely that the proposal would have a significant impact on the local population. Nonetheless, it is suggested that vehicle access to Laird Point be prohibited to reduce disturbance impacts at that site.

Eastern Curlew – Eastern Curlews were widely distributed throughout the study area. Curlews forage on intertidal habitat along the mainland and island coasts and small flocks roost in both Dredge Spoil Sites and at Lairds Point. Larger numbers of individuals (often up to 50) us the neap tide roost near the Friend Point (Figure 6b). The proposal would render the neap tide roost unsuitable for Eastern Curlews and reduce the suitability of the nearby spring tide roost. Lower value roosts on Curtis Island would also be affected by increased disturbance and the deposition of dredge spoil. Impacts on Curtis Island are either minor or can be managed by restricting vehicle access to Lairds Point. Impacts on the mainland are more severe as they affect an important roost site for Eastern Curlew and other migratory shorebirds. To reduce impacts on roosting habitat it is recommended that the mainland section of access road be realigned to the western side of the Saltpan and that a spring tide roost be constructed on the existing neap tide roost (Figure 7b). This would ensure that impacts on Eastern Curlews are minimised.

Powerful Owl – The subject site represents part of a foraging home range used by one, possibly two, Powerful Owls. Contrary to initial thoughts (i.e. SES & WES 2008) it is possible that Powerful Owls roost on or in close proximity to the proposed LNG facility. This information further substantiates the suggestion by SES & WES (2008) that Powerful Owls forage over most of the subject site and increases the potential impact of the proposal on this species. Potential nest sites (i.e. large hollows in live eucalypt) were recorded in the vicinity of the proposed access road. The distribution and abundance of Powerful Owls on Curtis Island is unknown. URS (2007) recorded Powerful Owl on the mainland near Yarwun and concluded that the species was widespread in the locality. Nonetheless, the subject site is situated at the northern distributional limit for this species (refer to Higgins 1999) and impacts on roost and/or nest sites have a high likelihood of causing detrimental effects on breeding pairs. Whilst it is possible that the proposal would affect only one pair of owls a cautious approach is warranted..

The cumulative effect of this and other adjoining proposals would remove a substantial area of potential foraging habitat and potential nest and roost sites. The ability of owls to alter home range size and distribution requires some understanding of their abundance and distribution in the locality. If suitable habitat occurs elsewhere on the island it is likely that this habitat is already used. The territorial nature of owls makes it difficult for pairs (or individuals) to overcome habitat loss by foraging elsewhere. Based on available evidence it is likely that the proposal would remove one pair of owls from Curtis Island. The impact on the local population is unknown. It is

recommended that additional targeted surveys be undertaken for Powerful Owls to obtain a better understanding of their distribution and abundance.

Square-tailed Kite – Square-tailed Kites are known to occur in the Gladstone area and habitat within the subject site is suitable for foraging and nesting (Marchant & Higgins 1993). Use of the site by kites would be influenced by the abundance of small birds and may be greatest during peak flowering periods when honeyeaters are most abundant. The field survey was conducted during the breeding season and at a time when small passerines (i.e. friarbirds and White-naped Honeyeaters) were relatively abundant. Due to their conspicuous nature and the level of survey effort it is highly likely that, if present, Square-tailed Kites would have been recorded. Use of the subject site may be restricted to occasional foraging outside the breeding season. Given the large area of similar quality foraging habitat on Curtis Island and the adjoining mainland it is unlikely that habitat removal associated with this project would affect the viability of the local Square-tailed Kite population.

Black-chinned Honeyeater - If present, the Black-chinned Honeyeater is likely to be an uncommon visitor to the study area and would most likely occur during peak flowering periods of Grey Ironbark and Queensland Blue Gum (Higgins *et al.* 2001). Given their scattered distribution in eastern Queensland and the abundance of similar habitat in the locality, detrimental impacts on the viability of the local Black-chinned Honeyeater population are unlikely.

Impact on the Habitat of a Threatened Species

The proposal would affect substantial areas of habitat at each of the proposed spoil dump sites, an additional 326ha within the proposed LNG facility and linear strips within the road and pipeline corridors. Habitat removal would directly affect Powerful Owl, Squatter Pigeon, Eastern Curlew and Beach Stone-curlew, whilst habitat of the latter two species (and other migratory shorebirds) would be affected by disturbance. The proposal would remove potential habitat for the Black-chinned Honeyeater and Square-tailed Kite.

In a broad context woodland habitat similar to that affected by the proposal is common and widespread in the Curtis Coast region and the proportion of this habitat removed is minor in a local context. However, the woodland habitat provides resources for Powerful Owl, and the endangered RE Queensland Blue Gum Woodland/Open Forest that dominates the alluvial flats may also provide foraging habitat for the Black-chinned Honeyeater and Square-tailed Kite. This habitat is of particular significance having a large number of large hollow-bearing trees, arboreal termitaria and seasonally important flowering gums.

Impacts on intertidal and Saltpan habitats are more severe as they affect habitats that are restricted in distribution (i.e. roosts) and used for nesting or roosting by flocks of threatened (and migratory) species. The proposal would remove the mainland neap tide roost and reduce the suitability of the nearby Saltpan spring tide roost (Figure 6b). Although intertidal habitat is widespread in Port Curtis roost sites require a specific suite of characteristics and are more restricted in distribution.

The proposed pipeline and road corridors would fragment woodland habitat particularly on Curtis Island where the two corridors are often separated by a narrow strip of vegetation. Narrow strips of vegetation retained between the pipeline and road corridors would have limited habitat value for threatened species and often become favoured sites for exotic and edge tolerant species.

Does the Proposal Constitute a Threatening Process

Vegetation removal is recognised as a threatening process under Commonwealth legislation. The proposal would therefore constitute a threatening process under the EPBC Act and the NC Act resulting in the removal of several hundred hectares of Open Woodland and reducing the

area of habitat available for a range of common and threatened bird species. Other threatening processes, such as grazing by feral animals, could be reduced as a result of the proposal, if appropriate environmental management measures are implemented.

Apart from potential benefits to Common Myna the proposal would not increase the abundance or distribution of pest species and would reduce the local impacts of horses, cattle and possibly pigs by excluding these species from the site. This would have positive benefits on vegetation and bird habitat.

Summary

The proposal would have a variety of impacts on threatened birds including:

- The removal of a substantial area of foraging habitat used by Powerful Owl.
- The removal of potential Powerful Owl roosting and nesting habitat.
- The removal of neap tide roosting habitat used by Eastern Curlew and increased disturbance at three roost sites.
- The removal or modification of a substantial area of foraging habitat used by Eastern Curlew.
- Hydrological impacts on a spring tide roost used by Eastern Curlews and possible disruption of movement paths between the neap and spring tide roost.
- Removal of potential Beach Stone-curlew nesting habitat and disturbance of shelter and foraging habitat near Friend Point and at Laird Point.
- Removal of a small area of known Squatter Pigeon foraging habitat and increased risk of mortality through road strike.

4.4 Impact on Matters of National Environmental Significance

In accordance with the requirements of the EPBC Act the short-term impacts of the proposal on Matters of National Environmental Significance were assessed. Matters of National Environmental Significance listed under the EPBC Act include:

- World Heritage Areas;
- Wetlands protected by international treaty (The Ramsar Convention);
- Nationally listed threatened species and ecological communities;
- Nationally listed migratory species;
- All nuclear actions; and
- The environment of Commonwealth marine areas.

The proposal would not impact on any World Heritage Areas, Ramsar wetlands, involve any nuclear actions or impact on any Commonwealth marine areas[2]. The subject site is known to be used by 28 species that satisfy the definition of 'migratory species' as per the EPBC Act (Table 4) and one threatened species, Squatter Pigeon.

In accordance with the EPBC Act Administrative Guidelines on Significance, with respect to migratory species, it is necessary to determine if habitat affected by the proposal is "important habitat". Important habitat is defined as:

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

The subject site is not situated at the limits of range or considered to be of critical importance at a particular life-cycle stage for any of the identified migratory species (Table 4). Migratory species that occur in significant numbers in the survey region (i.e. Curtis Coast) are Bar-tailed Godwit, Eastern Curlew, Whimbrel and Common Greenshank (Driscoll 1997). According to Driscoll (1997) the Curtis Coast region supports 6%, 8%, 4% and 8% of the respective statewide populations of these species. During one high tide survey approximately 299[3] Whimbrels were recorded using the neap tide roost near Friend Point (Table 6A). This represents approximately 49% of the Whimbrel population in the Curtis Coast Region (Driscoll 1997). According to Bamford *et al.* (2008) the 1% threshold for Whimbrel is 1000 individuals and the Curtis Coast Region does not therefore support a nationally significant proportion of the Whimbrel population. Nonetheless, considering that the data relate to a single site, as opposed to a geographic area, the subject roost is regarded to be of local and state importance. The count of 304 Red-necked Stints recorded foraging in the Saltpan in late January 2009 equates to 25% of the estimated population for that species in the Curtis Coast Region (Driscoll 1997).

The Eastern Curlew is the only migratory species occurring in the subject site whose population may be declining regionally. This conclusion is based on its 'rare' classification on the NC Act. All of the remaining migratory species are common within the locality and region. These species have not been considered further in this assessment.

The assessment of significance (Appendix B) concluded that the proposed road would have a detrimental impact on migratory species, due to:

- Direct impacts (i.e. habitat removal & disturbance) on a neap tide roost that supports a substantial proportion of the Whimbrel population within the Curtis Coast region;
- Direct impacts (i.e. habitat removal & disturbance) on a neap tide roost that is used by a species (Eastern Curlew) whose population is decline; and
- Indirect impacts (hydrology and visual barrier) on a nearby spring tide roost.

[2] Note that this assessment deals only with the terrestrial and shoreline components of the proposal and not issues associated with the adjoining marine environment.

[3] The count includes birds that landed at the roost but left after a brief period possibly because of disturbance caused by the observers.

Detrimental impacts on Squatter Pigeons are unlikely due to the very small area of habitat affected and the retention of known foraging habitat and freshwater wetlands.

Based on the potential impacts on migratory shorebirds it is recommended that the proposal is assessed in accordance with the requirements of the EPBC Act. Mitigation measures are proposed to reduce impacts on migratory and threatened species.

Table 4: Migratory species recorded on the subject site.

Common Name	Region Supports Ecologically Significant Proportion of Population	Limit of the Species Range	Area where a species is declining
Wandering Whistling Duck	no	no	no
Magpie Goose	no	no	no
Black Swan	no	no	no
Pacific Black Duck	no	no	no
Great Egret	no	no	no
Pacific Baza	no	no	no
Whistling Kite	no	no	no
Brown Goshawk	no	no	no
Brahminy Kite	no	no	no
Eastern Osprey	no	no	no
White-bellied Sea-eagle	no	no	no
Australian Hobby	no	no	no
Bar-tailed Godwit	Yes	no	No
Eastern Curlew	Yes	no	Yes
Whimbrel	Yes	no	no
Common Greenshank	Yes	no	no
Great Knot	no	no	no
Grey-tailed Tattler	no	no	no
Terek Sandpiper	no	no	no
Red-necked Stint	no	no	no
Sharp-tailed Sandpiper	no	no	no
Pacific Golden Plover	no	no	no
Lesser Sand Plover	no	no	no
Masked Lapwing	no	no	no
Caspian Tern	no	no	no
Fork-tailed Swift	no	no	no
White-throated Needletail	no	no	no
Rainbow Bee-eater	no	no	no

5. RECOMMENDATIONS

The following recommendations are proposed to minimise impacts on birds and where possible improve habitat value. Additional surveys are recommended for Powerful Owl to obtain a better indication of the distribution of this species on Curtis Island and allow for a more informed assessment of impacts.

Recommended measures include:

- Habitat removal associated with the deposition of dredge spoil is excessive, substantially increases the cumulative impact of the proposal and is likely to have long-term impacts, such as altered site drainage. Alternative locations for dredge spoil should be investigated;

- Realign the northern section of the mainland access road to reduce impacts on neap and spring tide roosts (Figure 7b). The realigned road should extend along the western side of the Saltpan and if possible both the pipeline and road should avoid Saltmarsh near Friend Point (Figure 7b);

- Construct a spring tide shorebird roost on the existing neap tide roost near Friend Point (Figure 7b). A detailed design plan should be developed with input from engineers and ecologists. Potential actions include modifying the neap roost by depositing dredge spoil and installing small rock groins to minimise erosion. The roost should be designed to provide habitat during both spring and neap high tides.

- Ensure that the mainland section of access road does not affect local hydrology and specifically the frequency, duration and intensity of tidal inundation of saltmarsh, mangrove and saltpan habitat.

- Ensure that vehicles cannot access Lairds Point via the main site access road.

- Impose an 80km/hr speed limit on the proposed access road.

- Minimise vegetation removal and, where possible, retain large hollow-bearing habitat trees. The distribution of hollow-bearing trees should be mapped to assist in site planning.

- Undertake additional targeted surveys for Powerful Owl to obtain a better understanding of their distribution on Curtis Island. This survey should be undertaken during favourable conditions in the breeding season i.e. April-May.

- Cattle, horses and pigs should be excluded from the subject site (on Curtis Island) as soon as practical to reduce grazing pressure on saltmarsh and general habitat degradation.

- Vehicles should be excluded from saltmarsh habitat except for designated access tracks. In general, Saltmarsh should be protected to allow natural rehabilitation.

- Protect all known roost and nest sites of the Barking Owl.

- Minimise disturbance to the mangrove communities.

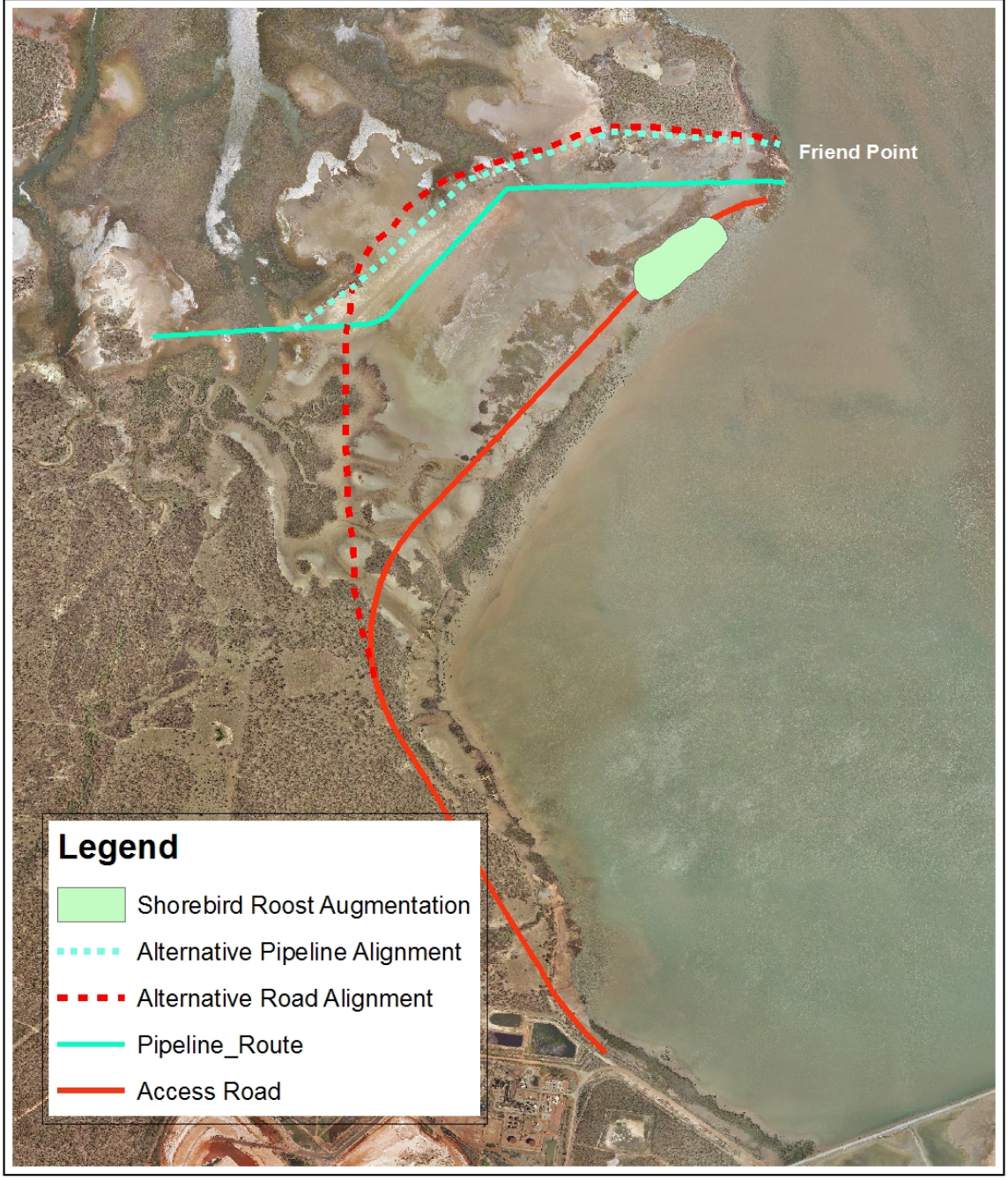

Figure 7b:
BG LNG Proposal:
Gladstone
Alternative routes.
March 2009

N

0 0.125 0.25 0.5 0.75
Kilometers

Sources:
Dept.of Natural Resources and Water.
Aerial Photo - 18.07.2007

GDA_1994_MGA_Zone56

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Sandpiper Ecological Surveys and
Wildsearch Environmental Services. March 2009

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APPENDIX A

Table A1: Summary of survey effort. Includes both spring and summer surveys.

Method	Number of Sites	Total time / area/ transect length	RE Sampled
2ha Area Searches	32	640mins	12.11.6 / 12.11.14, 12.3.3 / 12.3.7, 12.11.6
High Tide Surveys	2	2x 2698m	12.1.2
Low Tide Surveys	2	2x 2698m	12.1.2
Shoreline Survey	2	2x 1881m	12.1.2
Nocturnal Call Playback	3	2 nights / 158mins	12.11.6 / 12.11.14, 12.11.6
Bittern Call Playback Surveys	3	60mins	12.1.3
Dusk Census	4	6x20m	12.3.3 / 12.3.7, 12.11.6 / 12.11.14,
Habitat Assessments	30	30x (25mx25m) plots	12.11.6 / 12.11.14, 12.3.3 / 12.3.7, 12.11.6
Fauna Feature Traverse		9 days	12.11.6 / 12.11.14, 12.3.3 / 12.3.7, 12.11.6 12.1.2 12.1.3
Waterhole Surveys		3 x 60mins	

Table A2: Weather conditions experienced during the field survey. Temperature and Relative Humidity were recorded using a Kestrel 3000 pocket weather meter. RL = rustles leaves, MSB = moves small branches, MLB = moves large branches, nr = not recorded.

Date	Cloud Cover (%)		Temperature (^{0}C)		Relative Humidity (%)		Wind		Rainfall	
	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk	Dawn	Dusk
26.1.09	100	85	24.4	27.3	91.8	76.5	nil	MWT	showers	showers
27.1.09	90	50	24.2	nr	84.5	nr	rl	MWT	showers	nil
28.1.09	25	80	23.1	26.6	82.1	69.8	rl	mwt	nil	nil
16.2.09	40	nr	30.9	nr	71.4	nr	rl	nr	nil	nr
17.2.09	100	100	25	25.3	87.9	86.5	nil	msb	light	nil
18.2.09	nr	25	nr	26.8	nr	81.8	nr	rl	showers	nil
19.2.09	10	10	23.3	28	92.1	80	nil	rl	nil	nil
20.2.09	10	nil	26.8	26.6	87.4	86	nil	nil	nil	nil
21.2.09	10	25	25	28.1	84	81.4	rl	rl	nil	nil
22.2.09	35	25	24	27.4	88	80	rl	msb	nil	nil

Table A3: Birds recorded during the October 2008 and January - February 2009 surveys. Nomenclature follows Christidis and Boles (2008). * bold text = species listed on the NC Act 1992; # = migratory species listed on the EPBC Act 1999.

Common Name	Scientific Name	RE and Remnant Vegetation Cover	Number of 2ha Plots / survey site type, 2009	Recorded during 2008 survey
Australian Brush-turkey	Alectura lathami	12.11.6 / 12.11.14, 12.11.4	3 / general list	Yes
#Wandering Whistling-duck	Dendrocygna arcutata	freshwater wetland	general list	No
#Black Swan	Cygnus atratus	open water	general List	No
#Magpie Goose	Anseranus semipalmata	freshwater wetland	general list	No
#Pacific Black Duck	Anus superciliosa	12.11.6 / 12.11.14 wetland	2 / general list	Yes
Little Black Cormorant	Microcarbo melanoleucos	12.1.2 / open water	not recorded 2009	Yes
Pied Cormorant	Phalacrocorax varius	12.1.2 / open water	1 / general list	Yes
Australian Pelican	Pelecanus conspicillatus	12.1.2 / open water	not recorded 2009	Yes
White-faced Heron	Egretta novaehollandiae	12.1.2, 12.1.3	not recorded 2009	Yes
Little Egret	Egretta garzetta	12.1.2, 12.1.3	4, / general list	Yes
# Great Egret	Ardea alba	12.1.3, 12.1.2	general list	Yes
Black Bittern	Ixobychus flavicollis	12.1.3	not recorded 2009	Yes
Striated Heron	Butorides striatus	12.1.3	1, general list	Yes
Australian White Ibis	Threskiornis molucca	12.1.2, 12.1.3	1, general list	Yes
# Pacific Baza	Aviceda subcristata	12.11.6, 12.11.6/12.11.14	1 / general list	Yes
# Whistling Kite	Haliastur sphenura	12.11.6 / open water	1 / general list	Yes
# Brown Goshawk	Acciptera fasciatus	12.11.6, 12.3.3 / 12.3.7	not recorded 2009	Yes
# Brahminy Kite	Haliastur indus	12.1.3 / open water	1 / general list	Yes
# Eastern Osprey	Pandion cristatus	12.1.3 / open water	1 / general list	Yes
# White-bellied Sea-eagle	Haliaeetus leucogaster	12.1.3 / open water	2 / general list	Yes
# Australian Hobby	Falco longipennis	12.1.2, 12.11.6	not recorded 2009	Yes
Brolga	Grus rubicundus	11.3.29/12.3.3	general list	No
Buff-banded Rail	Gallirallus phillippensis	12.1.3	1- shorebird roost	No
Purple Swamphen	Porphyrio porphyrio	11.3.29/12.3.3	general list	No
Bush Stone-curlew	Burhinus grallarius	12.1.2, 12.3.7/12.3.11, 12.11.6, 12.11.6/12.11.14	1 NCP site, general list	Yes
*** Beach Stone-curlew**	**Esacus magnirostris**	12.1.3	1 2ha site / and 2 shorebird roosts / general list	Yes
Painted Button-quail	Turnix varia	12.11.6, 12.11.6/12.11.14	not recorded 2009	Yes
Red-backed Button-quail	Turnix maculosa	12.11.6, 12.11.6/12.11.14, 12.1.2	2 / general list	Yes
# Bar-tailed Godwit	Limosa lapponica	12.1.2, 12.1.3	2 / general list	Yes
*** # Eastern Curlew**	**Numenius madagascariensis**	12.1.2, 12.1.3	5 / general list	Yes
# Whimbrel	Numenius phaeopus	12.1.2, 12.1.3	4 / general list	Yes
#Common Greenshank	Tringa nebularia	12.1.2, 12.1.3	Shorebird roost	No
#Grey-tailed Tattler	Tringa brevipes	12.1.2, 12.1.3	3 / Shorebird roost	No

Common Name	Scientific Name	RE and Remnant Vegetation Cover	Number of 2ha Plots / survey site type, 2009	Recorded during 2008 survey
#Terek Sandpiper	Xenus cinereus	12.1.2, 12.1.3	Shorebird roost	No
#Great Knot	Calidris tenuirostris	12.1.2, 12.1.3	1 / Shorebird roost	No
#Red-necked Stint	Calidris ruficollis	12.1.2, 12.1.3	Shorebird roost	No
#Sharp-tailed Sandpiper	Calidris acuminata	12.1.2, 12.1.3	Shorebird roost	No
Australian Pied Oystercatcher	Haematopus longirostris	12.1.2, 12.1.3	1 / Shorebird roost / general list	Yes
Black-winged Stilt	Himantopus himantopus	12.1.2, 12.1.3	Shorebird roost	No
Red-capped Dotterel	Charadrius ruficapillus	12.1.2, 12.1.3	1 / Shorebird roost	No
#Pacific Golden Plover	Pluvialis fulva	12.1.2, 12.1.3	Shorebird roost	No
#Lesser Sand Plover	Charadrius mongolus	12.1.2, 12.1.3	Shorebird roost	No
Black-fronted Dotterel	Elseyornis melanops	12.1.2, 12.1.3	general list	No
#Masked Lapwing	Vanellus miles	12.1.2, 12.1.3	1 / Shorebird roost / general list	Yes
Silver Gull	Chroicephalus novaehollandiae	open water	Shorebird roost / general list	Yes
# Caspian Tern	Hydroprogne caspia	open water	3 / Shorebird roost / general list	Yes
Gull-billed Tern	Gelochelidon nilatica	open water	1 / Shorebird roost / general list	Yes
Crested Tern	Thalacceus bergii	open water	general list	Yes
Peaceful Dove	Geopelia striata	12.3.3 / 12.3.7, 12.11.6, 12.3.7/12.3.11	4 / general list	Yes
Common Bronzewing	Phaps chalcoptera	non-remnant	mainland general list	No
*** Squatter Pigeon**	**Geophaps scripta scripta**	11.3.29/12.3.3, non-remnant	mainland only / general list	No
Bar-shouldered Dove	Geopelia humeralis	12.3.3 / 12.3.7, 12.11.6/ 12.11.14, 12.11.6	8, general list	Yes
Crested Pigeon	Ocyphaps lophotes	12.3.3 / 12.3.7	general list	Yes
Superb Fruit-dove	Ptilinopus superbus	12.11.4	1 / sthn spoil dump / general list	No
Rose-crowned Fruit-dove	Ptilinopus regina	12.11.4	1 / sthn spoil dump / general list	No
Red-tailed Black-cockatoo	Calyptorhynchus banksii	12.11.6, non-remnant	4 / general list	Yes
Galah	Eolophus roseicapillus	11.1.4, 12.3.3 / 12.3.7, 12.1.3	general list	Yes
Rainbow Lorikeet	Trichoglossus haematodus	12.11.6 , 12.3.3/ 12.3.7, 12.11.6/12.11.14, 12.1.3, 11.3.29/12.3.3, non-remnant	25, general list	Yes
Scaly-breasted Lorikeet	Trichoglossus chloropidotus	12.11.6 , 12.3.3/ 12.3.7, 12.11.6/12.11.14, 12.1.3, 11.3.29/12.3.3, non-remnant	6 / general list	Yes
Little Lorikeet	Glossopsitta pusilla	12.11.6 , 12.3.3/ 12.3.7, 12.11.6/12.11.14, 12.1.3	1 / general list	Yes
Red-winged Parrot	Aprosmictus erythropterus	non-remnant	mainland general list	No
Pale-headed Rosella	Platycercus adscitus	12.3.3 / 12.3.7, 12.11.6, 11.3.29/12.3.3, non-remnant	8 / general list	Yes

Common Name	Scientific Name	RE and Remnant Vegetation Cover	Number of 2ha Plots / survey site type, 2009	Recorded during 2008 survey
Brush Cuckoo	Cacomantis variolosus	12.11.6, 12.11.6/12.11.14, 12.3.3/12.3.7	1 / general list	Yes
Horsfield's Bronze-cuckoo	Chalcites basilis	12.11.6, 12.11.6/12.11.14, 12.3.3/12.3.7	2 / general list	Yes
Eastern Koel	Eudynamys orientalis	12.11.6, 12.11.6/12.11.14, 12.3.3/12.3.7	3 / general list	Yes
Channel-billed Cuckoo	Scythrops novaehollandiae	12.11.6, 12.11.6/12.11.14, 12.3.3/12.3.7	4 / general list	Yes
Pheasant Coucal	Centropus phasianinus	12.11.6, 12.11.6/12.11.14, 12.3.3/12.3.7	20 / general list	Yes
Eastern Barn Owl	Tyto javanica	12.11.6	1 NCP site	No
*** Powerful Owl**	**Ninox strenua**	12.11.6, 12.11.6/12.11.14	1 NCP site	Yes
Barking Owl	Ninox connivens	12.11.6 , 12.3.3/ 12.3.7, 12.11.6/12.11.14, 12.1.3	1 / 4 NCP sites / general list	Yes
Southern Boobook	Ninox novaeseelandiae	12.11.6 , 12.3.3/ 12.3.7, 12.11.6/12.11.14	4 NCP sites / general list	Yes
Tawny Frogmouth	Podargus strigoides	12.3.3 / 12.3.7	2 / general list	Yes
Australian Owlet-nightjar	Aegotheles cristatus	12.11.6, 12.3.3 / 12.3.7, 12.3.7/12.3.11	3 NCP sites / general list	Yes
White-throated Nightjar	Eurostopodus mystacalis	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14	3 NCP sites / general list	Yes
Australian Swiftlet	Aerodromus terrareginae	Above canopy	1 / general list	No
#Fork-tailed Swift	Apus pacificus	Above canopy	3 / general list	No
#White-throated Needletail	Hirundapus caudacutus	Above canopy	2 / general list	No
Laughing Kookaburra	Dacelo novaeguineae	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 11.3.29/12.3.3, non-remnant	17 / general list	Yes
Blue-winged Kookaburra	Dacelo leachii	12.3.3 / 12.3.7, 11.3.29/12.3.3, non-remnant	2 / general list	Yes
Forest Kingfisher	Tadiramphus macleayii	12.11.6, 12.11.6/12.11.14, 12.3.3/12.3.7, 11.3.29/12.3.3, non-remnant	8 / general list	Yes
Sacred Kingfisher	Todiramphus sanctus	12.1.2, 12.1.3, 12.11.6	3 / general list	No
Collared Kingfisher	Todiramphus chloris	12.1.2, 12.1.3	3 / general list	No
# Rainbow Bee-eater	Merops ornatus	12.11.6 , 12.3.3/ 12.3.7, 12.11.6/12.11.14, 12.1.3, 11.3.29/12.3.3, non-remnant	20 / general list	Yes
Dollarbird	Eurystomus orientalis	12.11.6 / 12.11.14, 12.11.6, 12.3.3, non-remnant	8 / general list	Yes
Red-backed Fairy-wren	Malurus melanocephalus	12.3.3/12.3.7, 12.11.6 / 12.11.14, 12.11.6, 12.3.3, non-remnant	9 / general list	Yes
Spotted Pardalote	Pardalotus punctatus	12.11.6,	1 / general list	Yes
Striated Pardalote	Pardalotus striatus	12.3.3/12.3.7, 12.11.6 / 12.11.14, 12.11.6, 12.3.3, non-remnant	15 / general list	Yes
White-browed Scrubwren	Sericornis frontalis	12.11.6 /12.11.14	general list	Yes
Mangrove Gerygone	Gerygone levigaster	12.1.3	2 / general list	No

Common Name	Scientific Name	RE and Remnant Vegetation Cover	Number of 2ha Plots / survey site type, 2009	Recorded during 2008 survey
Fairy Gerygone	Gerygone palpebrosa	12.11.6, 12.11.4	2 / general list	No
Brown Thornbill	Acanthiza pusilla	12.11.6 /12.11.14	Not recorded 2009	Yes
Weebill	Smicrornis brevirostris	12.11.6 /12.11.14	1 / 2ha site	Yes
Noisy Friarbird	Philemon corniculatus	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 11.3.29/12.3.3, non-remnant	21 / general list	Yes
Little Friarbird	Philemon citreogularis	11.3.29/12.3.3, non-remnant	1 / general list	No
Striped Honeyeater	Plectorhyncha lanceolata	11.3.29/12.3.3	mainland general list	Yes
Blue-faced Honeyeater	Entomyzon cyanotis	12.11.6, 11.3.29/12.3.3, 12.3.3 / 12.3.7, non-remnant	2 / general list	Yes
Noisy Miner	Manorina melanocephala	12.11.6, 11.3.29/12.3.3, 12.3.3 / 12.3.7, non-remnant	1 / general list	Yes
Yellow-faced Honeyeater	Lichenostomus chrysops	non-remnant	1 2ha site	No
Mangrove Honeyeater	Lichenostomus fasciogularis	12.1.3	4 / general list	Yes
White-throated Honeyeater	Melithreptus albogularis	12.11.6 / 12.11.14, 12.3.3/12.3.7, 11.3.29/12.3.3, non-remnant	3 / general list	Yes
White-naped Honeyeater	Melithreptus lunatus	12.11.6 / 12.11.14, 12.3.3/12.3.7, 11.3.29/12.3.3, non-remnant	15 / general list	Yes
Dusky Honeyeater	Myzomela obscura	12.11.4	general list	No
Scarlet Honeyeater	Myzomela sanguinolenta	12.11.6	general list	No
Brown Honeyeater	Lichmera indistincta	12.1.3, 12.11.6, non-remnant	2 / general list	Yes
Eastern Yellow Robin	Eopsaltria australis	12.11.6 / 12.11.14	not recorded in 2009	Yes
Grey-crowned Babbler	Pomatostomus temporalis	non-remnant, 11.3.29/12.3.3	1 mainland site / general list	No
Varied Sitella	Daphoenositta chrysoptera	12.11.6 / 12.11.14, 12.11.6, 12.11.4, 12.1.3	general list – 1 location	Yes
Rufous Whistler	Pachycephala rufiventris	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14,	1 / general list	Yes
Grey Shrike-thrush	Colluricincla harmonica	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 12.11.4	6 / general list	Yes
Little Shrike-thrush	Colluricincla megarhyncha	12.11.4	1 / general list	Yes
Spectacled Monarch	Symposiarchus trivirgatus	12.11.6	Not recorded 2009	Yes
Black-faced Monarch	Monarcha melanopsis	12.11.6 / 12.11.14, 12.11.4	2 / general list	Yes
Leaden Flycatcher	Myiagra rubecula	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 11.3.26/12.3.3 non-remnant	8 / general list	Yes
Shining Fl;ycatcher	Myiagra alecto	12.1.3	2 / general list	Yes
Rufous Fantail	Rhipidura rufifrons	12.11.6 / 12.11.14	not recorded 2009	Yes
Willie Wagtail	Rhipidura leucophyrys	non-remnant	1/ general list	Yes
Black-faced Cuckoo-shrike	Coracina novaehollandiae	12.11.6 / 12.11.14, non-remnant	4 / general list	Yes
White-bellied Cuckoo-shrike	Coracina papuensis	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14	2 / general list	Yes

Common Name	Scientific Name	RE and Remnant Vegetation Cover	Number of 2ha Plots / survey site type, 2009	Recorded during 2008 survey
Cicadabird	Coracina tenuirostris	12.11.6, non-remnant, 12.11.6 /12.11.14, 12.3.3 / 12.3.7	10 / general list	No
Varied Triller	Lalage leucomela	12.11.4	2 / general list	No
Olive-backed Oriole	Oriolus sagittatus	non-remnant, 11.3.29/12.3.3	2 / general list	Yes
White-breasted Wood-swallow	Artamus leucorynchus	12.1.3	general list	Yes
Dusky Woodswallow	Artamus cyanopterus	12.11.6	general list	No
Grey Butcherbird	Cracticus torquatus	12.11.6, 12.3.3 / 12.3.7	general list	Yes
Pied Butcherbird	Cracticus nigrogularis	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 11.3.26/12.3.3 non-remnant	9 / general list	Yes
Magpie-lark	Grallina cyanoleuca	12.1.2	general list	No
Australian Magpie	Gymnorhina tibicens	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 11.3.26/12.3.3 non-remnant	22 / general list	Yes
Pied Currawong	Strepera graculina	12.3.3 / 12.3.7, 12.11.6, 12.11.6 /12.11.14, 11.3.26/12.3.3 non-remnant	7 / general list	Yes
Spangled Drongo	Dicrurus bracteatus	12.1.3, 12.11.6, 12.11.6/12.11.14, 12.11.4	12 / general list	Yes
Torresian Crow	Corvus orru	12.11.6	3 / general list	Yes
White-winged Chough	Corcorax melanorhamphos	12.3.7/12.3.3, 12.11.6	not recorded 2009	Yes
Australasian Pipit	Anthus novaeseelandiae	12.1.2	general list	Yes
Double-barred Finch	Taeniopygia bichenovii	11.3.26/11.11.15	2 / general list	No
Olive-backed Sunbird	Nectarinia jugularis	12.1.3, 12.11.4	general list	Yes
Mistletoebird	Dicaceum hirundinaceum	12.3.7/12.3.3, 12.11.6, 12.11.6/12.11.14	2 / general list	Yes
Welcome Swallow	Hirundo neoxena	12.1.3, 11.3.29/12.3.3, 12.11.6	1 / general list	Yes
Tree Martin	Hirundo nigricans	12.11.6	not recorded 2009	Yes
Fairy Martin	Hirundo ariel	12.11.6	not recorded 2009	Yes
Tawny Grassbird	Megalurus timoriensis	grassland clearing	general list	No
Golden-headed Cisticola	Cisticola exilis	grassland clearing	general list	No
Silvereye	Zosterops lateralis	12.3.3 / 12.3.7	1 / general list	Yes

Table A4: Shorebird Counts, January and February 2009

Tide	Low	High	Neap	Neap	Neap							High
Date	27.1.09	26.1.09	27.1.09	27.1.09**	19.2.09	18.2.09	19.2.09	20.2.09	20.2.09	20.2.09	20.2.09	22.2.09
Location	Mainland - claypan	Mainland claypan	Mainland neap roost	Rear of claypan	Mainland Neap roost	Laird Point	Laird Point	Sth Passage Is	Mainland neap roost	Laird Point	Grahams Creek Generally	Laird Point
Easting	311000	311280	311989	310480	311673	313744	313744	315301	311673	313744		313744
Northing	7371800	7372000	7372236	7371280	7372009	7372882	7372882	7368514	7372009	7372882		7372882
Common Name												
Bar-tailed Godwit	1	41	74	16	8	1			57			
Whimbrel	3	34	7	12	299	8	69		3		10	173
Eastern Curlew	1	27	15	3	56	2	6		7		1	3
Common Greenshank	1	1										
Grey-tailed Tattler	2	7	2		1			19***				
Terek Sandpiper								105***				
Great Knot		15	12	6					10			
Red-necked Stint	304	142										
Sharp-tailed Sandpiper	5											
Pied Oystercatcher		1		6	2					2		
Red-capped Plover	42	12			5	4			2	2	1	
Pacific Golden Plover	12			8								
Lesser Sand Plover		25										
Beach Stone-Curlew					3		1 (tracks)					2
Striated Heron								2				
Crested Tern						31						
Masked Lapwing												4
Caspian Tern		2	8									
Gull-billed Tern		2										
Little Egret				2		3	2	35		1		
Osprey								1				
Buff-banded Rail								2				
Black Swan									2			
Brahminy Kite											1	
Brown Goshawk											1	
Total numbers	**371**	**309**	**118**	**53**	**374**	**49**	**78**	**164**	**81**	**3**	**14**	**182**

Table A5: Threatened Species Recorded January – February 2009.

Note: Table includes significant records only. Numerous small groups or single Eastern Curlew were regularly encountered along the shoreline during the survey.

Date	Common Name	Observation Type	Number	Location	Easting	Northing	Datum	Comments
28.01.2009	Squatter Pigeon	O	1	Access Road near dams	311137	7368763	WGS84	Adult bird, dam within 100m
26.1.2009	Squatter Pigeon	O	3	Access Road near dams	311176	7368805	WGS84	dam within 100m
27.1.2009	Squatter Pigeon	O	1	Access road near creek	310768	7369702	WGS84	Juvenile
19.2.2009	Squatter Pigeon	O	2	North of small creek	310718	7369932	WGS84	Grassy woodland
26.1.2009	Eastern Curlew	O	2	Mudflats near southern end of road route	311502	7368575	WGS84	
26 – 27.1.2009	Eastern Curlew	O	1	End of peninsular between routes - mainland	309878	7371242	WGS84	
27.1.2009	Eastern Curlew	O	1	Island near western end of road route	310522	7370915	WGS84	
16.2.2009	Eastern Curlew	O	1	Southern spoil dump site	319535	7368015	WGS84	
27.1.2009	Eastern Curlew	O	15	Mainland neap roost	311989	7372236	WGS84	
26.1.2009	Eastern Curlew	O	27	Claypan roost	311280	7372000	WGS84	
27.1.2009	Eastern Curlew	O	3	Rear Claypan roost	310480	7371280	WGS84	
19.2.2009	Eastern Curlew	O	56	Mainland neap tide roost	311673	7372009	WGS84	Important roost
22.1.2009	Eastern Curlew	O	6	Laird Point	313744	7372882	WGS84	
20.2.2009	Eastern Curlew	O	7	Mainland neap tide roost	311673	7372009	WGS84	
	Eastern Curlew	O	2	Tidal Creek	311124	7371207	WGS84	
26.1.2009	Beach Stone-curlew	O	2	Mudflats at southern end of mainland road route	311502	7368575	WGS84	Pair
16.2.2009	Beach Stone-curlew	O	3	Edge mangroves at south eastern boundary southern spoil dump	319598	7367740	WGS84	Pair with Juvenile
19.2.2009	Beach Stone-curlew	O	3	Mainland neap tide roost	311673	7372009	WGS84	Pair with juvenile
26.1.2009	Beach Stone-curlew	O	1	Mudflats near mainland access road - creek 2	310755	7370241	WGS84	Possible nest site at location
22.2.2009	Beach Stone-curlew	O	2	Laird Point	313972	7373034	WGS84	Pair at entrance to Grahams Creek
20.2.2009	Powerful Owl	O	1	Eastern end of Quad bike track.	317421	7370906	WGS84	Possibly roosting nearby

Table A6: Butterflies recorded within the subject site during opportunistic surveys between 26.1.09 and 22.2.09. Nomenclature follows Braby (2004).

Family	Common Name	Scientific Name	RE and Remnant Vegetation Cover
Papilionidae	Chequered Swallowtail	*Papilio demoleus*	12.3.3; 12.11.6
	Orchard Swallowtail	*Papilio aegeus*	12.3.3
	Dainty Swallowtail	*Papilio anactus*	12.3.3; 12.11.6
	Clearwing Swallowtail	*Cressida cressida*	12.3.3; 12.11.6
Pieridae	Lemon Migrant	*Catopsilia pomona*	12.1.2; 12.3.3
	Small Grass Yellow	*Eurema* spp.	12.3.3
	Jezebel	*Delias spp.*	12.1.3
	Caper White	*Belenois java*	12.3.3
Nymphalidae	Evening Brown	*Melantis leda*	12.3.3; 12.11.6
	Orange Ringlet	*Hypochsta adiante*	12.1.3
	Glasswing	*Acraea andromacha*	12.1.3; 12.11.6; 12.3.3
	Varied Eggfly	*Hypolimnas bolina*	12.3.3; 12.11.6
	Common Crow	*Euploea core*	12.1.3; 12.3.3
	Lesser Wanderer	*Danaus chrysippus*	12.1.3; 12.3.3; 12.11.6
	Swamp Tiger	*Danaus affinis*	12.1.3
	Monarch	*Danaus plexippus*	12.1.2; 12.3.3
	Blue Tiger	*Tirumala hamata*	12.1.2; 12.1.3; 12.3.3
Lycaenidae	Small Dusky Blue	*Candalides erinus*	12.11.6
	Shining Oak-blue	*Arhopala micale*	12.1.3

Table A7a: Fauna Habitat – Site Characteristics, survey quadrats, Gladstone, Jan/Feb 2009. Regen. = regeneration; m = metres; yr = years;

Non-remnant | Lemon-Scented Gum/Grey Ironbark | Queensland Blue Gum | Mangrove | Saltmarsh/Saltpan/Muflat

	Site										
	MR01	MR02	MR03	MR04	R1	R15	R20	P1/R24	R30	P11/R35	R54
	Disturbance										
Fire	Light (5-10yr)	Moderate (5-10yr)	Light (>10yr)	Nil	Light (5-10yr)	Moderate (1-5yr)	Light (1-5yr)	Moderate (1-5yr)	Light (>10yr)	Moderate (1-5yr)	Light (1-5yr)
Logging	Moderate (>10yr)	Moderate (>10yr)	Light (>10yr)	Nil	Nil	Severe (>10yr)	Nil	Moderate (>10yrs)	Nil	Moderate (>10yr)	Nil
Clearing	Moderate (>10yr)	Severe (>10yr)	Moderate (>10yr)	Nil	Moderate (>10yr)	Severe (>10yr)	Moderate (>10yr)	Little (>10yr)	Light (>10yr)	Little (>10yr)	Moderate (>10yr)
Grazing	Light (current)	Light (1-5yr)	Light (1-5yr)	Nil	Moderate (current)	Light (current)	Moderate (current)	Light (current)	Light (current)	Light (current)	Light (current)
Weeds	Light (current)	Light (current)	Light (current)	Nil	Light (current)	Light (current)	Nil	Light (current)	Nil	Light (current)	Light (current)
Flooding	Nil	Nil	Nil	Severe (current)	Nil	Nil	Nil	Nil	Nil	Nil	Nil
	Vegt Structure & Floristics (height, cover, dominant species)										
Overstorey	24m, 50%, E. crebra/C. citriodora/E. tereticornis	18m, 60%, E. teretecornis/ E. crebra / C. citriodora	13m, 30%, E.crebra/C. tesselaris/E. tereticornis	6m, 30%, Mangroves	16m, 15%, E. tereticornis, E. crebra, C. tesselaris	28m, 30%, E. tereticornis/E crebra	20m, 20%, E. tereticornis	28m, 30%, C. citriodora/ E.tereticornis	22m, 20%, E. crebra, E. tereticornis	32m, 25%, C.citriodora/ E. crebra	22, 15%, E. crebra
Midstorey	10m, 15%, E. crebra/C. citriodora/ Acacia spp.	10m, 30%, Acacia spp./Euc. Spp.	6m, 20%, Cockatoo Apple/Euc spp.	2m, 10%, Mangroves	7m, 10%, Acacia spp.	10m, 15%, Euc. Regrowth/Acacia Spp.	12m, 15%, Swamp Box	15m, 30%, Acacia spp./Euc. Regrowth/ Allocasuarina spp	15m, 10%, E. crebra, E. tereticornis	14m, 20%, Euc regrowth	14m, 20%, E. crebra, C. citriodora
Understorey	2m, 15%, Melaleuca Spp./Acacia spp./Sida	3m, 30%, Acacia spp., Lantana / Sida	2m, 20%, Lantana/Sida spp.	1m, 10%, Mangroves	3m, 15%, Lantana camara, Sida spp., Acacia spp.	5m, 30%, Lantana/Rain forest Spp./Acacia Spp.	5m, 30%, Acacia spp.	6m, 30%, Acacia Spp.	6m, 25%, Acacia spp.	4m, 60%, Acacia Spp./Cockato o Apple	3m, 20%, Acacia spp
Groundcover	1m, 100%/Grasses	1m, 100%/Grasses / Sida/ vines	1m, 90%, grasses	Nil	1m, 80%, Grasses	1m, 80%, Grasses	1m, 75%, Grasses, Sida spp.	1.5m, 80%, Grasses	0.75m, 60%, Grasses	0.75m, 60%, Grasses	0.75m, 40%, Grasses
Age Structure	uneven age	advanced regen	advanced regen	uneven age	uneven age	uneven age	uneven age	uneven age	uneven age	advanced regen.	advanced regen
Soil types	clay loams	clay loams	Gravelly clay loam	marine muds	clay loam	grey clay loams	clay loam	grey clay loams	clay loam	Gravely clay loams	

Table A7a cont.

	Site									
	P43 / R65	R69	P51/R73	P56/R79	Near P61	R112	R106	R83	Extension 1	Extension 2
					Disturbance					
Fire	Moderate (1-5yr)	Moderate (1-5yr)	Severe (1-5yr)	Moderate (1-5yr)	nil	nil	nil	nil	Moderate (1-5yr)	Moderate (1-5yr)
Logging	Little (>10yr)	Nil	Light (>10yr)	Little (>10yr)	nil	nil	nil	nil	Nil	Nil
Clearing	Little (>10yr)	Severe (>10yr)	Moderate (>10yr)	Moderate (>10yr)	nil	Severe (>10yr)	Severe (>10yr)	nil	Moderate (>10yr)	Moderate (>10yr)
Grazing	Light (current)	Moderate (current)	Light (current)	Light (current)	nil	Moderate (5-10yr)	Light (5-10yr)	nil	Light (current)	Light (current)
Weeds	Light (current)	Light (current)	Light (current)	Light (current)	nil	Light (current)	Nil	nil	Light (current)	Light (current)
Flooding	Nil	Nil	Nil	Nil	nil	Nil	Light (<1yr)	nil	Nil	Nil
					Vegt Structure & Floristics (height, cover, dominant species)					
Overstorey	26m, 40%, C. citriodora	22m, 20%, NL Peppermint/ Corymbia spp.	24m, 40%, Peppermint / Ironbark	18m, 30%, Peppermint/ E. crebra	nil	10m, 15%, E. crebra	9m, 10%, E. tereticornis	3m, 5%, Avicennia marina	22m; 20%, C. citriodora	22m, 20%, E. crebra, C. citriodora
Midstorey	12m, 15%, C. citriodora/E. crebra	14m, 15%, Swamp Box, Euc regrowth	10m, 3%, Euc. Regrowth/ Acacia Spp.	6m, 20%, Euc. Regrowth	nil	7m, 15%, E. tereticornis, Acacia spp.	5m, 15%, Melaleuca spp.	1,5m, 7%, Rhizophora stylosa	12m, 10%, Euc. Regrowth	12m, 15%, E. crebra
Understorey	3m, 30%, Acacia Spp./ Dodonea Spp. / Xanthorro Spp.	3m, 50%, Acacia spp.	3m, 30%, Acacia regrowth/ Cockatoo Apple	2m, 20%, Dodonea/Acacia Spp.	nil	2.5m, 20%, Sida spp.	2m, 2%, Sida spp.	nil	3m, 45%, Acacia spp.	4m, 35%, Euc regrowth, Acacia spp.
Groundcover	0.4m, 30%, Grasses	1m, 60%, Grasses, Sida spp.	0.5m, 50%, Grasses	0.5m, 50%, Grasses	0.4, 50%, Sarcocornia spp, Suaeda spp, Zoysia spp.	1m, 80%, Grasses	0.75m, 45%, Grasses, sedges	nil	0.75m, 35%, Grasses, vines	1m, 75%, Grasses & Sida spp.
Age Structure	advanced regen.	advanced regen	advanced regen.	advanced regen.	mature age	advanced regen	advanced regen	mature age	uneven age	uneven age
Soil types	Gravelly clay loams	Clay loam	Gravelly clay loams	Gravelly clay loams	intertidal mud	gravelly clay loam	clay loam	Intertidal mudflat	Gravelly clay loams	Clay loam

Table A7a cont.

	Site								
	Nth Spoil 2	Nth Spoil 2	Nth Spoil 2	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1
	Disturbance								
Fire	Moderate (1-5yr)	Moderate (1-5yr)	nil	Light (1-5yr)	Light (1-5yr)	Light (1-5yr)	nil	light (1-5yr)	Nil
Logging	Nil	Nil	nil	nil	Severe (>10yrs)	Nil	nil	nil	Nil
Clearing	Moderate (>10yr)	Moderate (>10yr)	nil	Severe (>10yr)	Moderate (current)	Severe (>10yr)	nil	Severe (>10yr)	Moderate (>10yr)
Grazing	Moderate (current)	Light (current)	nil	Moderate (current)	nil	Moderate (current)	nil	Moderate (current)	light (current)
Weeds	nil	moderate (current)	nil	Nil	nil	nil	nil	nil	Nil
Flooding	nil	nil	nil	Nil	nil	nil	nil	nil	Nil
	Vegt Structure & Floristics (height, cover, dominant species)								
Overstorey	17m, 25%, NL Peppermint, Corymbia spp.	17m, 15%, E. crebra, Corymbia spp., E. tereticornis	3m, 90%, Rhizophora stylosa, Avicennia, marina	14m, 25%, E. tereticornis, E. crebra	14m, 20%, E. tereticornis	13m, 20%, Corymbia spp., NL Pepppermint	5m, 80%, Rhizophora stylosa	14m, 20%, E. crebra, Corymbia spp.	8m, 50%, RF species
Midstorey	10m, 15%, NL Peppermint, Lophostemon suaveolons.	10m, 25%, E. crebra	nil	7m, 20%, Acacia spp.	7m, 25%, E. crebra, E. tereticornis, Acacia spp.	8m, 10%, Foambark	nil	8m, 10%, Euc regrowth, Acacia spp.	4m, 25%, RF species
Understorey	3m, 25%, Acacia spp.	4m, 40%, Acacia spp.	nil	2m, 5%, Acacia spp, Melaleuca spp.	3m, 5%, Acacia spp.	5m, 25%, Foambark, Red Ash	nil	3m, 10%, Acacia spp.	2m, 15%, RF species
Groundcover	1m, 65%, Grasses	1m, 70%	nil	1m, 75%, Grasses	0.75m, 50%, Grasses	0.5m, 55%, Basket Grass	nil	0.5m, 35%, Grasses	0.5m, 3%, Creeping Christian
Age Structure	mature age	uneven age	mature age	advanced regen	advanced regen	advanced regen	mature age	advanced regen	uneven age
Soil types	clay loam	clay loam	intertidal mud	clay loam	clay loam	clay loam	intertidal mud	clay loam	red clay loam

Table A7a cont

	SSP01	SSP02	SSP03	SSP04	SSP05	NSP01	NSP02	NSP03	NSP04	NSP05
					Disturbance					
Fire	Moderate (1-5yrs)	Moderate (1-5yrs)	Nil	Moderate (5-10yrs)	Moderate (1-5yrs)	Moderate (1-5yrs)	Moderate (1-5yrs)	Moderate (1-5yrs)	Moderate (1-5yrs)	Moderate (1-5yrs)
Logging	Severe (>10yrs)	Severe (>10yrs)	Nil	Moderate (>10yrs)	Severe (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)
Clearing	Severe (>10yrs)	Severe (>10yrs)	Nil	Moderate (>10yrs)	Severe (>10yrs)	Severe (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)	Moderate (>10yrs)
Grazing	Light (current)	Light (current)	Nil	Light(current)	Light (current)	Light (current)	Light (current)	Light (current)	Light (current)	Light (current)
Weeds	Light (current)	Light (current)	Nil	Light (current)	Light (current)	Light (current)	Light (current)	Light (current)	Light (current)	Light (current)
Flooding	Light (current)	Nil	Severe (current)	Nil	Nil	Nil	Nil	Light (current)	Nil	Nil
					Vegetation Structure and Floristics					
Overstorey	26m, 50%, E. terreticormis	18m, 40%, Peppermint/ E. crebra/ C. citriodora	5m, 95%, Stilt Mangroves	18m, 40%, E. crebra/ Peppermint	14m, 50%, E.crebra	26m, 40%, C. citriodora / E. crebra	28m, 40%, Bloodwood / Qld Blue Gum/Swamp Box	20m, 20%, E. terreticornis /Bloodwood /Peppermint /Swamp Box	24m, 30%, E. crebra /C. citriodora/Peppermint	26m, 40%, Peppermint/ C. citriodora/E. crebra
Midstorey	12m, 30%, Melaleuca Spp./ Euc regrowth	8m, 50%, Acacia Spp. / Euc. Regrowth	0	10m, 20%, Euc regrowth	6m, 30%, E.crebra / Peppermint / Acacia spp.	10m, 15%, Euc. Regrowth	18m, 30%, Euc. Regrowth/Allocasuarina	16m,20%, Euc. Regrowth/Acacia Spp.	16m, 20%, Euc regrowth/Acacia Spp.	18m, 25%, Euc regrowth
Understorey	2m, 20%, Sida / Lantana	3m, 10%, Cockatoo Apple-Acacia Spp./ Sida	0	8m, 50%, Red Ash/ Rainforest species / Sida	4m, 30%, Cockatoo Apple / Acacia Spp. /Red Ash	3m, 50%, Acacia Spp.	2m, 50%, Acacia spp.	3m, 20%, Acacia Spp./Cocka too Apple	4m, 40%, Acacia Spp.	4m, 10%, Acacia spp, Xanthorr
Groundcover	0.4m, 80%, Grasses	05.m, 40%, Grasses	marine muds	grasses / native legumes	0.5m, 20%, grasses	0.5m, 50%, Grasses, Ghania	1m, 70%, Grasses/vines/legumes	1m, 70%, Grasses	0.5m, 70%, Grasses	0.4m, 60%, grasses
Age Structure	advanced regen.	advanced regen.	mature age	uneven age	uneven age	advanced regen.	advanced regen	advanced regen	advanced regen	advanced regen
Soils	heavy grey clay loam	Gravelly loam	marine muds	gravelly clay loams	gravelly clay loams	gravelly clay loams	clay loam	Grey clay loams	Gravelly clay loams	Gravelly clay loams

Table A7b: Fauna Habitat – Site Characteristics, quadrants, Curtis Island, October 2008 (Continued). % = percent of trees with feature present in the 1ha plot; m = metres; Logs = greater than 15cm diameter; Ck = creek

	MR01	MR02	MR03	MR04	R1	R15	R20	P1/R24	R30	P11/R35	R54
Hollows											
Large (>15cm)	0	0	5	0	0	0	0	0	1	0	0
Medium (5-15cm)	8	0	3	0	0	3	0	8	1	7	0
Small (<5cm)	2	0	3	0	2	3	0	2	1	3	0
					Fauna Features (% of midstorey and overstorey vegt)						
Mistletoe	0	1	1	0	0	0	0	0	0	0	0
Epiphytes	0	0	0	0	0	0	0	0	0	0	0
Fleshy Fruit	1	1	1	3	0	0	0	0	1	0	2
Flowers	0	1	1	3	0	1	2	2	2	1	0
Acacia	2	2	1	0	2	2	2	2	3	3	3
Banksia	0	0	0	0	0	0	0	0	0	0	0
Allocasuarina	0	0	0	0	0	0	0	1	0	0	0
Figs	0	0	0	0	0	1	0	0	0	0	0
Decorticating Bark	1	1	1	0	0	2	0	1	0	2	0
Melaleucas	1	1	0	0	0	0	1	0	0	0	0
Permanent Water	150m, ocean	10m, dam	30m, dam	0m, ocean	300m, dam	-	1000m, dam	-	1000m+	1000m, ocean	1000m+
Temporary Water	50m, creek	-	40m, drain	0m, ocean	100m, soak	30m, creek	onsite, creek	10m, creek	30m, creek	100m, creek	150m, creek
Tussocks	45%	40%	60%	0%	55%	5%	60%	10%	50%	20%	35%
Rhizomatous Grasses	50%	40%	25%	0%		45%		70%		40%	
Bed Rock	-	-	-	-		-		-		-	
Surface Rock	-	-	-	-		-		-		-	3%
Bare Earth	0%	0%	5%	100%	10%	-	5%	-	2%	-	2%
Leaf Litter	5%, <5cm	20%, <5cm	10%, <5cm	0	10%, <5cm	50%, <5cm	20%, <5cm	20%, <5cm	38%, <5cm	40%, <5cm	55%, <5cm
Humus	-	-	0%	0	0	-	0	-		-	
Fallen Logs (>15cm)	5	0	4	0	0	4	0	2	6	2	5
Hollow Fallen Logs (>15cm)	1	0	4	0	0	0	0	0	2	0	0

	P43 / R65	R69	P51/R73	P56/R79	Near P61	R112	R106	R83	Extension 1	Extension 2
Hollows										
Large (>15cm)	5	0	0	0	0	0	0	0	0	0
Medium (5-15cm)	7	2	7	6	0	0	0	0	1	0
Small (<5cm)	5	0	4	1	0	0	1	0	1	0
				Fauna Features (% of midstorey and overstorey vegt)						
Mistletoe	0	0	0	0	0	1	0	0	0	0
Epiphytes	0	0	0	0	0	0	0	0	0	0
Fleshy Fruit	0	0	0	0	0	0	0	1	0	0
Flowers	1	0	2	1	0	0	0	0	1	0
Acacia	3	3	3	1	0	2	1	0	3	3
Banksia	0	0	0	0	0	0	0	0	0	0
Allocasuarina	0	0	0	0	0	0	0	0	0	0
Figs	0	0	0	0	0	0	0	0	0	0
Decorticating Bark	1	0	2	1	0	1	2	0	0	0
Melaleucas	0	0	0	0	0	1	2	0	0	0
Permanent Water	600m, ocean	unknown	300m, ocean	100m, ocean	200m, ocean	200m, dam	300m	onsite	1000m+	1000m+
Temporary Water	50m, creek	250m, creek	150m, soak	-	onsite, saltmarsh	on-site	on-site	onsite	200m, creek	400m, creek
Tussocks	10%	50%	10%	50%	2%	70%	35%	nil	20%	60%
Rhizomatous Grasses	10%		60%	15%	0	15%	5%	nil		
Bed Rock	-		-	-	0	nil	0	nil		
Surface Rock	50%		-	10%	0%	nil	0%	nil	15%	
Bare Earth	-	5%	-	-	46%	5%	50%	95%	10%	
Leaf Litter	30%, <5cm	35%, <5cm	30%, <5cm	30%, <5cm	2%, <5cm	10%, <5cm	10%, <5cm	5%, <5cm	40%, <5cm	20%, <5cm
Humus	-		-	-	0	nil	nil	nil		
Fallen Logs (>15cm)	5	3	11	8	0.00	0	6	3	0	0
Hollow Fallen Logs (>15cm)	0	1	3	2	0.00	0	0	1	0	0

Table A7b cont.

	Nth Spoil 2	Nth Spoil 2	Nth Spoil 2	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1	Sth Spoil 1
					Hollows				
Large (>15cm)	3	0	0	0	0	0	0	0	0
Medium (5-15cm)	4	0	0	0	0	0	0	0	0
Small (<5cm)	1	0	0	0	0	0	0	0	0
					Fauna Features (% of midstorey and overstorey vegt)				
Mistletoe	0	0	0	0	0	0	0	0	0
Epiphytes	0	0	0	0	0	0	0	0	0
Fleshy Fruit	0	2	0	0	0	2	2	1	1
Flowers	0	1	0	0	0	2	2	1	1
Acacia	2	3	0	2	2	2	0	2	0
Banksia	0	0	0	0	0	0	0	0	0
Allocasuarina	0	0	0	0	0	0	0	0	0
Figs	0	0	0	0	0	0	0	0	0
Decorticating Bark	1	0	0	2	0	0	0	0	0
Melaleucas	1	0	0	2	0	0	0	1	0
Permanent Water	1000m, dam	1500m, dam	1000m, dam	50m, dam	500m, dam	1000m, dam	1000m, dam	1250m, dam	1500m, dam
Temporary Water	onsite, soak	500m, wetland	250m, soak	onsite, creek	50m, creek	250m	1000m, creek	1000m, creek	1250m, creek
Caves/Rock Fissures	nil	nil	nil	nil	nil	Nil	nil	nil	Nil
Nest or Roost Trees	nil	nil	nil	nil	nil	Nil	nil	nil	Nil
Tussocks	65%	10%	0	75%	50%	15%	0	35%	0%
Rhizomatous Grasses			0	0	0	40%	0	0	0%
Bed Rock			0	0	0	0	0	0	0
Surface Rock		5%	0	0%	20%	0%	0%	20%	0%
Bare Earth	5%	1%	100%	0%	20%	0%	100%	0%	5%
Leaf Litter	30%, <5cm	14%, <5cm	0%	25%	10%, <5cm	45%, <5cm	0%	45%, <5cm	90%, <5cm
Humus			0	0	0	0%	0	0	0.5cm
Fallen Logs (>15cm)	7	2	0	0	1	4.00	0.00	5.00	4.00
Hollow Fallen Logs (>15cm)	0	1	0	0	1	0.00	0.00	1.00	0.00

Table A7b cont.

	SSP01	SSP02	SSP03	SSP04	SSP05	NSP01	NSP02	NSP03	NSP04	NSP05
					Hollows					
Large (>15cm)	0	0	0	2	0	0	1	8	0	4
Medium (5-15cm)	0	0	10	8	0	2	2	3	4	8
Small (<5cm)	0	0	20	5	4	3	1	0	4	2
					Fauna Features					
Mistletoe	0	0	0	0	0	0	0	0	0	0
Epiphytes	0	0	0	1	0	0	0	0	0	0
Fleshy Fruit	0	0	4	0	0	0	0	0	0	0
Flowers	0	2	1	1	1	0	1	0	0	0
Acacia	0	2	0	0	2	3	1	2	2	2
Banksia	0	0	0	0	0	0	0	0	0	0
Allocasuarina	0	0	0	0	0	0	1	0	0	0
Figs	0	0	0	0	0	0	0	0	0	0
Decorticating Bark	2	1	0	3	1	1	1	2	2	1
Melaleucas	2	0	0	0	0	0	0	0	0	0
Permanent Water	1000m, ocean	1000m, ocean	0m, ocean	100m, ocean	200m, ocean	200m, ocean	600m, ocean	1000m, ocean	1000m+	1000m+
Temporary Water	10m, creek	150m, creek	0	10m, creek	100m, creek	50m, creek	150m, creek	10m, creek	150m, creek	100m, creek
Caves/Rock Fissures	0	0	0	0	0	0	0	0	-	-
Nest or Roost Trees	0	0	0	0	0	0	0	0	-	-
Tussocks	10%	30%	0%	20%	15%	<10%	10%	10%	60%	50%
Rhizomatous Grasses	70%	30%	0%	20%	<5%	<10%	50%	60%	10%	10%
Bed Rock	0	<5%	0	0	0	0	0	0%	0%	0%
Surface Rock	0%	<5%	0%	40%	<5%	15%	0%	0%	0%	0%
Bare Earth	5%	20%	100%	10%	10%	0%	0%	0%	0%	20%
Leaf Litter	15%, <5cm	20%, <5cm	0%	10%, <5cm	70%, <5cm	70%	40%	30%	30%, 5cm	20%
Humus	0	0	0%	0	0	0	0	0%	0%	0%
Fallen Logs (>15cm)	2	5	0	4	3	10	6	3	11	10
Hollow Fallen Logs (>15cm)	0	1	0	1	1	2	2	0	6	2

APPENDIX B

EPBC Act – Assessment of Significance for Migratory Species

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

The subject site is situated within a region (i.e. Curtis Coast) that provides important habitat for a large shorebird population (Driscoll 1997). The proposal would directly modify an identified neap tide roost and affect use of a nearby spring tide roost (Figure 6b). The proposed access road extends across the western edge of the neap tide roost. In addition to the removal of habitat an elevated roadway would reduce visibility from the roost, provide a source of disturbance to roosting birds, alter the hydrology of the adjoining (Saltpan) spring tide roost and disrupt movement between roosts. The proposal may also increase human visitation to Lairds Point.

The subject roosts are known to, at times, support a substantial proportion of the Whimbrel (49%) and Red-necked Stint (25%) populations in the Curtis Coast Region (Driscoll 1997). The maximum count of Whimbrels recorded in late February 2009 was undertaken in the late afternoon and included birds that stopped briefly at the site before being disturbed and flying to an alternative site. Whilst the value of the subject roosts to the local shorebird population is difficult to gauge from a baseline survey the data suggest that the roosts are important. Furthermore, the neap tide roost (at Friend Point) has been identified as a “Major Shorebird Roost Site” by the Queensland Environment Protection Agency. It is unlikely that shorebirds would continue to utilise the neap tide roost during or after road construction.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species;

The proposal is unlikely to result in an invasive species becoming established. Additional shipping would increase the probability of exotic marine fauna entering Port Curtis; however, issues relating to the marine environment are assessed elsewhere.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

According to data gathered during the field survey the subject roosts are used by up to 49% and 25% of the local Whimbrel and Red-necked Stint populations respectively. The proposal would disrupt use of roosting habitat forcing birds to fly further to roost during spring and neap high tides.

EPBC Act – Assessment of Significance for Threatened Species

SQUATTER PIGEON

"An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:"

Lead to a long-term decrease in the size of an important population of a species

The subject site is not known to support an important population of Squatter Pigeon, although the locality does appear to be used permanently (Barrett 2003). Squatter pigeons are widespread in coastal and central Queensland north of Bundaberg. The proposal would affect only a very small area of known Squatter Pigeon habitat and is unlikely to decrease the size of the local population. Most of the identified foraging habitat would remain unaffected as the road alignment is situated predominantly in areas with a dense ground cover.

Reduce the area of occupancy of an important population

The proposal is unlikely to reduce the area of occupancy of Squatter Pigeons as the proposal would affect a very small area of known habitat and most of the suitable habitat in the study area would remain unaffected.

Fragment an existing important population into two or more populations

The proposed road would act as minor barrier to movement, although fragmentation and isolation of the extant population is unlikely. If necessary, Squatter Pigeons would be capable of crossing the road, although individuals would experience a higher risk of road strike.

Adversely affect habitat critical to the survival of a species

Habitat within the study area is not regarded as critical to the survival of Squatter Pigeons.

Disrupt the breeding cycle of an important population

There is no evidence to suggest that an important population of squatter pigeons occurs in the study area. All individuals observed were immature. These birds may have moved into the subject site from nearby breeding areas.

Modify, destroy, remove, or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal would affect a very small area of known and potential Squatter Pigeon habitat. The maximum number of pigeons recorded in the study area during the field survey was three. Although the proposal may contribute to impacts that affect the long-term viability of the local population it would not cause the species as whole to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in a vulnerable species habitat

The proposal would not contribute to the distribution or abundance of a species that is harmful to Squatter Pigeons. Known predators such as the Red Fox (Vulpes vulpes), already occur in the study area. These species would not benefit from the proposal.

Interfere substantially with the recovery of the species

The proposed works would not impact on any significant roosting, breeding or foraging sites of the species and would have localised impacts on a very small area of known foraging habitat. Furthermore, the proposed works are not expected to:

- increase competition for resources with other species;
- increase rates of predation; or
- form any new physical or psychological barriers that could inhibit movement by the species between areas of suitable habitat.

Therefore, the proposed works are unlikely to interfere substantially with the recovery of the Squatter Pigeon.