Appendix 2

Flora and Fauna Assessment for Proposed PAM Haul Road and Acid Pipeline, GPN Refinery

HLA - Envirosciences Pty Ltd

Flora and Fauna Assessment for Proposed PAM Haul Road and Acid Pipeline
GPN Refinery

1 November 2007

Prepared for:
RLMS
GPO Box 2292
Brisbane Qld 4001

Report by:
HLA-Envirosciences Pty Limited (HLA ENSR)
ABN: 34 060 204 702
Level 1, 57 Berwick Street Fortitude Valley QLD 4006
PO Box 720 Fortitude Valley QLD 4006
Ph: +61 7 3606 8900
Fax: +61 7 3606 8999

HLA Ref: B60184001_PAM_RPTFinal_1Nov07.doc

“This page has been left blank intentionally”

DISTRIBUTION

Flora and Fauna Assessment for Proposed PAM Haul Road and Acid Pipeline
GPN Refinery
1 November 2007

Copies	Recipient	Copies	Recipient
TBA	**Samantha Hewton** **RLMS** GPO Box 2292 Brisbane QLD 4001		

By

HLA-Envirosciences Pty Limited (HLA ENSR)
ABN: 34 060 204 702
Level 1, 57 Berwick Street Fortitude Valley QLD 4006
PO Box 720 Fortitude Valley QLD 4006

David Fleming
Environmental Scientist

Con Lokkers
Associate Environmental Scientist

Technical Peer Reviewer: **Date:**

	2/11/07
Steve Fox **Workgroup Manager - Environmental Services**	

This page has been left blank intentionally"

CONTENTS

TABLES

Body Report

Tables Section

FIGURES

Figures Section

PLATES

Plates Section

APPENDICES

GLOSSARY OF TERMS

CORVEG	Queensland Herbarium database of vegetation field data
DPIF	Department of Primary Industries and Fisheries
DEW	Commonwealth Department of the Environment and Water Resources
EPA	Queensland Environmental Protection Agency
EP Act	Queensland *Environmental Protection Act 1994*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EVR species	Species listed as Endangered, Vulnerable or Rare under Commonwealth or state legislation
GPN	Gladstone Pacific Nickel Limited
HDD	Horizontal Directional Drilling
HERBRECS	Queensland Herbarium database of flora specimen collections
NC Act	Queensland *Nature Conservation Act 1992*
PAM	Pre Assembled Modules
RE	Regional Ecosystem
VM Act	Queensland *Vegetation Management Act 1999*

EXECUTIVE SUMMARY

Gladstone Pacific Nickel proposes to construct a haul road and acid pipeline from a proposed nickel refinery site near Yarwun to the Fisherman's Landing Port Facility approximately 6 km to the north of the refinery. The study area lies approximately 8 km to the west of Gladstone in central Queensland. The 7.7 km long haul road is required to transport Pre Assembled Modules from the port facility to the refinery. The 8.3 km long acid pipeline will convey chemical required for nickel processing at the refinery.

HLA – Envirosciences Pty Limited (HLA ENSR) has conducted desktop and field assessments of potential impacts of construction and maintenance of the proposed haul road and acid pipeline. Assessments have concentrated on the primary alignment, but alternative options which avoid significant ecological features were also investigated. Mitigation measures to avoid or minimise impacts have been recommended based on the results of these investigations.

Constraints identified along the proposed haul road and acid pipeline alignments included:

- Clearing of up to 32.4 ha of remnant vegetation for the haul road and 17.1 ha of remnant vegetation for the acid pipeline for the currently proposed alignments;
- Crossing of patches of Endangered Regional Ecosystem (RE 12.3.3; Blue Gum woodland) including a large patch from KP 5.5 – 6.5 (haul road alignment);
- Crossing of Boat Creek and associated riparian vegetation, freshwater wetlands and marine vegetation at KP 4.5;
- Intersection of marine plants, including salt marsh, Saltwater Couch grasslands, salt pan and mudflats and mangrove shrublands, within the Port Curtis Wetland, a Nationally Important Wetland; and
- Not of Concern REs transected or adjacent to about 4.1 km (53%) of the haul road alignment and 5.9 km (71%) of the acid pipeline alignment.

Field surveys did not detect any flora or fauna species that are considered to be Endangered, Vulnerable or Rare (EVR) under Australian or State legislation. However, potential habitat was recorded for two EVR flora species and 18 EVR fauna species. The alignments contain potential habitat for 44 fauna species of Regional Significance and one of these species was recorded during field surveys. Seven EVR fauna species may be impacted by the proposed alignments in the form of habitat loss (i.e. mature vegetation, nesting / roosting sites), loss of foraging resources and increased likelihood of vehicle strikes. Provided suitable mitigation measures (including consideration of alternative alignments) are implemented during construction and maintenance activities, no significant impacts on these species are considered likely.

Alignment modifications outlined in this report could substantially reduce clearing of REs and fauna habitat for the haul road and the acid pipeline. Recommended alignment changes for the haul road crossing of the Blue Gum woodland include (in order of preference):

- The Option 4 crossing of the Endangered Blue Gum woodland. This is the preferred option which reduces the amount of Endangered RE requiring clearing and consolidates the haul road with other infrastructure corridors, thereby reducing the potential effects of fragmentation and edge effects for fauna. It is recognised that other constraints may cause this option to be unviable;

- Option 3, which involves construction within saltpan and mudflat communities. This option reduces the amount of woodland vegetation to be cleared; however, may impact on the Port Curtis Wetlands;
- Option 2, which utilises a partly cleared infrastructure corridor though the Blue Gum woodland, thereby reducing the amount of vegetation to be cleared;
- The proposed alignment (Option 1) potentially involves the removal of a large proportion of this community and may result in increased fragmentation and edge effects and loss of connectivity; and
- Option 5 follows the existing rail corridor and will require removal of a large amount of observed Blue Gum woodland. This is the least preferred option in terms of impacts to flora and fauna.

Recommended alignment changes for the haul road crossing of Boat Creek include (in order of preference):

- Option 2 is the preferred crossing point of Boat Creek as this occurs along an existing access road crossing. It reduces clearance and further fragmentation of undisturbed riparian vegetation and avoids direct impacts on marine plant communities;
- The currently proposed alignment crosses approximately 100 m upstream of the Option 2 crossing and will result in the removal of generally intact riparian vegetation and has the potential to impact on aquatic wetland habitat for fauna; and
- Options 3 and 4 follow existing infrastructure crossings, where the creek is tidally influenced. Both options are likely to result in the removal of marine vegetation and have the potential to impact downstream wetlands.

Regardless of which alignment is used, the crossing should be designed and constructed to minimise clearing width and minimise impacts on watercourse hydrology.

Recommended alignment changes for the acid pipeline include consideration of the use of HDD underneath area of high ecological value (e.g. mangrove channels, vegetation areas of saltpans), relocating the entry point to the proposed refinery site at the haul road entry point and, if possible, incorporating the pipeline within the haul road alignment.

The following general mitigation and rehabilitation measures are recommended to help avoid and minimise potential impacts on flora and fauna during construction and operation of the proposed infrastructure:

- Consideration of alternative alignments that avoid or minimise impacts on vegetation and fauna habitats;
- Design, installation and maintenance of effective erosion, sediment and pollution control structures during construction within or adjacent to wetlands and waterways. Natural hydrology should be reinstated as soon as possible after construction;
- The corridor impacted for haul road construction within all areas of remnant vegetation should be minimised and should not exceed 100 m;
- The corridor impacted for acid pipeline construction within all areas of remnant vegetation should be minimised and should not exceed 30 m;

- The haul road should be sealed to minimise erosion and sedimentation within downstream habitats;
- Consideration of vegetation offsets and marine plant offsets to compensate for the proposed loss of remnant vegetation, particularly the Endangered Blue Gum woodland; and
- Use of speed limiting signs or devices, signage or fencing should be considered to minimise risk of fauna deaths from vehicle strikes.

Provided that mitigation measures and recommendations in this report are followed, significant ecological impacts from the construction and maintenance of the proposed haul road and acid pipeline are unlikely.

"This page has been left blank intentionally"

1 INTRODUCTION

1.1 Background

RLMS has commissioned HLA-Envirosciences Pty Limited (HLA ENSR), a subsidiary of ENSR Corporation (an AECOM company), to conduct a flora and fauna assessment for a proposed haul road and acid pipeline near Gladstone, central Queensland. The haul road and acid pipeline will run from the Fisherman's Landing Port Facility to the Gladstone Pacific Nickel Limited (GPN) Refinery, approximately 6 km to the south of the port. The haul road is required to transport Pre Assembled Modules (PAM) from the port facility to the refinery. The acid pipeline will convey chemical required for nickel processing at the refinery. The study area is located approximately 8 km to the west of Gladstone's town centre in Calliope Shire and is shown in **Figure F1**.

The flora and fauna study specifically targeted the identification of known and potential occurrences of listed Endangered, Vulnerable and Rare (EVR) flora and fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Queensland *Nature Conservation Act 1992* (NC Act). It also assessed the presence of protected vegetation communities under the EPBC Act and the Queensland *Vegetation Management Act 1999* (VM Act) and marine plants protected under the Queensland *Fisheries Act 1994*. Potential impacts and mitigation measures for these species and communities as well as flora and fauna in general have been identified.

1.2 Alignments and Options

This report assessed two potential haul road alignments from the port to the refinery (**Figure F1**). Alignment 1 is the currently proposed route, so is the primary focus of the present assessment. It passes through the port facility from KP 0-2.0 and then follows a constructed embankment from KP 2.0-3.7. It deviates westwards to cross Boat Creek at KP 4.5 and then heads eastwards to cross a conveyor at KP 5.0 and the Fisherman's Landing Railway at KP 5.4. The alignment turns south-eastwards at KP 5.5, running about 100 m east of an existing underground ammonia pipeline. It curves eastwards to pass along saltpan and mudflats beside the Port Curtis Highway, then turns southwards to cross the highway at KP 7.5 and run into the refinery site. Where possible, locations of features are referenced as Kilometre Points (KPs) along Alignment 1 (including features on other alignments and options).

Alignment 2 is a previously proposed route that is similar to Alignment 1, except for several deviations where it:

- Follows an existing track across Boat Creek from KP 3.9-4.7;
- Curves northwards to cross Fisherman's Landing Railway further north at KP 5.3;
- Follows an existing corridor cleared for an ammonia pipeline from KP 5.4-6.5; and
- Deviates southwards along an existing track from KP 6.5-7.0.

The report also examined a number of optional routes along the haul road to avoid or mitigate impacts on the Boat Creek crossing at KP 4.5 and areas of Endangered Blue Gum Woodland from KP 5.0-5.3 and KP 5.5-6.1. Four options for crossing Boat Creek (mapped in **Figure F5**) include:

- Option 1 - Alignment 1 (currently proposed alignment);
- Option 2 - Alignment 2 (previous alignment, following existing road);

- Option 3 - Beside existing conveyor; and
- Option 4 - Beside existing rail bridge.

Five options for passing through or around the Blue Gum community (mapped in **Figure F6**) include:

- Option 1 - Alignment 1 (currently proposed alignment);
- Option 2 - Alignment 2 (previous alignment, following existing ammonia pipeline);
- Option 3 - To east of woodland across edge of salt flat;
- Option 4 - To west of woodland near Port Curtis Highway; and
- Option 5 - Beside Fisherman's Landing Railway.

A corridor width of 100 m was assessed for all haul road alignments.

One potential alignment was examined for the acid pipeline, mostly following an existing ammonia pipeline (**Figure F1**). The acid pipeline deviates from the ammonia pipeline at KP 4.3 and continues east along the mudflats and mangroves adjacent to the Port Curtis Highway. At KP 6.5, the pipeline turns south to run beside the eastern boundary of the proposed GPN refinery site and then turns west at KP 8.1 to enter the refinery site. The portion of the alignment from KP 5.2 to KP 8.2 was not assessed during the field surveys as this section was added during the most recent route revision, which occurred after fieldwork was completed. Assessments of the vegetation and fauna habitats within this section are therefore based on desktop assessments only and may not represent actual features on the ground. A corridor width of 30 m was assessed for the proposed pipeline.

2 SCOPE OF WORKS

The existing floral and faunal characteristics of the proposed haul road and acid pipeline route were assessed using desktop and two separate field studies (i.e. June 2007 and August 2007). The scope of works included:

- Collation and ground-truthing of Regional Ecosystem (RE) and Ecologically Sensitive Area (ESA) mapping;
- Collation of flora and fauna data from available data sources, including EVR species;
- Targeted field surveys for EVR flora species and marine plants;
- Field assessment of fauna habitat types and values;
- Field surveys for pest flora and fauna; and
- Incidental observations of other ecological constraints (e.g. erosion areas).

Information was used to:

- Assess potential impacts and constraints of the proposed road alignment;
- Identify alignments that minimise impacts on flora, fauna, REs and ESAs; and
- Recommend appropriate mitigation measures to help avoid and minimise potential impacts on ecological features and values.

"This page has been left blank intentionally"

3 ASSUMPTIONS AND LIMITATIONS

Wet weather limited the area that could be surveyed during the June 2007 study. Existing land tenure, land use and infrastructure (e.g. railway lines, conveyors) also constrained access to some areas.

The section of the acid pipeline alignment from KP 5.2 to KP 8.2 was not assessed during the field surveys as this section was added during the most recent route revision, which occurred after fieldwork was completed. Assessments of the vegetation and fauna habitats within this section are therefore based on desktop assessments only and may not represent actual features on the ground.

"This page has been left blank intentionally"

4 ASSESSMENT METHODS

4.1 Flora

The flora assessment consisted of two stages: a desktop study followed by a field assessment of the proposed haul road and acid pipeline alignments. The flora assessment was conducted by Dr Con Lokkers (Associate Environmental Scientist).

4.1.1 Determination of Flora Species and Vegetation Community / RE Significance Level

The status of vegetation communities / REs is ascribed as per their listings in the EPBC Act as Critically Endangered, Endangered or Vulnerable and / or the VM Act as Endangered, Of Concern and Not of Concern.

Listed EVR flora taxa are defined as those taxa listed in the EPBC Act and / or the NC Act as Critically Endangered, Endangered, Vulnerable or Rare. All other native flora species have been designated as Least Concern.

4.1.2 Flora Desktop Assessment

The desktop components included:

- Review of the Flora and Fauna Assessment for the GPN Slurry Pipeline and residue pipeline (HLA, 2006). This report assessed pipeline alignments from the GPN refinery site to a proposed residue dam west of Gladstone and the refinery to the proposed mine site near Marlborough;
- Collection and review of existing Commonwealth Department of Environment and Water Resources (DEW) Protected Matters data and Queensland Herbarium HERBRECS and CORVEG data within a search area of approximately 55 km by 55 km centred on the alignments;
- Review of Queensland Herbarium RE mapping for a 10 km wide corridor centred on the alignments to identify those vegetation communities mapped by the Environmental Protection Agency (EPA) at a scale of 1:100 000;
- Review of Ecologically Sensitive Areas (ESAs) mapped by the EPA within a search area of approximately 55 km by 55 km centred on the alignments;
- Examination of aerial and satellite imagery to gain an appreciation of the project's proximity to sensitive areas, assess vegetation patterns and identify target areas for field investigations; and
- Review of EPA Biodiversity Planning Assessment data to identify areas that are recognised as State, Regional or Local Biodiversity Significance or flagged as important for their integrated biodiversity values within close proximity to the project area.

It is recognised that the information gained from these databases has caveats attached to it regarding the robustness or completeness of the information.

HERBRECS and CORVEG data is based almost exclusively on plant specimens actually recorded as present in the given locations. The absence of any specimen records for a particular species from an area does not imply that the species does not occur in that area.

Data from the DEW Protected Matters website is based on a combination of actual records, primarily from State Government databases, combined with modelled distributions of species according to their ecological characteristics. The mapping of a particular species in a search area does not guarantee that the species actually occurs in that area.

4.1.3 Flora Field Survey

Initial field surveys of the haul road were conducted on 22 June 2007. Field investigations of alternative haul road alignments and the acid pipeline route were undertaken on 15 to 16 August 2007. The majority of each alignment was traversed by vehicle and / or foot during the assessment. Along the haul road route, the survey assessed a 100 m wide corridor. Along the acid pipeline route, the survey examined a 30 m wide corridor. Surveys also assessed surrounding areas where relevant (e.g. to identify options for avoiding ecological constraints on the proposed alignment).

The field surveys included:

- Investigation of the presence / absence or likely presence / absence of EVR flora species and communities identified in Australian and State legislation;
- Ground truthing of 49 sites along the potential alignment options. Of these, eight sites were detailed Tertiary level assessments and the remainder were assessed to Quaternary level. Quaternary assessments recorded dominant canopy species only while Tertiary assessments recorded an inventory of all woody flora species, their average height and their approximate abundance (including native and exotic flora species). At least one tertiary survey site was located within each RE type encountered along the alignment. Tertiary assessments also included targeted searches for potential EVR flora species and regionally significant species. Comprehensive flora species lists and detailed abundance data were not collected or considered necessary for the purposes of this assessment; and
- Observations on the wider environment of the pipeline alignments so that the potential impacts associated with proposed clearing could be discussed in the local, regional and State contexts.

The flora site surveys were in accordance with the Queensland Herbarium vegetation survey methods described in Neldner *et. al.* (2005). The following data was collected for the Tertiary sites:

- Confirmation of mapped RE;
- General description of vegetation;
- Structural characteristics of vegetation (based on life forms, approximate height and canopy cover);
- Groundcover characteristics;
- Vegetation condition (integrity) as either pristine, excellent, very good, good, average, degraded or completely degraded;
- Occurrence of weed species;
- Dominant species in each structural component of the vegetation;
- Patch size and shape;
- Landscape characteristics;
- Soil characteristics; and

- Notes on particular sensitivities to the proposed impacts.

The locations of Tertiary and Quaternary flora assessment sites are described in **Appendix A**. Locations of tertiary sites are mapped in **Figure F2a**. Tertiary flora assessment data sheets are included in **Appendix B**.

GPS coordinates were taken using hand held GPS (accuracy +/- 10-20 m) to identify survey site locations and to assist in validating the existing Queensland Herbarium RE mapping. The general distributions of declared and other significant pest plants within the corridor were also noted.

4.2 Fauna Assessment

The fauna assessment consisted of two stages: a desktop study, followed by a field assessment of the proposed haul road and acid pipeline routes. The fauna assessment was conducted by David Fleming (Environmental Scientist) under supervision of HLA ENSR's senior fauna ecologist Dr. Simon Hudson.

4.2.1 Determination of Fauna Species Significance Level

Listed EVR fauna are defined as those taxa listed in the EPBC Act and / or the NC Act as Critically Endangered, Endangered, Vulnerable or Rare.

Regionally Significant fauna are defined as those taxa that have not been listed as EVR fauna under the EPBC Act or NC Act, but have been listed in the relevant Action Plan for their respective taxonomic group as Vulnerable, Rare, Near Threatened, Insufficiently Known or Data Deficient. Relevant Action Plans consulted to determine status were: Sands and New (2000) for butterflies, Wager and Jackson (1993) for freshwater fishes, Tyler (1997) for frogs, Cogger *et al.* (1993) for reptiles, Garnett and Crowley (2000) for birds, Maxwell *et al.* (1996) for monotremes and marsupials, Duncan *et al.* (1999) for bats and Lee (1995) for rodents. Also included in Regionally Significant fauna were those species identified as non-EVR priority taxa by the Brigalow Belt South (BBS) Fauna Expert Panel (EPA 2002) and / or the South East Queensland (SEQ) Fauna Expert Panel (EPA 2004). The study area is located at the interface of the BBS and SEQ Bioregions, hence the use of two expert panel reports for this assessment.

All other native fauna have been designated as Least Concern. This includes those species that have been afforded extra protection as Migratory and / or Marine Protected species under the EPBC Act, but which are not EVR listed fauna species.

4.2.2 Literature Review and Collection of Database Information

The desktop study involved a review of published material and searches of relevant databases and archives. This assessment was used to document known records for the study area, identify the potential presence of significant fauna species, and assist in targeting areas for field assessment. The desktop components undertaken included:

- Collection and review of existing EPA WildNet data, Birds Australia data and DEW data (EPBC Protected Matters Search) for the area $23^0$36'S to $24^0$6'S and $150^0$54'E to $151^0$24'E;
- Review of existing Queensland Museum data;
- Search of the Directory of Important Wetlands database;
- Review of BBS and SEQ Biodiversity Planning Assessment data (EPA 2003; 2005) to identify areas that are recognised as State, Regional or Local

Biodiversity Significant or flagged as important for their integrated biodiversity values that are within close proximity to the study area;

- Review of Queensland Herbarium RE mapping for the corridor to establish those vegetation communities mapped by the EPA at a scale of 1:100,000 as well as aerial photography to gain an appreciation of potential fauna habitats and of the project's proximity to sensitive areas; and
- Review of the following texts: Cogger (2000), Duncan *et al.* (1999), Ehmann (1992), Garnett and Crowley (2002), Greer (2005), Johnson (2003), Menkhorst and Knight (2004), Morcombe (2003), Robinson (1998), Strahan (1995), Wilson (2005a), Wilson and Swan (2003) and Wilson and Knowles (1988).

A precautionary approach has been adopted throughout this assessment. In other words, any species that could potentially occur within the study area as identified through ecological databases, and the habitat assessment coupled with knowledge of the fauna by HLA ENSR's senior fauna ecologist, have been assumed to occur in the study area. The presence or otherwise of a particular fauna species within the study area can only be confirmed by detailed targeted field surveys.

4.2.3 Field Fauna Study

Field assessment of the proposed haul road alignment was conducted on 22 June 2007. Field assessment for the proposed haul road alignment (including various options) and acid pipeline alignment was conducted from 15 to 16 August 2007. No fauna trapping methods such as Elliott trapping, pit fall trapping, hair tube sampling or harp trapping were employed during these assessments. Rather, field surveys targeted habitat assessments and these involved walk-through assessments of selected sites. Representative habitats within the vicinity of each alignment were selected for inspection. The selection of these sites was based on the following:

- Occurrence of forested patches and other fauna habitats (such as riparian corridors and wetlands) determined from aerial photography;
- Preferred habitat for EVR and Regionally Significant fauna identified from the database searches determined from Queensland Herbarium RE mapping and aerial photography; and
- Occurrence of Endangered and Of Concern REs as per the VM Act and ecological communities as per the EPBC Act. These were identified through the latest Queensland Herbarium mapping.

A total of six sites were visited and assessed along the proposed haul road (five sites) and acid pipeline alignments (one site). Data sheets for these sites are provided in **Appendix C**, and are shown in **Figure 2b**.

The primary aim of the field study was to assess the following:

- The presence of suitable habitat for significant fauna species and the likely presence of significant fauna species;
- Habitat types / features;
- Habitat integrity;
- Habitat connectivity; and
- Significance of habitats.

Assessments of the above attributes were supplemented by opportunistic and dedicated searches for fauna and fauna signs at each site. Survey techniques employed at each site involved:

- Audio identification (e.g. bird and frog calls); and
- Dedicated searches under rocks, logs, bark and leaf litter for reptiles; and
- Dedicated searches of likely faunal hotspots such as riparian vegetation and sources of water (e.g. dams, creeks); and
- Dedicated searches for animal signs (e.g. scats and tracks) and where possible, laboratory analysis of scat from predators; and
- Opportunistic observations.

4.3 Interpretation and Documentation

Using the habitat assessment and field observation data, refinements were made to the list of EVR fauna species that were identified as potentially occurring along the alignment during the desktop study. Likely impacts on these species were analysed based on the known ecology of each species.

"This page has been left blank intentionally"

5 EXISTING ENVIRONMENT

5.1 Environmentally Sensitive Areas

Queensland EPA mapping (EPA, 2007a) identifies the following ESAs that are transected or lie adjacent to the proposed haul road:

- Great Barrier Reef World Heritage Area / Great Barrier Reef Marine Park; and
- Port Curtis Nationally Important Wetlands; and
- Areas of marine plants; and
- Endangered REs.

The Great Barrier Reef World Heritage Area extends to the high water mark of the Coral Sea, so lies to the east of the proposed haul road.

The proposed haul road and acid pipeline transects the Port Curtis Wetlands area, which is listed as a Nationally Important Wetland (DEW, 2007a). These wetlands encompass all tidal areas in the vicinity of Gladstone. The haul road alignment transects or lies adjacent to tidal areas from KP 1.0-1.3, KP 2.6-3.2 and KP 6.3-7.6. The acid pipeline alignment lies within or adjacent to tidal areas from KP 2.5-3.0, KP 4.3-7.1 and KP 7.9-8.2.

Marine plants occurring within the proposed haul road and acid pipeline include salt marsh communities (RE 12.1.2), Saltwater Couch grasslands (RE 12.1.2) and mangroves (RE 12.1.3). These areas are mostly contained within the Port Curtis Wetlands.

The proposed haul road transects one mapped area of Endangered RE, while the proposed acid pipeline transects two areas mapped as Endangered. These REs and vegetation communities containing marine plants are discussed in more detail in **Section 5.2**.

5.2 Vegetation Communities / Regional Ecosystems

Queensland EPA mapping identified five areas of remnant vegetation that are transected by the proposed haul road and acid pipeline (**Figure F3**). Descriptions, legislative status and site locations for REs recorded during the field survey are given in **Table T1** and **T2**. The field survey generally agreed with EPA mapping. Of the eight tertiary sites assessed:

- Four sites matched RE mapping (Sites 2J, 5J, 6J, 10A); and
- Two sites contained one of the REs mapped in a mixed RE polygon (Sites 3J, 4J); and
- Two sites contained vegetation that did not correspond to the mapped RE (Site 1J, 11A).

Most apparent inaccuracies relate to the scale of the EPA mapping (1:100 000) not detecting small-scale variation within larger remnants. Two woodland sites (1J, 11A) were dominated by Coastal Paperbark (*Melaleuca quinquinervia*), corresponding most closely to RE 12.3.5. Although EPA mapping does not identify any occurrences of this community within 5 km of the alignment, it records over 700 ha within the Gladstone and Calliope Shire areas.

EPA mapping identifies the polygon transected by the haul road from KP 5.5-6.6 as containing mostly Ironbark woodland (RE 11.3.29) with a smaller component of Blue Gum woodland (RE 12.3.3). Field surveys found this polygon to contain three REs:

- Coastal Paperbark woodland (RE12.3.5) occurred along the eastern edge of the polygon in a narrow low-lying band adjacent to Saltwater Couch grasslands and salt flats; and
- Ironbark woodland (RE 11.3.29) occurred as a sub-dominant component in higher areas of the polygon; and
- Blue Gum woodland (RE 12.3.3) was the dominant component within the polygon, occurring in areas of intermediate elevation.

The field survey also examined the polygon immediately east of this polygon, as an option for alternative alignments. While EPA mapping records only Ironbark woodland (RE 11.3.29) within this polygon (lying between the Fisherman's Landing Railway and Port Curtis Highway), field surveys also identified a substantial proportion of Blue Gum Woodland (RE 12.3.3) within the polygon.

EPBC Act listed communities
The proposed haul road and acid pipeline do not transect any communities regarded as Threatened under the EPBC.

Endangered REs under VM Act
The proposed haul road and acid pipeline transect one RE considered Endangered under the VM Act. *Eucalyptus tereticornis* woodland to open forest on alluvial plains (RE 12.3.3; **Plate P1**) was observed within the haul road corridor from KP 5.0-5.3 and KP 5.5-6.1. Large trees have been selectively cut from this area, as evidenced by numerous stumps. Existing canopy height (15 to 20 m) and canopy density (10 to 35%) are probably lower than those for undisturbed communities, but is considered to be sufficient to qualify as remnant vegetation.

EPA mapping identifies the section from KP5.0-5.3 as non-remnant, but field surveys and aerial imagery found this area to contain Blue Gum dominated woodland typical of RE 12.3.3. EPA mapping also indicates that the haul road passes through a mixed polygon containing RE 12.3.3 and Ironbark woodland (RE 11.3.29) until KP 6.6. No Ironbark woodland was recorded within the section of the polygon transected by the alignment. However, from about KP 5.9, field surveys found that the alignment passed through Coastal Paperbark woodland (RE 12.3.5) and Saltwater Couch grassland (RE 12.1.2). Areas of RE 12.3.3 occurred in the western side of the 100 m haul road corridor from KP 5.9-6.1.

The field survey found that the proposed acid pipeline transects RE 12.3.3 from KP 3.0-4.3. EPA mapping also identifies another area of RE 12.3.3 from KP 7.1-7.9. However, this area was not ground-truthed as this section of the pipeline route was not proposed until after completion of fieldwork.

Of Concern REs under VM Act
No Of Concern communities were recorded along the proposed haul road.

Not Of Concern REs under VM Act
The proposed haul road transects five communities listed as Not of Concern under the VM Act. A narrow fringe of riparian woodland community (RE 12.3.7) occurred along Boat Creek from KP 4.45-4.54. A small band of Ironbark woodland (RE 11.3.29) occurred from KP 3.5-3.9. Swampy woodlands dominated by Coastal Paperbarks (RE 12.3.5) were observed from KP 5.9-6.3 and KP 7.6-7.7. The other two communities transected by the proposed haul road (and the two communities transected by the acid pipeline) are marine plant dominated communities, which are described in the following section.

Marine Plant Communities
The proposed infrastructure corridors transect two communities dominated by marine plants. A small area of mangrove forest (RE 12.1.3) occurred on the northern side of the haul road corridor from KP 1.0-1.2. Saltpans containing bare saline mud, Saltwater Couch (*Sporobolus virginicus*) grasslands and samphire shrublands (RE 12.1.2) were present in several areas within the haul road corridor, including KP 1.2-1.3, KP 2.6-3.2 and KP 6.3-7.6. At the time of survey, the section from KP 6.8-7.5 was bare saline mud with no plants evident.

The acid pipeline corridor transects several mangrove communities from KP 2.5-2.7, KP 6.0-6.5 and KP 8.0-8.2. It also transects saltpans from KP 2.5-2.7, KP 2.7-3.0, KP 4.3-6.0, KP 6.5-7.1 and KP 7.9-8.0. During the survey, the section from 4.7-5.7 was bare saline mud.

5.3 Flora Species

5.3.1 EVR Flora Species

Database searches identified a total of 25 EVR flora species that may occur in the broader study area (**Table T3**). The field survey recorded potential habitat for two of these EVR species, but targeted surveys failed to detect any EVR species. It is considered unlikely that significant populations of any EVR species occur along the alignment. However, the present survey cannot rule out the existence of populations of EVR species, as not all remnant vegetation was examined.

5.3.2 Regionally Significant Flora Species

The study area lies within the Southeast Queensland Bioregion. The only regionally significant species identified in literature searches for the broader study area is *Graptophyllum spinigerum*. Targeted surveys failed to detect any *Graptophyllum* species.

5.3.3 Declared Weeds

Six weed species declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) were recorded during the survey. These include:

- Lantana (*Lantana camara*) - Class 3;
- Mother of Millions (*Bryophyllum pinnatum*) - Class 2;
- Mother of Millions (*Bryophyllum tubiflorum*) - Class 2;
- Rubber Vine (*Cryptostegia grandiflora*) - Class 2;
- Prickly Pear (*Opuntia stricta*) - Class 2; and
- Velvet Pear (*Opuntia tomentosa*) - Class 2.

Several environmental weeds that may prove troublesome during rehabilitation works were also noted, including:

- Thatch Grass (*Hyparrhenia rufa*);
- Guinea Grass (*Megathyrsus maximus*); and
- Stinking Passionfruit (*Passiflora foetida*).

5.4 Fauna Species

A review of fauna databases identified a large number of fauna species that have been recorded from, or that may potentially utilise habitat, within the wider area. A total of 581 fauna species were identified, comprising 17 butterflies, 61 fish, 25 amphibians, 104 reptiles, 287 birds and 83 mammals. During the field assessments 37 fauna species were recorded, comprising one amphibian, three reptiles, 31 birds and two mammals (**Table T4**).

5.4.1 EVR Fauna Species

Database searches identified 46 fauna species listed as EVR under the EPBC Act and / or NC Act as previously recorded from the wider study area, or with geographic ranges that overlap the wider study area (one invertebrate, 15 reptiles, 21 birds and eight mammals) (refer **Table T5**). Of these species, 21 are listed under both the EPBC Act and NC Act, while two are listed under the EPBC Act only and 23 are listed under the NC Act only. **Table T5** lists these EVR fauna species, together with their preferred habitat and an indication as to whether this habitat is present within the proposed alignment. Based on a review of habitat preference for each species, 18 of these 48 listed EVR species could potentially utilise habitats within the proposed alignments.

No EVR fauna species were recorded along the proposed haul road during the field assessment.

5.4.2 Aquatic Fauna Species

Review of the Queensland Museum and WildNet fish databases found 28 freshwater fish species recorded from watercourses in the wider study area. Only two of these are exotic: Mosquitofish (*Gambusia holbrooki*) and Guppy (*Poecilia reticulata*).

No EVR fish species were identified as occurring in the region. Two species are Regionally Significant: Agassiz's Glassfish (*Ambassis agassizii*) and Southern Purple-spotted Gudgeon (*Mogurnda adspersa*).

Other aquatic EVR species identified as potentially occurring within the wider area include the Saltwater Crocodile (*Crocodylus porosus*). Six sea turtles were also identified as potentially occurring within the wider area: the Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Leatherback (*Dermochelys coriacea*), Hawksbill (*Eretmochelys imbricata*), Olive Ridley (*Lepidochelys olivacea*) and Flatback (*Natator depressus*) turtles. These turtle species are marine species that lay their eggs on sandy beaches. As such, it is unlikely that these species would occur within the proposed haul road corridor.

Saltwater crocodiles are found across northern Australia in fresh and salt-water habitats. In Queensland, they are found mainly in coastal waters between Rockhampton and Cape York and throughout the Gulf of Carpentaria. However, Saltwater Crocodiles have been sighted as far south as the Boyne River, south of Gladstone. Although the Saltwater Crocodile lives mainly in the tidal reaches of rivers, it is also common in freshwater lagoons, swamps and beaches. This crocodile also occurs in inland waterways hundreds of kilometres from the sea. The Saltwater crocodile is listed as Migratory and Marine under the EPBC Act and as Vulnerable in Queensland under the NC Act.

5.4.3 Other Fauna Species of Conservation Significance

A further 71 fauna species of Regional Significance were identified (**Table T6**). These comprised two fish, 10 frogs, 13 reptiles, 19 birds and 26 mammals. **Table T6** lists these Regionally Significant fauna, together with their preferred habitat and an indication as to whether this habitat is present within the proposed alignment. It was determined that 44 of these 71 Regionally Significant species could potentially utilise habitats within the proposed haul road corridor.

One Regionally Significant fauna species was recorded along the proposed haul road route, namely the Great Brown Broodfrog (*Pseudophyrne major*), at FA01J during the June survey.

An additional 113 bird species listed under the EPBC Act as Migratory and / or Marine protected species were identified as previously recorded from the wider study area, or with geographic ranges that overlap the wider study area. These include species listed under the Japan – Australia Migratory Bird Agreement (JAMBA), the China – Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention on the Conservation of Migratory Species. Fifty-one of these were listed as both Migratory and Marine Protected species and 36 as Marine only. Whilst these are not EVR fauna, they are EPBC Act protected species that may utilise local habitats on a seasonal basis, or marine species that may overfly or otherwise utilise the wider area.

These species are listed in **Table T7**, together with their preferred habitat and an indication as to whether this habitat is present within the proposed alignment. It was determined that 90 of these 112 listed Migratory and / or Marine protected species could potentially utilise habitats within the proposed corridor.

Nine species listed as Migratory and / or Marine species under the EPBC Act were observed during the field surveys. Five species are listed as Migratory and seven are listed as Marine species.

5.4.4 Common Fauna Species

All habitats (even cleared and degraded land), provide habitat for a range of common native fauna species. Remnant vegetation provides higher habitat values and thus will have a larger range of more common and abundant species. The desktop study and field survey indicates that the study area is utilised by a large number of common fauna species. A total of 388 common native fauna species were identified as potentially present by the database searches (excluding EVR and Regionally Significant fauna, and omitting obvious marine-restricted species such as whales and sea snakes). These comprised 15 butterflies, 28 fish, 14 amphibian, 66 reptiles, 237 birds (including the 113 species listed as Migratory and / or Marine Protected Species under the EPBC Act) and 28 mammals (of which 27 are bats).

Common fauna species recorded during the field survey totalled 1 amphibian, 3 reptiles, 31 birds and 1 mammal.

5.4.5 Introduced Fauna Species

Twenty-five introduced species have been recorded within the wider area, including two fish, one amphibian, five birds and 10 mammals.

Three introduced species were observed and / detected along the proposed haul road: the Indian Peafowl (*Pavo cristatus*), European Rabbit (*Oryctolagus cuniculus*) pellets and Dog (*Canis familiaris*) were observed within the study area.

Mosquitoes are known to occur along the length of the alignment, particularly in the vicinity of water bodies including wetlands and watercourses listed in **Table 1**. The potential to create new mosquito breeding grounds is discussed in **Section 6.3.3**.

5.5 Fauna Habitats

Based on field habitat assessments and RE mapping, seven broad fauna habitat types were identified as present within the proposed haul road route and alignment options. These are described in **Table 1**, along with the RE they correspond to (where relevant) in the flora survey and mapping, and the approximate KPs at which they occur along the proposed route.

Table 1: Description of Broad Fauna Habitats Occurring Within the Proposed Haul Road

Fauna Habitat	Description	Site No.	Approx. KPs
Paperbark Wetland	Wetland community dominated by Broad-leaved Paperbark (*M. quinquenervia*) and / or Broad-leaved Tea-tree (*M. viridiflora*). Understorey depends on duration of water-logging. Corresponds to RE 11.3.29 / 12.3.12.	FA01J FA01A	7.6 – 7.7 5.9 – 6.1
Blue Gum Woodland	Queensland Blue Gum (*Eucalyptus* tereticornis) woodland to open forest on broad alluvial plains, generally with a grassy understorey. Corresponds to RE 12.3.3.	FA02J	5.0 – 5.3 5.5 – 5.9 5.9 – 6.1 (west)
Fringing Riparian Open Forest	Fringing open forest along a creek / lagoon system dominated by Queensland Blue Gum, Narrow-leaved Red Ironbark (*E. crebra*) and Moreton Bay Ash (*Corymbia tessellaris*). The lower layers are generally dense and floristically diverse. Corresponds to RE 12.3.7.	FA03J	4.5 (Alignment 2)
Mangrove Open Forest	Mangrove shrubland to open forest. Corresponds to RE 12.1.2 and fringes saltmarsh, mudflats and drainage channels.	FA04J FA01A (acid pipeline)	1.0 – 1.2 2.5 – 2.7 (west) 6.0 – 6.5 8.0 – 8.2
Ironbark Woodland	Narrow-leaved Red Ironbark and Paperbark (*Melaleuca* spp.) woodland on alluvial plains	N / A	3.5 – 3.9 (west)
Saltpan and mudflats	Saltpan and mudflat occasionally including grassland and herbland depending upon frequency of tidal inundation. Corresponds to RE 12.1.2	Haul road Acid pipeline	1.2 – 1.3 (north) 2.6 – 3.2 (west) 6.3 – 7.6 2.5 – 2.7 (east) 2.7 – 3.0 4.3 – 6.0 6.5 – 7.1 7.9 – 8.0
Cleared land and Non-remnant vegetation	Land cleared or mostly cleared of trees and other woody vegetation, for agriculture such as grazing or crops. Often includes occasional scattered 'paddock' trees, remaining as individuals or small stands.	–	Remainder

The proposed haul road and acid pipeline routes are located within a landscape characterised by relatively large areas of remnant vegetation interspersed with compact, yet highly developed industrial areas and associated infrastructure. This landscape is likely to limit the habitat value of remnant vegetation within the proposed alignments for those fauna species sensitive to disturbance. In addition, historical clearing of remnant vegetation and the removal of large, old trees (possibly due to past logging practices) has resulted in a reduction of habitat for hollow-dependent fauna such as possums and gliders, some microbats and birds. Despite this, potential habitat for a number of significant species (i.e. EVR, Regionally Significant and Migratory and / or Marine species) exists within the alignments.

Initially, the haul road alignment crosses a thin strip of mangrove open forest at KP 1.0 – 1.2 adjacent to a small area of saltmarsh and mudflats. These vegetation communities provide habitat for such EVR species as the False Water Rat (*Xeromys myoides*) and Black-necked Stock (*Ephippiorhynchus asiaticus*) and Regionally Significant bird species. Mangroves and adjoining mudflats within the Port Curtis Wetland also provides foraging and roosting habitat for listed Migratory and Marine shorebirds such as Ruddy Turnstone (*Arenaria interpres*), Sharp-tailed Sandpiper (*Calidris acuminata*), Great Knot (*Calidris tenuiostris*) and Lesser Sand Plover (*Charadris mongolus*).

The alignment crosses a disturbed area of saltmarsh and mudflat community at KP 2.6 – 3.2 adjacent to an existing infrastructure corridor (railway, access road and conveyor belt). From KP 6.3 – 7.6 the alignment crosses the outer edge of a large expanse of mudflats. These communities provides temporary foraging habitat for a wide variety of wader and shorebirds, including EVR and listed Migratory and / or Marine species. EVR species likely to utilise these areas include Beach Stone-curlew (*Esacus neglectus*) and Eastern Curlew (*Numenius madagascariensis*). Use of these communities by wader and shorebirds; however, is dependent upon the frequency of tidal inundation.

From KP 3.5 to KP 3.9 the proposed haul road heads inland passing through a small patch of remnant Ironbark woodland within a partly cleared and disused pastureland. The remnant vegetation, although small in area, is likely to provide habitat and foraging resources for disturbance adapted and open country species. Larger patches of Ironbark Woodlands occur further to the west, which may provide some additional refuge habitat for fauna. This landscape provides some habitat for EVR species such as White-rumped Swiftlet (*Collocalia spodiopygius*), Squatter Pigeon (*Geophaps scripta*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Little Pied Bat (*Chalinolobus picatus*). Regionally Significant species likely to occur within this habitat include Emerald Spotted Treefrog (*Litoria peronii*), Open-litter Rainbow Skink (*Carlia pectoralis*), Australian Bustard (*Ardeotis australis*), Musk Lorikeet (*Glossopsitta concinna*), Agile Wallaby (*Macropus agilis*) and Common Brushtail Possum (*Trichosurus vulpecula*).

The haul road alignment crosses a strip of riparian vegetation along Boat Creek at KP 4.5. An access road has been constructed approximately 100 m further downstream of the proposed crossing point. Water has backed up along the creekline from the road which has created a freshwater lagoon extending for many hundreds of metres upstream (refer to **Plate P2**). The artificial lagoon, fringed by riparian vegetation, has created habitat for a wider range of species, predominantly birds, compared to the downstream creek habitats. The lagoon may provide habitat for waterbirds including the EVR listed Cotton Pygmy-goose (*Nettapus coromandelianus*) and Regionally Significant species such as Musk Lorikeet, Yellow-bellied Sunbird (*Nectarinia jugularis*), Brown Treecreeper (*Climacteris picumnus*), Barking Owl (*Ninox connivens*) and a number of microbats. The absence of large, old trees and associated hollows limits the suitability of this vegetation for hollow-dependent birds and mammals. A variety of woodland and open country listed Migratory birds are also expected to utilise this riparian vegetation as a migratory pathway from coastal marine environments to the adjacent forested hills and ranges.

Various options have been previously presented to cross Boat Creek (refer to **Figure F5**). The Option 1 crossing point transects similar fringing riparian vegetation to the Option 2 crossing point; however, this vegetation is predominantly intact and in generally better condition. The Option 3 and 4 crossing points for the haul road occur over fringing mangrove shrubland and saltmarsh communities. These communities have similar habitat values for fauna as other mangrove communities traversed by the proposed alignment (i.e. KP 1.0 – 1.2), although vegetation at both proposed crossing points has been previously disturbed. The acid pipeline is proposed to cross Boat Creek at KP 2.7. Significant fauna species likely to utilise these areas include, Black-necked Stock, Ruddy Turnstone, Sharp-tailed Sandpiper, Great Knot and Lesser Sand Plover.

The largest patch of remnant vegetation crossed by the proposed alignment occurs from KP 5.0 – 5.3, 5.5 – 5.9 and 5.9 – 6.1. The Blue Gum woodland provides suitable habitat for a wide variety of significant and common fauna species and provides a linkage to other woodland patches and riparian vegetation along Boat Creek. This community occurs adjacent to saltpan and mudflat communities and trees along the edge provide roosting habitat for Migratory and / or Marine bird species. The Blue Gum woodland also contains some hollow-bearing trees, which provide nesting and denning habitat for hollow-dependent fauna, including Regionally Significant species such as Common Brushtail Possum and Common Ringtail Possum (*Pseudocheirus peregrinus*) and other common mammals and bird species. This vegetation provides suitable habitat for EVR species such as Brigalow Scaly-foot (*Paradelma orientalis*), Square-tailed Kite (*Lophoictinia isura*), Large-eared Pied Bat and Little Pied Bat and a variety of Regionally Significant fauna and Migratory birds. In particular, this community also provides habitat for the Koala (*Phascolarctos cinereus*), which is listed as Vulnerable in the SEQ Bioregion under the NC Act and as Regionally Significant in the BBS Bioregion. Queensland Blue Gums (*Eucalyptus tereticornis*) are recognised as an important food source for Koalas in coastal SEQ (EPA 2001) and form the dominant species within this community.

A railway corridor of approximately 50 m in width transects the Blue Gum woodland through the middle of the patch. The rail line has been built up to a maximum height of approximately 10 m, which may prevent the movement of some fauna across the railway (e.g. kangaroos and wallabies, bandicoots, etc.).

Various options have been previously presented to cross this woodland community (refer to **Figure F6**). The Option 1 alignment occurs close to the north-eastern edge of this community and outside the existing infrastructure easement. This option transects good stands of Blue Gums and dense patches of Paperbarks (*Melaleuca* spp.), which provides good habitat for a variety of fauna species. The Option 2 alignment occurs within the infrastructure easement that contains a predominantly cleared width of approximately 10 m. The Option 3 alignment generally occurs within the mudflat community at the edge of the Blue Gum woodland. Habitat for wader and shorebirds occurs along this alignment, but is dependent upon frequency of tidal inundation. The Option 4 alignment traverses non-remnant vegetation and existing infrastructure easements to the west of the Blue Gum woodland. Vegetation within this alignment is generally degraded, although habitat is provided for a range of common fauna, predominantly open country birds and some macropods (i.e. kangaroos and wallabies).

The proposed haul road terminates within Paperbark wetlands at the proposed GPN refinery site. The corridor occurs within the edge of a stand of Paperbarks and adjacent tidal wetlands, which provides a diverse range of habitats for a wide variety of fauna (i.e. fresh / brackish Paperbark wetland, grassland, herbland and tidal mudflats). Suitable habitat within the Paperbark wetland is provided for EVR species such as Rusty Monitor (*Varanus semiremex*), Lewin's Rail (*Rallus pectoralis*) and Australian Painted Snipe (*Rostratula australis*) and for Regionally Significant species such as the Broodfrogs, Northern Laughing Treefrog (*Litoria rothii*), Emerald Spotted Treefrog, Little Wattlebird (*Anthochaera chrysoptera*), Shining

Flycatcher (*Myiagra alecto*), Dusky Honeyeater (*Myzomela obscura*), Barking Owl, Little Bentwing Bat (*Miniopterus australis*) and Little Red Flying-fox (*Pteropus scapularis*). Suitable habitat is also provided for a range of Migratory and / or Marine and common species.

6 POTENTIAL IMPACTS

6.1 Potential Impacts on Environmentally Sensitive Areas

Wetlands
The proposed haul road transects the Port Curtis Wetland, which is listed as a Nationally Important Wetland (DEW, 2007a). The wetland encompasses all tidal areas in the vicinity of Gladstone. Important attributes of this wetland have been identified by Danaher, *et al*. (2005) and are summarised below:

- Extensive mangrove forests and shrublands (3 300 ha), seagrass beds (2 430 ha) and salt flats (2 800 ha);
- One species of seagrass (*Halophila tricostata*) and several species of mangrove (*Acanthus ilicifolia, Avicennia eucalyptifolia, Xylocarpus australasicus* and *Bruguiera exaristata*) at the limits of their distribution;
- Habitat for significant species, including Beach Stone-curlew (*Esacus neglectus*), Radjah Shelduck (*Tadorna radjah*), Eastern Curlew (*Numenius madagascariensis*), Chestnut Teal (*Anas castanea*), Little Tern (*Sterna albifrons*), Sooty Oystercatcher (*Haematopus fuliginosus*) and Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Significant feeding areas for Dugongs (*Dugong dugon*);
- Habitat for significant marine turtle species, including Green Turtle (*Chelonia mydas*), Flatback Turtle (*Natator depressus*), Loggerhead Turtle (*Caretta caretta*) and Hawksbill Turtle (*Chelonia mydas*); and
- Colonies of Flying Foxes (*Pteropus scapulatus, P. alecto* and *P. poliocephalus*) in some mangrove areas.

The haul road alignment transects or lies adjacent to 2.2 km of tidal area, directly impacting on an area up to 17.5 ha. The acid pipeline lies within or adjacent to 3.6 km of tidal area, directly impacting on an area up to 10.8 ha.

No mangrove species considered to be at their southern limit of distribution were recorded within or adjacent to the proposed alignments.

Most tidal areas transected by the alignments are supra-tidal wetlands that are inundated only on spring tide events once to several times per year. These areas do not support seagrass or provide habitat for Dugongs or marine turtles. They may provide seasonal habitat for shorebirds such as Sooty Oystercatcher, Ruddy Turnstone, Sharp-tailed Sandpiper, Great Knot and Lesser Sand Plover.

The acid pipeline transects two areas of small mangrove-lined tidal channels from KP 2.6-2.7 and KP 6.1-6.4. These channels may be periodically used by Saltwater Crocodiles and other aquatic species such as Irrawaddy Dolphin and Indo-Pacific Humpback Dolphin.

Construction and use of the proposed haul road and to a lesser extent, the acid pipeline, may also cause indirect impacts on surrounding wetlands. Construction of the haul road and acid pipeline may promote erosion and alter sediment flows into wetlands. Operation of the haul road may lead to increased influx of sediment, nutrients and other pollutants into surrounding wetlands. Mitigation of these impacts may be possible through design and implementation of sediment, erosion and pollution control structures during construction and operational phases of the project.

Earthworks and excavation may alter hydrology, including natural fluxes of salt and fresh water and ponding of water in intermittent wetlands. Culverts and pipes may be needed in sections of raised embankments to mitigate impacts on hydrology.

Other potential indirect impacts associated with construction and operation includes the introduction and spread of weeds and generation of noise and vibration levels that disturb fauna of conservation significance. These issues are discussed **Sections 6.2** and **6.3**.

Great Barrier Reef World Heritage Area
The alignments do not transect or lie adjacent to the Great Barrier Reef World Heritage Area. Impacts of construction and operation of the haul road and acid pipeline are therefore likely to be limited to indirect direct impacts, similar to those outlined for the Port Curtis Wetlands.

Marine plants
Impacts on marine plants are discussed in **Section 6.2.4**.

Endangered RE
Impacts on Endangered REs are discussed in **Section 6.2.6**.

6.2 Potential Impacts on Flora

6.2.1 Potential Impacts on Vegetation Communities / REs

Table T8 provides a summary of lengths and areas of remnant vegetation impacted by the proposed haul road along Alignment 1. The proposed corridor transects or lies immediately adjacent to 4.1 km of remnant vegetation, including 0.9 km of Endangered RE and 3.2 km of Not of Concern RE. Assuming that all of this length was fully vegetated and required clearing to the full 100 m width, a total of 32.4 ha of remnant vegetation would be cleared. At least 0.7 km of the corridor contains bare saline mud, reducing this total to 25.4 ha.

To evaluate the impact of this scale of clearing, the cleared area of each RE has been compared to the total extent of that RE within an area extending 5 km from the proposed alignment corridor (referred to as the 10 km buffer). These proportions are presented in **Table T8**. Based on these calculations, the total RE clearing area of 32.4 ha represents about 1.1% of the total area of these REs within the 10 km buffer. This proportion is likely to be higher than the actual proportion of vegetation cleared, as:

- EPA mapping has not recorded the presence of Coastal Paperbark woodland (RE 12.3.5) within the haul road corridor or the 10 km buffer;
- About 7 ha within the corridor was unvegetated saline mud (at least at the time of survey); and
- Haul road construction may not require clearing of the full 100 m corridor width throughout the entire alignment.

Table T9 provides a summary of lengths and areas of remnant vegetation impacted by the proposed acid pipeline. The proposed corridor transects or lies immediately adjacent to 5.7 km of remnant vegetation, including 2.1 km of Endangered RE and 3.6 km of Not of Concern RE. Assuming that all of this length was fully vegetated and required clearing to the full 30 m width, a total of 17.1 ha of remnant vegetation would be cleared. This represents about 0.77% of the total area of these REs within the 10 km buffer. This is likely to be higher than the actual proportion of vegetation cleared for similar reasons to those discussed for the haul road. For example, at least 1 km of the pipeline corridor contains bare saline mud, reducing the total clearing to 14.1 ha.

Impacts on Endangered REs
The proposed haul road alignment will transect approximately 0.7 km of Blue Gum woodland (RE 12.3.3) and pass adjacent to a further 0.2 km. The proposed haul road will require clearing of up to 8 ha of Blue Gum woodland, which represents about 2.5% of the total mapped area of this RE in the 10 km buffer. Alternative haul road alignments that may reduce clearing of Blue Gum woodland are discussed in **Section 6.2.6**.

The proposed acid pipeline alignment will transect approximately 2.1 km of Blue Gum woodland (although 0.8 km has not been ground-truthed by field surveys). This may require clearing of up to 6.3 ha, representing about 2% of the total mapped area of this RE in the 10 km buffer. Alternative acid pipeline alignments that may reduce clearing of Blue Gum woodland are discussed in **Section 6.2.7**.

Impacts on Not of Concern REs
The proposed haul road alignment transects or lies adjacent to approximately 2 km of salt pan (RE 12.1.2) and 0.2 km of mangrove forest (RE 12.1.3). If the haul road footprint lies wholly outside existing infrastructure clearing, construction will directly impact on about 16.5 ha of salt pan and 1 ha of mangrove forest. However, if existing reclaimed areas can be used in the northern end of the alignment (KP 0-3.7), it may be possible to avoid all clearing of mangroves and reduce the total area of salt pan impacted by up to 6.5 ha.

The haul road alignment transects or lies adjacent to 0.4 km of Ironbark woodland (RE 11.3.29). Construction will require clearing of up to 2 ha, although this figure could be reduced by utilising areas previously cleared for existing infrastructure (e.g. reclaimed area, road).

The haul road alignment transects about 90 m of creek channel and associated riparian vegetation (RE 12.3.7) at Boat Creek. The proposed haul road will require clearing of up to 0.09 ha of vegetation. At the time of survey, the proposed route also crossed about 10 m of open water. Clearing and other impacts on riparian areas could be significantly reduced by utilising an existing creek crossing about 100 m downstream (as proposed in Alignment 2). Alternative crossing options are discussed further in **Section 6.2.5**.

The haul road alignment transects two areas of Coastal Paperbark woodland (RE 12.3.5) from KP 5.9-6.3 and KP 7.6-7.7. These communities occur in extremely low-lying areas that are intermittently inundated by heavy rains. They generally occur adjacent to Saltwater Couch grasslands (RE12.1.2). The proposed haul road will require clearing of up to 4 ha of this community. Although EPA mapping does not identify this community within the corridor or 10 km buffer, it records over 700 ha within the Gladstone and Calliope Shire areas. Field surveys also detected this community in numerous low-lying areas within and adjacent to the study area. Clearing of up to 4 ha is therefore considered unlikely to have a significant impact on this community on a regional basis.

The proposed acid pipeline alignment transects or lies adjacent to approximately 2.9 km of salt pan (RE 12.1.2) and 0.9 km of mangrove forest (RE 12.1.3). Construction will directly impact on up to 8.4 ha of salt pan and 2.4 ha of mangrove. It may be possible to reduce clearing associated with the pipeline by horizontal directional drilling (HDD) underneath areas of highest ecological values (e.g. mangrove channels, vegetated areas of salt pans). Use of this technique will be dependent on availability of suitable entry and exit areas for HDD construction works.

6.2.2 Reversible Versus Non-reversible Impacts on Communities

Direct impacts associated with the haul road are considered to be non-reversible for the life of the project, as the road surfaces will remain unvegetated and road verges are likely to be revegetated with non-original vegetation species. Impacts of clearing associated with construction facilities (e.g. soil and other material stockpiles, vehicle and equipment harbours,

temporary buildings) can be reversed by appropriate rehabilitation measures. However, it is likely that most construction facilities can be located in previously cleared areas that do not contain remnant vegetation.

In contrast, tree and shrub vegetation can be re-established over all but the area immediately over the acid pipeline following construction. Keeping a 3 m strip on either side of each pipeline free of trees and shrubs may be all that is necessary to protect the pipe from potential root damage and facilitate ongoing pipeline inspection and necessary maintenance. The remaining 80% of the pipeline disturbance corridor could therefore be revegetated over the medium term (10-50 years). The extent and form of any proposed revegetation works should be carefully planned, including consideration of ecological values of the original community, alterations in site conditions following construction (e.g. changed hydrology, topography) and future land use of the site and surrounding areas. It may be preferable to rehabilitate a degraded area located away from major proposed developments to offset clearing within the haul road and pipeline corridors. Offset rehabilitation is discussed further in **Section 8.3**.

6.2.3 Potential Impacts on EVR Flora Species

Targeted searches did not detect any EVR flora species. Although it is possible that isolated individuals of EVR species may be present, it is considered improbable that significant populations exist within the corridors and immediate vicinity. Construction of the proposed infrastructure is therefore unlikely to have any significant impacts on EVR flora species.

6.2.4 Potential Impacts on Marine Plants

The haul road corridor contains 17.5 ha of REs dominated by marine plants, representing about 0.91% of the total extent of these REs within the 10 km buffer. DEW (2007a) estimates that the Port Curtis Wetlands contain about 6 100 ha of these communities, so the area within the haul road corridor represents about 0.29% of this total.

The area containing marine plants is likely to be significantly less than the figures above, as substantial areas of salt pan (RE 12.1.2) contain bare saline mud. At the time of survey, about 7 ha of the haul road corridor had no vegetation. Construction of the haul road may therefore require the removal of up to 10.5 ha of marine plants. As discussed earlier, if existing reclaimed areas can be utilised in the northern end of the alignment (KP 0-3.7), marine plant clearing along the haul road could be further reduced.

The acid pipeline corridor contains 10.8 ha of REs dominated by marine plants. This represents about 0.57% of the total extent of these REs within the 10 km buffer and about 0.18% of the total within the Port Curtis Wetlands. About 3 ha of the pipeline corridor was bare saline mud during the survey, so it is estimated that construction will require clearing of up to 7.8 ha of marine plants. Clearing requirements could be reduced by the use of HDD at suitable locations. Alternative acid pipeline alignments that may reduce clearing of marine plants are discussed in **Section 6.2.7**.

6.2.5 Comparison of Haul Road Options for Crossing Boat Creek

Field surveys investigated three alternative crossings of Boat Creek that follow existing infrastructure (**Figure F5**). Options 3 and 4 follow existing conveyor and rail crossings, respectively, where the creek is tidal. Both of these options transect substantial areas of marine plant dominated communities and are likely to increase impacts on surrounding wetlands. The conveyor alignment also passes close to sites that are fenced no-go areas due to known cultural heritage values.

Option 2 follows an existing dirt road and crossing of Boat Creek, which lies about 100 m downstream of the currently proposed alignment. The crossing is constructed of road base material over several pipe culverts. It may have caused some damming of the watercourse, as a substantial pool extends several hundred metres on the upstream side. This is the ecologically preferred option, as it utilises an existing disturbed infrastructure corridor. It reduces clearance and further fragmentation of undisturbed riparian vegetation and avoids direct impacts on marine plant communities. If construction activities are confined to the downstream side of the existing crossing, impacts on the upstream pool may also be avoided.

Regardless of which alignment is used, the proposed haul road crossing should be designed and constructed to minimise clearing width and minimise impacts on watercourse hydrology.

6.2.6 Comparison of Haul Road Options for Crossing Endangered RE

Field surveys investigated five alternative alignments for passing through or around the Endangered Blue Gum Woodland community (**Figure F5**). Options 1, 2 and 5 traverse varying paths through the community, whilst Options 3 and 4 pass to the east and west of the community, respectively.

Option 1 (the currently proposed alignment) passes through or adjacent to 0.9 km of Blue Gum woodland. Although it lies on the eastern edge of the community, it will require up to 8 ha of clearing and will lead to some fragmentation, loss of connectivity and increased edge effects.

Option 2 follows an existing ammonia pipeline about 50 to 100 m west of the currently proposed alignment. It passes through a longer section of Blue Gum woodland (about 1.2 km), but utilises a previously cleared corridor about 10 m wide. It is likely that this option will require more clearing than Option 1 (up to 10 ha) and will cause greater dissection, fragmentation and loss of connectivity within the community.

Option 5 runs just west of the existing railway corridor. Although EPA mapping indicates this area is Ironbark woodland, the field survey recorded large sections that are dominated by Blue Gum. This option will therefore require clearing of a substantial area of this Endangered RE and increase fragmentation and loss of connectivity within the community. It is considered to be the least desirable option from an ecological perspective.

Option 4 passes west of the conveyor through partially cleared Ironbark woodland, then runs about 100 m east of Port Curtis Highway until the Fisherman's Landing Railway. After crossing the railway, it runs just north of a high voltage powerline and a substation, rejoining the currently proposed alignment at about KP 6.8. This alignment runs along the western edge of the polygon mapped as Endangered by the EPA. During field surveys, this route was found to contain mostly Ironbark woodland (RE 11.3.29), with no Blue Gum woodland recorded within the 100 m corridor. This option is therefore considered to be the ecologically preferred option, although it is acknowledged that this route has numerous other constraints (e.g. crossings of conveyor and railway close to where they cross Port Curtis Highway, proximity to high voltage powerlines).

Option 3 runs eastwards until reaching the salt pan, and then heads southwards along the salt pan boundary until joining the primary alignment at KP 6.8. This alignment avoids Blue Gum woodland, but transects about 1.5 km of salt pan communities. As well as directly impacting up to 15 ha of marine plant communities, this option is likely to increase impacts on surrounding wetlands. Option 4 is therefore considered to be less ecologically desirable than the primary alignment, but could be considered if suitable mitigation of impacts on salt pan communities and surrounding wetlands could be developed.

6.2.7 Comparison of Alternative Alignments for Acid Pipeline

EPA mapping indicates that the south-eastern section of the proposed acid pipeline alignment (from KP 4.6-8.2) passes through 2.4 km of marine plant dominated communities and 0.8 km of Endangered Blue Gum woodland. Impacts on these communities could be avoided by entering the GPN refinery site at an earlier point, for example where the proposed haul road enters the site.

It is also recommended that consideration be given to incorporating the acid pipeline within the proposed haul road alignment. This would reduce clearing and other impacts associated with pipeline construction and avoid multiple disturbance corridors that contribute to fragmentation, loss of connectivity and edge effects.

6.3 Potential Impacts on Fauna

6.3.1 Potential Impacts on Fauna in General

With successful implementation of appropriate environmental management controls (as recommended in **Section 7.3**), any potential impacts on fauna species are likely to be limited to direct impacts associated with construction of the proposed haul road and increased likelihood of vehicle strikes with fauna. The road construction will require some clearing of vegetation and this generally equates to a loss of potential fauna habitat and potential reduction in habitat connectivity. In relation to common fauna species, this is unlikely to result in a significant long-term impact, as similar habitats are available in areas adjacent to the proposed alignment, and common species would utilise these habitats.

Nevertheless, some potential impacts would remain, and these include the following:

- Removal of habitat such as mature vegetation, hollow-bearing trees and fallen logs, and therefore loss of nesting, refuge and foraging resources;
- Disturbance to seasonal and permanent wetlands;
- Disturbance to fauna movement corridors and dry season fauna refugia (predominantly associated with creeks and seasonal wetland / waterway areas);
- Unearthing of burrowing fauna during construction;
- Trenchfall – the potential for fauna to fall into and become trapped in the open acid pipeline trench during construction; and
- Potential increase in vehicle strikes along the haul road resulting in fauna injury or death.
-

Discussion of each of these potential impacts is as follows.

Removal of mature vegetation and tree hollows
The proposed haul road alignment currently transects a large patch of Blue Gum woodland (Options 1 and 2). Removal of mature vegetation in general reduces feeding resources and shelter for native fauna species.

The Option 1 alignment is likely to result in a large impact to fauna and fauna habitat in terms of loss of mature vegetation and reducing connectivity of habitat. As presented in **Section 6.2.6** alternative alignments have been considered which minimises the clearing footprint and may reduce the impacts on native fauna.

- The Option 2 alignment utilises a previously cleared pipeline easement of approximately 10 m in width. This option is likely to slightly reduce the amount of mature vegetation to be cleared, although is likely to result in increased fragmentation and edge effects of the Blue Gum woodland;
- The Option 5 alignment is likely to result in the clearing of a greater amount of vegetation to that of Option 1; however, this alignment is likely to reduce the impacts associated with habitat fragmentation given that it occurs adjacent to a cleared gap of approximately 50 m in width (i.e. the railway easement);
- The Option 3 alignment traverses the adjacent saltpan and mudflat communities, therefore would not result in clearing of any mature trees. This alignment, however, is likely to result in a significant impact on these saline communities (i.e. alterations to hydrology, increased sedimentation, pooling) if appropriate mitigation measures are not in place; and
- The Option 4 alignment minimises the clearing of mature vegetation by utilising existing infrastructure easements adjacent to Port Curtis Way. In addition, this option minimises fragmentation of existing patches by locating the alignment at the edge of vegetation patches. This option is the preferred option in terms of minimising impacts on fauna and habitat.

It is recommended that management practices be implemented that further reduce the loss of mature vegetation associated with the proposed haul road alignment (see **Section 7.3** for details).

The proposed acid pipeline alignment may involve the clearing of some fauna habitat within the Blue Gum woodland and mangrove shrubland. Impacts on these communities could be avoided by entering the GPN refinery site at an earlier point, for example where the proposed haul road enters the site. It is also recommended that consideration be given to incorporating the acid pipeline within the proposed haul road alignment. This would reduce clearing of mature vegetation and avoid multiple disturbance corridors that contribute to habitat fragmentation, loss of connectivity and edge effects.

A major potential impact on fauna is the potential loss of hollow-bearing trees. A large number of Australian vertebrate fauna species are dependent on tree hollows for shelter and nesting, including (amongst others) parrots, owls, possums, gliders and bats (Gibbons and Lindenmayer, 2002). Mature trees with hollows are a limited resource in many of the rural and grazed lands of Queensland where widespread clearing has removed much of the mature vegetation. Although regrowth vegetation is present along sections of the haul road route and various alignment options, such regrowth is typically not old enough to have produced tree hollows (in general, hollows form in trees older than 100 years). Large hollow-bearing trees are especially important habitat in strips of riparian vegetation along watercourses in otherwise cleared land. Even single or widely scattered mature hollow-bearing trees can be important habitat, for example, for hollow-roosting bats (Lumsden and Bennet, 2003). Hollow-bearing trees are present in varying but in lower than expected numbers in woodland habitats along the proposed haul road, including in the Blue Gum woodland and in fringing riparian woodland along Boat Creek.

Fallen logs and dead timber on the ground provide shelter and habitat for a broad range of small ground-dwelling fauna including native rodents, dasyurid marsupials, bandicoots, lizards, snakes, frogs, and some birds. Fallen timber may be used as shelter (either underneath timber or within hollow logs) and also as a source of food in the form of invertebrates sheltering under the logs. Large fallen logs also provide essential protection for fauna against bushfire. Loss or removal of fallen timber severely reduces the abundance and diversity of small ground-dwelling fauna. Impacts from removal of dead timber will reverse over time as dead tree limbs and fallen

trees accumulate, but are likely to result in loss of fallen timber-dependent species in the short to medium term.

The density of fallen logs and dead timber within the proposed haul road and acid pipeline alignments (and various alignment options) is generally low or are absent altogether. Additional habitat for ground-dwelling fauna can be created in the short term by relocating dead and cleared timber into adjacent patches during construction provided that an excessive bushfire hazard is not created.

Disturbance to seasonal and permanent wetlands
The haul road and acid pipeline alignments occur within the catchment of the Port Curtis Wetlands and encroach within marine vegetation communities at various points. In particular, **Option 3** for the crossing of the Blue Gum woodland by the haul road significantly increases the distance traversed through the saltpan and mudflat communities.

The major potential impact regarding these wetland habitats is considered to be changes to hydrology, either by changes in freshwater in-flow or by constructions that interrupt the tidal connections of these marine coastal floodplains (Olsen and Weston, 2004). Other issues include disturbance to rank vegetation fringing wetlands, and changes in turbidity and sedimentation associated with construction. The proposed haul road has the potential to affect the hydrology within this wetland in the form of changes in topography (i.e. via imported fill material) and downstream impacts. In addition, the disturbance corridor may include some clearing of roost habitat for various wader and shorebirds.

Disturbance to movement corridors and dry season fauna refugia
The study area is characterised by relatively large remnant vegetation patches which surrounds compact development nodes connected by infrastructure corridors (e.g. railway lines, highways, pipelines). Clearing for cattle grazing or more recently industrial uses has been generally contained to a linear strip along the coastal lowlands. Consequently, areas of retained riparian vegetation (i.e. fringing riparian open forest and riparian woodland) provide important connections between coastal wetlands and adjacent hills and ranges. Watercourses also provide a source of water and are often the only fresh water available during the dry season. This in turn provides a refuge for many fauna species. As such, Boat Creek and associated riparian vegetation (freshwater and marine environments) forms part of a locally important movement corridor and refugia for a range of fauna species. An access track has been constructed across the creek, which may have resulted in a significant disturbance to this watercourse and pooling upstream.

The potential impacts of the various alternative crossings of Boat Creek are discussed below:

- The Option 1 alignment crosses Boat Creek upstream of the existing access track, therefore creating an additional crossing point and requiring the removal of 0.9 ha of riparian vegetation.
- The Option 2 alignment crosses at the existing track. Some additional clearing of riparian vegetation may be cleared under this option; however, there may be an opportunity for a road design that prevents upstream pooling.
- The Option 3 alignment crosses the creek beside the existing conveyor. This may include the clearing of some marine vegetation including potential roost habitat for some wader and shorebirds.
- The Option 4 alignment crosses at the rail bridge further downstream from the conveyor and may involve the removal of marine vegetation.

Fauna injury or death by vehicle strikes
Roadkills are a noticeable feature of roads in Queensland and in the rest of Australia. Several reasons can account for roadkills, such as foraging resources provided on road reserves (e.g. productive grassy strips provide food for herbivores and granivores) and roads may bisect home ranges of fauna or migration pathways (Queensland Department of Main Roads, 2000). Predatory or carrion species (e.g. raptors, crows, quolls) may also be subject to vehicle strikes when feeding on roadkill.

The proposed haul road route traverses several patches of remnant and non-remnant vegetation (i.e. sparse woodlands, paddocks with isolated trees) including a fauna movement corridor (i.e. Boat Creek). The construction of a new road within these habitats increases the risk to fauna from vehicle strikes which may result in injury or death. The Blue Gum woodland, in particular, presents the largest patch of remnant vegetation traversed by the haul road. The Option 1 and Option 2 alignments are likely to have the greatest impact as these will result in further fragmentation of this patch. The Option 4 and Option 5 may result in a reduced impact on road kills as they are located at the edge of this woodland and adjacent to existing transport infrastructure. The Option 3 alignment may result in reduced likelihood of road kill as the road would be constructed predominantly outside the woodland community.

Unearthing of burrowing fauna species during construction
There is significant potential for direct impact on some burrowing fauna species by being unearthed during construction of the haul road and pipeline. Whilst many larger and more mobile fauna such as birds, macropods and larger reptiles are likely to move away from the disturbance resulting from construction, smaller burrowing fauna (especially nocturnal species) are likely to remain under the surface and therefore risk being dug up and injured or killed. A broad range of burrowing common fauna including frogs, lizards, snakes and small mammals are potentially present along the entire length of the alignment. EVR species vulnerable to being unearthed include Brigalow Scaly-foot.

Trench fall: the potential trap created by the open pipeline trench
To facilitate the laying of the acid pipeline, an open trench will be required. The open trench provides a temporary barrier to fauna movement and there is potential for ground-dwelling fauna to fall into the trench and become trapped and exposed to overheating, dehydration, predation and / or drowning. Fauna entrapment within pipeline trenches has been recognised as a key environmental issue by the Australian Pipeline Industry Association (APIA) Code of Environmental Practice (APIA, 2005).

Published information from other Australian pipeline projects has demonstrated that pipeline trenches can entrap a high diversity and abundance of ground-dwelling animals (including EVR species), particularly reptiles, frogs and small mammals, with the potential for very high levels of mortality (Ayers and Wallace, 1997, Woinarski *et al.*, 2000, Doody *et al.*, 2003, Wilson and Swan, 2004 and Wilson, 2005b). To help reduce potential impacts from trench fall, the length of open trench should be the minimum practicable at any one time.

6.3.2 Potential Impacts on EVR Fauna

Of the 18 EVR fauna species identified as potentially utilising preferred habitat within the proposed haul road corridor (refer **Table T10**), seven have the potential to be impacted by the proposed haul road construction due to potential effects on preferred habitat. These include two reptiles, one bird, two mammals and two bats. Each EVR species identified as potentially utilising habitat within the proposed pipeline alignment is individually discussed in **Appendix D.1** and potential impacts on these species are described. Species-specific mitigation recommendations required to avoid or minimise potential impacts on these species are also detailed in **Table T11** and are summarised in **Section 7.3**.

A number of EVR fauna species identified as potentially occurring within the proposed haul road and acid pipeline alignments are species that are nomadic, highly mobile or occupy very large home ranges. These include Squatter Pigeon, Black-necked Stork, Eastern Curlew, Radjah Shelduck, Saltwater Crocodile and Square-tailed Kite. Given the small amount of remnant vegetation to be cleared (as detailed in **Table T8** and **T9**) compared to the area over which individuals of these species range, no significant impact is likely upon these species.

Several other EVR fauna species have the potential to be directly impacted if they are present within the haul road route in open forest and woodland habitats, but also have preferred habitat types that are similarly well represented in the immediate vicinity of the alignment. These include Brigalow Scaly-foot, Large-eared Pied Bat, Little Pied Bat and the Koala. Although there is potential for some direct impact on these species, the small amount of habitat to be cleared combined with the implementation of appropriate mitigation recommendations (as provided in **Section 7.3**) would result in minimal potential for the road construction to significantly impact these EVR fauna species.

In addition, several EVR species that are likely to utilise wetland habitats within the proposed haul road and acid pipeline alignments may be impacted by the potential loss of habitat or alterations to hydrology of the wetlands. These species include Sooty Oystercatcher, Yellow Chat, Cotton Pygmy-goose, Lewin's Rail, Australian Painted Snipe and Rusty Monitor. Provided that appropriate mitigation recommendations (as provided in **Section 7.3**) are implemented prior to and during construction, these species are unlikely to be significantly impacted by these works.

6.3.3 Potential to Create New Pest Fauna Breeding Habitat

The potential for the proposed construction to create additional breeding sites for pest species such as mosquitoes the Cane Toad (*Bufo marinus*) relates to altered hydrological regimes which cause water to be retained in environments amenable to breeding. Cane toads will breed in almost any permanent or temporary standing water on the ground and mosquitoes will also breed in any standing water. Assuming the mitigation measures recommended in **Table T11** are successfully implemented there is limited potential to increase pest breeding sites.

7 MITIGATION AND REHABILITATION RECOMMENDATIONS

7.1 Alignment Specific Recommendations

The following recommendations are provided to minimise ecological impacts along specific sections of the haul road alignment:

- By using existing reclaimed areas in the northern end of the alignment (KP 0-3.7), it may be possible to avoid all clearing of mangroves and reduce the total area of salt pan impacted by up to 6.5 ha;
- Move the proposed crossing of Boat Creek about 100 m east to the existing road crossing (Option 2 in **Figure F5**) to reduce impacts on riparian communities and the upstream pool; and
- From KP 4.7-6.8, consider alignments that avoid the Endangered Blue Gum woodland (RE12.3.3). The ecologically preferred option passes to the west of the community (Option 4 in **Figure F6**).

The following recommendations are provided to minimise ecological impacts along specific sections of the acid pipeline alignment:

- Investigate potential use of horizontal directional drilling (HDD) underneath areas of highest ecological values (e.g. mangrove channels, vegetated areas of salt pans);
- From KP 5.2, reroute pipeline to enter refinery site along the proposed haul road alignment to reduce clearing of salt pans, mangroves and Endangered Blue Gum woodland; and
- Consider incorporating the acid pipeline partially or wholly within the proposed haul road alignment to avoid multiple disturbance corridors and reduce clearing requirements.

7.2 Mitigation and Rehabilitation Recommendations for Flora

The following general mitigation and rehabilitation measures are recommended to help avoid and minimise potential impacts on flora:

- The corridor impacted for haul road construction within all areas of remnant vegetation should be minimised and should not exceed 100 m;
- The corridor impacted for acid pipeline construction within all areas of remnant vegetation should be minimised and should not exceed 30 m;
- If impacts on Endangered Blue Gum woodland and marine plants cannot be avoided, consider rehabilitation of nearby degraded areas of similar vegetation to offset losses caused by proposed development;
- Clearing of remnant vegetation areas should be avoided for the purposes of siting construction camps and where possible, vehicle access tracks;
- Clearing boundaries within remnant vegetation areas should be clearly marked in the field;
- Along the acid pipeline, vegetative wastes resulting from clearing should, where practicable, be re-spread over the easement following construction. This will further encourage regrowth and minimise weed infestations;

- Subject to easement requirements, trees and shrubs should be allowed to naturally regenerate on those parts of the cleared pipeline corridor that are not required to be kept tree free for pipeline protection and maintenance purposes;
- Mulching of vegetative wastes is not preferable from a fauna habitat perspective as variation of fauna habitat niches is significantly reduced. Large scale burning of vegetative wastes should also be avoided. Rather, the timber should be stick raked into piles and left to provide animal habitat and to assist in revegetation and erosion control. If landholders are strongly opposed to stick rake piles, mulching is the next preferable method of dealing with vegetative wastes;
- All vehicles should contain spark arresters on diesel engines. A fire extinguisher and personnel trained in fire fighting are to be on-hand during welding operations to minimise damage caused by accidental fires;
- Topsoil should be removed and stockpiled prior to construction. Ensure stockpiles are limited to 2 m in height and have appropriate sediment and erosion controls. Topsoil should be re-spread across rehabilitation areas as soon as possible following disturbance (preferably within 12 months);
- A re-seeding plan should be developed based on soil types and existing local vegetation characteristics and landholder preferences along the alignment;
- Following construction, disturbed areas should be seeded with those species identified in the re-seeding plan;
- If available (and subject to landholder preferences), local provenance native seed should be used for regeneration seeding following construction in all disturbed areas. If local provenance seed cannot be collected or purchased, native grass seed from other parts of central Queensland should be purchased from commercial operators and respread in these locations;
- Vegetation re-establishment should be monitored during and post-construction. Key flora indicators should include percentage groundcover of desirable species. A suitable target may be 50% of the desirable species cover occurring on adjoining undisturbed areas within 24 months;
- Construction should be undertaken in the dry season wherever possible;
- Clearing width should be minimised at watercourse crossings and in areas with Endangered vegetation (RE 12.3.7 and RE 12.3.3);
- In riparian areas, wetlands and tidal areas, care should be taken to ensure hydrological characteristics are not altered and appropriate soil and erosion management is implemented;
- Drainage should be reinstated at watercourse crossings, wetlands and tidal areas immediately following completion of construction;
- Design, install and maintain effective erosion, sediment and pollution control structures during construction and operation (especially near wetlands, watercourses and tidal areas);
- Consider sealing of haul road surface to reduce sediment loss into surrounding wetlands;
- Monitoring of weed infestations within disturbed areas should occur at least monthly during construction and then quarterly for a period of two years following construction. Appropriate weed control measures should be

applied. Following the two year period, the frequency of monitoring should be reconsidered dependent on the success of control measures and the level of infestations;

- A Weed Management Plan that addresses the construction, rehabilitation and operation phases of the project should be prepared prior to construction. This Plan should include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural and declared weeds;
- All vehicles and plant should have certification that they are weed-free prior to their initial commencement of works; and
- Offsets may be proposed to compensate for the loss of significant vegetation communities, i.e. Endangered REs and marine plants. Offsets are discussed in **Section 8.3**.

7.3 Mitigation and Rehabilitation Recommendations for Fauna

Nineteen EVR species have been identified as potentially occurring within the proposed haul road and acid pipeline alignments. Of these, 12 species are considered to be highly mobile species (EPA 2004) and are unlikely to be significantly impacted by the road and pipeline construction or operation of the haul road. The remaining seven species may be impacted by the proposed alignments in the form of habitat loss (i.e. mature vegetation, nesting / roosting sites), loss of foraging resources and increased likelihood of vehicle strikes. To avoid or minimise these impacts, recommended mitigation measures are provided in **Table T11** and **Appendix D.1.**

The potential impacts of the proposed haul road construction have also been identified for common fauna (**Section 7.3**). Where appropriate, mitigation and rehabilitation recommendations to avoid or minimise potential impacts on common fauna are also provided in **Table T11.**

"This page has been left blank intentionally"

8 APPROVALS REQUIRED IN RELATION TO FLORA AND FAUNA

8.1 Australian Government Policy, Legislation and Guidelines

The EPBC Act protects the environment, particularly in relation to matters of National Environmental Significance. It streamlines national environmental assessment and approvals processes, protects Australian biodiversity and integrates management of important natural and cultural places.

Under the EPBC Act, assessment and approval is required for actions that are likely to have a significant impact on matters of National Environmental Significance, including Commonwealth listed EVR flora and fauna species, Migratory fauna species, threatened ecological communities, World Heritage properties and wetlands of international significance (Ramsar wetlands). DEW provides guidelines to assist in determination of whether or not impacts should be considered to be significant.

No vegetation communities listed under the EPBC Act were recorded during the survey. No Endangered or Vulnerable flora or fauna species listed under the EPBC Act were recorded within the proposed corridors. It is considered unlikely that any significant populations of EVR species occur within the corridors. No Ramsar listed wetlands occur within or adjacent to the study site. The Great Barrier Reef World Heritage Area lies to the east of the alignments, so no direct impacts from the proposed development are considered likely. Nine bird species, listed as Migratory and / or Marine species, were observed within the study area during the field surveys. It is considered unlikely that the alignments constitute a significant impact on an important population of any of these species.

Subject to the successful implementation of the mitigation recommendations provided in **Section 7**, no matters of National Environmental Significance are considered likely to be significantly impacted by the proposal. However, due to the proximity of the Great Barrier Reef World Heritage Area, it is recommended that an EPBC referral is submitted to DEW to determine whether the proposed action requires approval under the EPBC Act.

8.2 State Policy, Legislation and Guidelines

The NC Act provides for the conservation of wildlife and habitat for the whole of Queensland. The EPA administers this act. The *Nature Conservation (Wildlife) Regulation 2006* lists the plants and animals considered presumed extinct, endangered, vulnerable, rare, near threatened, least concern, international and prohibited. It discusses their significance and states the declared management intent and the principles to be observed in any taking and use for each group.

No EVR flora or fauna species listed under the NC Act were recorded within the proposed corridors. Subject to the successful implementation of the mitigation recommendations provided in **Section 7**, no NC Act listed flora or fauna species are considered likely to be significantly impacted by the proposal.

The Queensland VM Act provides a legislative framework for managing and assessing clearing of remnant vegetation on freehold and leasehold land. The Department of Natural Resources and Water (DNRW) administers this Act. The conservation status of vegetation communities is based on the remaining extent of REs within identified Bioregions. Three conservation categories are recognised under the Act. These are:

- Endangered: where there is either less than 10% of the pre-clearing extent remaining, or 10% - 30% of its pre-clearing extent remaining if the remnant is less than 10 000 hectares;
- Of concern: where there is either 10-30% pre-clearing extent remaining, or more than 30% remaining if the remnant is less than 10 000 hectares; and
- Not of Concern: where there is over 30% pre-clearing extent remaining and remnant is greater than 10 000 hectares.

Construction of the proposed haul road may require clearing of up to 8 ha of Endangered RE and 24.4 ha of Not of Concern RE. Construction of the proposed acid pipeline may require clearing of up to 6.3 ha of Of Concern RE and 10.8 ha of Not of Concern RE. There are requirements to obtain permits under the VM Act for any proposed clearing of Endangered, Of Concern or Not of Concern REs. This generally includes development of a Property Vegetation Management Plan (PVMP) for the properties that will be subject to clearing. Rehabilitation of a nearby area may be proposed to offset unavoidable clearing of remnant vegetation (as discussed in the following section). Note that clearing of mangroves, grasses and non-woody herbage are not regulated under the VM Act, as these plant groups are not included in the definition of vegetation.

The *Fisheries Act 1994* provides for the management, use, development and protection of fisheries resources and fish habitats, including marine plants. Plants protected under the Act include:

- Highest fisheries significance plants, which usually grow on tidal land that is seaward of HAT and are known to contribute to fisheries productivity (e.g. mangroves, seagrasses, marine algae, Saltwater Couch, samphires). These species are protected marine plants regardless of their location and whether or not they are on tidal lands; and
- Medium fisheries significance plants, which are plants that usually grow adjacent to tidal land and which have a capacity for a direct link to fisheries productivity (e.g. *Melaleuca* swamps, *Allocasuarina* woodlands with marine plant understoreys).

The proposed haul road corridor contains up to 10.5 ha of highest fisheries significance marine plants (mangroves, samphires and Saltwater Couch) and up to 4 ha of medium fisheries significance plants in Coastal Paperbark woodland (RE 12.3.5). The proposed acid pipeline corridor contains up to 7.8 ha of highest fisheries significance marine plants. A permit under Section 51 of the Fisheries Act is required for any works within intertidal areas that may disturb marine plants. Compensatory measures such as rehabilitation of a nearby area may be proposed to offset unavoidable clearing of marine plants (as discussed in the following section).

8.3 Rehabilitation of Offset Areas

Offset areas may be proposed to compensate for removal of certain vegetation communities and habitats.

VM Act offsets

The Policy for Vegetation Management Offsets (DNRW, 2006) outlines offsets that meet the aims of the VM Act and associated Regional Vegetation Management Codes to maintain the current extent of REs and essential habitat. Offsets are an acceptable solution only where a development is for a relevant purpose under the VM Act. The proponent of an offset must develop a Management Plan that specifies goals for each stage of the program, assessment of risks (e.g. weeds, fire), measures to achieve goals and minimise risks, a monitoring program and remedial actions if goals are not met. An offset must be legally secured, usually via a

legally binding mechanism (e.g. protected area under NC Act, area of high conservation value under VM Act, covenant).

The proposed offset area should be:

- Not currently mapped as remnant vegetation, unless:
  - The area has a current clearing approval; or
  - The area will deteriorate to non-remnant status within six months, due to an immediate threatening process.
- Geographically close to proposed clearing area (preferably within 20 km);
- Within the same Bioregion and preferably same Subregion; and
- Same pre-clearing RE where the RE of the proposed clearing area is:
  - Below 5% of pre-clearing extent and is less than 500 ha in total extent within the applicable Bioregion;
  - Less than 200 ha in total extent (before or after clearing); or
  - Essential Habitat.
- Pre-clearing RE that has the same or higher conservation status than the proposed clearing area; and
- On same Landzone (or demonstrate ecological equivalence) to the proposed clearing area;
- At least 2 ha in size;
- Likely to be mapped as remnant vegetation within 5-20 years; and
- Likely to become ecologically equivalent to the proposed clearing area.

The area to be rehabilitated for an offset varies depending on the status of the RE to be cleared and the status and condition of the proposed rehabilitation area. For example, if the proposed rehabilitation area is within 20 km of the cleared area, can be restored to the same RE as the original area within five years, has less than 10% weed cover and does not require revegetation, an offset ratio of 1.75 is required (i.e. area of offset = 1.75 x cleared area).

Marine plant offsets

The Fish Habitat Management Operational Policy for the Management and Protection of Marine Plants (Couchman. and Beumer, 2002) outlines compensation measures that may be carried out off-site to offset adverse impacts on marine plants, tidal lands and fish habitats, under the *Fisheries Act 1994*. Offsets will be considered only if the proposed loss is justifiable, unavoidable and acceptable under legislation and policies of the Department of Primary Industries and Fisheries (DPIF).

Compensation programs may include habitat exchange, restoration projects to create replacement fish habitats and / or contribution to a state-wide compensation program to fund research or extension on fish habitats. The restoration process is outlined in the Fish Habitat Guideline - Restoration of Fish Habitats (Hopkins *et. al*., 1998) and should include the following steps:

- Identify site;
- Identify baseline conditions and degrading factors;
- Set restoration objectives and criteria for success;
- Determine resource allocation;

- Determine and obtain relevant permits / approvals;
- Formulate restoration plan;
- Develop revegetation strategy (where necessary);
- Implement plan;
- Monitor site to asses the effectiveness of habitat restoration;
- Report results; and
- Maintain restored site.

9 CONCLUSION

Ecological constraints identified along the proposed PAM haul road and acid pipeline alignments included:

- Marine and intertidal vegetation, including mangrove shrublands, saltpan and mudflats and saltmarsh communities;
- Endangered Regional Ecosystems (RE 12.3.3);
- Riparian vegetation along Boat Creek;
- Freshwater and saline wetland habitat for a variety of significant and common fauna species; and
- Potential habitat for EVR, Regionally Significant and Migratory / Marine listed fauna species.

Up to 32.4 ha of remnant RE for the haul road and 17.1 ha of RE for the acid pipeline are likely to be directly impacted by construction and operation of the proposed infrastructure along the current alignments. These totals include tidal areas within the Port Curtis Wetlands. Clearing of woodland vegetation will be less as 7 ha of the proposed haul road corridor and 3 ha of the proposed acid pipeline corridor contains bare unvegetated mud flat.

Alignment modifications outlined in this report could substantially reduce clearing of REs for the haul road to and the acid pipeline. Recommended alignment changes for the haul road crossing of the Blue Gum woodland include (in order of ecological preference):

- The Option 4 crossing of the Endangered Blue Gum woodland. This is the preferred option which reduces the amount of Endangered RE requiring clearing and consolidates the haul road with other infrastructure corridors, thereby reducing the potential effects of fragmentation and edge effects for fauna;
- Option 3, which involves construction within saltpan and mudflat communities. This option reduces the amount of woodland vegetation to be cleared; however, may impact on the Port Curtis Wetlands;
- Option 2, which utilises a partly cleared infrastructure corridor though the Blue Gum woodland, thereby reducing the amount of vegetation to be cleared;
- The proposed alignment (Option 1) potentially involves the removal of a large proportion of this community and may result in increased fragmentation and edge effects and loss of connectivity; and
- Option 5 follows the existing rail corridor and is will require removal of a large amount of observed Blue Gum woodland. This is the least preferred option in terms of impacts to flora and fauna.

Recommended alignment changes for the haul road crossing of Boat Creek include (in order of ecological preference):

- Option 2 is the preferred crossing point of Boat Creek as this occurs along an existing access road crossing. It reduces clearance and further fragmentation of undisturbed riparian vegetation and avoids direct impacts on marine plant communities;

- The currently proposed alignment crosses approximately 100 m upstream of the **O**ption 2 crossing and will result in the removal of generally intact riparian vegetation and potentially impact on aquatic wetland habitat for fauna; and
- Options 3 and 4 follow existing infrastructure crossings, where the creek is tidally influenced. Both options are likely to result in the removal of marine vegetation and potential impacts to downstream wetlands.

Regardless of which alignment is used, the crossing should be designed and constructed to minimise clearing width and minimise impacts on watercourse hydrology.

Recommended alignment changes for the acid pipeline include: consideration of the use of HDD underneath area of high ecological value (e.g. mangrove channels, vegetation areas of saltpans); relocating the entry point to the proposed refinery site at the haul road entry point; and consideration should be given to incorporating the pipeline within the haul road alignment, thereby consolidating impacts along one corridor.

It may be preferable to offset impacts of clearing of remnant REs and marine plants by rehabilitation of other nearby sites to replace cleared areas. Measures to compensate for removal of marine plants will require negotiation with DPIF, while offset options for remnant REs (except mangroves) are managed by DNRW.

Construction and operation of the proposed infrastructure (particularly the haul road) may have significant indirect impacts on watercourses, wetlands and tidal areas. Mitigation will require careful design, installation and maintenance of effective erosion, sediment and pollution control structures during construction and operation. Natural hydrology should be reinstated as soon as possible after construction. Ongoing impacts of haul road operation could be reduced by sealing of the haul road. In addition, potential impacts on individual fauna and fauna habitat can be avoided or mitigated through the consideration of the alternative alignments described above and the implementation of recommended measures and procedures during construction.

10 REFERENCES

Ayers, D. and Wallace, G. 1997. “Pipeline trenches: an under-utilised resource for finding fauna”. pp. 349-357 in: Hale, P. and Lamb, D. (eds) Conservation Outside Nature Reserves. Centre for Conservation Biology, The University of Queensland, Brisbane.

Australian Pipeline Industry Association. 2005. *Code of Environmental Practice – Onshore Pipelines*. Kingston, ACT.

Cogger, H.G., Cameron, E.E., Sadlier, R.A. and Eggler, P. 1993. *The Action Plan for Australian Reptiles*. Australian Nature Conservation Agency, Canberra.

Couchman, D. and Beumer, J. 2002. *Fish Habitat Management Operational Policy for the Management and Protection of Marine Plants*. Departmental Assessment Procedures and Policy Position, Queensland Department of Primary Industries, FHMOP 001, 40pp.

Danaher, K.F., Rasheed, M.A. and Thomas, R. 2005. *The intertidal wetlands of Port Curtis*. Information Series QI05031. Department of Primary Industries and Fisheries, Queensland.

Department of Environment and Water Resources. 2007a. *Port Curtis Wetland*. Database Directory of Important Wetlands in Australia, website accessed July 2007. http://www.environment.gov.au/cgi-bin/wetlands/report.pl.

Department of Environment. 1997. *Systematic Vertebrate Fauna Survey Project Stage I – Vertebrate Fauna Survey In the SEQ Bioregion*. Department of Environment, Queensland.

Department of Main Roads. 2000. *Fauna Sensitive Road Design Volume 1: Past and Existing Practices*, Queensland Department of Main Roads, Planning, Design and Environmental Division. Brisbane.

Department of Natural Resources. 1999. *Species Management Manual Volume 3*. Environmental Management, Forest Resources. November 1999.

Doody, J.S., West, P., Stapley, J., Welsh, M., Tucker, A., Guarino, E., Pauza, M., Bishop, N., Head, M., Dennis, S., West, G., Pepper, A. and Jones, A. 2003. “Fauna by-catch in pipeline trenches: conservation, animal ethics, and current practices in Australia”. Australian Zoologist 32:410-419.

Duncan, A., Baker, G.B and Montgomery, N. 1999. *The Action Plan for Australian Bats*. Biodiversity Group, Environment Australia, Canberra.

Edginton, M. Personal Communication. Duty Botanist, Plant Identification and Advisory Services, Queensland Herbarium. Email received 6 May 2004.

Ehmann, H. 1992. *Encyclopaedia of Australian Reptiles*. Angus and Robertson, Sydney.

Environmental Protection Agency, 2001 *Planting Trees for Wildlife: Trees for Koalas*, The State of Queensland, Environmental Protection Agency.

Environmental Protection Agency. 2002b. *Brigalow Belt South: Fauna Expert Panel Report*. Biodiversity Planning Assessment, Environmental Protection Agency, Brisbane.

Environmental Protection Agency. 2003. *Brigalow Belt South Biodiversity Planning Assessment*, Biodiversity Planning Unit, EPA. Version 3.4, March 2005.

Environmental Protection Agency. 2004. *Southeast Queensland Fauna Expert Panel Report*, Biodiversity Planning Unit, EPA.

Environmental Protection Agency. 2005. *Southeast Queensland Biodiversity Planning Assessment*, Biodiversity Planning Unit, EPA. Version 3.4, March 2005.

Environmental Protection Agency. 2007. *Regional Ecosystem Description Database*. Version 5.1. Updated June 2007. Environmental Protection Agency.

Environmental Protection Agency. 2007a. *Environmentally Sensitive Areas*. Ecomap produced by Environmental Protection Agency, website accessed July 2007. http://www.epa.qld.gov.au/ecoaccess/ecomaps/

Forster, P.I. in Orchard, A.E. (Ed). 1996. *Flora of Australia.* 28: 142.

Garnett, S.T., and Crowley, G.M. 2002. *The Action Plan for Australian Birds*. Commonwealth of Australia, Environment Australia, Canberra.

Gibbons, P. and Lindenmayer, D. 2002. *Tree Hollows and Wildlife Conservation in Australia*. CSIRO Publishing, Melbourne.

Greer, A.E. 2006. *Encyclopaedia of Australian Reptiles*. Australian Museum Online http://www.amonline.net.au/herpetology/research/encyclopedia.pdf Version date: 7 August 2006.

HLA. 2006. Flora and Fauna Assessment, Gladstone Pacific Nickel Slurry Pipeline. Report to RLMS, Brisbane.

Hopkins, E., White, M. and Clarke, A. 1998. *Restoration of Fish Habitats: Fisheries Guidelines for Marine Areas*. Department of Primary Industries, Queensland, Fish Habitat Guideline FHG 002, 44 pp.

Houston, W., Porter, G., Elder, R, Black, R. and Sheaves, M. 2004a. “Rediscovery of Yellow Chats (Capricorn Subspecies) on the Fitzroy River Delta”, Central Queensland. Sunbird 34(1):36–42.

Houston, W., Porter, G., O'Neill, P. & Elder, R. 2004b. “The ecology of the Critically Endangered Yellow Chat Epthianura crocea macgregori on Curtis Island”. Sunbird 34:10-23.

Jaensch, R., Houston, W., Black, R, Campbell, L., Elder, R. & McCabe, J. 2004. “Rediscovery of the Capricorn subspecies of Yellow Chat E pthianura crocea macgregori at Torilla Plain, on the mainland coast of central Queensland“. Sunbird 34:24-35.

Johnson, P. 2003. *Kangaroos of Queensland*. Queensland Museum. Brisbane.

Lee, A.K. 1995. *The Action Plan for Australian Rodents*. Commonwealth of Australia, Environment Australia, Canberra.

Lumsden, L. and Bennet, A. 2003. *Bats and paddock trees: Insights from recent research*. Department of Sustainability and Environment, Melbourne.

Maslin, B.R. 2001. *Wattle – Acacias of Australia.* Interactive CD. Department of Conservation and Land Management, Perth.
Nicholls, W.H. 1938. 'A New Species of the Genus Cryptostylis R. Br.. *The Victorian Naturalist* 54(11):182.

Maxwell, S., Burbidge, A.A. and Morris, K. 1996. *Action Plan for Australian Marsupials and Monotremes*. Commonwealth of Australia, Environment Australia, Canberra.

Menkhorst, P., and Knight, F. 2004. *A Field Guide to the Mammals of Australia*, Second edition. Oxford University Press, Australia.

Morcombe, M. 2003. *Field Guide to Australian Birds*, Second Edition. Steve Parish Publishing, Archerfield.

Neldner, V.J., Wilson, B.A., Thompson and Dillewaard, H. A. 2005. *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Queensland Herbarium, Environmental Protection Agency.

Olsen, P. and Weston, M. 2004. "The State of Australia's Birds 2004: Water, Wetlands and Birds". Birds Australia. Supplement to Wingspan 14(4):I-XIV.

Queensland Herbarium. 2001. *Names and Distribution of Queensland Plants, Algae and Lichens.* Environmental Protection Agency, Brisbane.

Reynolds, S.T. 1991. New species and changes in Sapindaceae from Queensland. *Austrobaileya* 3(3): 492.

Robinson, M. 1998. *A Field Guide to the Frogs of Australia*. Reed New Holland, Sydney.

Sands, D.P.A. and New, T.R. 2000. *The Action Plan for Australian Butterflies*. Commonwealth of Australia, Environment Australia, Canberra.

Schodde, R. and Tidemann, S.C. (Eds) 1990. *Reader's Digest Complete Book of Australian Birds (2nd Edition)*. Reader's Digest (Australia) Pty Ltd, Sydney.

Stanley T. D. and Ross E. M. 1983. *Flora of south-eastern Queensland, Volume I*. Queensland Herbarium, Department of Primary Industries, State of Queensland.

Stanley T. D. and Ross E. M. 1986. *Flora of south-eastern Queensland, Volume II*. Queensland Herbarium, Department of Primary Industries, Queensland Government.

Strahan, R. (Ed) 1995. *The Mammals of Australia*, Second Edition. Reed New Holland, Sydney.

Tyler, M.J. 1997. *The Action Plan for Australian Frogs*. Commonwealth of Australia, Wildlife Australia, Canberra.

Vincent, M. and Wilson, S. 1999. *Australian Goannas*, New Holland Publishers, Sydney.

Wager, R. and Jackson, P. 1993. *The Action Plan for Australian Freshwater Fishes*. Australian Nature Conservation Agency, Canberra.

Wilson, S. 2005a. *A Field Guide to Reptiles of Queensland*. Reed New Holland, Sydney.

Wilson, S. 2005b. "Wildlife patrol on Australia's longest pit trap". Australian Geographic 79:26-27.

Wilson, S.K. and Knowles, D.G. 1988. *Australia's Reptiles*. Cornstalk, Sydney.

Wilson. S. and Swan. G. 2003. *A Complete Guide to Reptiles of Australia*. Reed New Holland, Australia.

Wilson, S. and Swan, G. 2004. "Life in the trenches: a happy mix of pipeline construction and wildlife conservation". Pp. 20 in Hogarth, D.(Ed) North Queensland Gas Pipeline – An Alliance Perspective.
http://www.enertrade.com.au/PDFS/NQGP%20-%20An%20Alliance%20Perspective.pdf

Woinarski, J.C.Z., Armstrong, M., Brennan, K., Connors, G.T., Milne, D., McKenzie, G. and Edwards, K. 2000. "A different fauna? Captures of vertebrates in a pipeline trench, compared with conventional survey techniques; and a consideration of mortality patterns in a pipeline trench". Australian Zoologist 31:421-431.

Tables

"This page has been left blank intentionally"

Table T1: Vegetation Communities / REs Transected by the Proposed Haul Road

Vegetation Communities / REs		Status		Occurrence^	
RE Code	Description	EPBC	VMA	Survey Sites	Approx. KPs
11.3.29	*Eucalyptus crebra, E. exserta, Melaleuca* spp. Woodland on alluvial plains.		N	Not visited	3.5-3.9 (west)
12.1.2	Saltpan vegetation including grassland and herbland on marine clay plains.		N	2J, 5J, 10A	1.2-1.3 (north) 2.6-3.2 (west) 6.3-7.6
12.1.3	Mangrove shrubland to low closed forest on marine clay plains and estuaries.		N	6J, 10A	1.0-1.2 (north)
12.3.3	*Eucalyptus tereticornis* woodland to open forest on alluvial plains		E	3J	5.0-5.3 5.5-5.9 5.9-6.1 (west)
12.3.5	*Melaleuca quinquenervia* open forest on coastal alluvium		N	1J, 11A	5.9-6.1 (east) 5.9-6.3 7.6-7.7
12.3.7	*Eucalyptus tereticornis, Callistemon viminalis, Casuarina cunninghamiana* fringing forest along watercourses.		N	4J	4.45-4.54

E = Endangered under both EPBC Act and VM Act

OC = Of Concern; N = Not of Concern under the VM Act

^ Refer **Figure 1**, **Figure 2a** and **Appendix A**

Table T2: Vegetation Communities / REs Transected by the Proposed Acid Pipeline

Vegetation Communities / REs		Status		Occurrence^	
RE Code	Description	EPBC	VMA	Survey Sites	Approx. KPs
12.1.2	Saltpan vegetation including grassland and herbland on marine clay plains.		N	2J, 5J, 10A	2.5-2.7 (east) 2.7-3.0 4.3-6.0 6.5-7.1 7.9-8.0
12.1.3	Mangrove shrubland to low closed forest on marine clay plains and estuaries.		N	6J, 10A	2.5-2.7 (west) 6.0-6.5 8.0-8.2
12.3.3	*Eucalyptus tereticornis* woodland to open forest on alluvial plains		E	3J	3.0-4.3 7.1-7.9 (unsurveyed)

E = Endangered under both EPBC Act and VM Act

OC = Of Concern; N = Not of Concern under the VM Act

^ Refer **Figure 1**, **Figure 2a** and **Appendix A**

Table T3: EVR Flora Species Potentially Occurring Within the Haul Road and Acid Pipeline Corridors and the Broader Study Area

Family	Scientific Name (Common Name)	Conservation Status	Preferred Habitat	Preferred Habitat Present Along Alignment	Located During Field Survey	Source
Acanthaceae	*Graptophyllum excelsum*	R (Qld)	Restricted to Qld, extending from near Mt Larcom north to the Chillagoe- Mt Mungana area. Occurs on rocky hillsides in semi-evergreen vine thickets. Also recorded growing in grassy eucalypt woodland (DNR, 1999).	Yes	No	2, 3
Apocynaceae	*Alyxia magnifolia*	R (Qld)	Remnant or depauperate rainforest, mainly north of Brisbane (Stanley and Ross, 1986).	No	No	2, 3
Apocynaceae	*Parsonsia larcomensis*	V (Aust) V (Qld)	Restricted to central east and south east Qld, from three locations in the Rockhampton to Mt Perry area. Occurs in open heathland and shrubland at or near the summits of mountain peaks from 350 to 750 m elevation (DNR, 1999).	No	No	1, 2, 3
Apocynaceae	*Parsonsia lenticellata* (Narrow-leaved Parsonsia)	R (Qld)	Coastal districts in drier rainforests and transitional zone to open forest from Mackay to Port Douglas. Previous records of this species in SE Queensland are now considered *P. paulforsteri* (Forster, 1996; Stanley and Ross, 1986).	No	No	2
Aspleniaceae	*Asplenium pellucidum*	V (Aust) V (Qld)	Grows on mossy branches and rocks near waterfalls in rainforest.	No	No	2
Caesalpiniaceae	*Senna acclinis*	R (Qld)	Rainforest margins and adjacent open forest between 100 to 660m altitude and in association with *Pleiogynium timorense*, *Elattostachys* spp., *Eucalyptus grandis* and *Syncarpia glomulifera* (DNR, 1999).	No	No	3
Celastraceae	*Denhamia parvifolia*	V (Aust) V (Qld)	Restricted to South-east Queensland from the Eidsvold area south to Chinchilla and east to Kingaroy. Occurs in vine thickets	No	No	2

Family	Scientific Name (Common Name)	Conservation Status	Preferred Habitat	Preferred Habitat Present Along Alignment	Located During Field Survey	Source
			and softwood scrubs and occasionally in ironbark forests (DNR, 1999).			
Combretaceae	*Dansiea elliptica*	R (Qld)	Sandy, granitic soils on rainforest margins in north eastern Queensland, and in low elevation dry rainforest and semi evergreen vine thickets in south eastern Queensland (DNR, 1999).	No	No	2, 3
Combretaceae	*Macropteranthes fitzalanii*	R (Qld)	Restricted to coastal areas of central Qld from the Proserpine area to Rockhampton. Occurs in notophyll and microphyll vine forests and littoral rainforests (DRN, 1999).	No	No	2, 3
Combretaceae	*Macropteranthes leiocaulis*	R (Qld)	Deciduous vine thickets, semi-evergreen vine thickets and araucarian microphyll vine forests on red euchrozems or sandstone talus (DNR, 1999).	No	No	2, 3
Cycadaceae	*Cycas megacarpa*	E (Aust) E (Qld)	Stony clay loams on hill tops and steep slopes. Commonly in spotted gum and ironbark open forest and woodland with a grassy understorey (DNR, 1999).	No	No	2, 3
Epacridaceae	*Leucopogon cuspidatus*	V (Aust)	Mainly on rocky slopes, cliffs and rocky outcrops. Commonly in woodland or open woodland and sometimes in heath or shrubland communities (M. Edginton, pers. Comm.).	No	No	3
Euphorbiaceae	*Actephilia sessilifolia*	R (Qld)	Restricted range from Bowling Green Bay near Townsville, south to Mt Larcom near Gladstone. Occurs in notophyll / microphyll vine forests or vine thickets on red talus or granitic soils at 30 to 320 m altitude (DNR, 1999).	No	No	2, 3
Fabaceae	*Indigofera baileyi*	R (Qld)	On clay soil derived from sandstone.	No	No	2, 3

Family	Scientific Name (Common Name)	Conservation Status	Preferred Habitat	Preferred Habitat Present Along Alignment	Located During Field Survey	Source
			Associated with *Eucalyptus crebra* (Narrow Leaved Ironbark), *E. orgadophila* (Mountain Colibah) or *Corymbia erythrophloia* (Gum-topped Bloodwood) (DNR, 1999).			
Hernandiaceae	*Hernandia bivalvis* (Grease Nut, Cudgerie)	R (Qld)	Vine forests on rocks with shallow soils (DNR, 1999).	No	No	2, 3
Mimosaceae	*Acacia storyi*	R (Qld)	On the Blackdown Tableland and adjacent lower land on the west side. Grows on sandstone plateau in open forest (Maslin, 2001).	No	No	2
Orchidaceae	*Bulbophyllum globuliforme* (Miniature Moss-orchid)	V (Aust) V (Qld)	Dry notophyll and microphyll vine forests, between 500 and 800 m, on old hoop pines (DNR, 1999).	No	No	2, 3
Poaceae	*Dichanthium setosum*	V (Aust) R (Qld)	Grassy woodland and open forest, primarily on heavy black soils.	No	No	2, 3
Rutaceae	*Bosistoa transversa* (Three-leaved Bosistoa)	V (Aust)	Lowland rainforest (Stanley and Ross, 1983).	No	No	1, 2, 3
Rutaceae	*Zieria* sp. (Mt Larcom N.Gibson TOI8)	V (Qld)	Records of five specimens, all from various areas of Mt Larcom. Habitat details for a single specimen are as follows: "Mt Larcom, 5 km north-west of Yarwun. Summit. Clifflines and exposed outcrops with scattered vegetation in open woodland / shrubland." (EPA, 2005).	No	No	2, 3
Sapindaceae	*Atalaya calcicola* (Rock White-wood)	R (Qld)	In dry rainforest and deciduous vine thicket on boulder-strewn slopes, and on hills with granite, limestone, sandstone and basaltic rock outcrops (Queensland Herbarium, 2001).	No	No	1, 2, 3

Family	Scientific Name (Common Name)	Conservation Status	Preferred Habitat	Preferred Habitat Present Along Alignment	Located During Field Survey	Source
Sapindaceae	*Atalaya collina*	E (Aust) E (Qld)	Grows on hillsides, in remnant dry scrubs, together with A. salicifolia, but is not as common as that species (Reynolds, 1991).	No	No	1, 2, 3
Sapindaceae	*Atalaya rigida*	R (Qld)	Restricted to eastern Qld from Mt Aberdeen near Bowen, south to Mt Glastonbury south west of Gympie. Occurs in vine thicket and araucarian microphyll notophyll vineforest on red clay soil or black clay loam (DNR, 1999).	No	No	1
Sapindaceae	*Cupaniopsis shirleyana* (Wedge-leaf Tuckeroo)	V (Aust) V (Qld)	Depauperate rainforests from Brisbane to Bundaberg (Stanley and Ross, 1983).	No	No	1
Simaroubaceae	*Quassia bidwillii* (Quassia)	V (Aust) V (Qld)	Below 650 m in rainforests, open forest, woodland and mangroves (DNR, 1999).	Yes	No	1

Conservation status: E = Endangered; V = Vulnerable; R = Rare.

Aust = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Qld = Queensland *Nature Conservation (Wildlife) Regulation 1994.*

Source: 1 = EPBC Protected Matters Search; 2 = Queensland Herbarium Herbrecs database; 3 = Environmental Protection Agency Wildnet database.

Table T4: Fauna Species Recorded During Field Assessments (June and August 2007)

Common Name	*Scientific Name*	Status*	Time & Location of Surveys
AMPHIBIANS			
Large Brown Broodfrog	*Psedophryne major*	SEQ	(Jun) FA01
REPTILES			
Fence Skink	*Cryptoblepahrus virgatus*		(Aug) FA01
Bynoe's Gecko	*Heteronotia binose*		(Aug) FA01
Zig-zag Velvet Gecko	*Oedura rhombifer*		(Aug) FA01
BIRDS			
Australian Magpie	*Gymnorhina tibicen*		(Jun) Opportunistic
Australian White Ibis	*Threskiornis molucca*	Ma	(Jun) Opportunistic
Bar-shouldered Dove	*Geopelia humeralis*		(Aug) FA01 acid pipeline
Black Kite	*Milvus migrans*	Mi / Ma	(Jun) Opportunistic
Brown Quail	*Coturnix ypsilophora*		(Jun) FA04
Brown Honeyeater	*Lichmera indistincta*		(Aug) FA01, FA01 acid pipeline
Dusky Moorhen	*Gallinula tenebrosa*		(Jun) Opportunistic
Gull-billed Tern	*Sterna nilotica*	Ma	(Jun) FA01
Grey Fantail	*Rhipidura fuliginosa*		(Jun) FA02, FA03
Indian Peafowl^	*Pavo cristatus*		(Jun) Opportunistic
Laughing Kookaburra	*Dacelo novaeguineae*		(Jun) FA02
Little Friarbird	*Philemon citreogularis*		(Jun) FA01
Little Pied Cormorant	*Phalacrocorax sulcirostris*		(Jun) FA03
Noisy Friarbird	*Philemon corniculatus*		(Aug) ACID – FA01
Magpie-lark	*Grallina cyanoleuca*	Ma	(Jun) Opportunistic
Masked Lapwing	*Vanellus miles*	Mi	(Jun) Opportunistic

Common Name	*Scientific Name*	Status*	Time & Location of Surveys
Mangrove Gergone	*Gerygone levigaster*		(Jun) FA04
Nutmeg Manniken^	*Lonchura punctulata*		(Jun) FA03 (Aug) FA01 acid pipeline
Purple Swamphen	*Porphyrio porphyrio*		(Jun) FA01
Rainbow Bee-eater	*Merops ornatus*	Mi	(Jun) FA03, FA08, FA11
Rainbow Lorikeet	*Trichoglossus haematodus*		(Aug) FA01
Red-backed Fairy-wren	*Malurus melanocephalus*		(Jun) FA03
Scarlet Honeyeater	*Myzomela sanguinolenta*		(Jun) FA01
Striated Pardalote	*Pardalotus striatus*		(Jun) FA02, FA03 (Aug) FA01, FA01 acid pipeline
Torresian Crow	*Corvus orru*		(Jun) FA01
Welcome Swallow	*Hirundo neoxena*	Ma	(Jun) FA03
Whistling Kite	*Haliastur sphenurus*	Mi / Ma	(Jun) FA02, FA03, FA11
White-bellied Sea-eagle	*Haliaetus leucogaster*	Mi / Ma	(Aug) FA01
White-faced Heron	*Egretta novaehollandiae*		(Jun) Opportunistic
White-throated Gerygone	*Gerygone olivacea*		(Jun) FA01
Willie Wagtail	*Rhipidura leucophrys*		(Jun) FA01
MAMMALS			
Eastern Grey Kangaroo	*Macropus giganteus*		(Aug) Opportunistic
Rabbit (scat)^	*Oryctolagus cuniculus*		(Jun) Opportunistic
Dog (scat)^	*Canis familiaris*		(Jun) FA03

* STATUS: SEQ – Regionally Significant species in SEQ Bioregion; Mi – Listed Migratory species under the EPBC Act; Ma – Listed Marine species under the EPBC Act.

^ Introduced species

Table T5: EVR Fauna Species Potentially Occurring Within the Haul Road and Acid Pipeline Alignments and the Wider Study Area

Common Name	*Scientific Name*	Status**	Preferred habitats	Preferred habitats within Study Area	Source^
INVERTEBRATES					
Imperial Hairstreak (northern subspecies)	Jalmenus evagoras eubulus	V (Qld)	Only breeds in mature Acacia forest, generally Brigalow, which is the preferred food plant of the larvae. Has been observed feeding on other Acacia species.	**N**	2
REPTILES					
Short-necked Worm-skink	Anomalopus brevicollis	R (Qld)	Fine soil under large rocks and fallen wood in subtropical dry sclerophyll forest, vine thicket and moist rainforest. Often found along edges e.g. watercourses or clearings.	**N**	4
Loggerhead Turtle	Caretta caretta *	E (Aust) E (Qld)	Tropical and warm temperature marine waters. Nests on beaches.	**N**	1, 2
Green Turtle	Chelonia mydas *	V (Aust) V (Qld)	Tropical and warm subtropical seas of northern Australia. Nests on beaches, with breeding records south to South East Queensland.	**N**	1, 2
Salt-water Crocodile	Crocodylus porosus	V (Qld)	Tropical coastal rivers and swamps south to about Rockhampton, extending well inland via major rivers and billabongs.	**Y**	1
Leatherback Turtle	Dermochelys coriacea *	V (Aust) E (Qld)	Tropical and temperature marine waters, including estuaries and tidal river mouths. Limited nesting recorded on beaches between Fraser Is. And Mackay.	**N**	1

Common Name	*Scientific Name*	Status**	Preferred habitats	Preferred habitats within Study Area	Source^
Ornamental Snake	Denisonia maculata *	V (Aust) V (Qld)	Low-lying areas with cracking clay soils in open forests, woodlands and riparian habitats. Lives under fallen timber and bark and in soil cracks and forages for frogs at night.	**N**	1
Yakka Skink	Egernia rugosa *	V (Aust) V (Qld)	Dry open forests or woodland with dense ground vegetation, rocky areas, fallen timber and other debris.	**N**	1
Hawksbill Turtle	Eretmochelys imbricata *	V (Aust) V (Qld)	Coastal marine waters south to NSW, breeding predominantly on beaches in the Gulf of Carpentaria and Great Barrier Reef islands.	**N**	1
Dunmall's Snake	Furina dunmalli *	V (Aust) V (Qld)	Dry sclerophyll forest and woodland and Brigalow scrub on floodplains of cracking clay soils.	**N**	1
Olive Ridley Turtle	Lepidochelys olivacea *	E (Aust) E (Qld)	Marine waters, generally tropical. Scattered nesting records on beaches in Cape York and the Northern Territory.	**N**	1
Flatback Turtle	Natator depressus *	V (Aust) V (Qld)	Inshore coastal waters of northern Australia. Breeds exclusively on Australian beaches, south to Bundaberg region in Qld.	**N**	1, 2
Cooloola Snake-skink	Ophioscincus cooloolensis	R (Qld)	Coastal heaths, woodlands, SEVT and rainforests on white sands in Cooloola and Fraser Is areas of SE Qld. Also recorded from GSDA and Kroombit Tops.	**N**	2
Brigalow Scaly-foot	Paradelma orientalis	V (Aust) V (Qld)	Eucalypt woodland, usually found under logs and debris. Also found climbing in rough Acacia trees.	**Y**	1, 2, 4
Fitzroy River turtle	Rheodytes leukops	V (Aust) V (Qld)	Riverine species dependent upon shallow fast-flowing water (riffle zones).	**N**	1, 4
Rusty Monitor	Varanus semiremex	R (Qld)	Poorly known. Hollow trees in mangrove forests fringing tidal estuaries, and melaleucas along freshwater streams and swamps, from Cape York to Gladstone.	**Y**	2

Common Name	*Scientific Name*	Status**	Preferred habitats	Preferred habitats within Study Area	Source^
BIRDS					
Grey Goshawk	Accipiter novaehollandiae	R (Qld)	Heavy, humid forests and rainforests – utilises eucalypt and paperbark woodlands only where they are dense or form tall galleries along streams.	**N**	2, 3
Glossy Black Cockatoo	Calyptorhynchus lathami	V (Qld)	Coastal forest and open inland woodland. Feeds primarily on Allocasuarina littoralis or Allocasuarina torulosa.	**N**	2, 3
White-rumped Swiftlet	Collocalia spodiopygius	R (Qld)	Aerial forager; coastal ranges / cliffs, grassland and islands.	**Y**	2
Black-necked Stork	Ephippiorhynchus asiaticus	R (Qld)	Lakes, swamps, freshwater pools and mangroves. Nests in trees or large bushes, often over swamps.	**Y**	2, 3
Carpentaria Yellow Chat	Epthianura crocea macgregori	CE (Aust) E (Qld)	Freshwater or saline drainage channels on coastal marine plains, connected to tidally influenced wetlands. Breeding habitat is rank vegetation (rushes, sedges, grasses) flanking wetlands, adjacent to muddy substrates used for foraging.	**Y**	1
Beach Stone-curlew	Esacus neglectus	V (Qld)	Reefs, beaches and coastal mudflats.	**Y**	2, 3
Red Goshawk	Erythrotriorchis radiatus	V (Aust) E (Qld)	Tropical open woodland, edges of rainforest and dense riverine vegetation. Nests in trees taller than 20 m and within 1 km of a permanent watercourse or wetland. Foraging usually occurs in open forests and gallery forests.	**N**	1
Squatter Pigeon (southern subspecies)	Geophaps scripta scripta	V (Aust) V (Qld)	Open grasslands often in eucalypt woodland. Preference for areas on sandy soil with low gravel ridges and nearby water.	**Y**	1, 2, 3
Sooty Oystercatcher	Haematopus fulignosus	R (Qld)	Coastal; prefers rocky coastlines, exposed reefs, occasionally muddy esturaries.	**N**	2, 3
Square-tailed Kite	Lophoictinia isura	R (Qld)	Sparsely distributed in open eucalypt forests, woodlands and sand plains.	**Y**	2, 3

Common Name	*Scientific Name*	Status**	Preferred habitats	Preferred habitats within Study Area	Source^
Southern Giant-Petrel	Macronectes giganteus	E (Aust) E (Qld)	Coastal and offshore waters, shorelines south of Rockhampton.	**N**	1
Black-chinned Honeyeater	Melithreptus gularis	R (Qld)	Open eucalypt woodland in eastern and northern Australia, especially ironbarks and box, paperbarks, and tree-lined watercourses of arid areas.	**N**	2
Cotton Pygmy-goose	Nettapus coromandelianus	R (Qld)	Freshwater lakes, swamps and impoundments.	**Y**	1, 2, 3
Powerful Owl	Ninox strenua	V (Qld)	Eucalypt forests along the Great Dividing Range, preferring tall wet sclerophyll forests, where 800-1000 ha territories centre on densely vegetated gullies.	**N**	2
Eastern Curlew	Numenius madagascariensis	R (Qld)	Summer non-breeding migrant to eastern and northern Australian coasts. Estuaries, mud flats and soft, sandy beaches.	**Y**	2, 3
Kermadec Petrel (western)	Pterodroma neglecta neglecta	V (Aust)	Pelagic: forages at sea in tropical and subtropical waters of the South Pacific; nests on high islands among rocks and vegetation.	**N**	1
Lewin's Rail	Rallus pectoralis	R (Qld)	Brackish and freshwater marshes, wet heaths and swampy grasslands in coastal southern and eastern Australia.	**Y**	2, 3
Australian Painted Snipe	Rostratula australis	V (Aust) V (Qld)	Shallow muddy freshwater swamps and marshes.	**Y**	1
Little Tern	Sterna albifrons	E (Qld)	Ocean beaches and coral reefs from Port Headland on WA coast along northern and eastern coasts to Bass Strait. It spreads along the coast to breed in spring and summer but returns north to breed in winter.	**N**	1, 2

Common Name	*Scientific Name*	Status**	Preferred habitats	Preferred habitats within Study Area	Source^
Black-breasted Button-quail	Turnix melanogaster	V (Aust) V (Qld)	Semi-evergreen vine-thickets with a closed canopy and deep litter layer, or lantana thickets adjacent to semi-evergreen vine thickets.	**N**	1, 2, 3
Radjah Shelduck	Tadorna radjah	R (Qld)	Mainly brackish waters, mud banks and the mangrove fringed mouths and lower reaches of tropical rivers. Also lagoons and pools along rivers and swamps.	**Y**	2, 3
MAMMALS					
Large-eared Pied Bat	Chalinolobus dwyeri	V (Aust) R (Qld)	Dry forests and woodlands, moist eucalypt forests, caves and mine.	**Y**	1
Little Pied Bat	Chalinolobus pictatus	R (Qld)	Dry sclerophyll forest, woodland and scrub. Roosts in caves, mineshafts, tree hollows	**Y**	2
Northern Quoll	Dasyurus hallucatus	E (Aust)	Most abundant in rocky eucalypt woodlands but occurs in a variety of habitats, often near creeklines. Dens in tree hollows and rock crevices.	**N**	1
Humpback Whale	Megaptera novaeangliae	V (Aust) V (Qld)	Travels from Antarctic feeding grounds to Australian waters during spring to breed. Australian breeding ground lies on the Barrier Reef, so occurs along the eastern coast throughout spring.	**N**	1
Eastern Long-eared Bat	Nyctophilus timoriensis (South-eastern form)	V (Aust) V (Qld)	River Red Gum forest, semi-arid woodlands and savannas. Appears to prefer semi-arid areas but can be found in high rainfall areas. Roosts in tree hollows, fissures in branches and under sheets of bark.	**N**	1, 2
Irrawaddy Dolphin	Orcaella brevirostris	R (Qld)	Coastal and estuarine northern waters from Onslow, WA to Brisbane. Prefers muddy and brackish waters and will travel long distances up tropical rivers.	**N**	1

Common Name	*Scientific Name*	Status**	Preferred habitats	Preferred habitats within Study Area	Source^
Indo-Pacific Humpback Dolphin	Sousa chinensis	R (Qld)	Coastal tropical and warm temperate waters, including estuaries, tidal rivers and mangrove channels, from Exmouth in WA to Coffs Harbour in NSW.	**N**	1
False Water Rat	Xeromys myoides	V (Aust) V (Qld)	Saline grassland, saltmarsh, mangroves, margins of freshwater swamps close to fore-dunes. Forages in the mangrove on low tides at night.	**Y**	1
Koala	Phascolarctos cinereus	V in SEQ Bioregion only (Qld)	Sclerophyll woodland and forests in eastern Australia. The Blue Gum woodland contains a high density of Queensland Blue Gums, which is recognised as an important food tree for the Koalas in coastal SEQ habitats (EPA 2001)	**Y**	2

**Status: CE = Critically Endangered; EN = Endangered; VU = Vulnerable. (Aust) – listed under the *Environment Protection and Biodiversity Conservation Act 1999*; (Qld) – listed under the Queensland *Nature Conservation Act 1992.*

^Source: 1 = EPBC Protected Matters Report; 2 = WildNET; 3 = Ozbirds; 4 = Queensland Museum.

Table T6: Regionally Significant Vertebrate Fauna Species Potentially Occurring Within the Haul Road and Acid Pipeline Corridors and the Wider Study Area

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
FISH						
Agassiz's Glassfish	Ambassis agassizii	R		Billabongs and larger tropical rivers to desert waterholes and creeks.	**N**	2
Jungle Perch	Kuhlia rupestris		SEQ	Fast flowing streams with overhanging vegetation providing shade.	**N**	2
AMPHIBIANS						
Salmon-striped Frog	Limnodynastes salmini		SEQ, BBS	Spends much of it's time underground, only emerging after rain. Uses temporary marshes and ditches for breeding.	**Y**	4
Chirping Froglet	Crinia deserticola		SEQ	Creek beds and clay pans associated with broad river channels in semi-arid areas.	**N**	2
Superb Collared Frog	Cyclorana brevipes		SEQ	Dry savannah woodland and clay pans.	**N**	2
Eastern Snapping Frog	Cyclorana novaehollandiae		SEQ	Woodland and associated grassland and clay pans.	**Y**	2
Bumpy Rocketfrog	Litoria inermis		SEQ	Flood plains, woodlands and monsoonal forests.	**N**	2, 4
Emerald Spotted Treefrog	Litoria peronii		SEQ	Forested habitats including adjacent grassland and other open areas.	**Y**	2
Northern Laughing Treefrog	Litoria rothii		SEQ	Varied tropical and sub-tropical habitats around trees close to water.	**Y**	2, 4
Great Brown Broodfrog	Pseudophryne major		SEQ	Damp or boggy areas in forest or heathland.	**Y**	2

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
Copper Backed Broodfrog	Pseudophryne raveni		SEQ	Varied habitats including open forest and swamps.	**Y**	2
Dusky Gungan	Uperoleia fusca		BBS	Open eucalypt forest, shrubland, grassland.	**Y**	2
REPTILES						
Cone-eared Calyptotis	Calyptotis lepidorostrum		SEQ	Rainforest, wet and dry sclerophyll forests and heaths of SEQ and coastal Central Qld.	**Y**	2
Open-litter Rainbow-skink	Carlia pectoralis		SEQ	Dry sclerophyll forests, woodlands and heaths in coastal and adjacent inland regions.	**Y**	2, 4
Tommy Roundhead	Diporiphora australis		SEQ	Heaths, dry forests and woodlands of coastal and adjacent inland environs.	**Y**	2, 4
Fine-spotted Mulch-skink	Glaphyromorphus punctulatus		SEQ	Woodlands, vine thickets, rock outcrops in coastal areas south of the Wet Tropics to northern SEQ.	**N**	2, 4
Common Dwarf Skink	Menetia greyii		SEQ	Varied habitats tending towards drier sites.	**Y**	2
Dwarf Litter-skink	Menetia timlowi		SEQ	Varied habitats from closed semi-evergreen vine thickets to open woodlands and heath / Spinifex.	**Y**	2, 4
South-eastern Morethia Skink	Morethia boulengeri		SEQ	Lightly timbered areas usually in association with heavy soils.	**N**	2, 4
Fire-tailed Skink	Morethia taeniopleura		SEQ	Ranges and well-drained coastal areas, often associated with rock outcrops.	**N**	2, 4
Eastern Small-eyed Snake	Cryptophis nigrescens		SEQ	Varied forested habitats including rainforests to moist sites within dry forests.	**Y**	2

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
Black-striped Snake	Cryptophis nigrostriatus		SEQ	Dry forest, woodlands and rock outcrops of coastal environs.	**N**	2
Pink-tongued Lizard	Cyclodomorphus gerrardii		BBS	Rainforests, wet forests and gullies in eastern Australia from Sydney to Cairns	**N**	2
Carpentaria Whip Snake	Cryptophis boschmai		BBS	Dry forests and woodlands in eastern Qld, often on deep cracking soils	**Y**	2
Bandy-bandy	Vermicella annulata	R / IK		Varied habitats from cool upland rainforest to sandy deserts, tropical woodland.	**Y**	2
BIRDS						
Australian Bustard	Ardeotis australis	NT		Grasslands, open dry woodlands, mulga, mallee, heath.	**Y**	2, 3
Black-faced Woodswallow	Artamus cinereus		SEQ	Aerial species, drier woodlands, mulga, Spinifex, gibber plains, samphire; avoids denser forests.	**Y**	2, 3
Little Wattlebird	Anthochaera chrysoptera		SEQ	Forest, woodlands, banksia heath, gardens.	**Y**	3
Bush Stone-curlew	Burhinus grallarius	NT	SEQ, BBS	Open forest, woodland, mallee, mulga. Avoids dense forests.	**Y**	2, 3
Large-tailed Nightjar	Caprimulgus macrurus		SEQ	Margins of rainforest, monsoon and vine forest, mangroves and adjoining tropical woodland.	**N**	2, 3
Blue-winged Kookaburra	Dacelo leachii		SEQ	Open forest, semi-arid woodland, tropical woodlands, tree-line rivers.	**Y**	2, 3
Fairy Gerygone	Gerygone palpebrosa		SEQ	Lowland rainforest, monsoon, riparian forests, mangroves and adjacent eucalypt woodland.	**Y**	2, 3

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
Musk Lorikeet	Glossopsitta concinna		SEQ	Woodland, open forest, mallee, cleared country with trees along watercourses.	**Y**	2
Yellow-tufted Honeyeater	Lichenostomus melanops		SEQ	Eucalypt forest and woodland with shrub undergrowth, also mallee, brigalow and cypress.	**Y**	2
Shining Flycatcher	Myiagra alecto		SEQ	Forest and woodland, mangroves, coastal heath; avoids rainforest.	**Y**	2
Dusky Honeyeater	Myzomela obscura		SEQ	Rainforest, paperbarks, mangroves, watercourse thickets, nearby woodland.	**Y**	2, 3
Yellow-bellied Sunbird	Nectarinia jugularis		SEQ	Rainforest, plantations, gardens and watercourse vegetation, mangroves and coastal scrub.	**Y**	2, 3
Rose-crowned Fruit-dove	Ptilinopus regina		SEQ	Rainforest, monsoon forest, vine scrub, mangroves, swampy woodlands.	**Y**	2, 3
Paradise Riflebird	Ptiloris paradiseus		SEQ	Subtropical, temperate rainforest, nearby paperbark swamps, wet eucalypt forest.	**N**	2
Brown Treecreeper	Climacteris picumnus		BBS	Eucalypt forests and woodlands, scrubs of drier regions, river-edges, timbered paddocks.	**Y**	2, 3
Grey-crowned Babbler	Pomatostomus temporalis		BBS	Open forests and woodlands.	**Y**	2, 3
Green Pygmy-goose	Nettapus pulchellus		SEQ	Deep permanent freshwater lakes, dams and lagoons with abundant aquatic vegetation.	**N**	3
Barking Owl	Ninox connivens		SEQ, BBS	Open country with stands of trees, tree-lined watercourses and paperbark swamps.	**Y**	2, 3

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
Little Curlew	Numenius minutus		SEQ	Dry grassland of clay and black soil plains, river floodplains, woodland with grassy understorey.	**N**	1
MAMMALS						
Rufous Bettong	Aepyprymnus rufescens		BBS	Eucalypt forests and woodlands with sparse or grassy understoreys between Cooktown to coastal mid-NSW.	**Y**	2
Hoary Wattled Bat	Chalinolobus nigrogriseus		BBS	Varied habitats including vine forest, tropical savannah, dry sclerophyll forest and coastal scrub.	**Y**	2
Northern Quoll	Dasyurus hallucatus		BBS	Most abundant in rocky eucalypt woodlands but occurs in a variety of habitats, often near creeklines. Dens in tree hollows and rock crevices.	**N**	1
Northern Brown Bandicoot	Isoodon macrourus		BBS	Wet tropical and subtropical forest, woodland, grassland, gardens in northern Australia.	**Y**	2
Agile Wallaby	Macropus agilis		SEQ	Varied habitats including grassy forests and woodlands predominantly in flatter areas.	**Y**	2
Black-striped Wallaby	Macropus dorsalis		BBS	Rainforests, brigalow, vine thicket, eucalypt forest and woodland with a dense shrub layer.	**Y**	2, 4
Little Bent-wing Bat	Miniopterus australis		BBS	Lowland rainforest, wet and dry sclerophyll forest, paperbark swamps. Roosts in caves and tunnels.	**Y**	2
Eastern Bent-wing Bat	Miniopterus schreibersii oceanensis		BBS	Roosts in colonies in caves, old mines. Populations centred on areas with suitable cave roosts in N and E Australia.	**N**	2

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
East Coast Freetail Bat	Mormopterus norfolkensis	DD	SEQ	Dry and wet sclerophyll forests, coastal woodlands from Brisbane to the Illawarra in NSW.	**Y**	2
Large-footed Myotis	Myotis macropus		SEQ	Coastal and sub-coastal regions in northern and eastern Australia.	**Y**	2
Long-nosed Bandicoot	Perameles nasuta		BBS	Rainforest, wet and dry sclerophyll forest, woodlands, scrub.	**Y**	2
Common Ringtail Possum	Pseudocheirus peregrinus		BBS	Open and closed forests, coastal scrub, gardens.	**Y**	2
Greater Glider	Petauroides volans		SEQ, BBS	Wet and damp sclerophyll forest on ranges and coastal plains of eastern Australia.	**Y**	2
Squirrel Glider	Petaurus norfolcensis		SEQ, BBS	Dry sclerophyll forest, riparian forest, damp coastal eucalypt and banksia forest in eastern Australia	**Y**	2
Herbert's Rock-wallaby	Petrogale herberti		SEQ	Rock piles and cliffs with numerous crevices and ledges.	**N**	2
Koala (outside SEQ)	Phascolarctos cinereus		BBS	Sclerophyll forest and woodland in eastern Australia.	**Y**	2
Little Red Flying-fox	Pteropus scapulatus		SEQ	Varied habitats in coastal and sub-coastal environs.	**Y**	2
Delicate Mouse	Pseudomys delicatulus		SEQ	Open country in tropical coastal and sub-coastal environs.	**N**	4
Greater Broad-nosed Bat	Scoteanax rueppellii		SEQ	Coastal eastern Australia in tall wet forests and into drier forests along gullies.	**N**	2
South-eastern Broad-nosed Bat	Scotorepens orion		SEQ	Confined to Great Dividing Range and adjacent coastal plains from SEQ to Melbourne, Vic.	**N**	2

Common Name	Scientific Name	AP Status*	Non-EVR Priority Taxon*	Preferred habitats	Preferred habitats within Study Area	Source
Broad-nose Bat (undescribed)	Scotorepens sp.	DD		Known from coastal NE NSW and SEQ in dry sclerophyll forest and coastal woodland.	**Y**	2
Common Dunnart	Sminthopsis murina		SEQ	Variety of heathy dry forests and mallee heath.	**N**	2, 4
Common Sheathtail Bat	Taphozous georgianus		SEQ	Varied habitats in northern Australia.	**Y**	2
Common Brushtail Possum	Trichosurus vulpecula		BBS	Forests, woodlands, farmland, gardens, towns and cities.	**Y**	2
Red-legged Pademelon	Thylogale stigmatica		SEQ	Rainforest in coastal environs from Cape York to Tamworth, NSW.	**N**	2
Common Rock Rat	Zyzomys argurus		BBS	Rocky outcrops and scree slopes in northern Australia, usually within vine thicket, monsoon and riparian forest, woodland.	**N**	4

**Status: Action Plan: VU = Vulnerable, R = Rare, NT = Near Threatened, IK = Insufficiently Known, R / IK = Rare or Insufficiently Known, CD = Conservation Dependent, DD = Data Deficient.

Non-EVR Priority Taxon: BBS = Listed as a Non-EVR Priority Taxa for the Brigalow Belt South Bioregion by EPA (2003b), SEQ = Listed as a Non-EVR Priority Taxa for the South East Queensland Bioregion by EPA (2005). ^Source: 1 = EPBC Protected Matters Report; 2 = WildNET; 3 = Ozbirds; 4 = Qld Museum

Table T7: Fauna Species Listed as Migratory Protected Species and / or Marine Protected Species Potentially Occurring Within the Haul Road and Acid Pipeline Corridors and the Wider Study Area

(Note: Marine-restricted species (sea snakes and whales) have been omitted from this table).

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
REPTILES					
Estuarine Crocodile	Crocodylus porosus	Mi / Ma	Tropical coastal rivers and swamps south to about Gladstone, extending well inland via major rivers and billabongs.	**Y**	1
BIRDS					
Collared Sparrowhawk	Accipiter cirrhocephalus	Mi	Forests and woodlands throughout Australia; tree lines along watercourses of arid interior; coastal forests.	**Y**	2, 3
Brown Goshawk	Accipiter fasciatus	Mi / Ma	Temperate and tropical forest, woodlands, dry scrub and farms.	**Y**	2, 3
Grey Goshawk	Accipiter novaehollandiae	Mi	Rainforest, gallery forest, mangroves, eucalypt forest, woodland and riparian forest.	**N**	2, 3
Clamorous Reed-warbler	Acrocephalus stentoreus	Mi / Ma	Wetlands, lakes and rivers with stands of reeds; lantana, bamboo and tall crops beside water.	**Y**	2, 3
Common Sandpiper	Actitis hypoleucos	Mi / Ma	Muddy edges of billabongs, waterholes, mangroves, rocky beaches.	**Y**	2, 3
Chestnut Teal	Anas castanea	Mi	Salt and brackish coastal estuaries, lakes, salt marshes, tidal mudflats and coastal islands.	**Y**	2, 3
Grey Teal	Anas gracilis	Mi	Diverse habitats including most wetlands.	**Y**	2, 3
Australasian Shoveler	Anas rhynchotis	Mi	Prefers permanent lakes or swamps with abundant cover.	**Y**	2, 3
Pacific Black Duck	Anas superciliosa	Mi	Almost any wetland habitat including fresh and marine environs.	**Y**	2, 3
Magpie Goose	Anseranas semipalmata	Ma	Open wetlands, swamps, farmlands and major watercourses.	**Y**	1, 2, 3
Richard's Pipit	Anthus novaeseelandiae	Ma	Grasslands, grassy woodlands, forest clearings, grassy roadsides.	**Y**	2, 3

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Fork-tailed Swift	Apus pacificus	Mi / Ma	Varied; airspace over habitat ranging from rainforest to semi-desert.	**Y**	1, 2, 3
Wedge-tailed Eagle	Aquila audax	Mi	Diverse habitats including, forest, woodland, scrub, alpine, mallee, coastline, wetlands and farmland.	**Y**	2, 3
Great Egret	Ardea alba	Mi / Ma	Floodwater, rivers, shallows of wetlands, intertidal mudflats.	**Y**	1, 2, 3
Cattle Egret	Ardea ibis	Mi / Ma	Pasture, shallows of freshwater wetlands.	**Y**	1, 2, 3
Intermediate Egret	Ardea intermedia	Ma	Floodwater, rivers, shallows of wetlands, intertidal mudflats.	**Y**	2, 3
Ruddy Turnstone	Arenaria interpres	Mi / Ma	Rocky shores, exposed rocky reefs and platforms, mudflats.	**Y**	2, 3
Pacific Baza	Aviceda subcristata	Mi	Margins of gallery forest, monsoon forest, swamp forest, rainforest and tropical and subtropical open forests often near water.	**Y**	2, 3
Hardhead	Aythya australis	Mi	Lakes and swamps with abundant aquatic vegetation; also on creeks, floodplain pools.	**Y**	2, 3
Fan-tailed Cuckoo	Cacomantis flabelliformis	Ma	Wet eucalypt forests, rainforest edges and open forests including river gum forests, in S and E Australia.	**N**	2, 3
Sharp-tailed Sandpiper	Calidris acuminata	Mi / Ma	Fresh or salt wetlands, muddy edges of swamps, lagoons, lakes, dams.	**Y**	2, 3
Sanderling	Calidris alba	Mi / Ma	Open sandy beaches exposed to oceanic swells.	**N**	3
Red Knot	Calidris canutus	Mi / Ma	Sheltered coastal mudflats and sandbars of estuaries, inlets, lagoons, mangroves and swamps.	**Y**	2, 3
Curlew Sandpiper	Calidris ferruginea	Mi / Ma	Coastal mudflats, estuaries, lagoons, mangrove channels, lakes, dams, floodwaters.	**Y**	2, 3
Red-necked Stint	Calidris ruficollis	Mi / Ma	Diverse wetlands including mudflats, saltmarshes, beaches, floodwaters, inland waters.	**Y**	2, 3

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Great Knot	Calidris tenuirostris	Mi / Ma	Sheltered coastal mudflats of estuaries, inlets, lagoons and mangroves.	**Y**	2, 3
Greater Sand Plover	Charadrius leschenaultii	Mi / Ma	Coastal: intertidal mudflats and sandbanks, rarely saltmarsh.	**Y**	2
Lesser Sand Plover	Charadrius mongolus	Mi / Ma	Non-breeding summer migrant found along coastal areas, beaches and estuaries.	**Y**	2, 3
Red-capped Plover	Charadrius ruficapillus	Mi / Ma	Estuaries, saltmarsh, lagoons, inland waterways, salt lakes, brackish lagoons. Sedentary or nomadic.	**Y**	2, 3
Whiskered Tern	Chlidonias hybridus	Ma	Shallow inland wetlands, swamps, lakes, claypans, floodwaters, irrigated pastures.	**Y**	3
Horsfiled's Bronze Cuckoo	Chrysococcyx basalis	Ma	Rainforest, open forests, woodlands, roadside trees, mallee, mulga, farmland, mangroves, gardens	**Y**	2, 3
Shining Bronze-cuckoo	Chrysococcyx lucidus	Ma	Dense wet rainforests, eucalypt forests and woodlands, gardens.	**Y**	2, 3
Little Bronze-cuckoo	Chrysococcyx minutillus	Ma	Dense wet vegetation, rainforest, monsoon forest, mangroves, paperbark swamps, lush gardens in N and NE Australia.	**Y**	2, 3
Rufous Songlark	Cincloramphus mathewsi	Mi	Open grassland and grassy open woodland	**Y**	2
Spotted Harrier	Circus assimilis	Mi	Grassland, Spinifex, open shrubland, saltbush, very open woodland, crops; mostly inland vegetation.	**N**	2, 3
Golden-headed Cisticola	Cisticola exilis	Mi	Edges of wetlands, swamps, irrigated pastures, wet grass, samphire, roadsides	**Y**	2, 3
Black-faced Cuckoo-shrike	Coracina novaehollandiae	Ma	Rainforests, eucalypt forests and woodlands, tree-lined watercourses of the interior, farmland, gardens.	**Y**	2, 3
White-bellied Cuckoo-shrike	Coracina papuensis	Ma	Eucalypt forests and woodlands, mangroves, riparian forests, gallery forests.	**Y**	2, 3

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Cicadabird	Coracina tenuirostris	Ma	Rainforests, eucalypt forests, woodlands, paperbark swamps and mangroves	**Y**	2, 3
Stubble Quail	Coturnix pectoralis	Ma	Grassland, spinifex, saltbush, stubble, pasture, crops	**N**	2, 3
Pallid Cuckoo	Cuculus pallidus	Ma	Open forests, woodlands, scrublands, roadsides, farmlands	**Y**	2, 3
Oriental Cuckoo	Cuculus saturatus	Mi / Ma	Rainforest margins, vine thicket, wet sclerophyll forest, paperbark swamp, mangroves.	**Y**	2
Black Swan	Cygnus atratus	Mi	Diverse habitats including lakes, estuaries, rivers, temporary wetlands of arid interior.	**N**	2, 3
Wandering Whistling-duck	Dendrocygna arcuata	Mi / Ma	Wetlands with permanent water and aquatic vegetation in N & NE Australia, such as billabongs, dams, lagoons, swamps, tidal creeks.	**Y**	2, 3
Plumed Whistling-duck	Dendrocygna eytoni	Mi	Grasslands and margins of wetlands.	**Y**	2, 3
Spangled Drongo	Dicrurus bracteatus	Ma	Woodlands, rainforest margins, mangroves and paperbark swamps, riverside thickets, gardens.	**Y**	2, 3
Little Egret	Egretta garzetta	Ma	Fresh and saltwater wetlands – swamps, billabongs, floodplains, mangroves, mudflats.	**Y**	2, 3
Eastern Reef Egret	Egretta sacra	Mi / Ma	Coasts, islands, estuarine mudflats, roosts in trees and shrubs.	**Y**	2, 3
Black-shouldered Kite	Elanus axillaris	Mi	Coastal regions; rare in semi-arid, arid regions.	**Y**	2
Black-fronted Dotterel	Elseyornis melanops	Mi	Usually shallow muddy-bottomed freshwater swamps and wetlands, billabongs, edges of lakes and dams. Rarely on tidal mudflats or other shore habitats	**Y**	2, 3
Red Goshawk	Erythrotriorchis radiatus *	Mi	Tropical open woodland, edges of rainforest and dense riverine vegetation. Nests in trees taller than 20 m and within 1 km of a permanent watercourse or wetland. Foraging usually occurs in open forests and gallery forests.	**N**	1

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Common Koel	Eudynamis scolopacea	Ma	Rainforests, wet sclerophyll forests, woodlands, farmlands and gardens	**Y**	2, 3
White-throated Nightjar	Eurostopodus mystacalis	Ma	Forests, woodlands and heathlands, often among rocks, leaves and fallen timber	**Y**	2
Dollarbird	Eurystomus orientalis	Ma	Woodlands, forest edges, inland watercourse trees, farmlands	**Y**	2, 3
Brown Falcon	Falco berigora	Mi	Widespread throughout woodlands, farmland, mulga scrub, watercourses, heath and coastal dunes.	**Y**	2, 3
Nankeen Kestrel	Falco cenchroides	Mi / Ma	Open woodlands, grasslands, farmland, heathlands.	**Y**	2, 3
Australian Hobby	Falco longipennis	Mi	Woodland, open forest, surrounds of swamps and lakes, tree-lined watercourses in interior, scrub, heath, farmland.	**Y**	2, 3
Latham's Snipe	Gallinago hardwickii *	Mi / Ma	Breeds in Japan. Low rank vegetation around shallows of wetlands, reeds, sedges, saltmarsh. Summer migrant.	**Y**	1
Australian Magpie-lark	Grallina cyanoleuca	Ma	Varies, almost anywhere with trees and water, coastal to semi-arid.	**Y**	2, 3
White-bellied Sea Eagle	Haliaeetus leucogaster	Mi / Ma	Coastal seas, islands, estuaries and inlets. Follows major rivers and wetlands far inland. Huge nests of sticks, usually in tall trees.	**Y**	1, 2, 3
Brahiminy Kite	Haliastur indus	Mi / Ma	Tropical and subtropical Australian coasts, estuaries, mudflats, travels inland along rivers.	**Y**	2, 3
Whistling Kite	Haliastur sphenurus	Mi / Ma	Open woodlands, scrublands, farmlands, wetlands.	**Y**	2, 3
Grey-tailed Tattler	Heteroscelus brevipes	Mi / Ma	Estuarine mudflats, beaches, shallows, intertidal pools, rocky coasts and reefs.	**Y**	2, 3
Little Eagle	Hieraaetus morphnoides	Mi	Diverse habitats including coastal forest, woodland, open scrub, tree-lined watercourses of interior, lower slopes of hills.	**Y**	2

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Black-winged Stilt	Himantopus himantopus	Mi / Ma	Shallow freshwater wetlands, swamps, dams, lakes, estuaries, mudflats	**Y**	2, 3
White-throated Needletail	Hirundapus caudacutus	Mi / Ma	Variety of habitats. Aerial forager. Breeds in northern hemisphere, nests in tree hollows.	**Y**	2, 3, 1
Welcome Swallow	Hirundo neoxena	Ma	Diverse, most habitats except densest forests and most arid deserts.	**Y**	2, 3
Tree Martin	Hirundo nigricans	Ma	Open woodlands and farmlands near lakes and rivers.	**Y**	2, 3
Barn Swallow	Hirundo rustica	Mi / Ma	Forages in open country and cultivated lands. Most populations breed in Asia but some southern populations appear sedentary.	**Y**	1
Silver Gull	Larus novaehollandiae	Ma	Diverse: ocean coasts, inland rivers, lakes, floodwaters, farmlands, coastal towns, rubbish dumps.	**Y**	2, 3
Broad-billed Sandpiper	Limicola falcinellus	Mi / Ma	Sheltered coastal estuaries and lagoon with mudflats, muddy coastal creeks and swamps.	**Y**	2, 3
Bar-tailed Godwit	Limosa lapponica	Mi / Ma	Coastal tidal mudflats, estuaries, saltmarsh.	**Y**	2, 3
Square-tailed Kite	Lophoictinia isura	Mi	Sparsely distributed in open eucalypt forests, woodlands and sand plains.	**Y**	2, 3
Southern Giant-Petrel	Macronectes giganteus	Mi / Ma	Marine environs including open seas and inshore waters.	**N**	1
Tawny Grassbird	Megalurus timoriensis	Mi	Inhabits bulrushes, adjoining lush, wet grass, cumbungi swamps.	**N**	2, 3
Rainbow Bee-eater	Merops ornatus	Mi / Ma	Open country, most vegetation types, sand dunes, banks.	**Y**	1, 2, 3
Black Kite	Milvus migrans	Mi	Woodland, scrub, tree-lined watercourses, mangroves, mudflats, swamps.	**Y**	2, 3
Black-faced Monarch	Monarcha melanopsis	Mi / Ma	Rainforests, mangroves and their fringes, eucalypt forests.	**Y**	1, 2, 3
Spectacled Monarch	Monarcha trivirgatus	Mi / Ma	Rainforests, mangroves, dense gullies in wet forests.	**Y**	1, 2, 3

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Satin Flycatcher	Myiagra cyanoleuca	Mi / Ma	All wet eucalypt forests in gullies, plains and tablelands of coastal eastern Australia and nearby ranges.	**N**	1, 2, 3
Cotton Pygmy-goose	Nettapus coromandelianus	Mi	Freshwater lakes, swamps and impoundments.	**Y**	1, 2, 3
Green Pygmy-goose	Nettapus pulchellus	Mi / Ma	Deep freshwater lakes, lagoons, and dams, with abundant vegetation.	**Y**	3
Southern Boobook	Ninox novaeseelandiae	Ma	Almost anywhere with trees – forests, open forests and woodlands, farmland with scattered trees, parks and gardens.	**Y**	2, 3
Eastern Curlew	Numenius madagascariensis	Mi / Ma	Bare dry subcoastal plains, floodplains, billabongs, freshwater swamps, sports fields and lawns.	**Y**	2, 3
Little Curlew	Numenius minutus	Mi / Ma	Bare dry subcoastal plains, floodplains, billabongs, freshwater swamps, sports fields and lawns.	**Y**	1
Whimbrel	Numenius phaeopus	Mi / Ma	Mudflats, estuaries, lagoons, mangroves.	**Y**	2, 3
Nankeen Night Heron	Nycticorax caledonicus	Ma	Shallow margins of swamps, lakes, mangroves and rivers. Roosts in dense vegetation	**Y**	2, 3
Osprey	Pandion haliaetus	Mi / Ma	Coastal waters and estuaries, follows major rivers far inland	**Y**	2, 3
Australian Pelican	Pelecanus conspicillatus	Ma	Large shallow waters both coastal and inland, islands, mudflats, arid temporary lakes	**Y**	2, 3
Glossy Ibis	Plegadis falcinellus	Mi / Ma	Shallows of swamps, floodwaters, irrigated pastures	**Y**	2, 3
Pacific Golden Plover	Pluvialis fulva	Mi / Ma	Beaches, estuaries, mudflats, saltmarshes, shallow inland swamps.	**Y**	2, 3
Grey Plover	Pluvialis squatarola	Mi / Ma	Coastal: mudflats, beaches, rocky coasts, coastal lakes and swamps.	**Y**	2, 3
Purple Swamphen	Porphyrio porphyrio	Ma	Margins of swamps, lakes and shallow rivers will cover of rushes or reeds	**Y**	2, 3

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Red-necked Avocet	Recurvirostra novaehollandiae	Mi / Ma	Salt and freshwater wetlands, salt lakes, freshwater swamps and lakes, floodwaters, claypans, dams.	**Y**	2, 3
Rufous Fantail	Rhipidura rufifrons	Mi / Ma	Rainforest, dense wet eucalypt forest, paperbark and mangrove swamps, riparian vegetation.	**Y**	1, 2, 3
Painted Snipe	Rostratula australis	Mi / Ma	Dense vegetation around swamps.	**Y**	1
Channel-billed Cuckoo	Scythrops novaehollandiae	Ma	Rainforest, open forest, woodland, swamp woodland.	**Y**	2, 3
Little Tern	Sterna albifrons	Mi / Ma	Ocean beaches and coral reefs from Port Headland on WA coast along northern and eastern coasts to Bass Strait. It spreads along the coast to breed in spring and summer but returns north to breed in winter.	**N**	1, 2
Lesser Crested Tern	Sterna bengalensis	Ma	Coastal seas, sandy shores, mudflats, creek channels.	**Y**	2, 3
Crested Tern	Sterna bergii	Ma	Coastal lagoons, estuaries, inland on major rivers, ocean beaches, offshore islands, pelagic waters	**Y**	2, 3
Caspian Tern	Sterna caspia	Mi / Ma	Estuaries, inlets, lagoons with muddy shores; also well inland on lakes, rivers, floodwaters.	**Y**	2, 3
Gull-billed Tern	Sterna nilotica	Ma	Inland and coastal waters, floodplains, lagoons, saltmarshes, mudflats, saltpans.	**Y**	2, 3
Brown Booby	Sula leucogaster	Ma	Marine: deep waters and inshore shallows, mostly tropical.	**N**	2, 3
Radjah Shelduck	Tadorna radjah	Mi / Ma	Mainly brackish waters, mud banks and the mangrove fringed mouths and lower reaches of tropical rivers. Also lagoons and pools along rivers and swamps.	**Y**	2, 3
Australian White Ibis	Threskiornis molucca	Ma	Shallow fresh and tidal wetlands, pastures, parks and gardens, rubbish tips	**Y**	2, 3
Straw-necked Ibis	Threskiornis spinicollis	Ma	Swamps, irrigated pastures, wet or dry grasslands.	**Y**	2, 3

Common Name	Scientific Name	Status*	Preferred habitat	Preferred habitat with the Study Area	Source^
Forest Kingfisher	Todiramphus macleayii	Ma	Open forests, woodlands, margins of rivers, swamps and billabongs, mangroves, farmlands	**Y**	2, 3
Sacred Kingfisher	Todiramphus sanctus	Ma	Open forests, woodlands, semi-arid scrublands, mangroves.	**Y**	2, 3
Common Greenshank	Tringa nebularia	Mi / Ma	Permanent and temporary wetlands: swamps, lakes, dams, irrigated crops, estuaries, tidal mudflats and mangroves. Summer migrant	**Y**	2, 3
Marsh Sandpiper	Tringa stagnatilis	Mi / Ma	Coastal and inland wetlands: estuaries, mudflats, mangroves, beaches, swamps, lakes, dams, floodwaters. Summer migrant.	**Y**	2, 3
Masked Lapwing	Vanellus miles novaehollandiae	Mi	Varied habitats including open, short-grassed sites	**Y**	2
Terek Sandpiper	Xenus cinereus	Mi / Ma	Coastal mudflats, estuaries, lagoons, sandbars, coastal swamps.	**Y**	2, 3
Silvereye	Zosterops lateralis	Ma	Diverse: woodlands and forests, heath, mallee, mangroves, farmland, gardens.	**Y**	2, 3

* Status under the Environment Protection and Biodiversity Conservation Act 1999:: Mi = Migratory Protected Species; Ma = Marine Protected Species, Mi / Ma = both.

Table T8: Approximate Areas of Remnant Vegetation Impacted by Proposed Haul Road

(a) Endangered REs

RE Code	Approximate KPs within haul road corridor (km)	Length within haul road corridor (km)	Area within haul road corridor (ha)	Area within 10 km buffer (ha)	% of buffer area impacted
12.3.3	5.0-5.3, 5.5-5.9, 5.9-6.1 (west)	0.9	8	320.8	2.5

(b) Not Of Concern REs

RE Code	Approximate KPs within haul road corridor (km)	Length within haul road corridor (km)	Area within haul road corridor (ha)	Area within 10 km buffer (ha)	% of buffer area impacted
11.3.29	3.5-3.9 (west)	0.4	2	528.8	0.4
12.1.2	1.2-1.3 (north), 2.6-3.2 (west), 6.3-7.6	2.0	16.5	910.7	1.8
12.1.3	1.0-1.2 (north)	0.2	1	995.7	0.1
12.3.5	5.9-6.1 (east), 6.1-6.3, 7.6-7.7	0.5	4	0	100*
12.3.7	4.45-4.54	0.09	0.9	79.9	1.1

* The haul road alignment transects two areas of this RE. Although EPA mapping does not identify this community within the corridor or 10 km buffer, it records over 700 ha within the Gladstone and Calliope Shire areas. Field surveys also detected this community in numerous low-lying areas within and adjacent to the study area. Clearing of up to 4 ha is therefore considered unlikely to have a significant impact on this community on a regional basis.

Table T9: Approximate Areas of Remnant Vegetation Impacted by Proposed Acid Pipeline

(a) Endangered REs

RE Code	Approximate KPs within pipeline corridor (km)	Length within pipeline corridor (km)	Area within pipeline corridor (ha)	Area within 10 km buffer (ha)	% of buffer area impacted
12.3.3	3.0-4.3, 7.1-7.9 (unsurveyed)	2.1	6.3	320.8	2.0

(b) Not Of Concern REs

RE Code	Approximate KPs within pipeline corridor (km)	Length within pipeline corridor (km)	Area within pipeline corridor (ha)	Area within 10 km buffer (ha)	% of buffer area impacted
12.1.2	2.5-2.7 (east), 2.7-3.0, 4.3-6.0, 6.5-7.1, 7.9-8.0	2.9	8.4	910.7	0.9
12.1.3	2.5-2.7 (west), 6.0-6.5, 8.0-8.2	0.9	2.4	995.7	0.2

Table T10: EVR Fauna Potentially Impacted by the Proposed Haul Road and Acid Pipeline Routes

Common Name	Scientific Name	Ecology and Preferred Habitats	HMT*	Potential Impacts
REPTILES				
Estuarine Crocodile	*Crocodylus porosus*	Tropical coastal rivers and swamps south to about Rockhampton, extending well inland via major rivers and billabongs. Recent sightings from the Boyne River south of Gladstone.	✓	No significant impact
Brigalow Scaly-foot	*Paradelma orientalis*	Eucalypt woodland, usually found under logs and debris. Also found climbing on rough Acacia trees.		Habitat loss (vegetation, logs),
Rusty Monitor	*Varanus semiremex*	Poorly known. Hollow trees in mangrove forests fringing tidal estuaries, and melaleucas along freshwater streams and swamps, from Cape York to Gladstone.		Habitat loss (vegetation)
BIRDS				
White-rumped Swiftlet	*Collocalia spodiopygius*	Aerial forager; coastal ranges / cliffs, grassland and islands. Found along the coast from northern NSW to Cape York Peninsula.	✓	No significant impact
Black-necked Stork	*Ephippiorhynchus asiaticus*	Lakes, swamps, freshwater pools and mangroves. Nests in trees or large bushes, often over swamps. Has been found throughout Queensland.	✓	No significant impact
Carpentaria Yellow Chat	*Epthianura crocea macgregori*	Freshwater or saline drainage channels on coastal marine plains, connected to tidally influenced wetlands. Breeding habitat is rank vegetation (rushes, sedges, grasses) flanking wetlands, adjacent to muddy substrates used for foraging. Large population on Curtis Island, but has been found from south of Rockhampton and north of Gladstone.	✓	No significant impact
Beach Stone-curlew	*Esacus neglectus*	Reefs, beaches and coastal mudflats. Has been found along the entire Queensland coast.	✓	No significant impact
Squatter Pigeon (southern subspecies)	*Geophaps scripta scripta*	Open grasslands often in eucalypt woodland. Preference for areas on sandy soil with low gravel ridges and nearby water. Many records of this species from the Gladstone area.	✓	No significant impact
Square-tailed Kite	*Lophoictinia isura*	Sparsely distributed in open eucalypt forests, woodlands and sand plains. Records are from throughout Queensland.	✓	No significant impact

Common Name	Scientific Name	Ecology and Preferred Habitats	HMT*	Potential Impacts
Cotton Pygmy-goose	*Nettapus coromandelianus*	Freshwater lakes, swamps and impoundments. Has been found along the Queensland coast and adjacent inland areas.	✓	No significant impact
Eastern Curlew	*Numenius madagascariensis*	Summer non-breeding migrant to eastern and northern Australian coasts. Estuaries, mud flats and soft, sandy beaches. Has been found along the entire Queensland coast.	✓	No significant impact
Lewin's Rail	*Rallus pectoralis*	Brackish and freshwater marshes, wet heaths and swampy grasslands in coastal southern and eastern Australia. Queensland populations are concentrated in the south east, however some records made from Gladstone area.		Habitat loss and loss of nesting vegetation (wetland vegetation)
Australian Painted Snipe	*Rostratula australis*	Shallow muddy freshwater swamps and marshes. Isolated records throughout Queensland.	✓	No significant impact
Radjah Shelduck	*Tadorna radjah*	Mainly brackish waters, mud banks and the mangrove fringed mouths and lower reaches of tropical rivers. Also lagoons and pools along rivers and swamps. Records from Gladstone area to North Queensland.	✓	No significant impact
MAMMALS				
Large-eared Pied Bat	*Chalinolobus dwyeri*	Dry forests and woodlands, moist eucalypt forests, caves and mine. No roosting sites for this species occur within the proposed haul road route.		Habitat loss (foraging resources)
Little Pied Bat	*Chalinolobus pictatus*	Dry sclerophyll forest, woodland and scrub. Roosts in caves, mineshafts and tree hollows.		Habitat loss (foraging, roosting resources)
False Water Rat	*Xeromys myoides*	Saline grassland, saltmarsh, mangroves, margins of freshwater swamps close to fore-dunes. Forages in the mangrove on low tides at night.		Habitat loss (nesting and foraging resources)
Koala	*Phascolarctos cinereus*	Sclerophyll woodland and forests in eastern Australia. The Blue Gum woodland contains a high density of Queensland Blue Gums, which is recognised as an important food tree for the Koalas in coastal SEQ habitats (EPA 2001)		Habitat loss (foraging and refuge resources)

HMT* = High Mobility Taxon: EVR fauna with large home ranges (greater than 100 ha per reproductive unit), as defined by EPA (2004).

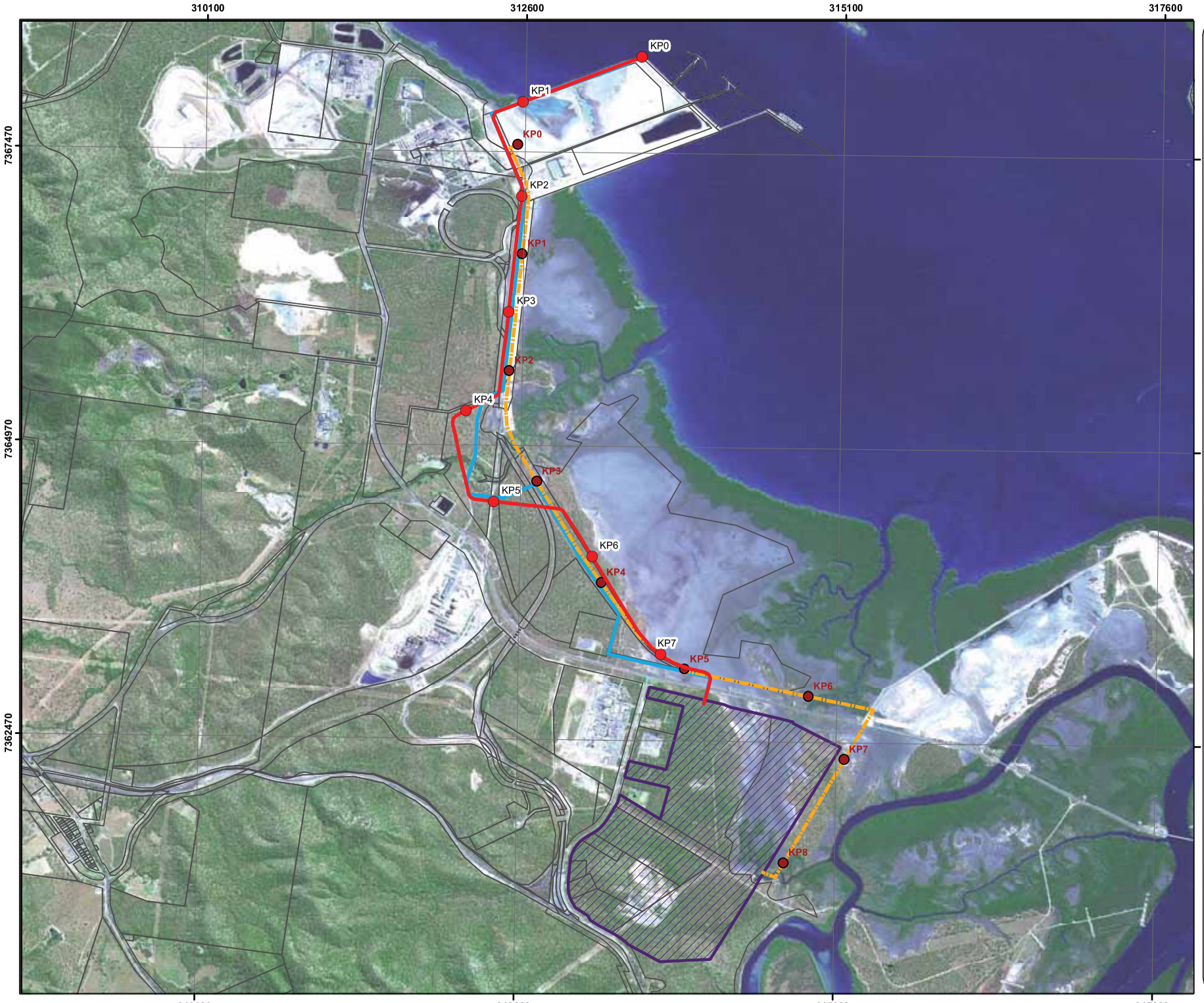
Table T11: Fauna Mitigation and Rehabilitation Recommendations

Relevant KP	Issue	Mitigation and Rehabilitation Recommendation
Full route and 5.5 – 6.5	Removal of mature vegetation and transect Blue Gum woodland	If possible, an alternative alignment should be considered to avoid the Blue Gum woodland as this represents the largest intact patch of vegetation traversed by the haul road. The Option 4 alignment is the most desirable option (in terms of least ecological impact) as this route is consolidated with other, largely cleared, infrastructure corridors thus will not greatly contribute to habitat fragmentation and loss of connectivity. Within all other vegetation patches (including non-remnant vegetation) and fauna habitats the clearance footprint should be the minimum width required to safely construct the haul road and acid pipeline. Consideration should be given to incorporate the acid pipeline within the haul road alignment, hence consolidating the impacts to single corridor. In addition, the majority of the pipeline easement should also be left to naturally revegetate in order to provide habitat for fauna and to facilitate fauna movement.
Full route	Clearing of hollow-bearing trees	Hollow-bearing trees are potential nesting and roosting habitat for the Little Pied Bat and Regionally Significant and common arboreal fauna species. All trees that contain hollows should be retained wherever practicable. Where such trees cannot be retained the hollow should be plugged with a cloth or hessian bag and carefully removed from the tree with a chainsaw. The hollow should be affixed to a retained tree or left on the ground adjacent to the cleared corridor to provide habitat for ground-dwelling fauna.
Full route	Construction within wetland and catchment	Where construction is proposed within the mudflat and saltpan communities, the road design should incorporate culverts or similar devices to maintain tidal influence within these communities. Erosion and sediment control devices (e.g. pollutant traps, swales, sediment fencing) should be installed where there is potential for erosion. The haul road's surface should be sealed to prevent erosion and sediment entering the wetland catchment.
4.2 – 4.3	Bisect Boat Creek and riparian vegetation	Option 2 is the preferred ecological outcome for the crossing of Boat Creek. This option minimises the amount of remnant vegetation to be lost and contains clearing to an existing disturbance corridor. Consideration should be given to a crossing design that preserves as much existing vegetation as possible and promotes adequate flow through the crossing point.
3.5 – 5.0; 2.1 – 7.0; 7.7 – 7.8	Increased vehicular traffic and road kill	Several areas of remnant and non-remnant vegetation (i.e. sparse woodland, paddocks with isolated trees) are traversed by the proposed haul road route. If possible, Option 4 should be considered to avoid the relatively intact Blue Gum woodland, therefore retaining habitat connectivity within this patch and reducing the risk of fauna crossing the road. Within other habitats, several mitigation measures may be considered including, use of warning signs along the route or speed-limiting the road from dusk to dawn (most ground-dwelling fauna are most active at these times). The use of exclusionary fencing at the Boat Creek crossing should be considered in order to direct fauna to safe crossing points. Depending upon the final design of the road crossing a safe crossing point may involve the use of culverts or similar underpass structure or limiting speed across the watercourse.

Relevant KP	Issue	Mitigation and Rehabilitation Recommendation
Full acid pipeline route	Revegetating pipeline corridor (post construction)	Where possible, native shrubs should be allowed to regenerate at the edge of the construction corridor to reduce the barrier to fauna movement, especially by small ground-dwelling fauna. Spreading of logs, hollows and dead timber across any disturbed areas within woodland habitats should be carried out to facilitate small ground fauna movement.
Full route	Pest fauna species breeding grounds	Equipment and materials used during construction should be stored in a manner that prevents retention of water. Drainage systems should be protected during construction to prevent surface water retention wherever possible. Natural drainage patterns should be protected during construction where possible and reinstated immediately following construction.

Figures

"This page has been left blank intentionally"



PROJECT NUMBER	B60184001
DATE	September 2007
DRAWN	CS
VERSION	A

Legend

- Haul Road KPs (1km)
- Haul Road Alignment 1
- Haul Road Alignment 2
- Acid Pipeline KPs (1km)
- Acid Pipeline Alignment
- Yarwun Refinery
- DCDB

N

Datum GDA94 56s

0 0.2 0.4 0.8 1.2

Kilometres
1:30,000 at A3

Source:
Haul Road, Acid Pipeline, Yarwun Refinery & imagery supplied by RLMS, 2007. (c) RLMS, 2007. DCDB sourced from the Department of Natural Resources & Water, 2005. (c) NRW, 2007.

Haul Road & Acid Pipeline
Site Locality
RLMS
Gladstone

HLA

Figure
F1

PROJECT NUMBER B60184001
DATE September 2007
DRAWN CS
VERSION A

Legend

- Flora Survey Sites
- Haul Road Alignment 1
- Acid Pipeline Alignment
- Yarwun Refinery
- DCDB

N

Datum GDA94 56s

0 0.2 0.4 0.8 1.2

Kilometres
1:30,000 at A3

Source:
Haul Road, Acid Pipeline, Yarwun Refinery & imagery supplied by RLMS, 2007.
(c) RLMS, 2007. DCDB sourced from the Department of Natural Resources & Water, 2005. (c) NRW, 2007.

Haul Road & Acid Pipeline
Flora Survey Sites
RLMS
Gladstone

HLA

Figure
F2a

PROJECT NUMBER	B60184001
DATE	September 2007
DRAWN	CS
VERSION	A

Legend

- Fauna Survey Sites
- Haul Road Alignment 1
- Acid Pipeline Alignment
- Yarwun Refinery
- DCDB

N

Datum GDA94 56s

0 0.2 0.4 0.8 1.2

Kilometres

1:30,000 at A3

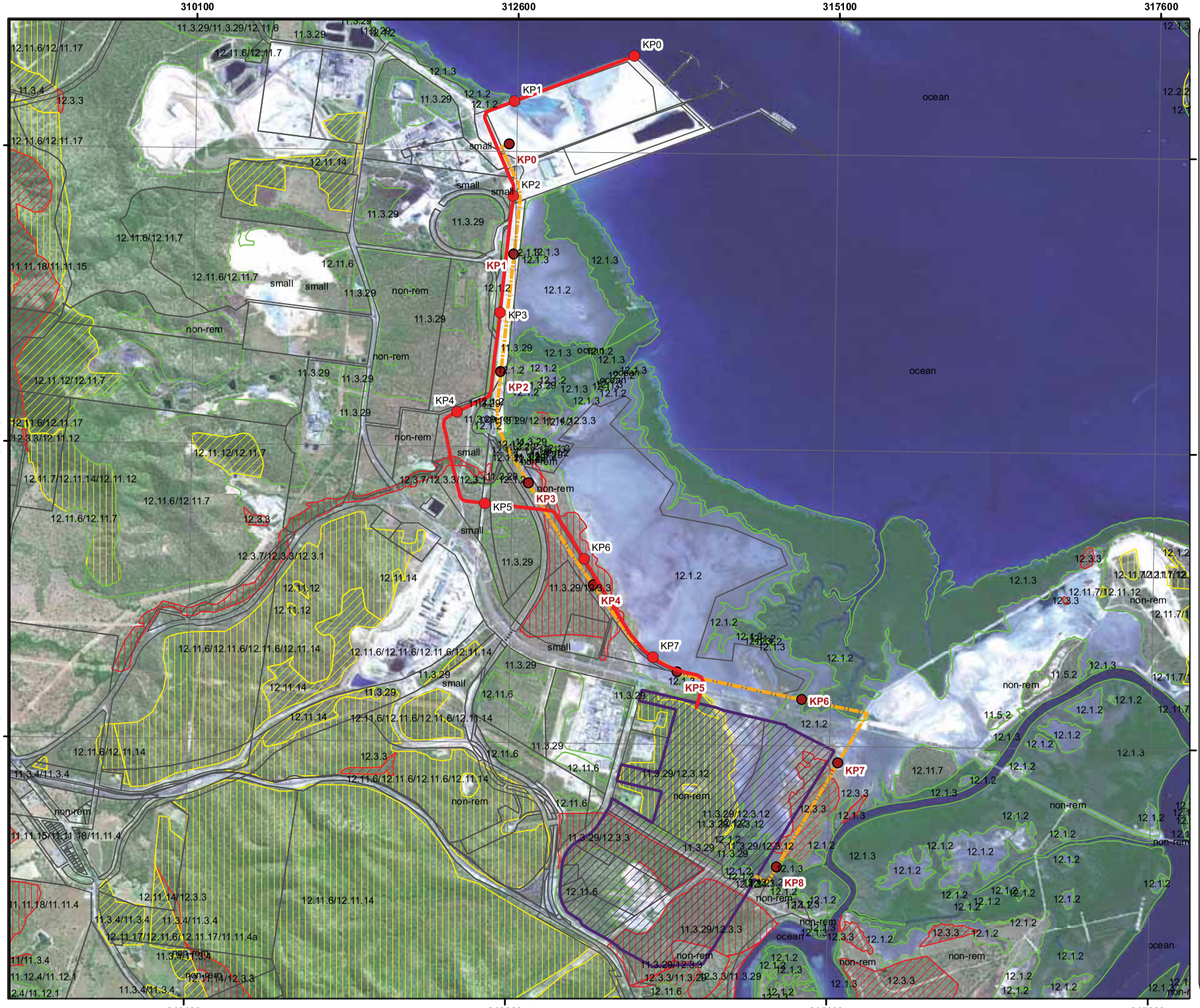
Source:
Haul Road, Acid Pipeline, Yarwun Refinery & imagery supplied by RLMS, 2007.

Haul Road & Acid Pipeline
Fauna Survey Sites
RLMS
Gladstone

HLA

Figure

F2b



PROJECT NUMBER B60184001
DATE September 2007
DRAWN CS
VERSION A

Legend

- Haul Road KPs (1km)
- Haul Road Alignment 1
- Acid Pipeline KPs (1km)
- Acid Pipeline Alignment
- Yarwun Refinery
- DCDB

Regional Ecosystem

- Endangered - Dominant
- Endangered - Subdominant
- Of Concern - Dominant
- Of Concern - Subdominant
- Not Of Concern

N

Datum GDA94 56s

0 0.2 0.4 0.8 1.2

Kilometres
1:30,000 at A3

Source:
Haul Road, Acid Pipeline, Yarwun Refinery & imagery supplied by RLMS, 2007. (c) RLMS, 2007. Regional Ecosystem data sourced from Queensland Herbarium, Environmental Protection Agency. Current as at December, 2005. (c) Qld, Herbarium, EPA, 2007. DCDB sourced from the Department of Natural Resources & Water, 2005. (c) NRW, 2007.

Haul Road & Acid Pipeline
Regional Ecosystems
RLMS
Gladstone

HLA

Figure
F3

PROJECT NUMBER	B60184001
DATE	September 2007
DRAWN	CS
VERSION	A

Legend

- Significant Features (RE 12.3.3)
- Haul Road KPs (1km)
- Haul Road Alignment 1
- Acid Pipeline Alignment
- Yarwun Refinery
- DCDB

N

Datum GDA94 56s

0 0.2 0.4 0.8 1.2

Kilometres

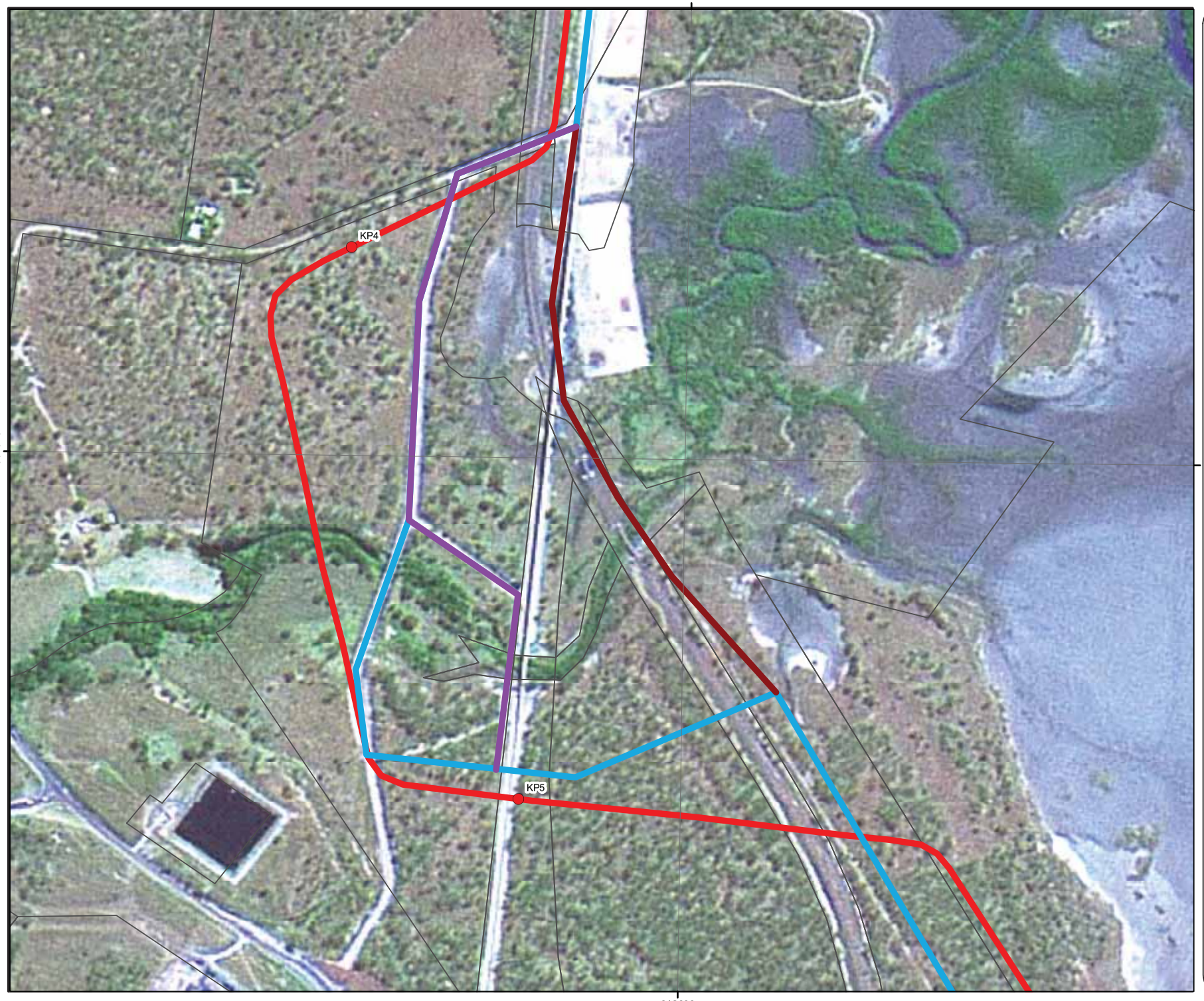
1:30,000 at A3

Source:
Haul Road, Acid Pipeline, Yarwun Refinery & imagery supplied by RLMS, 2007. (c) RLMS, 2007. DCDB sourced from the Department of Natural Resources & Water, 2005. (c) NRW, 2007.

Haul Road & Acid Pipeline
Significance Features
RLMS
Gladstone

HLA

Figure
F4



PROJECT NUMBER	B60184001
DATE	September 2007
DRAWN	CS
VERSION	A

Legend

- Haul Road KPs (1km)
- Option 1
- Option 2
- Option 3
- Option 4
- DCDB

N

Datum GDA94 56s

0 0.03 0.06 0.12 0.18

Kilometres

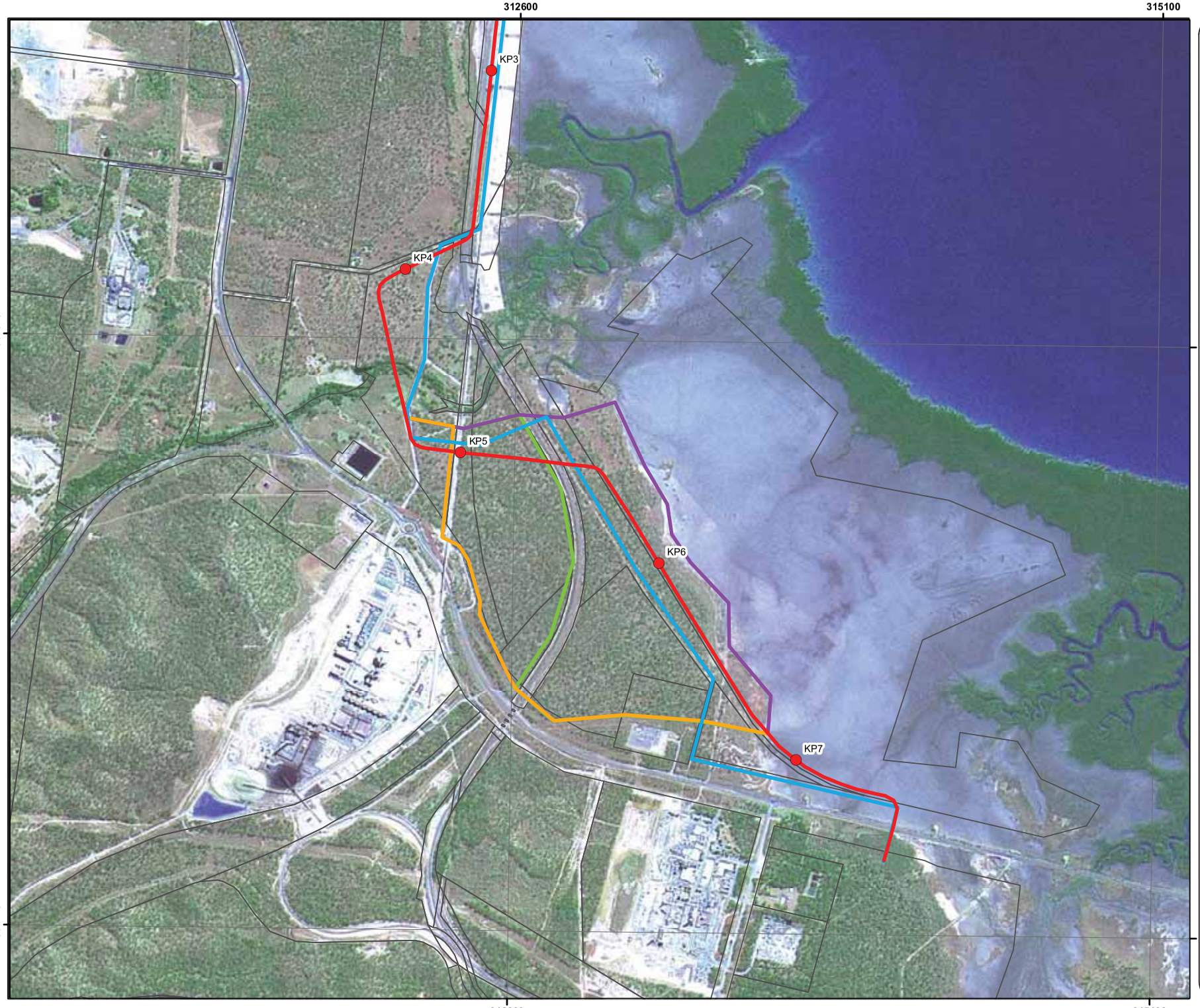
1:5,000 at A3

Source:
Haul Road, Acid pipeline & imagery supplied by RLMS, 2007. (c) RLMS, 2007. DCDB sourced from the Department of Natural Resources & Water, 2005. (c) NRW, 2007.

Haul Road - Options for crossing Boat Creek
RLMS
Gladstone

HLA

Figure
F5



PROJECT NUMBER	B60184001
DATE	September 2007
DRAWN	CS
VERSION	A

Legend

- Haul Road KPs (1km)
- Option 1
- Option 2
- Option 4
- Option 3
- Option 5
- DCDB

N

Datum GDA94 56s

0 0.1 0.2 0.4 0.6

Kilometres

1:15,000 at A3

Haul Road - Options for traversing Endangered RE RLMS

Gladstone

HLA

Figure

F6

Plates

"This page has been left blank intentionally"

Plate P1: Blue Gum Woodland (RE12.3.3) on Haul Road Alignment

Plate P2: Upstream pooling along Boat Creek from Option 2 proposed crossing point

Appendix A: Location of Flora and Fauna Assessment Sites

"This page has been left blank intentionally"

Latitude	Longitude	Route	Date	Flora site	Fauna Site	Significant feature	Dominant flora species	RE
-23.81663036	151.15983993	Acid Pipeline	August	FL10A	FA01A		Ceriops tagal, Sporobolus virginicus	12.1.2 / 12.1.3
-23.81468659	151.15905412	Acid Pipeline	August					12.1.2
-23.87229550	151.14133495	HDD	August					clear
-23.85385984	151.16655157	HDD	August					clear
-23.85426485	151.16559394	HDD	August	FL9A	FA09A		C. citriodora, E. crebra	12.11.6
-23.81173004	151.15795928	PAM 1	August				E. crebra	11.3.29
-23.81664134	151.15451750	PAM 1	August				E. tereticornis, Melaleuca, Casuarina	12.3.7
-23.81641268	151.15531445	PAM 1	August				E. tereticornis, Melaleuca, Casuarina	12.3.7
-23.82413769	151.16585604	PAM 1	August	FL11A	FA01A		Melaleuca quinquinervia	12.3.5
-23.81856968	151.15821694	PAM 1	August				Ceriops tagal, Sporobolus virginicus	12.1.2 / 12.1.3
-23.82005973	151.15818643	PAM 1	August			RE 12.3.3	E. tereticornis	12.3.3
-23.82215026	151.15858063	PAM 1	August				E. crebra	11.3.29
-23.82448110	151.15866462	PAM 1	August				E. crebra	11.3.29

Latitude	Longitude	Route	Date	Flora site	Fauna Site	Significant feature	Dominant flora species	RE
-23.82662645	151.15890115	PAM 1	August				*E. crebra*	11.3.29
-23.82900640	151.16047276	PAM 1	August				*E. crebra*	11.3.29
-23.82797996	151.16154204	PAM 1	August				*E. crebra*	11.3.29
-23.82746095	151.16191437	PAM 1	August			RE 12.3.3	*E. crebra*	11.3.29
-23.82637910	151.16244402	PAM 1	August			RE 12.3.3	*E. tereticornis*	12.3.3
-23.82581642	151.16258031	PAM 1	August				*E. crebra*	11.3.29
-23.82305676	151.16274132	PAM 1	August			RE 12.3.3	*E. crebra*	11.3.29
-23.82226442	151.16260193	PAM 1	August			RE 12.3.3	*E. tereticornis*	12.3.3
-23.82119782	151.16225442	PAM 1	August			RE 12.3.3	*E. tereticornis*	12.3.3
-23.81952220	151.16130995	PAM 1	August			RE 12.3.3	*E. tereticornis*	12.3.3
-23.81780240	151.16029389	PAM 1	August				*E. crebra*	11.3.29
-23.81875307	151.16265642	PAM 1	August			RE 12.3.3	*Sporobolus virginicus*	12.1.2
-23.81781740	151.16382645	PAM 1	August				*Sporobolus virginicus*	12.1.2
-23.82029660	151.16474267	PAM 1	August				*Sporobolus virginicus*	12.1.2

Latitude	Longitude	Route	Date	Flora site	Fauna Site	Significant feature	Dominant flora species	RE
-23.82483498	151.16722019	PAM 1	August				*Sporobolus virginicus*	12.1.2
-23.82804383	151.16831470	PAM 1	August				*Sporobolus virginicus*	12.1.2
-23.82913582	151.16949513	PAM 1	August				*Sporobolus virginicus*	12.1.2
-23.82871421	151.16782017	PAM 1	August			RE 12.3.3	*E. tereticornis*	12.3.3
-23.83113641	151.16461460	PAM 1	August				*E. crebra*	11.3.29
-23.83066233	151.16290620	PAM 1	August				*E. crebra*	11.3.29
-23.82999153	151.16141380	PAM 1	August				*E. crebra*	11.3.29
-23.82991374	151.16483646	PAM 1	August				*Lophostemon suaveolens*	11.3.29
-23.83016487	151.16630103	PAM 1	August				*E. crebra*	11.3.29
-23.81512564	151.15705479	PAM 2	August					clear
-23.81646255	151.15672027	PAM 2	August					clear
-23.83202573	151.16962136	PAM 2	August				*Sporobolus virginicus*	12.1.2
-23.83064917	151.16727920	PAM 2	August				*E. crebra*	11.3.29
-23.83031884	151.16720024	PAM 2	August				*E. crebra*	11.3.29

Latitude	Longitude	Route	Date	Flora site	Fauna Site	Significant feature	Dominant flora species	RE
-23.83449747	151.17455562	PAM 1	June	FL1J			*Melaleuca quinquinervia*	12.3.5
-23.83303978	151.17147619	PAM 2	June	FL2J			*Salt flat*	12.1.2
-23.82534628	151.16530200	PAM 2	June	FL3J		RE 12.3.3	*E. tereticornis*	12.3.3
-23.82118064	151.16279782	PAM 2	June			RE 12.3.3	*E. tereticornis*	12.3.3
-23.82871698	151.16781942	PAM 2	June			RE 12.3.3	*E. tereticornis*	12.3.3
-23.83030258	151.16737769	PAM 2	June			RE 12.3.3	*E. tereticornis*	12.3.3
-23.81846113	151.15774839	PAM2	June				*Sporobolus virginicus*	12.1.2
-23.81696924	151.15665522	PAM 2	June	FL4J			*E. tereticornis, Melaleuca spp., Casuarina cunninghamii*	12.3.7
-23.79849317	151.16003380	PAM 1	June					clear
-23.80073424	151.15910299	PAM 1	June	FL5J			*Sporobolus virginicus*	12.1.2
-23.78955077	151.15930961	PAM 1	June	FL6J			*Rhizophora stylosa*	12.1.3

Appendix B: Flora Assessment Data Sheets

"This page has been left blank intentionally"

Tertiary Site Vegetation Assessment Data Sheet Job Number: B60184001

Site Number: 1 KP: ..... Assessor: CL Date: 22/6/2007

Location: PAM route, adjacent to Port Curtis Highway

Photo Number: Partic 1284 UTM WGS84 Easting 314074 Northing 7362898 GPS 001

Width of RE: <35m wide ; 35-75m ; 75-150m ; 150-300m ; >300 ; (not linear)

Width of total remnant: <35m wide ; 35-75m ; 75-150m ; 150-300m ; >300 ; (not linear)

Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	11.3.29/12.3.12	—	NOC / OC	NC / OC
Survey result	12.3.5	—	NOC	OC

Canopy stratum growth form: tree Canopy Crown Cover: 30 %

Canopy Median Height: 8 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m)) E	T1	T2	T3	S1	S2	G	Abundance (Basal Area); C (Cover Estimate) % E	T1	T2	T3	S1	S2	G
Melaleuca quinquenervia	D		8							30					
Mel. viridiflora	C			6							<5				
Panicum maximum *	U							1.5							5
Ludwigia octovalvis	U							1							<5
C Tall sedge	D							1							30
(Rhynchospora browniii?)															
Solanum nigrum *	U							0.5							<5
Centella asiatica	U							0.1							<5
Ageratum houstonianum *	U							0.3							<5
Passiflora foetida *	U						2								<5
Scoparia dulcis *	U							0.4							<5
Macroptilium atropurpureum *	U						2								<5
Gymnanthera oblonga	U						1.5								<5
C Aster subulatus? *	U							0.3							<5
Blechnum sp	U							0.5							
Water 40%															
Rock cover (%) —															
Bare ground cover (%) —															
Litter cover (%) 20%															
Cryptogam cover (%)															
Average/Total															

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / ~~Yes~~ (if so .....collected? Y / N
.....collected? Y / N

Additional notes on pest plants .....

.....

.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50 highest near edge (5-25%)

Disturbance (% of site affected): 0, (<1;) 1-5; >5

Health: Pristine / Excellent / (Very Good) / Good / Average / Degraded / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat;) Open depression; Closed depression

Soils: Map; Cutting, Core; Surface observation **Reliability:** (Low,) Medium, High

Soil Colour: whitish; grayish; mottled; yellow; orange; brown; red; black; (dark;) (grey;) pale

Soil Texture: clay; clay loam; silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; sandy clay loam; loam sand
clay / mud

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees – permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds – intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–8	7–18	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes: – Occasionally inundated paperbark swamp .....

.....

.....

.....

.....

.....

.....

.....

Tertiary Site Vegetation Assessment Data Sheet Job Number: B601840001

Site Number: 2 KP: ..... Assessor: CL Date: 22/06/2006

Location: PAM route, adjacent to Port Curtis Highway

Photo Number: ..... UTM WGS84 Easting 313758 Northing 7363055

GPS 002

Width of RE: <35m wide ; 35-75m ; 75-150m ; 150-300m ; (>300) ; not linear
Width of total remnant: <35m wide ; 35-75m ; 75-150m ; 150-300m ; (>300) ; not linear
Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha
Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	12.1.2	—	NOC	NC
Survey result	12.1.2	—	NOC	NC

Canopy stratum growth form: ..... Canopy Crown Cover: .....%
Canopy Median Height: .....m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m))							Abundance (~~B (Basal Area)~~; C (Cover Estimate))						
		E	T1	T2	T3	S1	S2	G	E	T1	T2	T3	S1	S2	G
Ochr. vegetation along fringe of raised road and power towers. Fringe about 2-3 m wide															
Sarcocornia quinqueflora	C							0.2							
Sporobolus virginicus	C							0.3							
Sesuvium portulacastrum	U							0.2							
Suaeda arbusculoides	U							0.2							
Mud 100%															
Rock cover (%)															
Bare ground cover (%)															
Litter cover (%)															
Cryptogam cover (%)															
Average/Total															

} only on fringe 2-3 m wide

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / ~~Yes~~ (if so .....collected? Y / N
.....collected? Y / N

Additional notes on pest plants .....
.....
.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50

Disturbance (% of site affected): 0, <1; (1-5;) >5

Health: Pristine / Excellent / Very Good / (Good) / Average / Degraded / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat) Open depression; Closed depression

Soils: Map; Cutting, Core; Surface observation **Reliability:** Low, Medium, High

Soil Colour: whitish; grayish; mottled; yellow; orange; brown; red; black; dark; (grey;) pale

Soil Texture: clay; clay loam; silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; sandy clay loam; loam sand

Marine mud

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees + permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds + intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	(Y)

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–6	7–16	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....
Numerous vehicle tracks across mud
.....

Special conservation significance:.....
cultural .....
commercial .....
recreational .....
observed or Horticultural Crops .....

Other notes: Recent fire
.....
.....
.....
.....
.....
.....
.....
.....

Tertiary Site Vegetation Assessment Data Sheet Job Number: .....

Site Number: PAM 003 KP: ..... Assessor: CL Date : 22/6/2006 7

Location: PAM route

Photo Number: 1285 UTM WGS84 Easting 313118 Northing 7363895

GPS 03

Width of RE: <35m wide ; 35-75m ; 75-150m ; (150-300m) ; >300 ; not linear

Width of total remnant: <35m wide ; 35-75m ; 75-150m ; 150-300m ; (>300) ; not linear

Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; (>50ha)

Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; (>50ha)

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	11.3.29 / 12.3.3	—	NOC / E	NC / E
Survey result	12.3.3	—	E	E

Canopy stratum growth form: 15-20 Canopy Crown Cover: 5-25 %

Canopy Median Height: 15-20 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m))							Abundance (~~B (Basal Area)~~; C (Cover Estimate))						
		E	T1	T2	T3	S1	S2	G	E	T1	T2	T3	S1	S2	G
Euc. tereticornis	D		15-20							10-25					
" "	D			10-15							10				
Melaleuca quinquenervia	U-C			10	7						10	<5			
Melaleuca viridiflora	U				6							<5			
Planchonia careya	U				6							<5			
Acacia crassicarpa	U				4							<5			
Pongamia pinnata	U					2							<5		
Euc. crebra	U			12							<5				
Cenchrus setigerus	C							0.5							5
Arundinella nepalensis	C							1							10
Heteropogon contortus	C							0.5							10
Dichanthium sp	U							0.5							<5
Bothriochloa bladhii	U														<5
Lophostemon suaveolens	U			12							<5				
Rock cover (%) —															
Bare ground cover (%) 20															
Litter cover (%) 30															
Cryptogam cover (%) —															
Average/Total															

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*

Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)

Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum

Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / Yes (if so .....collected? Y / N

.....collected? Y / N

Additional notes on pest plants ..M. alsia repens, Hyparrhenia rufa

Gomphocarpus physocarpus, Ricinus communis,

.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50

Disturbance (% of site affected): 0, <1; 1-5; (>5)

Health: Pristine / Excellent / Very Good / Good / Average / (Degraded) / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat); Open depression; Closed depression

Soils: Map; Cutting, Core; (Surface observation **Reliability:** (Low,) Medium, High

Soil Colour: whitish; grayish; mottled; yellow; orange; (brown;) red; black; dark; grey; pale

Soil Texture: clay; clay loam; silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; (sandy clay loam;) loam sand

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	'	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees + permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds + intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–5	7–16	19–29	30–45	>45
Relief class			**Erosional landform pattern**				
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B Badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes:

- All large trees previously removed (probably logged)
- height and density possibly below remnant level
- recent fire

remnant? 12.3.3 - wpt 004 - 005 (bend point); 005 - 006 (near substation)

- route follows existing track about 5m wide

Tertiary Site Vegetation Assessment Data Sheet Job Number: B60184001

Site Number: 004 KP: ..... Assessor: CL Date: 22/6/2006 7

Location: PAM route

Photo Number: Pastor 1286-7 UTM WGS84 Easting 312222 Northing 7364820 GPS 008

Width of RE: (<35m wide); 35-75m ; 75-150m ; 150-300m ; >300 ; not linear

Width of total remnant: (<35m wide); 35-75m ; 75-150m ; 150-300m ; >300 ; not linear

Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; (5-20ha); 20-50ha ; >50ha

Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; (5-20ha); 20-50ha ; >50ha

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	12.3.7/12.3.3/12.3.1	–	NOC/E/E	NC/E/E
Survey result	12.3.7	–	NOC	NC

Canopy stratum growth form: Tree Canopy Crown Cover: 30 %

Canopy Median Height: 18 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m))							Abundance (~~B (Basal Area)~~; C (Cover Estimate))						
		E	T1	T2	T3	S1	S2	G	E	T1	T2	T3	S1	S2	G
Acacia fasciculifera	U			8							<5				
Corymbia tessellaris	C		18							5					
Eucalyptus tereticornis	C		18							5					
Casuarina cunninghamii	C		15							10					
Eucalyptus crebra	C		15							5					
Melaleuca fluviatilis	U			10							10				
Acacia salicina	U					4							<5		
Callistemon viminalis	C					5							5		
Ricinus communis *	C					4							<5		
Cryptostegia grandiflora**	C		15							5					
Panicum maximum *	D							1.5							70
Phragmites australis	C							2							10
Melinis repens *	C							1							<5
Macroptilium atropurpureum*	C							2							<5
Typha domingensis	C							1.5							5
Persicaria attenuata	U							1							5
Cyperus sp	C							1							5
Sonchus oleraceus **	U							2							<5
C Sarcocornia simplicifolium	U							1.5							<5
Bryophyllum pinnatum **	U							1							<5
Opuntia tomentosa **	U					3							<5		
Rock cover (%) –															
Bare ground cover (%) –															
Litter cover (%) –															
Cryptogam cover (%) –															
Average/Total															

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / Yes (if so .....collected? Y / N

.....collected? Y / N

Additional notes on pest plants Rubber vine towers into canopy

Hyparrhenia rufa

.....

Weed Cover (%): <5 ; 5-25 ; 25-50 ; (>50)

Disturbance (% of site affected): 0, <1; 1-5; (>5)

Health: Pristine / Excellent / Very Good / Good / Average / (Degraded) / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; Flat; Open depression; Closed depression Creek bank

Soils: Map; Cutting, Core; Surface observation **Reliability:** (Low,) Medium, High

Soil Colour: whitish; grayish; mottled; yellow; orange; (brown;) red; black; dark; grey; pale

Soil Texture: clay; clay loam; silty loam; loam; sandy loam; sand; stony; (silty clay); sandy clay; silty clay loam; sandy clay loam; loam sand

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees – permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds – intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–5	7–18	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes:

- Existing road which has probably created pond on upstream side.
- Good Casuarina regrowth along road.

Tertiary Site Vegetation Assessment Data Sheet Job Number: B60184001

Site Number: 005 KP: ..... Assessor: CL Date: 22/6/2006 7

Location: PAM beside railway

Photo Number: 1291 – saline swale, 1292 – woodland UTM WGS84 Easting 312451 Northing 7366 618 GPS 010

Width of RE: <35m wide ; 35-75m ; 75-150m ; 150-300m ; >300 ; not linear
Width of total remnant: <35m wide ; 35-75m ; 75-150m ; 150-300m ; >300 ; not linear
Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha
Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	Not remnant	–	–	–
Survey result	Not remnant.	–	–	–

Canopy stratum growth form: tree Canopy Crown Cover: .....%
Canopy Median Height: 5 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m))							Abundance (B (Basal Area); C (Cover Estimate))						
		E	T1	T2	T3	S1	S2	G	E	T1	T2	T3	S1	S2	G
Saline Swales															
Sporobolus virginicus	D							0.3							90-5
Sarcocornia	U														5
mud															5-90
Closed WL															
Melaleuca quinquenervia	C		5												<5
Eucalyptus tereticornis	U			12											<5
Sporobolus virginicus	D							0.3							80
Panicum maximum *	U							0.5							5
Passiflora foetida *	U							1							<5
Dianella sp	U							1							<5
Rock cover (%)															
Bare ground cover (%)															
Litter cover (%)															
Cryptogam cover (%)															
Average/Total															

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / Yes (if so .....collected? Y / N
.....collected? Y / N

Additional notes on pest plants .....

.....

.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50

Disturbance (% of site affected): 0, <1; (1-5;) >5

Health: Pristine / Excellent / Very Good / Good / Average / (Degraded) / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat;) Open depression; Closed depression

Soils: Map; Cutting, Core; Surface observation **Reliability:** Low, Medium, High

Soil Colour: whitish; grayish; mottled; yellow; orange; brown; red; black; dark; grey; pale

Soil Texture: clay; clay loam; silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; sandy clay loam; loam sand

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees = permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— = intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds = intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–6	7–18	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes:

– Woodland area previously cleared with some regrowth.

– Saline area dominated by marine plants

– heavily impacted by embankments for roads, railway conveyor and other infrastructure for port.

Tertiary Site Vegetation Assessment Data Sheet Job Number: B60184001

Site Number: 006 KP: ..... Assessor: CL Date: 22/6/2007

Location: PAM

Photo Number: 1293 UTM WGS84 Easting 312455 Northing 7367857

GPS 011

Width of RE: <35m wide ; 35-75m ; (75-150m); 150-300m ; >300 ; not linear
Width of total remnant: <35m wide ; 35-75m ; (75-150m); 150-300m ; >300 ; not linear
Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; (5-20ha) ; 20-50ha ; >50ha
Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; (>50ha)

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	12.1.3	—	NOC	NC
Survey result	12.1.3 ✓	—	NOC	NC

Canopy stratum growth form: tree Canopy Crown Cover: 90 %
Canopy Median Height: 7 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height Ocular estimate (m)							Abundance B (Basal Area); C (Cover Estimate)						
		E	T1	T2	T3	S1	S2	G	E	T1	T2	T3	S1	S2	G
Rhizophora stylosa	D		7							90					
Roots 25%															
Mud 75%															
Rock cover (%)															
Bare ground cover (%)															
Litter cover (%)															
Cryptogam cover (%)															
Average/Total															

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / ~~Yes~~ (if so .....collected? Y / N
.....collected? Y / N

Additional notes on pest plants .....

.....

.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50

Disturbance (% of site affected): 0, (<1;) 1-5; >5

Health: Pristine / Excellent / Very Good / Good / Average / Degraded / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat;) Open depression; Closed depression

Soils: Map; Cutting, Core; (Surface observation) **Reliability:** Low, Medium, (High)

Soil Colour: whitish; grayish; mottled; yellow; orange; brown; red; black; dark; (grey;) pale

Soil Texture: clay; clay loam; silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; sandy clay loam; loam sand

marine mud

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees + permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds + intermidently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–6	7–18	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes:

.....

.....

.....

.....

.....

.....

.....

.....

Tertiary Site Vegetation Assessment Data Sheet Job Number: B60184001

Site Number: 1 (was site 10) KP: ..... Assessor: CL Date: 15/8/2007

Location: Boat Ck - Acid Pipeline (PAM survey)

Photo Number: 1765 UTM WGS84 Easting 312550 Northing 7364859 loft 71

Width of RE: (<35m wide) ; 35-75m ; 75-150m ; 150-300m ; >300 ; not linear

Width of total remnant: <35m wide ; 35-75m ; 75-150m ; 150-300m ; >300 ; not linear

Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

	RE code	EPBC status	VMA status	EPA status
DNRW RE map				
Survey result	12.1.			

Canopy stratum growth form: Shrub Canopy Crown Cover: 70 %

Canopy Median Height: 1.5 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m)) E	T1	T2	T3	S1	S2	G	Abundance (B (Basal Area); C (Cover Estimate)) E	T1	T2	T3	S1	S2	G	
Ceriops tagal	D					1.5				10						in SL
Avicennia marina	C		4										70			in SL
Sporobolus virginicus	D							0.3							80	in GL
Enchylaena tomentosa	U							0.3								in GL
C+ Suaeda australis	C														20	in GL
Limonium solandri	U															
GL / SL																
Rock cover (%)	— / —															
Bare ground cover (%)	— / 90															
Litter cover (%)	— / 10															
Cryptogam cover (%)																
Average/Total																

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

SL - shrubland

GL - grassland

Scheduled flora possibilities: No / Yes (if so .....collected? Y / N
.....collected? Y / N

Additional notes on pest plants .....

.....

.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50

Disturbance (% of site affected): 0, (<1;) 1-5; >5

Health: Pristine / (Excellent) / Very Good / Good / Average / Degraded / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat); Open depression; Closed depression

Soils: Map; Cutting, Core; Surface observation **Reliability:** (Low), Medium, (High)

Soil Colour: whitish; grayish; mottled; yellow; orange; brown; red; black; dark; grey; pale

Soil Texture: (clay); clay loam; silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; sandy clay loam; loam sand

marine

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees – permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash – + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds + intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–6	7–18	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes:

Weeds nearby:

Cryptostegia grandiflora **

Bryophyllum tubiflorum **

B. pinnatum **

Opuntia stricta **

.....

.....

.....

.....

Tertiary Site Vegetation Assessment Data Sheet Job Number: B60184001

Site Number: 2 (was site 11) KP: ..... Assessor: ..... Date: 15/8/2007

Location: Gladstone – PAM

Photo Number: 1790-2 UTM WGS84 Easting 313172 Northing 7364033 wpt 73

Width of RE: <35m wide ; 35-75m ; (75-150m) ; 150-300m ; >300 ; not linear

Width of total remnant: <35m wide ; 35-75m ; 75-150m ; 150-300m ; >300 ; not linear

Total RE Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

Total remnant Area: Does not extend beyond site; <1ha ; 1-5ha; 5-20ha ; 20-50ha ; >50ha

	RE code	EPBC status	VMA status	EPA status
DNRW RE map	11.3.29/12.3.3	—	N/E	N/E
Survey result	12.3.5	—	N	N

Canopy stratum growth form: tree Canopy Crown Cover: .....%

Canopy Median Height: 7 m. Structural Code: .....

All woody species present within 50m x 10m plot (plus dominant and EVR non-woody species)

Name	Rel. Dom.	Height (Ocular estimate (m)) E	T1	T2	T3	S1	S2	G	Abundance (B (Basal Area); C (Cover Estimate)) E	T1	T2	T3	S1	S2	G
C– Melaleuca quinquenervia	D		7							50					
Euc tereticornis	U	10							<5						
Lomandra sp	C							0.5							5
C– Eremophila debilis	U							0.1							
Passiflora foetida *	U							0.5							
Epaltes australis								0.3							
Sporobolus virginicus	D (10m band adjacent to salt flat)							0.3							
Rock cover (%) —															
Bare ground cover (%) 10															
Litter cover (%) 80															
Cryptogam cover (%)															
Average/Total															

*Species annotations: C Collected * Exotic Species ** Declared Species + Outside but adjoining 50m x 10m plot*
Rel. Dom. = Relative Dominance within stratum (D = dominant; C = Common; U = Uncommon; R = Rare)
Strata: E = Emergent; T1-3 = Tree strata 1-3; S1-2 = Shrub strata 1-2; G = Ground stratum
Basal Area = Basal area using Bitterlich technique (m^2/ha) Cover = Percentage Cover using ocular estimate

Scheduled flora possibilities: No / Yes (if so .....collected? Y / N
.....collected? Y / N

Additional notes on pest plants .....

.....

.....

Weed Cover (%): (<5) ; 5-25 ; 25-50 ; >50

Disturbance (% of site affected): 0, (<1;) 1-5; >5

Health: Pristine / (Excellent) / Very Good / Good / Average / Degraded / Completely Degraded (almost without natives)

Slope: Crest; Ridge; Hillock; Simple slope; Upper slope; Mid slope; Lower slope; (Flat); Open depression; Closed depression

Soils: Map; Cutting, Core; (Surface observation) **Reliability:** (Low,) Medium, High

Soil Colour: whitish; grayish; mottled; yellow; orange; (brown;) red; black; dark; grey; pale

Soil Texture: clay; (clay loam;) silty loam; loam; sandy loam; sand; stony; silty clay; sandy clay; silty clay loam; sandy clay loam; loam sand

Table 24 CORVEG landform situation codes

Landform situation	Code	Landform situation	Code
PLAIN		HILLS, MOUNTAINS, TABLELANDS	
Not otherwise specified, flat gentle slopes, undulating terrain	A	Slope or hill not specified	F
Downs, open downs, rolling downs, ashy downs, pebbly downs	*	Cliff (steep rocky faces), rocky ledge, rocky outcrop, scarp, crack in rock, crevices	L
Alluvial plain or flat, alluvium, flood plain	B	Coastal rocky headland	N
Inland clay pan, salt flat or pan (inland)	U	Top, crest of mountain or ridge	K
Tidal flat, salt flat (coastal)	V	Jump-up, mesa, tableland, plateau	Q
STREAMS		DUNE	
Lakes, banks of lake, river, stream, water course, levees + permanent water	C	Fossil coastal dune, high dune	S
Gully, drainage line, ravine gorge, outwash— + intermittently wet	D	Unspecified coastal dune, beach dune, recent coastal dune, low dune, coastal sandhill	R
Bed of channel—distributaries of inland streams, beds + intermittently flooded	E	Inland dune, inland sandhill	T
		WATER	
		Freshwater lake, lagoon, spring, stream	X
		Freshwater swamp, marsh, soak, seepage area	W
		Gilgai, melon hole, sinkhole	Z
		Saltwater, sea, saltwater swamp	Y

Table 25 CORVEG types of erosional landform patterns by slope and relief class codes

Slope class							
Class	LE Level	VG Very gently inclined	GE Gently inclined	MO Moderately inclined	ST Steep	VS Very steep	PR Precipitous
Percentage	<1	1–3	3–10	10–32	32–56	56–100	100
Degrees (rounded to nearest whole number)	0	1–2	3–6	7–16	19–29	30–45	>45
Relief class	**Erosional landform pattern**						
M Very high >300 m (about 500 m)	–	–	–	RM Rolling mountains	SM Steep mountains	VM Very steep mountains	PM Precipitous
H High 90–300 m (about 150 m)	–	–	UH Undulating hills	RH Rolling hills	SH Steep hills	VH Very steep hills	PH Precipitous hills
L Low 30–90 m (about 50 m)	–	–	UL Undulating low hills	RL Rolling low hills	SL Steep low hills	VL Very steep low hills	B Badlands
R Very low 9–30 m (about 15 m)	–	GR Gently undulating rises	UR Undulating rises	RR Rolling rises	SR Steep rises	B Badlands	B Badlands
P Extremely low <9 m)	LP Level plain	GP Gently undulating plain	UP Undulating plain	RP Rolling plain	B badlands	B Badlands	B Badlands

Source: Speight (1990)

Particular sensitivities to proposed impacts (incl. fragmentation):.....

.....

.....

Special conservation significance:.....

cultural .....

commercial .....

recreational .....

observed or Horticultural Crops .....

Other notes:

– occurs in strip between salt flat and Eucalyptus woodland (RE 12.3.3)

– strip ≤ 100 m wide

Eremophila – ph 1779–89

Appendix C: Fauna Assessment Data Sheets

"This page has been left blank intentionally"

HLA

HABITAT ASSESSMENT FOR 1 ha SEARCH AREA

PROJECT: GLADSTONE – PAM DATE: 22/6/07

SITE NO.: FA Ø 2 LOCATION: 001 NAME: D. Fleming

AMG: 56 EASTING: 314074 NORTHING: 7362899

DISTANCE and DIRECTION from TOWN: SITE IS ____ km (s) ____ (N. S. E. W.) OF ____ IN ____ (state)

WAS GPS USED? ☑ YES ☐ NO IF YES, WHICH DATUM WAS USED? ☐ Aust (84/66) ☑ WGS 84 or GDA ALTITUDE: 0–5

GENERAL

☑ Remnant trees ☐ Regrowth ☐ Plantation

☐ Native grasses (trees / shrubs may be present)

☐ Non-native grasses (trees / shrubs may be present)

☐ Improved pasture ☐ Other

Habitat type: Paperbark Wetland

RE: 11·3·29/12·3·1vr VEG: FE LANDFORM: SWP

SOIL: Clay / mud.

LANDSCAPE

Shape of patch?

☑ Circular / square ☐ Irregular ☐ Strip <50 m

☐ Strip >50 m

Strip details: ☐ Creek / river ☐ Roadside ☐ Windbreak ☑ Other: Swamp / Intertidal

Width: ____

Area of full patch that contains 1 ha area:

☐ < 3 ha ☐ 3-10 ha ☐ 11-30 ha

☐ 31-100 ha ☑ 101-400 ha ☐ > 400 ha

Is the 1 ha patch connected to other similar sized or larger patches of vegetation?

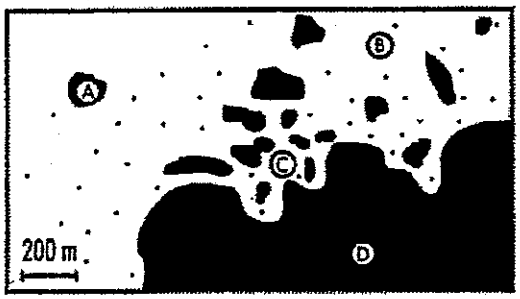
☑ YES ☐ NO

Position of this 1 ha search area relative to the surrounding tree / shrub cover?

☐ A- Isolated ☐ B-Semi isolated

☐ C-Not isolated ☑ D-Continuous tree / shrub (adjacent to mudflats)

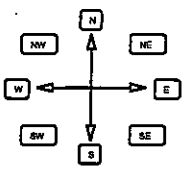
■ Continuous tree/shrub cover ⁘ Scattered trees ☐ Grassland



Is this 1 ha area on a:

☑ Flat ☐ Ridge ☐ Gully ☐ Slope

If slope, give aspect over 20 m



Degrees of slope over 20 m: ____

VEGETATION STRUCTURE : OVERSTORY

Tree canopy cover (trees taller that 3 m):

☐ Absent ☐ Sparse ☑ Open ☐ Dense

If trees present:

☐ single tree species

☑ two or three species

☐ more than three species

Are trees mostly?

☑ native ☐ exotic

Species: (Melaleuca quinquenervia, M. viridiflora

Average height of overstory?

☐ 3-5 m ☑ 5-10 m ☐ 10-15 m ☐ > 15 m

Are the trees?

☑ Even-aged (Trees mostly the same age or size)

☐ Multi-aged (Trees of varing size or age)

Are there obvious signs of dieback in the tree canopy?

☐ None ☑ Some dieback ☐ Extensive dieback

VEGETATION STRUCTURE : UNDERSTORY

Tall understory shrub cover (>2 m):

☐ Absent ☑ Scattered ☐ Common ☐ Abundant

If shrubs present:

☑ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: Canopy species juveniles

Low shrub cover (0.5 m – 2 m):

☐ Absent ☑ Scattered ☐ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☐ two or three species

☑ more than three species

Are shrubs mostly?

☐ native ☑ exotic

Species: Paricum maximum, Ageratum houstonianum, Passiflora foetida

Dominant ground cover within this 1 ha area:

☐ Tussocks ☐ Hummocks ☑ Continuous grass / herbs (sedge cover)

☐ Low Heath ☐ Weeds ☐ Bare dirt / rocks / litter

LAND USE

Used for?

☐ Mixed grazing ☐ Sheep ☐ Cattle

☐ Crops Crop type: ____

☐ Other Other: ____

HLA

HABITAT ASSESSMENT (*cont.*)

KEY HABITAT FEATURES

HOLLOWS and LOGS

No. of hollows within 1 ha patch?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

If present, are they mostly? ☐ dead ☐ living

Fallen trees or branches present 10-50 cm diameter?

☐ Absent (0) ☑ Scattered (1-10) ☐ Common (10-20) ☐ Abundant (> 20)

Fallen trees or branches present >50 cm diameter?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

Leaf litter?

☑ Absent ☐ Sparse ☐ Patchy ☐ Dense

Mistletoe within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

ROCKS

Outcrops within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of 10–30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of > 30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Cliffs and overhangs within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If present, are they mostly?

☐ Sandstone ☐ Granite

☐ Basalt ☐ Karst

☐ Other

CRACKING CLAY SOILS

☐ YES ☑ NO

HABITAT QUALITY FOR:

Hollow dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Rock dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Log dependent fauna

☐ Absent ☑ Poor ☐ Average ☐ Good ☐ Excellent

Small birds

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

OTHER HABITAT QUALITY ASPECTS:

Dense Paperbark fringing wetland adjacent to tidal mudflats. Low intensity ground fire evidence.

WETLANDS

Wetlands present?

☑ YES ☐ NO

TYPE OF WETLAND:

MARINE:

☐ Coral reef ☐ Rocky shore ☐ Beach (all)

☐ Estuarine ☐ Tidal mudflat ☐ Tidal marsh

☐ Tidal forest (e.g. mangrove) ☐ Lagoon

☑ Saline / brackish lake / swamp

INLAND WETLAND:

☐ Creek ➡ ☐ Dry ☐ Flowing

☐ River ☐ Floodplain, river flat

☐ Small billabong , pools (<8 ha) ☐ Freshwater lake (>8 ha)

☐ Shrubby swamp ☐ Wooded swamp

☐ Gilgai ☐ Claypan

☐ Ephemeral Marsh / swamp with emergent veg

ARTIFICIAL WETLANDS:

☐ Large dam, reservoir (>8 ha) ☐ Small dam, pond, tank

☐ Irrigation channel, rice field ☐ Wastewater treatment

☐ Canal, drainage channel, ditch ☐ Salt pond / field

AREA OF WETLAND:

☐ < 2 ha ☐ 2-8 ha ☐ 8-100 ha ☑ >100 ha

➡ Water mostly

☐ Fresh ☑ Brackish / saline ☐ Salty

FEATURES PRESENT

☑ Broad, shallow, swampy areas for birds to feed

☐ Islands for birds to roost and nest

☐ Dead or living trees in the water (partly submerged) for roosting and nesting habitat

☐ Fencing to exclude grazing stock from direct access to the waters edge

☑ Dense tree and / or shrub cover close to the edge of the water

ADDITIONAL NOTES:

photo 0180, 0181

Lemon-bellied flycatcher
Torressian Crow
Willy wagtail
Little friarbird
Purple Swamphen
Cuttle-billed tern.

Pseudophryne major calling.

SITE NO.

HLA

HABITAT ASSESSMENT FOR 1 ha SEARCH AREA

PROJECT: GLADSTONE - PAM DATE: 22/6/07

SITE NO.: FA02 LOCATION: 003 NAME: D. Fleming

AMG: 56 EASTING: 313116 NORTHING: 7363901

DISTANCE and DIRECTION from TOWN: SITE IS ____ km (s) ____ (N. S. E. W.) OF ____ IN ____ (state)

WAS GPS USED? ☑ YES ☐ NO IF YES, WHICH DATUM WAS USED? ☐ Aust (84/66) ☑ WGS 84 or GDA ALTITUDE: 0-5

GENERAL

☑ Remnant trees ☑ Regrowth ☐ Plantation

☑ Native grasses (trees / shrubs may be present)

☐ Non-native grasses (trees / shrubs may be present)

☐ Improved pasture ☐ Other

Habitat type: Woodland

RE: 12-3-3 VEG: DS LANDFORM: PLA

SOIL: Sandy clay loam.

LANDSCAPE

Shape of patch?

☐ Circular / square ☑ Irregular ☐ Strip <50 m

☐ Strip >50 m

➧ Strip details: ☐ Creek / river ☐ Roadside ☐ Windbreak ☐ Other ____

Width ____

Area of full patch that contains 1 ha area:

☐ < 3 ha ☐ 3-10 ha ☐ 11-30 ha

☑ 31-100 ha ☐ 101-400 ha ☐ > 400 ha

Is the 1 ha patch connected to other similar sized or larger patches of vegetation?

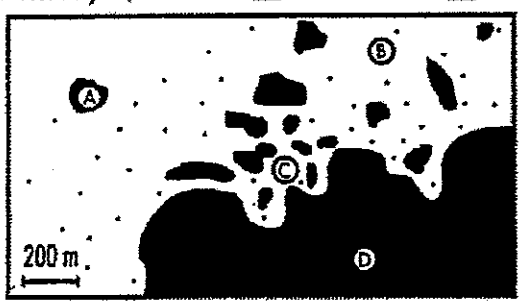
☑ YES ☐ NO

Position of this 1 ha search area relative to the surrounding tree / shrub cover?

☐ A- Isolated ☐ B-Semi isolated

☑ C-Not isolated (adjacent to mudflats) ☐ D-Continuous tree / shrub

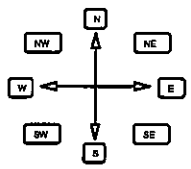
■ Continuous tree/shrub cover ⁘ Scattered trees ☐ Grassland



Is this 1 ha area on a:

☑ Flat ☐ Ridge ☐ Gully ☐ Slope

If slope, give aspect over 20 m



Degrees of slope over 20 m: ____

VEGETATION STRUCTURE : OVERSTORY

Tree canopy cover (trees taller that 3 m):

☐ Absent ☐ Sparse ☑ Open ☐ Dense

If trees present:

☑ single tree species

☐ two or three species

☐ more than three species

Are trees mostly?

☑ native ☐ exotic

Species: E. tereticornis

Average height of overstory?

☐ 3-5 m ☐ 5-10 m ☐ 10-15 m ☑ > 15 m

Are the trees?

☑ Even-aged (Trees mostly the same age or size)

☐ Multi-aged (Trees of varing size or age)

Are there obvious signs of dieback in the tree canopy?

☐ None ☑ Some dieback ☐ Extensive dieback

VEGETATION STRUCTURE : UNDERSTORY

Tall understory shrub cover (>2 m):

☐ Absent ☐ Scattered ☑ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☐ two or three species

☑ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: E. tereticornis, E. crebra, M. quinquenervia, Lophostemon suaveolens

Low shrub cover (0.5 m – 2 m):

☐ Absent ☑ Scattered ☐ Common ☐ Abundant

If shrubs present:

☑ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: Pogonolobus reticulatus,

Dominant ground cover within this 1 ha area:

☐ Tussocks ☐ Hummocks ☑ Continuous grass / herbs

☐ Low Heath ☐ Weeds ☐ Bare dirt / rocks / litter

LAND USE

Used for?

☐ Mixed grazing ☐ Sheep ☐ Cattle

☐ Crops Crop type: ____

☑ Other Other: Ammonia pipeline + access road

HLA

HABITAT ASSESSMENT (*cont.*)

KEY HABITAT FEATURES

HOLLOWS and LOGS

No. of hollows within 1 ha patch?

☐ Absent (0) ☑ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

If present, are they mostly? ☐ dead ☑ living

Fallen trees or branches present 10-50 cm diameter?

☐ Absent (0) ☐ Scattered (1-10) ☐ Common (10-20) ☑ Abundant (> 20)

Fallen trees or branches present >50 cm diameter?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

Leaf litter?

☐ Absent ☐ Sparse ☑ Patchy ☐ Dense

Mistletoe within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

ROCKS

Outcrops within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of 10–30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of > 30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Cliffs and overhangs within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If present, are they mostly?

☐ Sandstone ☐ Granite

☐ Basalt ☐ Karst

☐ Other

CRACKING CLAY SOILS

☐ YES ☑ NO

HABITAT QUALITY FOR:

Hollow dependent fauna

☐ Absent ☑ Poor ☐ Average ☐ Good ☐ Excellent

Rock dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Log dependent fauna

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

Small birds

☐ Absent ☑ Poor ☐ Average ☐ Good ☐ Excellent

OTHER HABITAT QUALITY ASPECTS:

Adjacent to tidal mudflats, provides refuge for some birds, inc. raptors. Some adjacent Acacia scrub. Most large trees logged out.

WETLANDS

Wetlands present?

☐ YES ☐ NO

TYPE OF WETLAND:

MARINE:

☐ Coral reef ☐ Rocky shore ☐ Beach (all)

☐ Estuarine ☐ Tidal mudflat ☐ Tidal marsh

☐ Tidal forest (e.g. mangrove) ☐ Lagoon

☐ Saline / brackish lake / swamp

INLAND WETLAND:

☐ Creek ➡ ☐ Dry ☐ Flowing

☐ River ☐ Floodplain, river flat

☐ Small billabong , pools (<8 ha) ☐ Freshwater lake (>8 ha)

☐ Shrubby swamp ☐ Wooded swamp

☐ Gilgai ☐ Claypan

☐ Ephemeral Marsh / swamp with emergent veg

ARTIFICIAL WETLANDS:

☐ Large dam, reservoir (>8 ha) ☐ Small dam, pond, tank

☐ Irrigation channel, rice field ☐ Wastewater treatment

☐ Canal, drainage channel, ditch ☐ Salt pond / field

AREA OF WETLAND:

☐ < 2 ha ☐ 2-8 ha ☐ 8-100 ha ☐ >100 ha

➡ Water mostly

☐ Fresh ☐ Brackish / saline ☐ Salty

FEATURES PRESENT

☐ Broad, shallow, swampy areas for birds to feed

☐ Islands for birds to roost and nest

☐ Dead or living trees in the water (partly submerged) for roosting and nesting habitat

☐ Fencing to exclude grazing stock from direct access to the waters edge

☐ Dense tree and / or shrub cover close to the edge of the water

ADDITIONAL NOTES:

Striated pardalote
Whistling kite
Grey fantail
Laughing kookaburra

photos 0184, 0185

SITE NO.

HLA

HABITAT ASSESSMENT FOR 1 ha SEARCH AREA

PROJECT: GLADSTONE - PAM DATE: 22/6/07

SITE NO: FA03 LOCATION: 008 NAME: D. Fleming.

AMG: 56 EASTING: 312222 NORTHING: 7364819

DISTANCE and DIRECTION from TOWN: SITE IS ____ km (s) ____ (N. S. E. W.) OF ____ IN ____ (state)

WAS GPS USED? ☑ YES ☐ NO IF YES, WHICH DATUM WAS USED? ☐ Aust (84/66) ☑ WGS 84 or GDA ALTITUDE: 5-10.

GENERAL

☑ Remnant trees ☐ Regrowth ☐ Plantation

☐ Native grasses (trees / shrubs may be present)

☑ Non-native grasses (trees / shrubs may be present)

☐ Improved pasture ☐ Other

Habitat type: Fringing Open Forest w/ adjacent pasture

RE: 12.3.3 VEG: MK LANDFORM: STC

SOIL: Silty clay.

LANDSCAPE

Shape of patch?

☐ Circular / square ☐ Irregular ☑ Strip <50 m

☐ Strip >50 m

Strip details: ☑ Creek / river ☐ Roadside ☐ Windbreak ☐ Other ____

Width: 35-40

Area of full patch that contains 1 ha area:

☐ < 3 ha ☑ 3-10 ha ☐ 11-30 ha

☐ 31-100 ha ☐ 101-400 ha ☐ > 400 ha

Is the 1 ha patch connected to other similar sized or larger patches of vegetation?

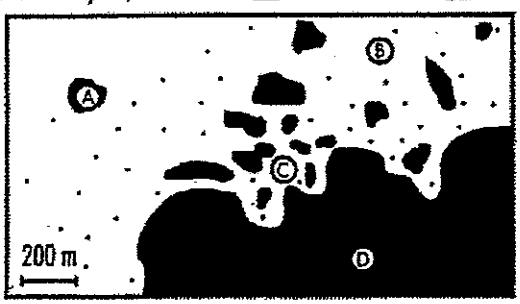
☐ YES ☑ NO but other fringing RE's plus tidal swamp nearby.

Position of this 1 ha search area relative to the surrounding tree / shrub cover?

☐ A- Isolated ☑ B-Semi isolated

☐ C-Not isolated ☐ D-Continuous tree / shrub

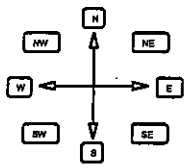
■ Continuous tree/shrub cover ⁘ Scattered trees ☐ Grassland



Is this 1 ha area on a:

☑ Flat ☐ Ridge ☐ Gully ☐ Slope

If slope, give aspect over 20 m



Degrees of slope over 20 m: ____

VEGETATION STRUCTURE : OVERSTORY

Tree canopy cover (trees taller that 3 m):

☐ Absent ☐ Sparse ☑ Open ☐ Dense

If trees present:

☐ single tree species

☐ two or three species

☑ more than three species

Are trees mostly?

☑ native ☐ exotic

Species: C. tessellaris, E. tereticornis, E. crebra, Casuarina cunninghamiana.

Average height of overstory?

☐ 3-5 m ☐ 5-10 m ☐ 10-15 m ☑ > 15 m

Are the trees?

☑ Even-aged (Trees mostly the same age or size)

☐ Multi-aged (Trees of varing size or age)

Are there obvious signs of dieback in the tree canopy?

☐ None ☑ Some dieback ☐ Extensive dieback

VEGETATION STRUCTURE : UNDERSTORY

Tall understory shrub cover (>2 m):

☐ Absent ☐ Scattered ☑ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☑ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: Acacia salicina, Callistemon viminalis, Ricinus communis

Low shrub cover (0.5 m – 2 m):

☐ Absent ☐ Scattered ☑ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☑ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: Phragmites australis, Typha domingensis, Lantana camara

Dominant ground cover within this 1 ha area:

☐ Tussocks ☐ Hummocks ☐ Continuous grass / herbs

☐ Low Heath ☑ Weeds ☐ Bare dirt / rocks / litter

LAND USE

Used for?

☐ Mixed grazing ☐ Sheep ☑ Cattle past

☐ Crops Crop type: ____

☑ Other Other: Industrial landscape

HLA

HABITAT ASSESSMENT (*cont.*)

KEY HABITAT FEATURES

HOLLOWS and LOGS

No. of hollows within 1 ha patch?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

If present, are they mostly? ☐ dead ☐ living

Fallen trees or branches present 10-50 cm diameter?

☑ Absent (0) ☐ Scattered (1-10) ☐ Common (10-20) ☐ Abundant (> 20)

Fallen trees or branches present >50 cm diameter?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

Leaf litter?

☑ Absent ☐ Sparse ☐ Patchy ☐ Dense

Mistletoe within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

ROCKS

Outcrops within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of 10–30 cm diameter?

☐ Absent ☐ Scattered ☑ Common ☐ Abundant

Surface rocks of > 30 cm diameter? imported for road construction

☐ Absent ☐ Scattered ☑ Common ☐ Abundant

Cliffs and overhangs within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If present, are they mostly?

☐ Sandstone ☐ Granite

☐ Basalt ☐ Karst

☐ Other

CRACKING CLAY SOILS

☐ YES ☑ NO

HABITAT QUALITY FOR:

Hollow dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Rock dependent fauna

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

Log dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Small birds

☐ Absent ☐ Poor ☐ Average ☑ Good ☐ Excellent

OTHER HABITAT QUALITY ASPECTS:

Lagoon created by road crossing, creek disturbed downstream. Dense phragmites cover and mid-storey quite dense.
Aquatic plants (lilies) on Lagoon.

WETLANDS

Wetlands present?

☐ YES ☑ NO

TYPE OF WETLAND:

MARINE:

☐ Coral reef ☐ Rocky shore ☐ Beach (all)

☐ Estuarine ☐ Tidal mudflat ☐ Tidal marsh

☐ Tidal forest (e.g. mangrove) ☐ Lagoon

☐ Saline / brackish lake / swamp

INLAND WETLAND:

☐ Creek ➡ ☐ Dry ☐ Flowing

☐ River ☐ Floodplain, river flat

☐ Small billabong , pools (<8 ha) ☐ Freshwater lake (>8 ha)

☐ Shrubby swamp ☐ Wooded swamp

☐ Gilgai ☐ Claypan

☐ Ephemeral Marsh / swamp with emergent veg

ARTIFICIAL WETLANDS:

☐ Large dam, reservoir (>8 ha) ☐ Small dam, pond, tank

☐ Irrigation channel, rice field ☐ Wastewater treatment

☐ Canal, drainage channel, ditch ☐ Salt pond / field

AREA OF WETLAND:

☐ < 2 ha ☐ 2-8 ha ☐ 8-100 ha ☐ >100 ha

➡ Water mostly

☐ Fresh ☐ Brackish / saline ☐ Salty

FEATURES PRESENT

☐ Broad, shallow, swampy areas for birds to feed

☐ Islands for birds to roost and nest

☐ Dead or living trees in the water (partly submerged) for roosting and nesting habitat

☐ Fencing to exclude grazing stock from direct access to the waters edge

☐ Dense tree and / or shrub cover close to the edge of the water

ADDITIONAL NOTES:

Red-backed fairy wren
Grey fantail
Little pied Cormorant
Rainbow bee-eater
Nutmeg mannikin (intro.)
Whistling kite
Striated pardalote
Welcome Swallow
Dog scat
photo 0186.

SITE NO.

HLA

HABITAT ASSESSMENT FOR 1 ha SEARCH AREA

PROJECT: GLADSTONE - PAM DATE: 22/6/07

SITE NO.: FA04 LOCATION: 011 NAME: D. Fleming

AMG: 56 EASTING: 312457 NORTHING: 7367855

DISTANCE and DIRECTION from TOWN: SITE IS ____ km (s) ____ (N. S. E. W.) OF ____ IN ____ (state)

WAS GPS USED? ☑ YES ☐ NO IF YES, WHICH DATUM WAS USED? ☐ Aust (84/66) ☑ WGS 84 or GDA ALTITUDE: 0-5

GENERAL

☑ Remnant trees ☐ Regrowth ☐ Plantation

☐ Native grasses (trees / shrubs may be present)

☐ Non-native grasses (trees / shrubs may be present)

☐ Improved pasture ☐ Other

Habitat type: Mangrove Shrubland

RE: 12.1.2 VEG: Sx LANDFORM: TOF

SOIL: Marine mud.

LANDSCAPE

Shape of patch?

☐ Circular / square ☐ Irregular ☑ Strip <50 m

☐ Strip >50 m

Strip details: ☐ Creek / river ☐ Roadside ☐ Windbreak ☑ Other: Fringing mudflats

Width: 80-90

Area of full patch that contains 1 ha area:

☐ < 3 ha ☐ 3-10 ha ☐ 11-30 ha

☑ 31-100 ha ☐ 101-400 ha ☐ > 400 ha

Is the 1 ha patch connected to other similar sized or larger patches of vegetation?

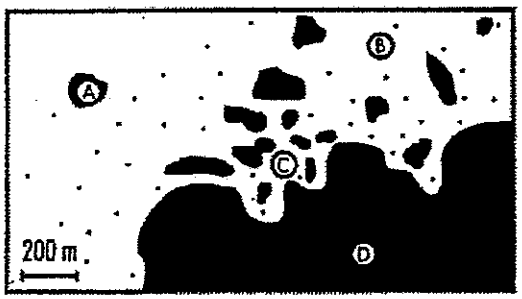
☑ YES ☐ NO

Position of this 1 ha search area relative to the surrounding tree / shrub cover?

☐ A- Isolated ☐ B-Semi isolated

☐ C-Not isolated ☑ D-Continuous tree / shrub

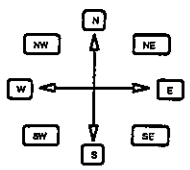
■ Continuous tree/shrub cover ⁝⁝ Scattered trees ☐ Grassland



Is this 1 ha area on a:

☑ Flat ☐ Ridge ☐ Gully ☐ Slope

If slope, give aspect over 20 m



Degrees of slope over 20 m: ____

VEGETATION STRUCTURE : OVERSTORY

Tree canopy cover (trees taller that 3 m):

☐ Absent ☐ Sparse ☐ Open ☑ Dense

If trees present:

☑ single tree species

☐ two or three species

☐ more than three species

Are trees mostly?

☑ native ☐ exotic

Species: Rhizophora stylosa

Average height of overstory?

☐ 3-5 m ☑ 5-10 m ☐ 10-15 m ☐ > 15 m

Are the trees?

☑ Even-aged (Trees mostly the same age or size)

☐ Multi-aged (Trees of varing size or age)

Are there obvious signs of dieback in the tree canopy?

☑ None ☐ Some dieback ☐ Extensive dieback

VEGETATION STRUCTURE : UNDERSTORY

Tall understory shrub cover (>2 m):

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☐ native ☐ exotic

Species:

Low shrub cover (0.5 m – 2 m):

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☐ native ☐ exotic

Species:

Dominant ground cover within this 1 ha area:

☐ Tussocks ☐ Hummocks ☐ Continuous grass / herbs

☐ Low Heath ☐ Weeds ☑ Bare dirt / rocks / litter

LAND USE

Used for?

☐ Mixed grazing ☐ Sheep ☐ Cattle

☐ Crops Crop type: ____

☑ Other Other: Industrial buffer.

HLA

HABITAT ASSESSMENT (*cont.*)

KEY HABITAT FEATURES

HOLLOWS and LOGS

No. of hollows within 1 ha patch?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

If present, are they mostly? ☐ dead ☐ living

Fallen trees or branches present 10-50 cm diameter?

☑ Absent (0) ☐ Scattered (1-10) ☐ Common (10-20) ☐ Abundant (> 20)

Fallen trees or branches present >50 cm diameter?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

Leaf litter?

☑ Absent ☐ Sparse ☐ Patchy ☐ Dense

Mistletoe within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

ROCKS

Outcrops within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of 10–30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of > 30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Cliffs and overhangs within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If present, are they mostly?

☐ Sandstone ☐ Granite

☐ Basalt ☐ Karst

☐ Other

CRACKING CLAY SOILS

☐ YES ☑ NO

HABITAT QUALITY FOR:

Hollow dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Rock dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Log dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Small birds

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

OTHER HABITAT QUALITY ASPECTS:

Mangrove shrubland fringing tidal mudflats. Patches of salt couch.

WETLANDS

Wetlands present?

☑ YES ☐ NO

TYPE OF WETLAND:

MARINE:

☐ Coral reef ☐ Rocky shore ☐ Beach (all)

☐ Estuarine ☐ Tidal mudflat ☐ Tidal marsh

☑ Tidal forest (e.g. mangrove) ☐ Lagoon

☐ Saline / brackish lake / swamp

INLAND WETLAND:

☐ Creek ➡ ☐ Dry ☐ Flowing

☐ River ☐ Floodplain, river flat

☐ Small billabong , pools (<8 ha) ☐ Freshwater lake (>8 ha)

☐ Shrubby swamp ☐ Wooded swamp

☐ Gilgai ☐ Claypan

☐ Ephemeral Marsh / swamp with emergent veg

ARTIFICIAL WETLANDS:

☐ Large dam, reservoir (>8 ha) ☐ Small dam, pond, tank

☐ Irrigation channel, rice field ☐ Wastewater treatment

☐ Canal, drainage channel, ditch ☐ Salt pond / field

AREA OF WETLAND:

☐ <2 ha ☐ 2-8 ha ☑ 8-100 ha ☐ >100 ha

➡ Water mostly

☐ Fresh ☐ Brackish / saline ☑ Salty

FEATURES PRESENT

☑ Broad, shallow, swampy areas for birds to feed

☐ Islands for birds to roost and nest

☑ Dead or living trees in the water (partly submerged) for roosting and nesting habitat

☐ Fencing to exclude grazing stock from direct access to the waters edge No stock at site.

☑ Dense tree and / or shrub cover close to the edge of the water

ADDITIONAL NOTES:

Photo 0191 - 0195

Brown quail

Mangrove gerygone?

Water mouse habitat.

SITE NO.

HLA

HABITAT ASSESSMENT FOR 1 ha SEARCH AREA

PROJECT: GPN- ACID | DATE: 15/8/2007

SITE NO.: FA01 | LOCATION: GPS 071 - Boat Creek | NAME: D. Fleming

AMG: 56 | EASTING: 312550 | NORTHING: 7364859

DISTANCE and DIRECTION from TOWN: SITE IS ____ km (s) ____ (N. S. E. W.) OF ____ IN ____ (state)

WAS GPS USED? ☒ YES ☐ NO | IF YES, WHICH DATUM WAS USED? ☐ Aust (84/66) ☒ WGS 84 or GDA | ALTITUDE ____

GENERAL

☑ Remnant trees ☐ Regrowth ☐ Plantation

☑ Native grasses (trees / shrubs may be present)

☐ Non-native grasses (trees / shrubs may be present)

☐ Improved pasture ☐ Other

Habitat type: Saltmarsh - Mangroves

RE: 12.1.2 | VEG: SX | LANDFORM: TDC

SOIL: Marine clay

LANDSCAPE

Shape of patch?

☐ Circular / square ☐ Irregular ☑ Strip <50 m

☐ Strip >50 m

Strip details: ☑ Creek / river ☐ Roadside ☐ Windbreak ☐ Other ____

Width: 35

Area of full patch that contains 1 ha area:

☑ < 3 ha ☐ 3-10 ha ☐ 11-30 ha

☐ 31-100 ha ☐ 101-400 ha ☐ > 400 ha

Is the 1 ha patch connected to other similar sized or larger patches of vegetation?

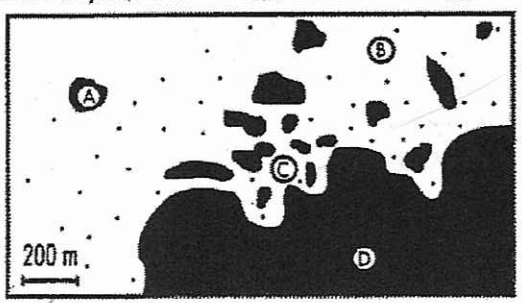
☑ YES ☐ NO

Position of this 1 ha search area relative to the surrounding tree / shrub cover?

☐ A- Isolated ☐ B-Semi isolated

☑ C-Not isolated ☐ D-Continuous tree / shrub

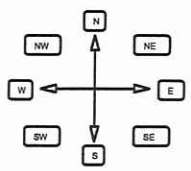
■ Continuous tree/shrub cover ⊡ Scattered trees ☐ Grassland



Is this 1 ha area on a:

☑ Flat ☐ Ridge ☐ Gully ☐ Slope

If slope, give aspect over 20 m



Degrees of slope over 20 m: ____

VEGETATION STRUCTURE : OVERSTORY

Tree canopy cover (trees taller that 3 m):

☐ Absent ☐ Sparse ☑ Open ☐ Dense

If trees present:

☐ single tree species

☑ two or three species

☐ more than three species

Are trees mostly?

☑ native ☐ exotic

Species: Avicennia marina; E. tereticornis + E. crebra emergent layer on higher slope

Average height of overstory?

☑ 3-5 m ☐ 5-10 m ☐ 10-15 m ☐ > 15 m

Are the trees?

☑ Even-aged (Trees mostly the same age or size)

☐ Multi-aged (Trees of varing size or age)

Are there obvious signs of dieback in the tree canopy?

☐ None ☑ Some dieback ☐ Extensive dieback

VEGETATION STRUCTURE : UNDERSTORY

Tall understory shrub cover (>2 m):

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If shrubs present:

☐ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☐ native ☐ exotic

Species:

Low shrub cover (0.5 m – 2 m):

☐ Absent ☐ Scattered ☐ Common ☑ Abundant

If shrubs present:

☑ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: Ceriops sp.

Dominant ground cover within this 1 ha area:

☐ Tussocks ☐ Hummocks ☑ Continuous grass / herbs

☐ Low Heath ☐ Weeds ☐ Bare dirt / rocks / litter

LAND USE

Used for?

☐ Mixed grazing ☐ Sheep ☐ Cattle

☐ Crops Crop type: ____

☑ Other Other: Rail corridor

HLA

HABITAT ASSESSMENT (*cont.*)

KEY HABITAT FEATURES

HOLLOWS and LOGS

No. of hollows within 1 ha patch?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

If present, are they mostly? ☐ dead ☐ living

Fallen trees or branches present 10-50 cm diameter?

☑ Absent (0) ☐ Scattered (1-10) ☐ Common (10-20) ☐ Abundant (> 20)

Fallen trees or branches present >50 cm diameter?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

Leaf litter?

☑ Absent ☐ Sparse ☐ Patchy ☐ Dense

Mistletoe within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

ROCKS

Outcrops within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of 10–30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of > 30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Cliffs and overhangs within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If present, are they mostly?

☐ Sandstone ☐ Granite

☐ Basalt ☐ Karst

☐ Other

CRACKING CLAY SOILS

☐ YES ☑ NO

HABITAT QUALITY FOR:

Hollow dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Rock dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Log dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Small birds

☐ Absent ☐ Poor ☐ Average ☑ Good ☐ Excellent

OTHER HABITAT QUALITY ASPECTS: Fringing mangrove community along tidal creek. Surrounded by saltmarsh and eucalypt open woodland on higher slopes.

WETLANDS

Wetlands present?

☑ YES ☐ NO

TYPE OF WETLAND:

MARINE:

☐ Coral reef ☐ Rocky shore ☐ Beach (all)

☐ Estuarine ☐ Tidal mudflat ☑ Tidal marsh

☐ Tidal forest (e.g. mangrove) ☐ Lagoon

☐ Saline / brackish lake / swamp

INLAND WETLAND:

☐ Creek ➡ ☐ Dry ☐ Flowing

☐ River ☐ Floodplain, river flat

☐ Small billabong , pools (<8 ha) ☐ Freshwater lake (>8 ha)

☐ Shrubby swamp ☐ Wooded swamp

☐ Gilgai ☐ Claypan

☐ Ephemeral Marsh / swamp with emergent veg

ARTIFICIAL WETLANDS:

☐ Large dam, reservoir (>8 ha) ☐ Small dam, pond, tank

☐ Irrigation channel, rice field ☐ Wastewater treatment

☐ Canal, drainage channel, ditch ☐ Salt pond / field

AREA OF WETLAND:

☑ < 2 ha ☐ 2-8 ha ☐ 8-100 ha ☐ >100 ha

➡ Water mostly

☐ Fresh ☐ Brackish / saline ☑ Salty

FEATURES PRESENT

☑ Broad, shallow, swampy areas for birds to feed

☐ Islands for birds to roost and nest

☑ Dead or living trees in the water (partly submerged) for roosting and nesting habitat

☐ Fencing to exclude grazing stock from direct access to the waters edge

☑ Dense tree and / or shrub cover close to the edge of the water

ADDITIONAL NOTES:

Brown honeyeater. 0554 - 0558

Bar-shouldered Dove.

Nutmeg Mannikin

Noisy Friarbird

Striated Pardalote.

SITE NO. FA01

HLA

HABITAT ASSESSMENT FOR 1 ha SEARCH AREA

PROJECT: GPN - PAM | DATE: 16/8/2007

SITE NO.: FA01 | LOCATION: IPS 073 | NAME: D. Fleming

AMG: 56 | EASTING: 313172 | NORTHING: 7364033

DISTANCE and DIRECTION from TOWN: SITE IS ____ km (s) ____ (N. S. E. W.) OF ____ IN ____ (state)

WAS GPS USED? ☒ YES ☐ NO | IF YES, WHICH DATUM WAS USED? ☐ Aust (84/66) ☒ WGS 84 or GDA | ALTITUDE ____

GENERAL

☑ Remnant trees ☐ Regrowth ☐ Plantation

☑ Native grasses (trees / shrubs may be present)

☐ Non-native grasses (trees / shrubs may be present)

☐ Improved pasture ☐ Other

Habitat type: Paperbark Wooded wetland

RE: 11.3.29/12.3.3 | VEG: FE | LANDFORM: PLA

SOIL: Loamy clay

LANDSCAPE

Shape of patch?

☐ Circular / square ☑ Irregular ☐ Strip <50 m

☐ Strip >50 m

Strip details: ☐ Creek / river ☐ Roadside ☐ Windbreak ☐ Other ____

Width ____

Area of full patch that contains 1 ha area:

☐ < 3 ha ☐ 3-10 ha ☑ 11-30 ha

☐ 31-100 ha ☐ 101-400 ha ☐ > 400 ha

Is the 1 ha patch connected to other similar sized or larger patches of vegetation?

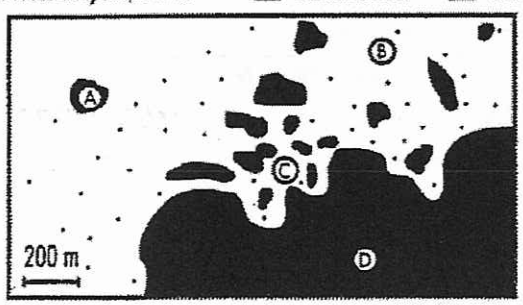
☐ YES ☑ NO

Position of this 1 ha search area relative to the surrounding tree / shrub cover?

☐ A- Isolated ☑ B-Semi isolated

☐ C-Not isolated ☐ D-Continuous tree / shrub

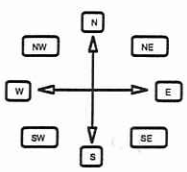
■ Continuous tree/shrub cover ⁘ Scattered trees ☐ Grassland



Is this 1 ha area on a:

☑ Flat ☐ Ridge ☐ Gully ☐ Slope

If slope, give aspect over 20 m



Degrees of slope over 20 m: ____

VEGETATION STRUCTURE : OVERSTORY

Tree canopy cover (trees taller that 3 m):

☐ Absent ☐ Sparse ☑ Open ☐ Dense

If trees present:

☐ single tree species

☑ two or three species

☐ more than three species

Are trees mostly?

☑ native ☐ exotic

Species: Melaleuca quinquenervia, E. tereticornis (emergent)

Average height of overstory?

☐ 3-5 m ☑ 5-10 m ☐ 10-15 m ☐ > 15 m

Are the trees?

☐ Even-aged (Trees mostly the same age or size)

☑ Multi-aged (Trees of varing size or age)

Are there obvious signs of dieback in the tree canopy?

☐ None ☑ Some dieback ☐ Extensive dieback

VEGETATION STRUCTURE : UNDERSTORY

Tall understory shrub cover (>2 m):

☐ Absent ☑ Scattered ☐ Common ☐ Abundant

If shrubs present:

☑ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: juvenile Paperbarks

Low shrub cover (0.5 m – 2 m):

☐ Absent ☑ Scattered ☐ Common ☐ Abundant

If shrubs present:

☑ single shrub species

☐ two or three species

☐ more than three species

Are shrubs mostly?

☑ native ☐ exotic

Species: Lomandra sp.

Dominant ground cover within this 1 ha area:

☐ Tussocks ☐ Hummocks ☐ Continuous grass / herbs

☐ Low Heath ☐ Weeds ☑ Bare dirt / rocks / litter

LAND USE

Used for?

☐ Mixed grazing ☐ Sheep ☐ Cattle

☐ Crops Crop type ____

☑ Other Other: Unused

HLA

HABITAT ASSESSMENT (*cont.*)

KEY HABITAT FEATURES

HOLLOWS and LOGS

No. of hollows within 1 ha patch?

☐ Absent (0) ☑ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

If present, are they mostly? ☐ dead ☑ living

Fallen trees or branches present 10-50 cm diameter?

☐ Absent (0) ☐ Scattered (1-10) ☑ Common (10-20) ☐ Abundant (> 20)

Fallen trees or branches present >50 cm diameter?

☑ Absent (0) ☐ Scattered (1-5) ☐ Common (6-10) ☐ Abundant (>10)

Leaf litter?

☐ Absent ☐ Sparse ☐ Patchy ☑ Dense

Mistletoe within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

ROCKS

Outcrops within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of 10–30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Surface rocks of > 30 cm diameter?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

Cliffs and overhangs within this 1 ha area?

☑ Absent ☐ Scattered ☐ Common ☐ Abundant

If present, are they mostly?

☐ Sandstone ☐ Granite

☐ Basalt ☐ Karst

☐ Other

CRACKING CLAY SOILS

☐ YES ☑ NO

HABITAT QUALITY FOR:

Hollow dependent fauna

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

Rock dependent fauna

☑ Absent ☐ Poor ☐ Average ☐ Good ☐ Excellent

Log dependent fauna

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

Small birds

☐ Absent ☐ Poor ☑ Average ☐ Good ☐ Excellent

OTHER HABITAT QUALITY ASPECTS: Fringing paperbark woodland to tidal mudflats and Blue gum Woodland.

WETLANDS

Wetlands present?

☑ YES ☐ NO

TYPE OF WETLAND:

MARINE:

☐ Coral reef ☐ Rocky shore ☐ Beach (all)

☐ Estuarine ☐ Tidal mudflat ☐ Tidal marsh

☐ Tidal forest (e.g. mangrove) ☐ Lagoon

☐ Saline / brackish lake / swamp

INLAND WETLAND:

☐ Creek ➡ ☐ Dry ☐ Flowing

☐ River ☑ Floodplain, river flat

☐ Small billabong , pools (<8 ha) ☐ Freshwater lake (>8 ha)

☐ Shrubby swamp ☐ Wooded swamp

☐ Gilgai ☐ Claypan

☐ Ephemeral Marsh / swamp with emergent veg

ARTIFICIAL WETLANDS:

☐ Large dam, reservoir (>8 ha) ☐ Small dam, pond, tank

☐ Irrigation channel, rice field ☐ Wastewater treatment

☐ Canal, drainage channel, ditch ☐ Salt pond / field

AREA OF WETLAND:

☐ < 2 ha ☑ 2-8 ha ☐ 8-100 ha ☐ >100 ha

➡ Water mostly

☐ Fresh ☑ Brackish / saline ☐ Salty

FEATURES PRESENT

☐ Broad, shallow, swampy areas for birds to feed

☐ Islands for birds to roost and nest

☐ Dead or living trees in the water (partly submerged) for roosting and nesting habitat

☐ Fencing to exclude grazing stock from direct access to the waters edge

☐ Dense tree and / or shrub cover close to the edge of the water

ADDITIONAL NOTES:

Whitebellied Sea-eagle 0569-0570.
Brown Honeyeater
Scarlet Honeyeater
Cryptblepharus virgatus
Striated Pardalote
Rainbow lorikeet
Oedura rhombifer
Bynoe's Gecko.

SITE NO. FA01

Appendix D: Significant Fauna Species Dossiers

"This page has been left blank intentionally"

D.1 EVR Fauna Species

D.1.1 Brigalow Scaly-Foot (*Paradelma orientalis*)

The Brigalow Scaly-foot inhabits eucalypt woodland and Brigalow scrub and is usually found under logs, rocks and debris, particularly in areas with cracking clay soils (Cogger 2000, Wilson 2005a). It has been observed to climb, in the early morning or evening, to perch well off the ground on the bark of rough Acacia trees. Potential habitat for the Brigalow Scaly-foot occurs along the proposed alignment in eucalypt woodland, particularly within the Blue Gum woodland, therefore has the potential to impact this species. Selection of the Option 4 alignment for the Blue Gum woodland crossing will minimise the clearing of eucalypt woodland and reduce the impact on this species habitat. Brigalow Scaly-foot individuals may also fall into the open trench of the acid pipeline and become trapped during construction. Implementing mitigation measures such as laying of moist sand bags in the trench and fauna retrieval procedures during construction will help reduce any potential impact upon this species.

D.1.2 Saltwater Crocodile (*Crocodylus porosus*)

Saltwater Crocodiles inhabit coastal rivers and swamps in northern Australia, extending well inland via major rivers and billabongs. They are a tropical species, extending south to about Rockhampton although recent sightings have been made at Tannum Sands to the south of Gladstone. Potential habitat for Saltwater Crocodiles exists at the mouth of Boat Creek near the Fishermans Landing Port Facility. These are large and highly mobile animals which are unlikely to be significantly affected by the proposed haul road or acid pipeline contruction.

D.1.3 Rusty Monitor (*Varanus semiremex*)

The Rusty Monitor is confined to coastal areas of eastern Queensland from Gladstone to Cape York. It occurs along the margins of waterways, particularly in mangroves but also paperbarks in freshwater areas. The biology of this species is poorly known, but it is believed to shelter in hollow trees and limbs, and to feed on crustaceans, insects and fish (Vincent and Wilson 1999). The Rusty Monitor has been recorded from the Gladstone area, and may be present in mangrove forest along Boat Creek, near the proposed GPN refinery site and near the Fisherman's Landing Port Facility. Given that the construction of the haul road and pipeline is likely to result in minimal clearing of mangrove habitats, no significant impact is likely upon this species.

D.1.4 Squatter Pigeon – southern subspecies (*Geophaps scripta scripta*)

The Squatter Pigeon inhabits dry grassy eucalypt woodlands and open grass fields with low gravel ridges and nearby water. Individuals of this species feed on grass seeds, including the seeds of introduced pasture species (Garnett and Crowley 2002), and are regionally nomadic following feeding resources. Squatter Pigeons nest on the ground, with breeding occurring in all months but peaking in the dry season between May and June (Schodde and Tidemann 1990). This species is believed to have declined rapidly in the south of its range, associated with overgrazing, clearing and fox predation (Garnett and Crowley 2002).

Squatter Pigeons may potentially utilise eucalypt woodland and non-remnant habitats, as well as cleared land, along the entire alignment. This species is considered a High Mobility Taxon

(EPA 2002), and given the small amount of vegetation to be cleared and the mobility of this species it is unlikely that there will be any significant impact upon the Squatter Pigeon.

D.1.5 Square-tailed Kite (*Lophoictinia isura*)

The Square-tailed Kite is a widespread but sparsely distributed bird of prey, occurring through much of coastal and subcoastal mainland Australia (DOE 1997, Garnett and Crowley 2002). It hunts in open eucalypt forests and woodlands, along with adjacent heathlands, flying slowly through or adjacent to the canopy of trees or shrubs and seizing small birds and their nestlings. The Square-tailed Kite is generally nomadic, and may be solitary or in well dispersed pairs. This species typically nests in mature living trees, in areas of forest or woodland at least several hundred hectares in size (DOE 1997). Land clearing is thought to be the major threat to this species, which is believed to have declined due to extensive clearing of its preferred habitat (DOE 1997, Garnett and Crowley 2002). Square–tailed Kites were not recorded during the current survey, but may utilise suitable eucalypts woodland habitat (particularly with the Blue Gum woodland) along the alignment as part of a larger hunting range. This species is considered a High Mobility Taxon (EPA 2002), and given the small amount of vegetation proposed to be cleared as part of the proposed alignment, along with the high mobility of this species, no significant impact is expected upon the Square-tailed Kite.

D.1.6 Black-necked Stork (*Ephippiorhynchus asiaticus*)

This large bird inhabits swamps, mangroves, mudflats, dry floodplains and irrigated lands in northern and eastern Australia. Occasionally it forages in open grassy woodland. It usually occurs singly or in pairs, sometimes accompanied by young. It forages in water to 0.5 m deep, feeding on fish and invertebrates. In monsoonal areas the bird uses ephemeral wetlands in the wet season and retreats to permanent water in the dry. It favours remnant or receding pools where fish are trapped. The Black-necked Stork usually nests near water constructing a large flat pile of sticks, rushes or grass in a live or dead tree. Nests are usually in tall trees with commanding views over the surrounding area. Populations have reduced in number most likely due to loss of feeding and nesting habitat, coupled with disturbance during nesting, which mainly occurs between July and November. The Black-necked Stork may utilise the major watercourses crossed by the alignment such as the Balonne, Moonie, Weir and Barwon Rivers. The Black-necked Stork is considered a High Mobility Taxon (EPA 2002) and given the small amount of suitable habitat affected, no significant impact is expected on this species.

D.1.7 Capricorn Yellow Chat (*Epthianura crocea macgregori*)

The critically endangered Capricorn subspecies of the Yellow Chat was believed to occur only on Curtis Island near Gladstone, until two additional small populations were discovered in 2003-04 on the mainland in the 12 Mile Creek – Raglan Creek area of the Fitzroy River Delta, and at Toorilla Plain north of Rockhampton (Houston *et al.* 2004a, b; Jaensch *et al.* 2004). It is a largely unknown subspecies, although its habitat is known to include shallow saline and freshwater drainage lines connected to tidally influenced wetlands, including samphire and inundated sedgelands. Rank vegetation (thick sedges, rushes and grasses) surrounding freshwater lagoons provide shelter, while foraging takes place on adjacent exposed muddy substrates. Breeding has been recorded between October and February (Houston *et al.* 2004a, b). Threats to the Capricorn Yellow Chat include damage to their preferred rush habitat by grazing, feral pigs and changes in hydrology.

This species was not recorded during the survey; however, foraging habitat occurs within the study area and more extensive habitat occurs within the Port Curtis Wetland. Construction of the haul road and pipeline through Boat Creek has the potential to impact upon the habitat of

the Capricorn Yellow Chat, through loss of rank vegetation at the proposed crossing point, and possibly through alterations to hydrology and downstream impacts. The Option 2 alignment is the preferred crossing point as this is likely to minimise the amount of vegetation to be cleared and minimise impacts on downstream marine and freshwater wetland habitats.

D.1.8 Australian Painted Snipe (*Rostratula australis*)

The Australian Painted Snipe is usually found in the surrounds and shallows of freshwater or brackish wetlands that are either permanently or temporarily filled (Morcombe 2003). It is a cryptic bird that is hard to see and often overlooked, and is considered a High Mobility Taxon (EPA 2002). Habitat for this species occurs within the Paperbark wetlands near the proposed GPN refinery site and the lagoon at Boat Creek, although more extensive habitat is found with the Port Curtis Wetland. Therefore, considering the relatively small amount of habitat to be cleared and the high mobility of this species, the construction of the haul road and pipeline is unlikely to constitute a significant impact. The Option 2 alignment is the preferred crossing point to minimise impacts on wetland habitat and Boat Creek.

D.1.9 White-Rumped Swiftlet (*Collocalia spodiopygius*)

The White-rumped Swiftlet is an aerial feeder over a variety of habitats along the eastern Queensland coast. It roosts and nests in colonies of up to several hundred in caves, deep rock overhangs and cavities between boulders (Schodde and Tidemann 1986). The White-rumped Swiftlet is considered a High Mobility Taxon (EPA 2002), and as this species is predominantly aerial, the proposed works are not considered likely to significantly impact individuals of the species.

D.1.10 Radjah Shelduck (*Tadorna radjah*)

This large duck occurs in freshwater wetlands and estuarine and littoral habitats. It favours shallow pools and mudbanks or the shallow fringes of deep pools. During the wet season, it visits freshwater swamps and lagoons further inland. This species feeds on aquatic invertebrates, foraging during the afternoon and night, before returning to their daytime roosts in the morning. Each pair has a feeding territory, often many kilometres from the roosting location (Schodde and Tiddemann 1990). The species nests in large hollow trees or large limbs close to water. The Radjah Shelduck is uncommon and widespread in suitable areas throughout its range in northern Australia and coastal central Queensland. It normally occurs groups of a few birds, except in the dry season when there are larger congregations on permanent coastal waters. It is threatened where settlements, agriculture, mining or roads are established, but, like all waterfowl, it takes advantage of artificial wetlands. It also may be threatened by hunting and competition from expansion of Grey Teal and Black Swan populations. The Radjah Shelduck is considered a High Mobility Taxon (EPA 2002), and given the small amount of suitable wetland habitat affected, no significant impact is expected on this species. The Option 2 alignment is the preferred crossing point of Boat Creek to minimise impacts on wetland habitat and downstream impacts on marine vegetation.

D.1.11 Cotton Pygmy-Goose (*Nettapus coromandelianus*)

In Australia, the Cotton Pygmy-Goose is only found in coastal and near-coastal Queensland, although it also occurs in Pakistan, India, eastern China and south-east Asia. It prefers deep permanent waters with abundant growth of floating and submerged aquatic vegetation, interspersed with open water, especially those associated with rivers and creeks on coastal plains. It feeds on surface aquatic vegetation. Population range reported to have contracted from an area south to the Hunter River in NSW, and now restricted largely to Queensland. The Cotton Pygmy-Goose appears to be sedentary and its movements are local except during the

wet season when they disperse inland to breed. As inland waters dry, they return to permanent lagoons closer to the coast. The construction of deep farm dams and impoundments have created new habitat for this species. Within the study area, habitat for this species occurs within the artificial lagoon on Boat Creek. The Cotton Pygmy-Goose is considered a High Mobility Taxon (EPA 2002), and given the small amount of suitable wetland habitat affected, no significant impact is expected on this species. Nevertheless, the Option 2 alignment is the preferred crossing point to minimise impacts on habitat for this species.

D.1.12 Lewin's Rail (*Rallus pectoralis*)

Lewin's Rail is a ground dwelling bird inhabiting swamps, paperbarks and other swampy woodlands, and the dense vegetation along watercourses (Morcombe 2003). It is visually cryptic and rarely seen, and has been described as uncommon and patchy in suitable habitat from Townsville through to western Victoria (DOE 1997). This species probes into cracks and holes in the ground for food, mainly insects, molluscs, crustaceans and plant matter. It makes runways beneath marshy vegetation, runs rather than flies when disturbed, and swims readily, both on and under water. Breeding occurs during August-December, in a nest of grasses or rushes woven into a cup (Schodde and Tidemann 1996). The major threats to Lewin's Rail include drainage of their wetland habitats, degradation of fringing vegetation by grazing or burning, and predation by foxes and cats (Garnett and Crowley 2002).

Habitat for this species occurs with the Paperbark wetlands and in wetland vegetation along Boat Creek. However, given the relatively small amounts of its potential habitat to be cleared, significant impact upon this species is unlikely. The Option 2 alignment is the preferred crossing point of Boat Creek to minimise impacts on wetland habitat.

D.1.13 Little Pied Bat (*Chalinolobus picatus*)

This microbat is sparsely distributed in dry sclerophyll forest, woodland and scrub in the semi-arid zone of Queensland, NSW and SA (Strahan 1995, Menkhorst and Knight 2004). It is known to forage along watercourses, and infrequently inhabits caves. This species has broad habitat requirements and is found in several vegetation communities. Little is known of the behaviour or ecology of this species, but it is known to roost in tree hollows, and so clearing of hollow-bearing trees has the potential to impact this species. The Little Pied Bat may utilise remnant and non-remnant woodland habitats with hollow-bearing trees along the entire alignment, particularly within the Blue Gum woodland. However, given the relatively small amount of vegetation to be cleared, it is unlikely that the project will significantly impact upon this species. The Option 4 alignment is the preferred crossing route of the Blue Gum woodlands, which potentially reduces the clearing of suitable habitat. In addition, hollow-bearing trees should be retained where possible as these provide roosting habitat for the Little Pied Bat.

D.1.14 Large-eared Pied Bat (*Chalinolobus dwyeri*)

The Large-eared Pied Bat occurs in eucalypt forest and rainforest from central Queensland to southeastern NSW (Menkhorst and Knight 2004). Habitat requirements are poorly understood for this species, but most records are from drier sclerophyll forests and woodlands (DOE 1997). The Large-eared Pied Bat roosts in small groups in mine shafts, caves and the abandoned conical mud nests of Fairy Martins (Strahan 1995) and it has been suggested that natural roosts of this species may depend heavily on sandstone outcrops (Duncan *et al.* 1999). Currently, no maternity sites are known. This species appears to be sparsely distributed within its range, with localised distributions. Destruction of roost sites is a known threat to the Large-eared Pied Bat, and other possible threats include clearing of habitat for agriculture and urban development, and predation by feral animals (Duncan *et al.* 1999).

The Large-eared Pied Bat may utilise remnant and non-remnant woodland habitats with hollow-bearing trees along the entire alignment, particularly within the Blue Gum woodland. No roost potential roost sites for this species were observed within the study area during the field surveys. Given the relatively small amount of vegetation to be cleared, it is unlikely that the project will significantly impact upon the foraging resources of this species. To reduce the amount of intact woodland habitat to be lost, the Option 4 alignment to cross the Blue Gum woodlands should be considered.

D.1.15 False Water Rat (*Xeromys myoides*)

This largely unknown species is a small rodent, slightly larger than a House Mouse (*Mus musculus*) that inhabits mangroves and saltmarshes in coastal areas of the Top End and central and south east Queensland (Menkhorst and Knight 2004). It is a nocturnal carnivore taking a variety of marine shellfish, crabs and marine flatworms from within inundated mangrove forests, sedgelands and saltmarshes. It builds a nest, sometimes at the base of a mangrove tree, including a network of underground burrows with a raised hollow mound on the surface (Strahan 1995). Threats to this species include reclamation of wetlands, alteration of adjacent water tables and offshore pollution (Strahan 1995). It also appears to be particularly sensitive to disturbance by human activity in the southern parts of it's range along the Queensland coast (H. Janetzki *pers. comm.*).

The False Water Rat or signs of its activity was not observed during the surveys. Suitable habitat for the species was observed near the Fisherman's Landing Port Facility and some habitat may be present along the eastern section of the acid pipeline (unsurveyed). The proposed removal of 3.4 ha of mangrove forest is not expected to significantly impact on this species provided that suitable mitigation measures (e.g. sediment and erosion control) are implemented during construction adjacent to wetlands and marine vegetation.

D.1.16 Beach Stone-curlew (*Esacus neglectus*)

The Beach Stone-curlew is a medium sized marine wader bird that occurs along the coastline from mid-north Western Australia and north-east New South Wales. It is restricted to the tidal zone foraging on mudflats, mangroves, sandy, stony and rocky shorelines (Morcombe 2003). It takes a variety of marine invertebrates including crabs and soft-bodied animals of the inter-tidal zone. The breeding season occurs from September to November with birds calling with a distinctive mournful wail during the night. One egg is laid in a nest located in a variety of habitats including sandbanks, spits or islands in estuaries, among mangroves, or in sand surrounded by short grasses and scattered casuarinas. Threats to this species include loss of habitat from coastal development, nest disturbance from human activity, nest predation by dogs, cats and foxes and nest destruction by wild pigs.

The Port Curtis Wetland provides extensive habitat for the Beach Stone-curlew. Potential foraging and nesting habitat also occurs within the alignments including mangrove forest, saltmarsh and saline mudflats. In particular, the Option 3 alignment of the Blue Gum woodland crossing involves construction of the haul road across approximately 1 km of the mudflats. Nevertheless, given the small amount of habitat to be cleared and if approximate mitigation measures are implemented no significant impact upon this species is likely.

D.1.17 Eastern Curlew (*Numenius madagascariensis*)

The Eastern Curlew is the largest wader bird and a non-breeding migrant to Australia. They breed in northeastern Asia and Siberia in May and June, migrating to Australia in August and September. In Australia, this species can occur in all coastal areas, but tend to congregate

along the eastern Australian flyway. They prefer estuaries, mudflats, and soft sandy beaches, where they forage for marine invertebrates either alone or in small groups (Morcombe 2003).

The Port Curtis Wetland provides extensive habitat for the Eastern Curlew. Potential foraging habitat occurs within the alignments including saltmarsh and saline mudflats. In particular, the Option 3 alignment of the Blue Gum woodland crossing involves construction of the haul road across approximately 1 km of the mudflats. Nevertheless, given the small amount of habitat to be cleared and if approximate mitigation measures are implemented no significant impact upon this species is likely.

"This page has been left blank intentionally"