

GLADSTONE – FITZROY  
**PIPELINE PROJECT**  
Environmental Impact Statement

Terrestrial Flora



Gladstone Area  
Water Board



# Contents

<b>6. Terrestrial Flora</b>	<b>188</b>
<b>6.1 Matters of National Environmental Significance</b>	<b>188</b>
<b>6.1.1 Introduction</b>	<b>188</b>
<b>6.1.2 Description of the Affected Environment Relevant to the Controlling Provisions</b>	<b>188</b>
<b>6.1.3 Aquatic Fauna and Flora Habitat Values for EPBC Act Listed Species</b>	<b>188</b>
<b>6.1.4 Threatened Terrestrial Flora and Threatened Ecological Communities</b>	<b>189</b>
<b>6.1.5 Assessment of Impacts on NES Matters and Mitigation Measures</b>	<b>190</b>
<b>6.1.6 Matters of NES Summary</b>	<b>191</b>
<b>6.2 Terrestrial Flora</b>	<b>191</b>
<b>6.2.1 Background</b>	<b>191</b>
<b>6.2.2 Aims</b>	<b>192</b>
<b>6.3 Methodology</b>	<b>192</b>
<b>6.3.1 Nomenclature and Terminology</b>	<b>192</b>
<b>6.3.2 Terms of Reference</b>	<b>193</b>
<b>6.3.3 Review of Existing Information</b>	<b>193</b>
<b>6.3.4 Field Investigation</b>	<b>194</b>
<b>6.4 Assumptions and Limitations</b>	<b>195</b>
<b>6.5 Relevant Legislation and Policy</b>	<b>195</b>

This information has been prepared by, or on behalf of, the Gladstone Area Water Board (GAWB) regarding the Gladstone-Fitzroy Pipeline project. Care has been taken to ensure that the information is accurate and up to date at the time of publishing.



<b>6.6</b>	<b>Baseline</b>	<b>196</b>
6.6.1	Background	196
6.6.2	Remnant Vegetation Communities	196
6.6.3	Rare and Threatened Species	212
6.6.4	<i>EPBC Act</i> Referral Triggers Identified from Existing Information	216
6.6.5	Biodiversity Planning Assessment Mapping	216
6.6.6	Crops	218
6.6.7	Weeds	218
6.6.8	Summary of Ecological Values	219
<b>6.7</b>	<b>Description of Impacts</b>	<b>220</b>
6.7.1	Main Potential Impacting Processes	220
6.7.2	Remnant Vegetation Communities	220
6.7.3	Rare and Threatened Species	224
6.7.4	Cultural Impacts	227
<b>6.8</b>	<b>Mitigation and Residual Impacts</b>	<b>227</b>
6.8.1	Assessment of Impact Severity	227
6.8.2	Remnant Vegetation Communities	227
6.8.3	Rare and Threatened Species	234
6.8.4	Cultural Impacts	235
6.8.5	Environmental Offsets	235
<b>6.9</b>	<b>Cumulative and Interactive Impacts</b>	<b>237</b>
<b>6.10</b>	<b>Summary and Conclusions</b>	<b>237</b>
<b>6.11</b>	<b>References</b>	<b>240</b>
<b>6.12</b>	<b>Bibliography</b>	<b>240</b>

## Figures

<b>Figure 6.1</b>	Regional Ecosystem Mapping with Site Locations	197
-------------------	--	-----

## Tables

<b>Table 6.1</b>	Land Zones of Queensland from EPA (2007b)	205
<b>Table 6.2</b>	Regional Ecosystems that Occur Along the Corridor	206
<b>Table 6.3</b>	Wildlife Online and EPBC Protected Matters Report	212
<b>Table 6.4</b>	Threatened Species and Likelihood of Occurrence	215
<b>Table 6.5</b>	Biodiversity Planning Assessment Mapping Summary	217
<b>Table 6.6</b>	Significant Weeds within the Project Area	219
<b>Table 6.7</b>	Impacts on Vegetation Remnants Along the Corridor (Fitzroy to Bajool section)	221
<b>Table 6.8</b>	Impacts on Vegetation Remnants Along the Corridor (Bajool to Gladstone section)	222
<b>Table 6.9</b>	Summary of Significant Impact Criteria for EPBC Act Endangered Ecological Communities	225
<b>Table 6.10</b>	Summary of Significant Impact Criteria for Reported EPBC Threatened Flora Species	226
<b>Table 6.11</b>	Significance Criteria for Residual Impacts	228
<b>Table 6.12</b>	Residual Impact Severity on Vegetation Remnants Along the Corridor (Fitzroy to Bajool section)	228
<b>Table 6.13</b>	Residual Impact Severity on Vegetation Remnants Along the Corridor (Bajool to Gladstone section)	230
<b>Table 6.14</b>	Summary of Key Impacts and Mitigation Measures	238

## 6. Terrestrial Flora

### 6.1 Matters of National Environmental Significance

#### 6.1.1 Introduction

Appendix G describes the likely significant impacts of the Gladstone-Fitzroy Pipeline project (the project) on matters of National Environmental Significance (NES) as defined in the *Environment Protection Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

There is one matter of NES that functions as a controlling provision for this action. This is the controlling provision on listed Threatened species and communities (EPBC Act, Sections 18 and 18a). Hence, the Terms of Reference (ToR) for the EIS require that information be provided specifically on Threatened species and Ecological Communities.

The assessment of potential impact to EPBC Act listed Threatened species and Ecological Communities has been undertaken through desktop research and detailed fieldwork. The chapters of the EIS that address these matters are Chapter 6, Terrestrial Flora; Chapter 7, Terrestrial Fauna; and Chapter 8, Aquatic Flora and Fauna. The findings of these chapters are summarised in the summary of Appendix G and Appendix G itself. Existing information regarding the terrestrial fauna of the project area and surrounding area was collated and reviewed. The findings of the desktop assessments indicated that a number of species of conservation significance may use habitats of the project area and surrounding lands. Consequently, consideration was given to these species (termed target species) in the design and implementation of the field survey program and habitat assessments. The review of existing information assisted in prioritising the variety of habitats and locations for field surveys.

The field study methodology for terrestrial fauna, flora and aquatic flora and fauna are further explained in Appendix G, Sections 4, 5 and 6. These sections also include existing information reviews, information on target species, the field survey program and the assumptions and limitations of the associated field study.

#### 6.1.2 Description of the Affected Environment Relevant to the Controlling Provisions

This section describes the EPBC Act listed Threatened species and Threatened Ecological Communities that have been identified as potentially occurring within the project area. The section is divided into EPBC Act listed threatened fauna (see Appendix G.6.1), and also into EPBC Act listed threatened flora and Threatened Ecological Communities (see Appendix G.6.2). These species, with relevant conservation status and notes on habitat and distribution are provided in Table 3 of Appendix G. The list of EPBC Act listed Threatened fauna derived from review of existing information (including an EPBC Act Protected Matters database search) found three Endangered terrestrial species, 12 Vulnerable terrestrial species and one Critically Endangered terrestrial species. Four Vulnerable aquatic species and two Endangered aquatic species were also found.

The field survey results revealed the following:

##### ***Fitzroy to Bajool***

The recorded assemblage comprised two EPBC Act listed Threatened fauna species:

- The Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*), which is listed as Vulnerable
- The Ornamental Snake (*Denisonia maculata*), which is also listed as Vulnerable.

##### ***Bajool to Gladstone***

The recorded assemblage comprised two EPBC Act listed Threatened fauna species:

- The Yellow Chat (*Epthianura crocea macgregori*), which is Critically Endangered
- The Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*), which is Vulnerable.

#### 6.1.3 Aquatic Fauna and Flora Habitat Values for EPBC Act Listed Species

A review of the EPBC Protected Matters Report (DEWHA 2007) and the Wildlife Online (EPA 2007) database for aquatic macrophyte species of conservation significance identified no EPBC Act listed Threatened species occurring, or likely to occur within the project area.

In terms of aquatic fauna, in Fitzroy to Bajool, the Fitzroy River site represents the largest waterbody within the project area, and has a number of inherent functional ecological values, including a potential habitat for the Fitzroy River Turtle, classified as Vulnerable. In addition, several off-stream lagoons (oxbow lakes) and ephemeral streams occur within the project area. It is unlikely that the lagoons and streams within the project area support habitat for EPBC Act listed Threatened aquatic fauna species due to their small size, absence of optimal habitat for these species, and historical (clearing) and ongoing pressures from adjacent catchment land uses.

In Bajool to Gladstone, the only listed marine fauna species that could potentially occur within the project area is the Saltwater Crocodile (*Crocodylus porosus*); however this is listed as Migratory and not as Threatened under the EPBC Act (therefore impacts upon this species is outside of the scope of this report. Nonetheless, an impact assessment concerning the species is provided in Chapter 8, Aquatic Flora and Fauna).

#### 6.1.4 Threatened Terrestrial Flora and Threatened Ecological Communities

A search of the Wildlife Online database (EPA 2007a) for species that are simultaneously listed under the EPBC Act returned a list of 13 plant species (See Table 8 of Appendix G and Section G.6.2 for more information). An EPBC Act Protected Matters Report (DEWHA 2007) was generated from a similar search, but with a more narrowly defined search area (search area and results from original extract are shown in Appendix E2) and returned a list of 11 plant species and their conservation status (nine Vulnerable and two Endangered, as shown in Table 8). Five species were reported that did not occur on the Wildlife Online list, indicating that these species are expected to occur, but have not been recorded in the search area. For these species, refer to the last four entries in Table 8 of Appendix G.

No targeted EPBC Act listed Threatened plant species were observed during survey in either section of the corridor. However, one non-target species was observed, although it was a sterile specimen and absolute confirmation of identification was not possible. This was a Vulnerable species (listed under the EPBC Act), and was one individual of (probably) ooline (*Cadellia pentastylis*) found at Detailed Site 14 (Marble Creek) (see Figure 6.1).

Several EPBC Act referral triggers were identified from preliminary data. Those triggers, based on likelihood of occurrence from habitat and distribution data, were:

- The presence of “semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions” (referred to as scrub), as defined in the EPBC Act Protected Matters Report as Threatened Ecological Communities
- A 200 m stretch of low-growing Brigalow (*Acacia harpophylla*) with extensive gilgai (a high density of small waterholes or pools, each ranging from about 5 m to 10 m in diameter) was observed on the south side of Inkerman Creek on Lot 68 DS141. This patch of vegetation occurred between the tidal interface of Inkerman Creek, and the taller Brigalow further east towards the Toonda Port Alma Road. Brigalow (*Acacia harpophylla*) is a Threatened Ecological Community under the EPBC Act. However, the height of the community on-site averaged approximately 3 m, which does not meet the structural requirements for the definition of remnant Brigalow (11 to 15 m) under the Vegetation Management Act 1999 (VM Act), and the EPBC Act uses the structural classification of the VM Act (in this case Regional Ecosystem 11.3.1 or 11.4.3)

Whilst Brigalow (*Acacia harpophylla*) regrowth may occur immediately south of Inkerman Creek, it constitutes a Threatened Ecological Community under the EPBC Act (if of sufficient structure), but the species as an individual is not listed as Threatened under the Act.

Two species of tree cycads (*Cycas megacarpa* and *C. ophiolitica*) are known to occur in areas that may be intersected by the proposed corridor. They are Endangered under the EPBC Act, and could be impacted through removal and/or disturbance of vegetation. Scrub species could potentially be impacted along this section of the corridor, through removal and/or disturbance of vegetation.

## 6.1.5 Assessment of Impacts on NES Matters and Mitigation Measures

### 6.1.5.1 Terrestrial Threatened Fauna

#### 6.1.5.1.1 Potential Impacts

The alignment of the Gladstone-Fitzroy Pipeline was selected to minimise impact to native fauna habitats. Potential impacts include:

- Vegetation clearing and habitat disturbance
- Habitat fragmentation and disturbance to wildlife movement corridors
- Disturbance to wetlands and waterways
- Trench fall (entrapment of fauna within open trenches during construction)
- Creation of environments favourable to the colonisation and expansion of environmental weeds and pest animals.

These are further explained in Section G.7.1.1 in Appendix G.

More specifically, the primary potential impacts on EPBC species include loss of shelter and food resources, loss of breeding sites, trench fall (primarily herpetofauna) and possibly increased predation (primarily small ground mammals and birds) resulting from:

- Clearing of remnant vegetation and riparian communities
- Removal of habitat trees, especially mature hollow-bearing trees
- Removal of ground debris in the construction of the pipeline;
- Trenching operations
- Increased ease of access for introduced predators.

#### 6.1.5.1.2 Mitigation

Table 10 in Appendix G provides a summary of occurrence status and potential impacts and mitigation responses for EPBC Act listed Threatened fauna that are known to occur, or have the potential to occur, within habitats of the project area and/or land immediately adjacent.

The assessment of potential impacts to these values has generated an extensive suite of mitigation measures for the project in keeping with best management practices (see, Chapter 20, Planning Environmental Management Plan). With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on EPBC Act listed Threatened fauna will be relatively low in significance.

#### 6.1.5.1.3 Residual impact and Significance Criteria classification

As described in Appendix G, the majority of the project area is highly disturbed. For these largely cleared and grazed lands, the implementation of the mitigation strategies outlined above will result in the project creating a negligible residual impact on EPBC Act listed Threatened fauna species (see Table 14 of Appendix G). However, due to the impact upon the key locations (see Section G.7.1.2), the residual impact upon EPBC Act listed Threatened fauna species is considered minor adverse.

### 6.1.5.2 Aquatic Fauna and Flora

#### 6.1.5.2.1 Potential Impacts

Potential impacts to EPBC Act listed Threatened aquatic flora, fauna and their habitat resulting from the construction and operation phases of the Gladstone-Fitzroy Pipeline project are:

Construction phase:

- Vegetation clearing and channel disturbance
- Water quality modifications (due to changes in turbidity and the mobilisation of organic sediments, Acid Sulfate Soils (ASS) and other toxicants)
- Creation of in-stream barriers (i.e. culverts).

Operational phase:

- Alterations to habitat, both surrounding the intake pipe and within the Fitzroy River weir pool
- Translocation of exotic species, especially the noxious Water Hyacinth\* (*Eichhornia crassipes*) from the Fitzroy River
- Water treatment plant (WTP) operational impacts.

#### 6.1.5.2.2 Mitigation

Due to the low probability of occurrence of EPBC Act listed Threatened aquatic flora and fauna species within the project area, significant impacts to listed Threatened species are considered unlikely. Despite this, mitigation measures will still be implemented for non-EPBC Act listed species. These mitigation measures cover impacts on all aquatic flora and fauna (not only EPBC Act species which are listed as Threatened) and hence these can be found in Chapter 8, Aquatic Flora and Fauna.

#### 6.1.5.2.3 Residual impact and Significance Criteria classification

- After mitigation, impacts upon aquatic flora and fauna that are listed under the EPBC Act as Threatened are considered negligible.

### 6.1.5.3 Threatened Terrestrial Flora and Threatened Ecological Communities

#### 6.1.5.3.1 Potential Impacts

The main potential impacting processes to EPBC Act listed Threatened flora and Threatened Ecological Communities associated with the clearing of the 30 m right-of-way (ROW) and construction of the pipeline are:

- Clearing of vegetation remnants
- Reduction of flora species habitat
- Removal of individual species of significance
- Reduction of wildlife corridor functionality
- Remnant vegetation edge effects
- Riparian vegetation disturbance
- Weed introduction.

Table 15 of Appendix G lists those relevant Ecological Communities which are classified as Endangered under the EPBC Act and responses to the Significant Impact Criteria as described within the EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance (May 2006). None of the Significant Impact Criteria will be met as a result of the project, but the reduction in area of a low-growing patch of Brigalow may occur (at Site 9c). The structural form of this patch of Brigalow does not meet the requirements for classification as remnant under the VM Act, nor the EPBC Act, which uses the structural classification of the VM Act.

Partial clearing of the semi-evergreen vine thickets of the Brigalow Belth (North and South) and Nandewar bioregions at Short Site 4 (see Figure 6.1 of the EIS) would only occur if the right-of-way were extended across existing road. If the corridor is located on the other side of the road, and this is the current intention, then no scrub will need to be cleared.

In addition, it is unlikely that EPBC Act listed Threatened species will be encountered along the corridor, during removal and/or disturbance of vegetation with the possible exception of ooline (*Cadellia pentastylis*). Table 16 of Appendix G shows that none of the Significant Impact Criteria (under the EPBC Act) will be met for EPBC Act listed flora species as a result of the project.

#### 6.1.5.3.2 Mitigation

While it is considered unlikely that EPBC Act listed Threatened species and Ecological Communities along the corridor will be impacted by the proposed project, pre-construction surveys will be conducted.

When any EPBC Act listed Threatened individuals remain within the construction footprint, these can be translocated (or replacements planted, depending on species).

#### 6.1.5.3.3 Residual impact and Significance Criteria classification

The construction of the pipeline and clearing of the ROW is likely to have an overall **negligible to minor** adverse impact to EPBC Act listed Threatened flora and Ecological Communities.

### 6.1.6 Matters of NES Summary

For EPBC Act listed fauna, the assessment of potential impacts to these values has generated an extensive suite of mitigation measures for the project in keeping with best management practices (see, Chapter 20, Planning Environmental Management Plan). With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on EPBC Act listed Threatened fauna will be relatively low in significance.

The construction of the pipeline and clearing of the ROW is likely to have an overall **negligible to minor adverse** impact to (aquatic and terrestrial) EPBC Act listed Threatened flora and ecological communities. Prior to construction, a trained ecologist will identify areas within the corridor where negative impacts on flora communities (in general) and EPBC Act listed Threatened species are possible. This information will be documented in the Construction Environmental Management Plan (CEMP).

## 6.2 Terrestrial Flora

### 6.2.1 Background

This chapter constitutes the terrestrial flora component for the EIS for the project.

The study of terrestrial flora investigated the vegetation communities classified as Regional Ecosystems (REs) by the Environmental Protection Agency (EPA) 2007 and Threatened species (as defined under relevant legislation) along the proposed pipeline corridor, which are likely to be impacted by the project. The corridor considered is on average approximately 100 m wide. The ROW for the project is approximately 30 m wide (within the corridor), and vegetation is likely to be completely cleared in this area. Impacts on Threatened Species were assessed for the ROW, with consideration of possible edge effects on Threatened species within 100 m either side of the corridor (i.e. a total width of assessment of approximately 300 m). Impacts on vegetation communities were considered on a broader scale, to account for the effects of fragmentation. In this case the distance assessed from the corridor was highly variable, depending on existing remnant vegetation surrounding the corridor.



In all cases a minimum buffer distance of 100 m either side of the corridor was taken into consideration when assessing impacts, but remnant vegetation corridors were also taken into consideration, and these corridors can extend many kilometres away from the pipeline corridor.

The impacts on terrestrial flora were considered in conjunction with the related indirect effects on other factors including aquatic ecology, fauna, soils and cultural values. The most significant relationships were those of:

- Dependence of aquatic ecology stability on riverine vegetation
- Dependence of terrestrial fauna on terrestrial flora habitat
- Dependence of particular fauna species on particular plant species (not necessarily Threatened plant species)
- Dependence of soil stability on intact terrestrial vegetation
- Dependence of modern and traditional cultures on remnant vegetation and plant species.

The study also considered weed issues in the project area, to avoid exacerbating problems particularly with Parthenium (*Parthenium hysterophorus*) around the northern end of the corridor, and Giant Rats-tail Grass (a number of *Sporobolus* spp.) around the southern end of the corridor.

### 6.2.2 Aims

The aims of the study were to provide:

- A detailed assessment of the conservation values of terrestrial vegetation within and directly adjacent to the proposed corridor
- An assessment of Threatened species known or potentially occurring within the project area, including species listed under the EPBC Act and Queensland's *Nature Conservation Act 1992*, (NC Act)
- An assessment of Threatened Ecological Communities known or potentially occurring within the project area, listed under the EPBC Act. See Chapter 6, Section 6.1 for a summary and Appendix G for a full assessment specifically dealing with the project's relevant matters of NES (Threatened species and Ecological Communities) under the EPBC Act
- An assessment of Endangered and Of Concern REs known or potentially occurring within the project area, listed under the VM Act
- An identification of significant habitats within the study area
- Mitigation measures proposed in response to potential impacts.

Specifically, the information required is stipulated in the ToR issued by the Queensland Government Coordinator-General, included in Appendix A.

## 6.3 Methodology

### 6.3.1 Nomenclature and Terminology

In this chapter, project area refers to lands and waterways within the project corridor, which runs from the Fitzroy River in the north to the Gladstone State Development Area (GSDA) in the south as shown in Figure 1.3. The average width of the corridor investigated is approximately 100 m. The ROW is generally 30 m wide passage within the corridor that is likely to be substantially cleared for the construction and operation of the pipeline, its associated infrastructure, and access. The term *surrounding area* refers generally to the lands within 2 km of the project area. The project area is considered in two sections - the northern section is referred to as the *Fitzroy to Bajool* section, and the southern section as the *Bajool to Gladstone* section.

In this chapter, the conservation status of a species may be described as *Endangered*, *Vulnerable*, *Rare*, *Culturally Significant* or *Common*. These terms are used in accordance with the provisions of the *Nature Conservation Act 1992* (Qld) (NC Act) and its amendments<sup>1</sup>, and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). *Threatened* is used in this chapter to collectively describe Endangered and Vulnerable species.

This chapter describes the potential impacts of the project on *remnant vegetation* as defined under the *Vegetation Management Act 1999* (Qld) (VM Act). The VM Act and the presence of RE provide the legislative framework for vegetation conservation in Queensland. This occurs through two processes that are administered by the Department of Natural Resources and Water (DNRW) under the VM Act and a process developed by the Queensland Environmental Protection Agency (EPA) and administered under the *Integrated Planning Act 1997* (Qld) (IP Act). The descriptions of conservation status used in this chapter reflect those defined under the VM Act and Regional Ecosystem Description Database (REDD) maintained by the Queensland Herbarium.

*Remnant vegetation* is that which is defined by RE mapping by the EPA (2005), but also includes vegetation that has not been covered by that mapping process due to reasons of scale or error. The minimum mappable size of a vegetation remnant in coastal areas for RE mapping is 1 ha (EPA 2005a, Section 3.8.1.1 of EPA methodology), and it must meet the height and cover requirements as defined by REDD (EPA 2007b). Unmapped remnant vegetation is recognised as *non-remnant* under the VM Act, but can be incorporated into RE mapping, and converted to remnant, through the *map modification process*, which is administered by DNRW.

<sup>1</sup> For the purposes of this chapter, relevant NC Act regulations and amendments refer to the Nature Conservation (Wildlife) Regulation 1994 and reprinted as in force on 8 March 2004 (including amendments up to 2004 SL No.9).

Botanical names conform to those recognised by the Queensland Herbarium (see Bostock and Holland 2007).

The term *scrub* in this chapter refers to non-eucalypts (i.e. not *Eucalyptus* species) which usually grow in dense communities, and are defined REs, RE 11.11.18 and RE 11.11.5 (EPA 2007b) which are considered as possibly occurring along the corridor (see Table 6.2 for short descriptions of those REs).

The following abbreviations are used in this chapter:

<b>ASS</b>	Acid Sulphate Soils
<b>AVH</b>	Australia's Virtual Herbarium
<b>BAMM</b>	Biodiversity Assessment Mapping Methodology
<b>BPA</b>	Biodiversity Planning Assessment
<b>CEMP</b>	Construction Environmental Management Plan
<b>DEWHA</b>	Australian Department of the Environment, Water, Heritage and the Arts
<b>DIP</b>	Department of Infrastructure and Planning
<b>DNRW</b>	Department of Natural Resources and Water
<b>EMP</b>	Environmental Management Plan
<b>EPA</b>	Queensland Environmental Protection Agency
<b>EPBC Act</b>	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
<b>EVR</b>	Endangered, Vulnerable or Rare
<b>GIS</b>	Geographical Information System
<b>GPS</b>	Global Positioning System
<b>GSDA</b>	Gladstone State Development Area
<b>IP Act</b>	<i>Integrated Planning Act 1997</i>
<b>Land Protection Act</b>	<i>Land Protection (Pest and Stock Route Management) Act 2002</i>
<b>NC Act</b>	<i>Nature Conservation Act 1992</i>
<b>NES</b>	National Environmental Significance
<b>REs</b>	Regional Ecosystems
<b>REDD</b>	Regional Ecosystem Description Database
<b>ROW</b>	Right-of-way
<b>SGIC</b>	Stanwell - Gladstone Infrastructure Corridor
<b>ToR</b>	Terms of Reference
<b>VM Act</b>	<i>Vegetation Management Act 1999 (Qld)</i>
<b>Wildlife Online</b>	public internet access to Queensland EPA flora and fauna records

## 6.3.2 Terms of Reference

Methods followed as closely as possible to those stipulated in the ToR, which are presented in Appendix A.

## 6.3.3 Review of Existing Information

### 6.3.3.1 Spatial Data

A number of Geographical Information System (GIS) datasets, including the project corridor, were overlaid on rectified aerial photography. The datasets were:

- Rectified aerial photo mosaic (average age of component photos 2005)
- Cadastre (produced by DNRW)
- RE vegetation mapping by the Queensland Herbarium (Version 5.0 with December 2006 Amendments) (EPA 2005b)
- Biodiversity Planning Assessment (BPA) mapping (Version 3.4 – 7 March 2005) (EPA 2005c).

### 6.3.3.2 Existing Reports

A number of reports pertaining to the project area and surrounds were assessed for relevance and were used for general background information (see references in Section 6.11).

### 6.3.3.3 Desktop Review of Mapping

RE mapping (EPA 2005b) was used to locate the larger patches of native vegetation intersected by the corridor. Air-photo interpretation was used to identify any other unmapped patches of native vegetation. Representative remnant REs were sampled along the entire length of the proposed corridor, with the exception of those private properties where access was not granted. Each vegetation remnant shown in RE mapping (EPA 2005b) and intersected by the corridor was sampled in detail at least once. Unmapped remnants of sufficient size or width to be mappable according to Queensland Herbarium mapping methodology (EPA 2005a) were also sampled<sup>2</sup>. This was done to verify the mapping, and to check for targeted Rare or Threatened flora species known to occur in the area.

### 6.3.3.4 Existing Field Data

Brief site data collected in April 2007 by BMT WBM for a preliminary assessment of the corridor were incorporated into this study and used as the main source of background information. Brief site data included the recording of dominant plant species at each site, and other relevant information such as condition and soil type. Conspicuous

<sup>2</sup> According to Herbarium methodology the remnant size can be as small as 0.25 ha and/or 25 m wide.



Threatened species were also targeted as part of the preliminary assessment. For example, for the Threatened species listed in the EPBC Act, *Cycas* spp. were conspicuous in eucalypt forest during reconnaissance, and *Atalaya* spp. in softwood scrub were also relatively distinctive. Publicly accessible roads were mostly used in this stage of the study, and site data is presented in Appendix E2.

### 6.3.3.5 Databases

Two publicly accessible databases with restricted locational precision were searched to identify Rare or Threatened flora known to occur, or likely to occur, in the project area and surrounds. Both Rare and Threatened categories are used in the NC Act, and Threatened is used in the EPBC Act. Both searches were done by specifying coordinates (defining a rectangle) that contained the entire project area:

- Wildlife Online – a Queensland EPA internet database accessible to the public which stores records of plant collections (and other groups including algae and fungi) for a search area defined by the user. Rare and Threatened species can be selected from the data. The latest data retrieval was performed on 7 August 2007.
- EPBC Act Protected Matters Report – a DEWHA internet database accessible to the public which lists Rare and Threatened Species for a search area defined by the user. The latest data retrieval was performed on 3 July 2008.

The likelihood of occurrence of individual Threatened flora species (strictly, they are *taxa*, since sub-species levels can apply) was assessed in two ways: firstly whether the species was considered likely to occur within close proximity to the corridor (creating a risk of disturbance); secondly whether the species was considered likely to be consistently associated with one or more of the categories defined by the GIS coverages (e.g. a particular RE on the RE mapping).

### 6.3.4 Field Investigation

A field survey for Threatened species was done concurrently with a detailed site survey as described below for vegetation community sampling, for which both conspicuous and inconspicuous species were searched. Conspicuous Threatened species were also searched for during the entire course of survey work, particularly during Brief site surveys.

Field surveys were undertaken to assess the following:

- To determine where the mapped remnant vegetation communities would be directly intersected by the corridor, by intensive 50 m x 10 m site surveys in a representative location, identifying structure, condition and usually all species (depending on appropriate level of detail). This data was then used to verify the accuracy of the RE mapping and if necessary, revise the mapping in the adjacent area (i.e. approximately a 200 m radius), by broader reconnaissance and/or air-photo interpretation. Vegetation sampling was done in accordance with Queensland Herbarium vegetation survey methodology (EPA 2005a). Sample types were either:
  - **Detailed** – all plant species present on-site were recorded within a 50 m x 10 m plot, along with structural details such as height and cover. This type of site is consistent with a Queensland Herbarium Secondary site, except stem counts were not included. It is more comprehensive than a Queensland Herbarium Tertiary site, in that all plant species in the plot are recorded. Every RE (each type, not each remnant) which occurred along the corridor was intended to be sampled at least once, so that correct RE allocation for the RE mapping could be verified. Detailed sites were only considered in remnants of good condition, so that structural data and complete species lists were meaningful, and could be applied (extrapolated) to other remnants within the corridor of the same RE
  - **Short** – mid-way between a Detailed site and a Brief site. A short list of the most common species was made of the site but structural details were not formally recorded. Like a Detailed site, a Short site was usually strategically placed, and was often a site that was originally intended to be Detailed. Detailed sites were not done where, on initial field assessment, site conditions indicated that a Detailed site was not necessary or not possible (e.g. due to disturbance such as a selectively thinned canopy, or weed infestation). A Short site was also used to confirm an RE when a Detailed site had been done in a nearby remnant of the same RE, especially to consolidate a detailed species list for the local variation of any particular RE
  - **Brief** – only the dominant and indicator plant species present on-site were recorded. This type of site is consistent with a Queensland Herbarium Quaternary site, but some Brief sites were extended species lists similar to a Short site. The data were usually recorded without leaving the vehicle. Brief sites were done to confirm RE mapping, and get an overview of the project area. Brief sites were essential for checking mapped RE polygons.

- To visually check for the presence of Rare or Threatened flora as identified by relevant legislation, which may have been identified as occurring somewhere in the area of the proposed corridor. Any Rare or Threatened species seen *ad hoc* during the vegetation survey were also recorded
- To visually check for small remnants of vegetation which may not feature on the RE mapping due to error or scale, and to assess the value of those remnants based on any or all of the criteria in these methods. These unmapped remnants included stands of trees, or other communities (including grasslands and wetlands) and significant trees (e.g. old growth).

Photographs were taken of each site to illustrate vegetation structure (see Appendix E2), and the position was recorded, where possible, with a hand-held Global Positioning System (GPS). Flora species unable to be identified in the field were collected for later identification. Individual unknown plants were not collected if whole plant removal was required, and instead, close-up photographs and descriptions were taken, along with highly specific location information for return to site if necessary. Public roads and reserves were used to visit all possible publicly accessible sampling points along the corridor, and relevant areas adjacent to the corridor. When areas of interest were on private property, sampling was conducted where permission was granted by landowners.

The location of each sample site is shown overlaid on the RE mapping in Figure 6.1. Sites are identified by arbitrary numerical allocation, in order (north to south) along the corridor, but with subsequent additions of alphabetical characters to allow for insertion of new sites. Some site numbers have been omitted, indicating that a proposed site was subsequently considered redundant or unnecessary, in light of further information becoming available (e.g. a revision of the proposed corridor alignment).

## 6.4 Assumptions and Limitations

Preliminary site surveys using Brief site observations were done in April 2007, with subsequent Detailed site surveys conducted from 27 August to 7 September 2007. There was little rainfall before and during surveys resulting in drought conditions throughout the project area. Rainfall events in the catchment in February 2008 are likely to have had a positive impact on ground layer flora, but it is not expected that any additional Rare or Threatened species would establish following the rain.

RE mapping (EPA, 2005b) in the project area is relatively coarse and suitable for general planning only. It is not suitable for precise location of infrastructure, and errors of tens or hundreds of metres can occur. The exact extent of some existing vegetation communities is still uncertain due to the age of the aerial photography used in the study. Sources of error that may cause planning problems are:

- **Scale** – base mapping relies on satellite images in many areas and this is coarser than the aerial photography
- **Time lapse** – a considerable amount of clearing or disturbance can occur between the time the remote sensing was done and when the planning begins
- **Remote sensing interpretation error** – this can lead to incorrect REs being applied to vegetation types (due to inability to access ground-truthing areas)
- **Local variation in vegetation type** – this can render RE classification too coarse to be correct. Sub-REs are developed for this purpose but they are being continually developed.

It was assumed for the purposes of the EIS that the ROW for the project is generally 30 m wide, but can be reduced in sensitive areas.

## 6.5 Relevant Legislation and Policy

The Queensland and Commonwealth statutes, regulations and policies relevant to this chapter are:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) – this Act protects Threatened Species at the Federal level
- Queensland *Nature Conservation Act 1992* (NC Act) (and Regulations and Conservation Plans) – this Act protects Threatened Species at the State level
- Queensland *Vegetation Management Act 1999* (VM Act) – this Act protects vegetation from unauthorised clearing (i.e. it focuses on plant communities, not individual plants)
- Queensland *Integrated Planning Act 1997* (IP Act) – this Act coordinates the various Acts described here with other legislation, particularly local government planning schemes
- Queensland *Land Protection (Pest and Stock Route Management) Act 2002 and Regulation 2003* – the Act and Regulation define noxious weeds, which are formally referred to in the Act as Declared Pest Plants.

## 6.6 Baseline

### 6.6.1 Background

#### 6.6.1.1 Regional Ecosystems

The project area is located within the Brigalow Belt South and Southeast Queensland bioregions. A bioregion is an area of land that is dominated by similar broad landscape patterns that reflect major structural geologies and climate, as well as major changes in floristic and faunal assemblages (adapted from Sattler and Williams 1999).

The southeastern end of the project area (east of Yarwun) is within the Southeast Queensland bioregion, and this area is characterised by part of the Great Dividing Range, and hilly country with eucalypt forest (but with Poplar Box (*Eucalyptus populnea*) notably absent). The northwestern part of the project area is within the Brigalow Belt South bioregion, and is characterised by flatter, undulating country, with less eucalypt forest (but notably with Poplar Box), and more clay plains, sometimes with Brigalow (*Acacia harpophylla*).

The Fitzroy to Bajool section is located entirely within the Brigalow Belt South bioregion, whereas the Bajool to Gladstone section of the project area is situated within both bioregions. These bioregions represent two of the 13 biogeographical regions (i.e. bioregions) located within Queensland (Sattler and Williams 1999). Other bioregions, for comparison, include the Mulga Lands in Southwest Queensland, Mitchell Grass Downs in Central West Queensland and the Wet Tropics around Cairns.

Remnant vegetation in Queensland is mapped by the EPA (2005b) using REs. These are defined by Sattler and Williams (1999) as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. Each RE is defined by a three-number code:

- The first number defines the bioregion. In the Brigalow Belt South bioregion the bioregional number is 11. In the Southeast Queensland bioregion the bioregional number is 12
- The second number defines the Land Zone, which is based on geology, landform and/or soil. Land Zones of Queensland are shown in Table 6.1. Note that in Southeast Queensland, Land Zones 9 and 10 are combined (as "9/10" or "9-10") because of their similarity
- The third number is a unique identifier for the RE, and sometimes there is also a sub-RE identified by a letter of the alphabet. Examples of REs include 11.3.4 and 12.9-10.17b.

The REDD (EPA 2007b) is an internet-based list of REs, with descriptions that are continually updated, and explanations of the RE classification system, including bioregions, land zones, and the individual REs.

#### 6.6.1.2 Links Between Terrestrial Vegetation, and Fauna and Aquatic Flora

Remnant terrestrial vegetation provides habitat for fauna, so the assessment of terrestrial vegetation is able to provide an indication of fauna habitat value. Refer to Chapter 7, Terrestrial Fauna, for those assessments.

Remnant riparian vegetation provides habitat protection for aquatic flora and fauna, through processes such as shading, erosion control and stream flow regulation. Refer to Chapter 8, Aquatic Flora and Fauna, for assessment of those processes.

### 6.6.2 Remnant Vegetation Communities

#### 6.6.2.1 General

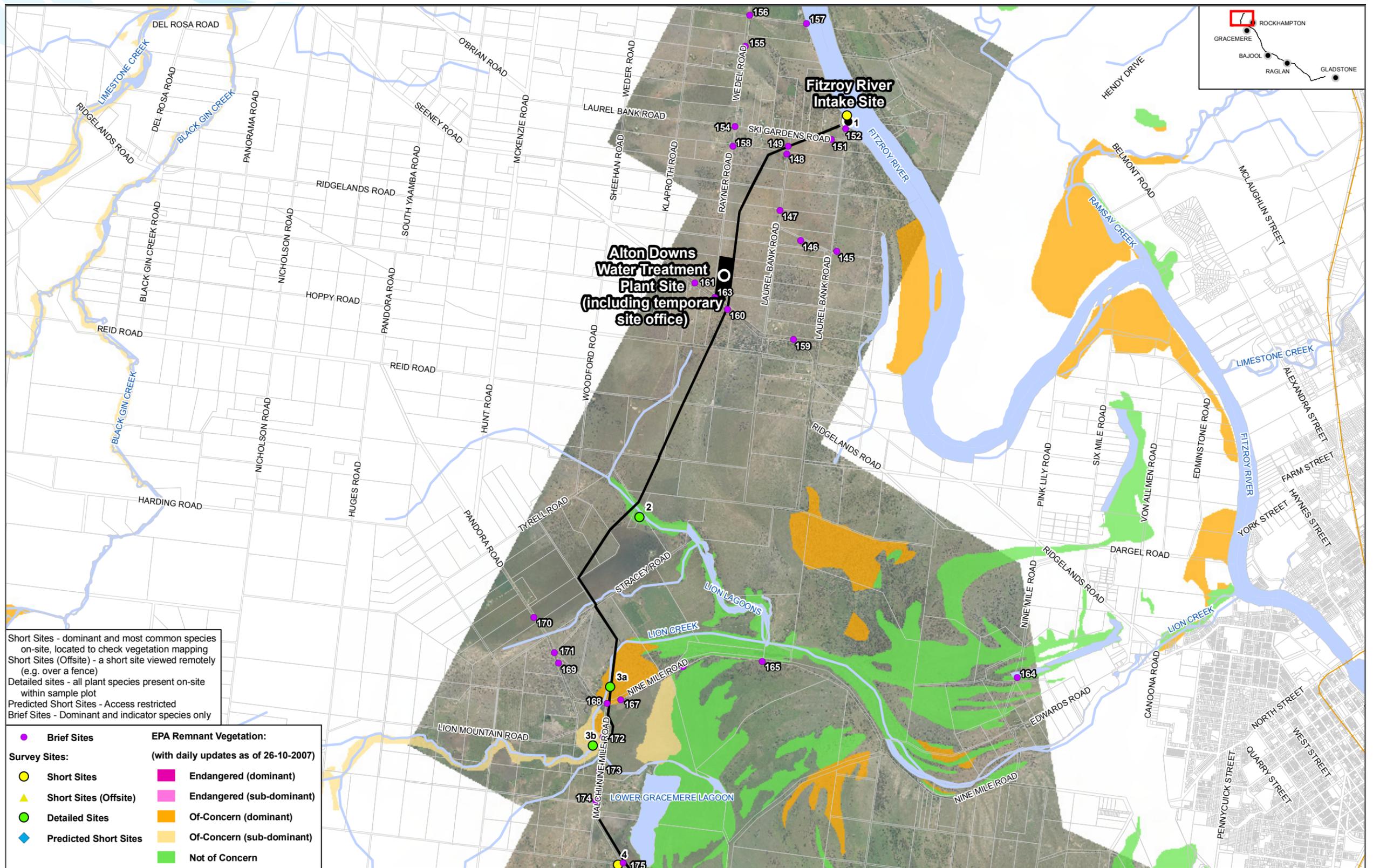
##### **General Condition of Vegetation**

Extended drought conditions in the region at the time of field surveys caused what was perceived to be a relative paucity of terrestrial flora species in the lower stratum (the ground layer). As such, it is likely that the full species composition of many terrestrial vegetation communities was not recorded. Upper strata (trees and shrubs) did not appear to be adversely affected by drought. It is likely that recent rain and flooding in the region will have had a positive impact on ground layer flora. However it is not expected that any additional Rare or Threatened Species would establish following the rain, and would not significantly alter the baseline terrestrial flora values as outlined in this chapter.

##### **Scrub Areas Along the Full Length of the Corridor**

*Softwood scrub* is a collective term for non-eucalypt species which are often diverse, and sometimes regarded as "dry rainforest". Some types of softwood scrub in this area are classified as "semi-evergreen vine thicket", but *scrub* (or *softwood scrub*) will be used hereon as a collective term. Scrub in the study area is defined mainly by the RE 11.11.18, as this defines lowland scrub on metamorphic sediments. Scrub in the project area was not necessarily restricted to this RE, depending on geological substrate and species assemblage.

Scrub occurred in patches, along (or near) the corridor. Notable localities included the "Hillview" property in the Gracemere area, Twelve Mile Creek and Marble Creek. These patches were sampled as Sites 4, 13 and 14 respectively, and are discussed further in this section.



Short Sites - dominant and most common species on-site, located to check vegetation mapping  
 Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)  
 Detailed sites - all plant species present on-site within sample plot  
 Predicted Short Sites - Access restricted  
 Brief Sites - Dominant and indicator species only

● Brief Sites	EPA Remnant Vegetation:
● Survey Sites:	(with daily updates as of 26-10-2007)
● Short Sites	■ Endangered (dominant)
▲ Short Sites (Offsite)	■ Endangered (sub-dominant)
● Detailed Sites	■ Of-Concern (dominant)
◆ Predicted Short Sites	■ Of-Concern (sub-dominant)
	■ Not of Concern

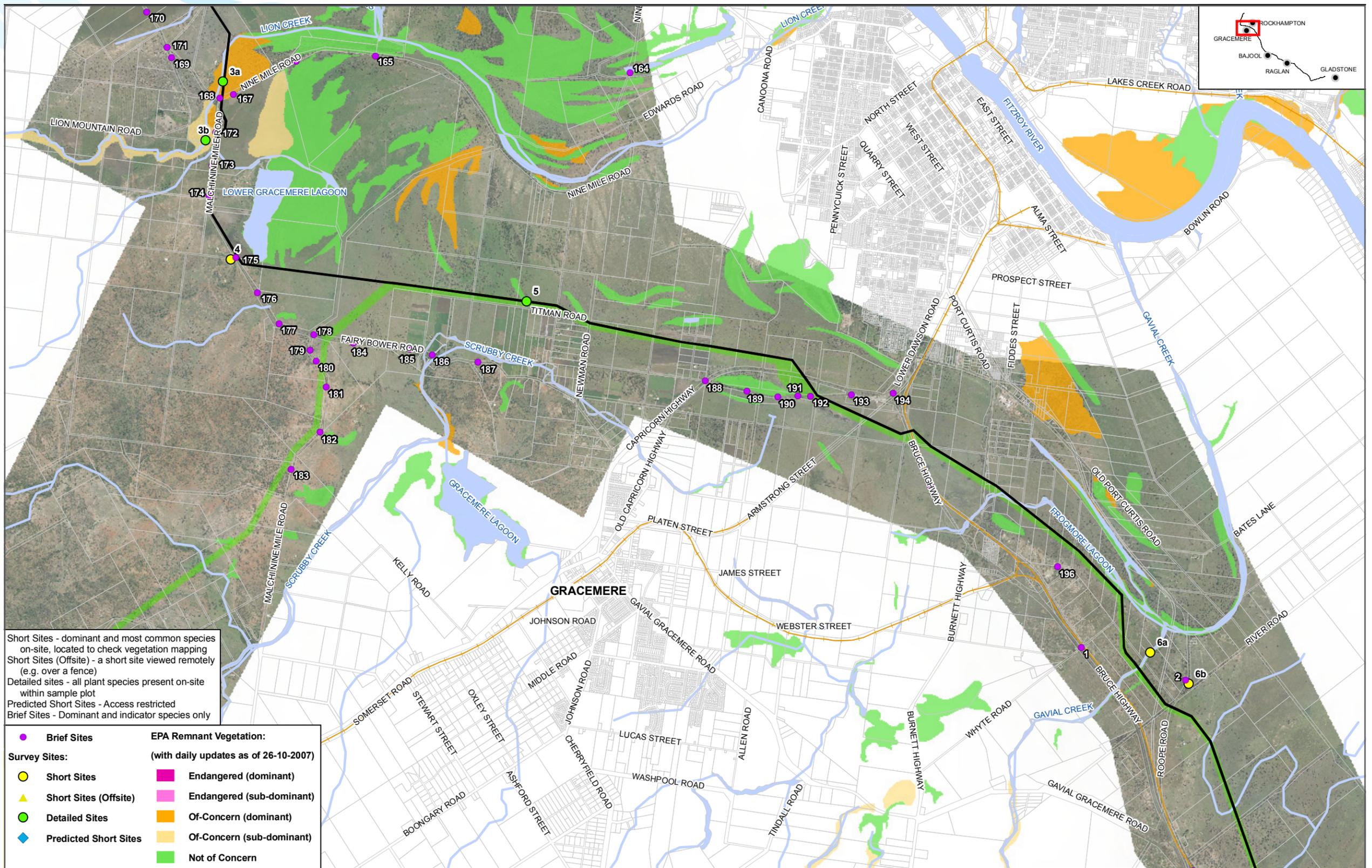
Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 1 of 8

— The Right of Way	— Waterways	— SGIC
● Project Infrastructure	□ Cadastre	□ GSDA
— Railway Line	— LGA Boundary	

0 1 2 3 4 km  
 1:50,000 at A3

ARUP  
 Gladstone Area Water Board

While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



Short Sites - dominant and most common species on-site, located to check vegetation mapping  
 Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)  
 Detailed sites - all plant species present on-site within sample plot  
 Predicted Short Sites - Access restricted  
 Brief Sites - Dominant and indicator species only

● Brief Sites	EPA Remnant Vegetation:
● Survey Sites:	(with daily updates as of 26-10-2007)
● Short Sites	■ Endangered (dominant)
▲ Short Sites (Offsite)	■ Endangered (sub-dominant)
● Detailed Sites	■ Of-Concern (dominant)
◆ Predicted Short Sites	■ Of-Concern (sub-dominant)
	■ Not of Concern

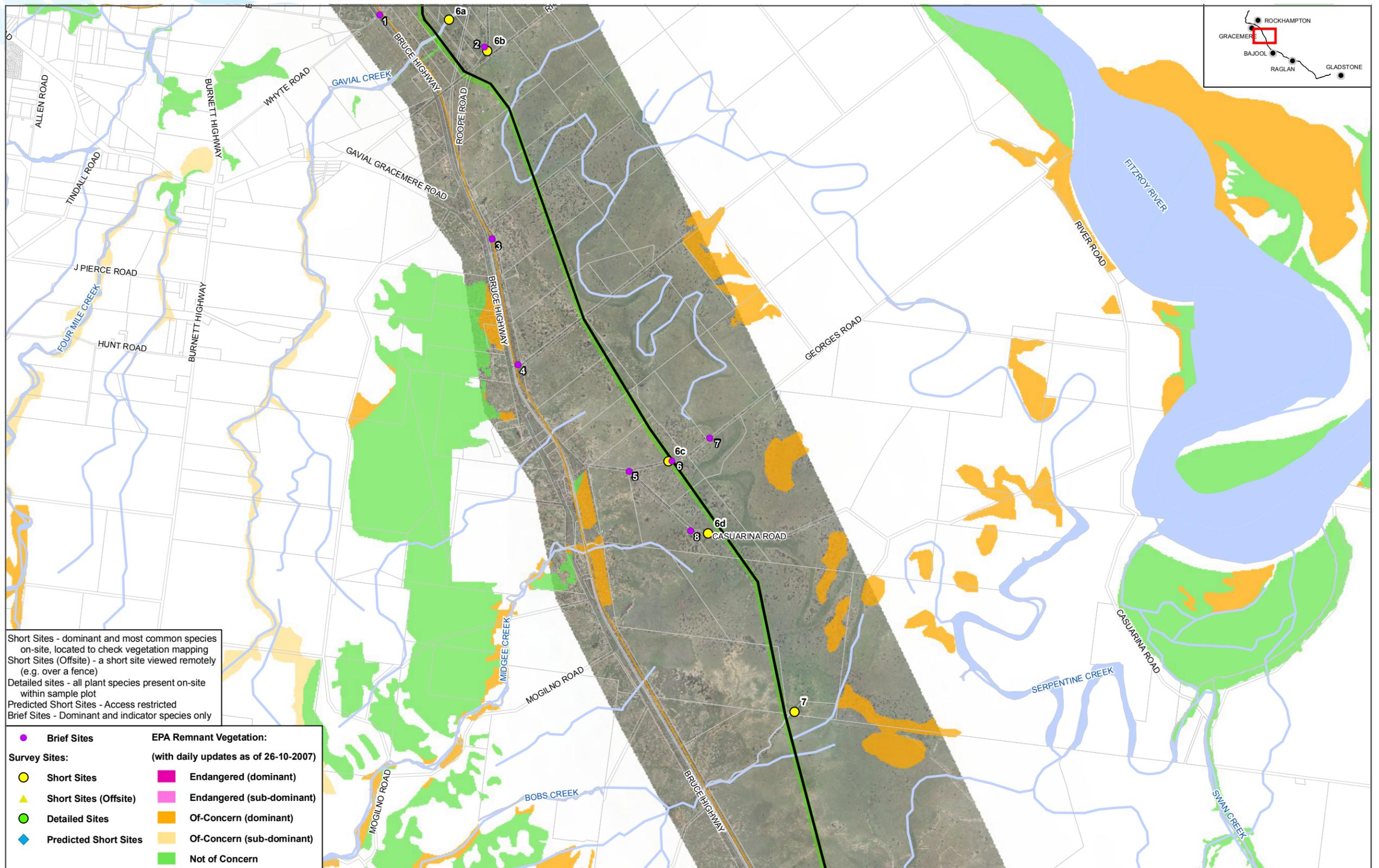
Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 2 of 8

— The Right of Way	— Waterways	— SGIC
● Project Infrastructure	□ Cadastre	□ GSDA
— Railway Line	— LGA Boundary	

0 1 2 3 4 km  
 1:50,000 at A3



While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



Short Sites - dominant and most common species on-site, located to check vegetation mapping  
 Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)  
 Detailed sites - all plant species present on-site within sample plot  
 Predicted Short Sites - Access restricted  
 Brief Sites - Dominant and indicator species only

● Brief Sites	EPA Remnant Vegetation:
● Survey Sites:	(with daily updates as of 26-10-2007)
● Short Sites	● Endangered (dominant)
▲ Short Sites (Offsite)	● Endangered (sub-dominant)
● Detailed Sites	● Of Concern (dominant)
◆ Predicted Short Sites	● Of Concern (sub-dominant)
	● Not of Concern

Gladstone - Fitzroy Pipeline Project

**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**

Sheet 3 of 8

— The Right of Way	— Waterways	— SGIC
● Project Infrastructure	□ Cadastre	▨ GSDA
— Railway Line	— LGA Boundary	

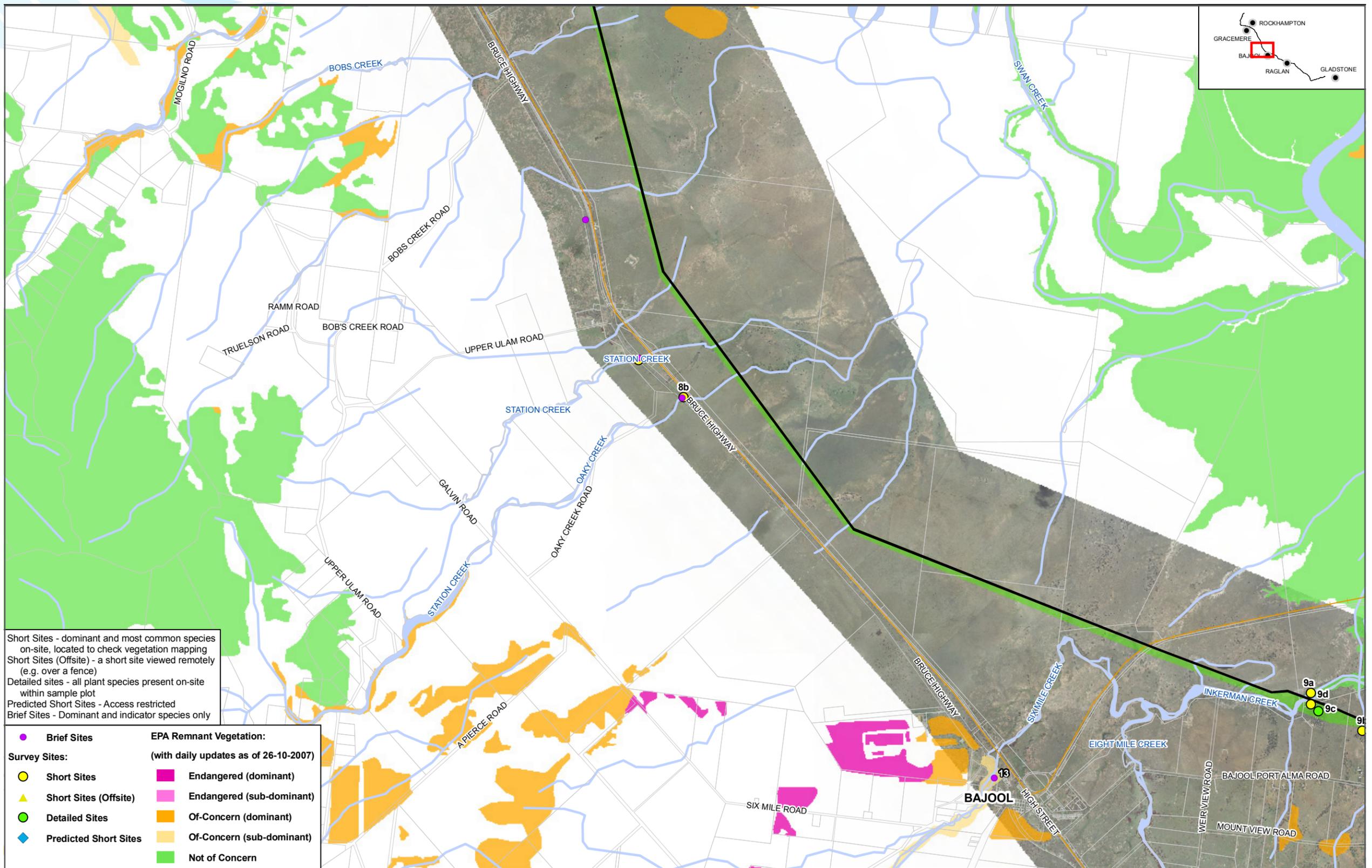
0 1 2 3 4 km

1:50,000 at A3

**ARUP**

Gladstone Area Water Board

While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



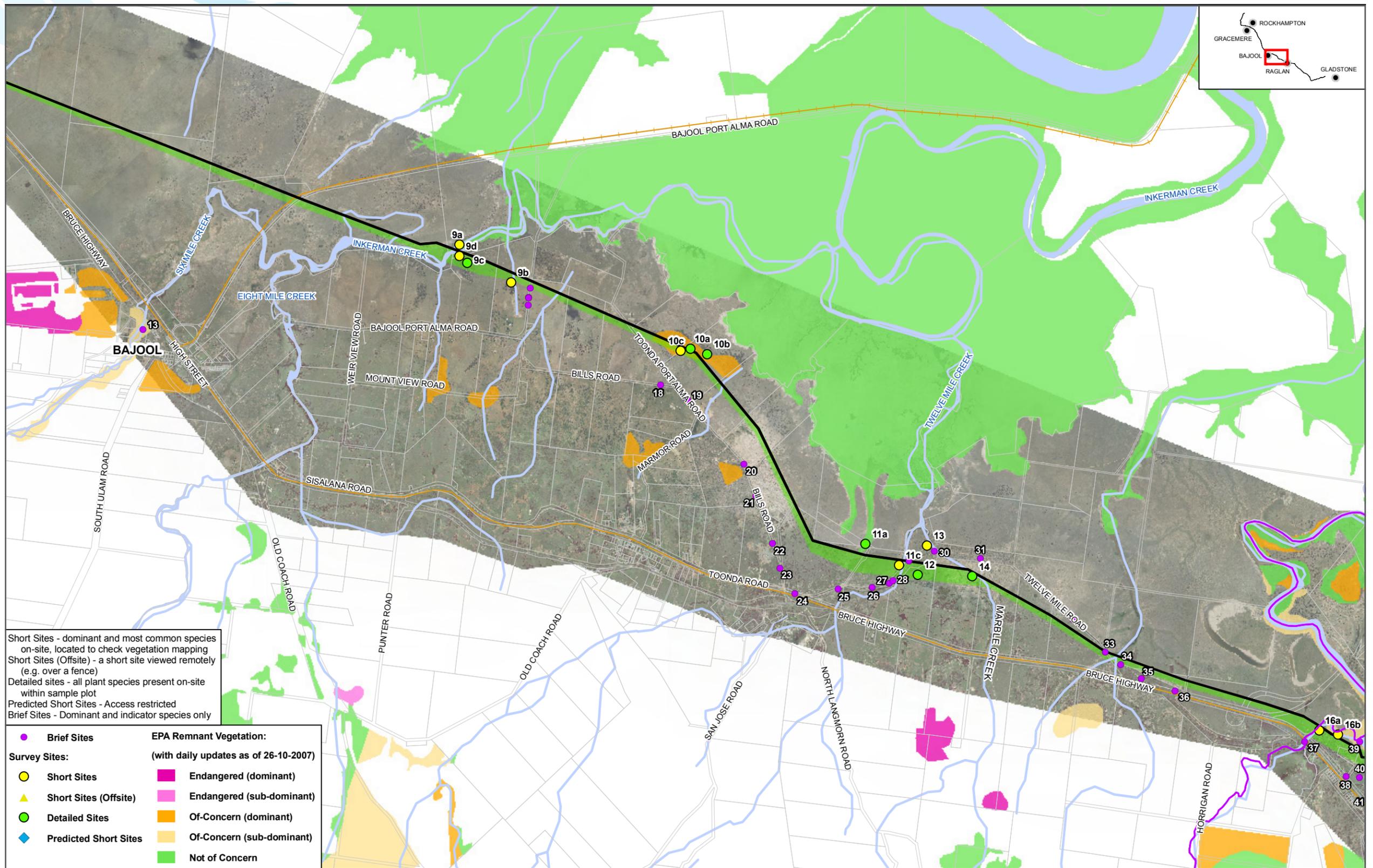
Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 4 of 8

—	The Right of Way	—	Waterways	—	SGIC
●	Project Infrastructure	□	Cadastre	□	GSDA
—	Railway Line	—	LGA Boundary		

0 1 2 3 4 km  
 1:50,000 at A3



While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



Short Sites - dominant and most common species on-site, located to check vegetation mapping  
 Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)  
 Detailed sites - all plant species present on-site within sample plot  
 Predicted Short Sites - Access restricted  
 Brief Sites - Dominant and indicator species only

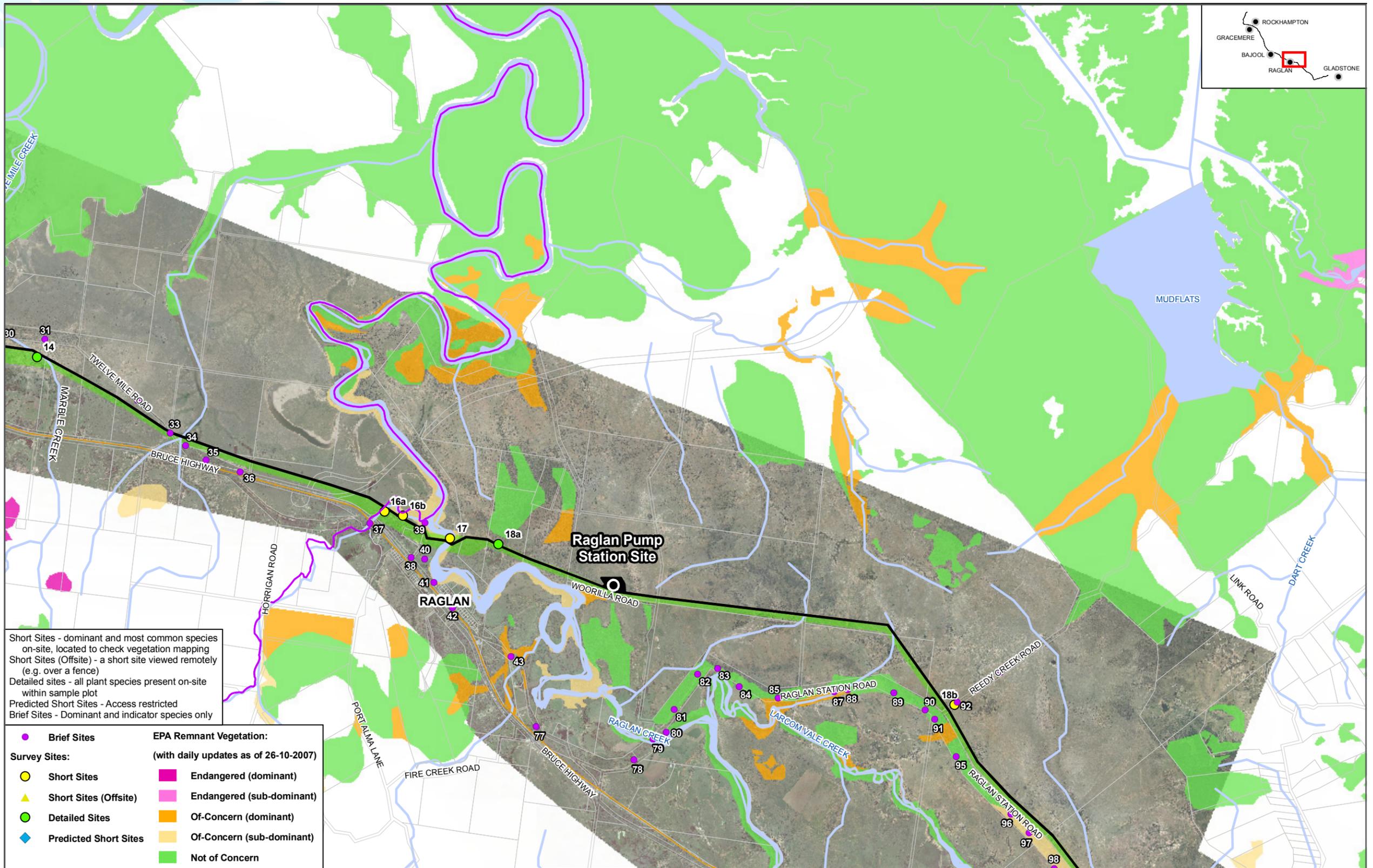
● Brief Sites	<b>EPA Remnant Vegetation:</b> (with daily updates as of 26-10-2007)
● Survey Sites:	
● Short Sites	■ Endangered (dominant)
▲ Short Sites (Offsite)	■ Endangered (sub-dominant)
● Detailed Sites	■ Of-Concern (dominant)
◆ Predicted Short Sites	■ Of-Concern (sub-dominant)
	■ Not of Concern

Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 5 of 8

— The Right of Way	— Waterways	— SGIC	0 1 2 3 4 km	N
● Project Infrastructure	□ Cadastre	□ GSDA	1:50,000 at A3	
— Railway Line	— LGA Boundary			



While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



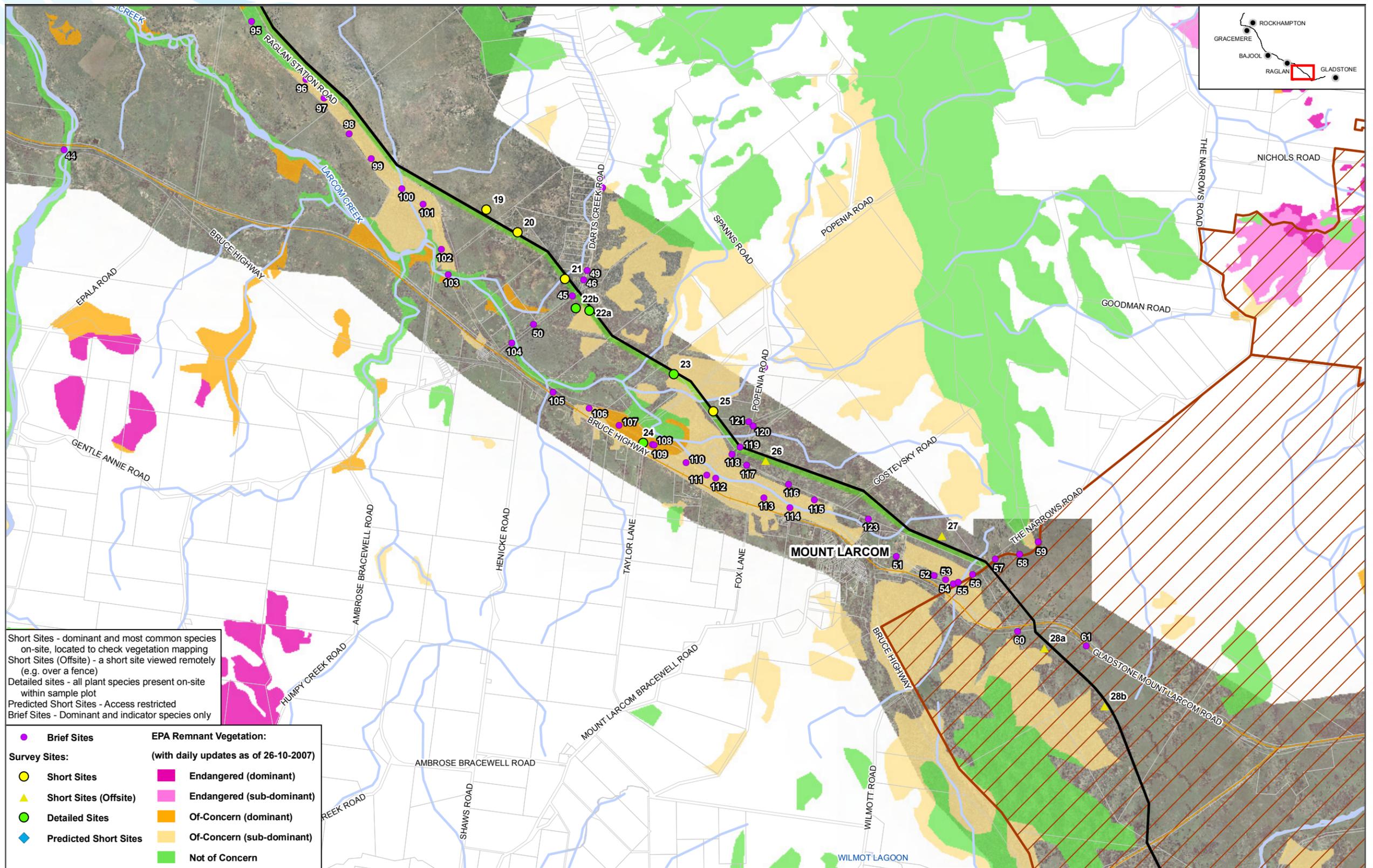
Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 6 of 8

—	The Right of Way	—	Waterways	—	SGIC
●	Project Infrastructure	□	Cadastre	□	GSDA
—	Railway Line	—	LGA Boundary		

0 1 2 3 4 km  
 1:50,000 at A3



While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.



Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 7 of 8

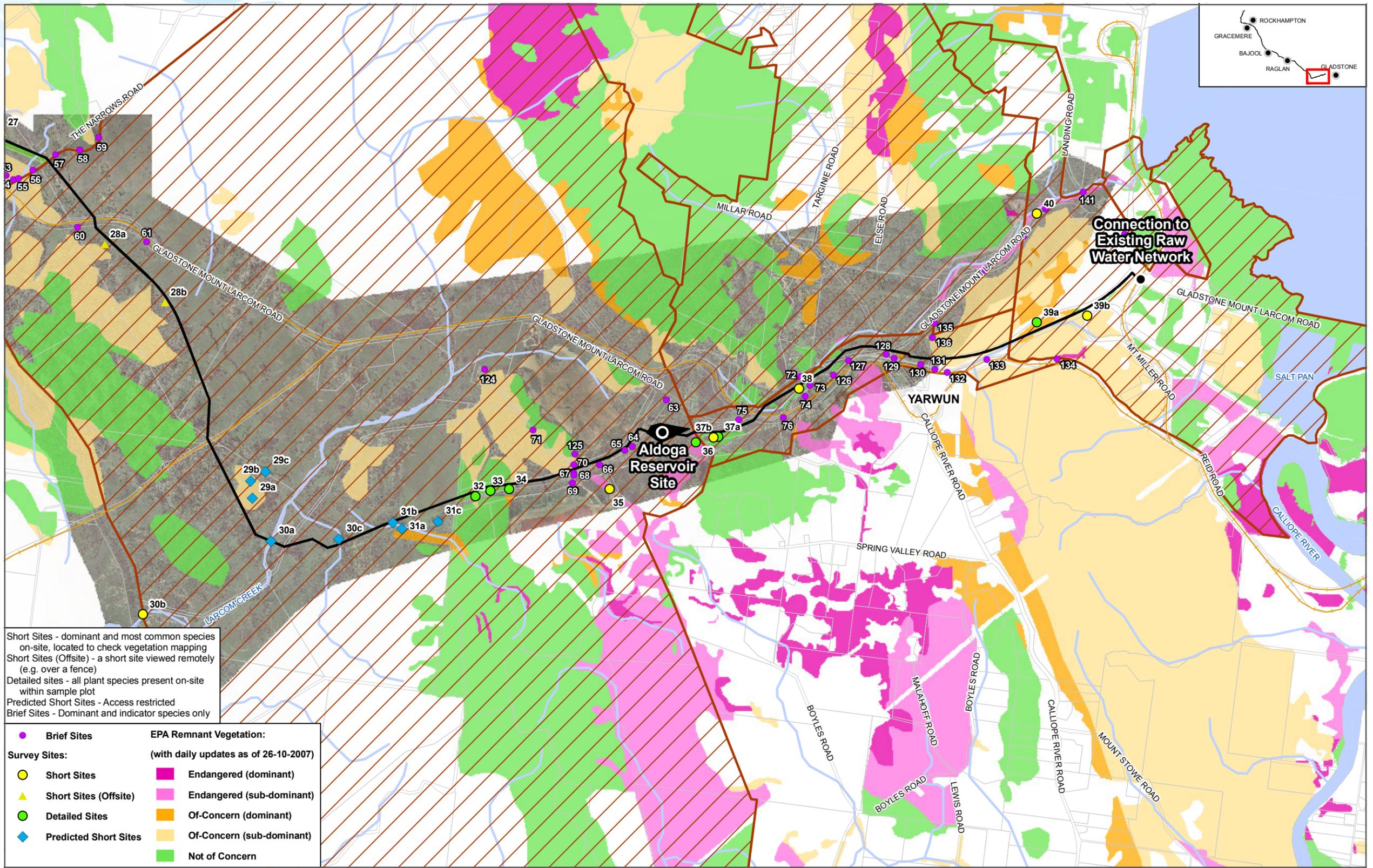
—	The Right of Way	—	Waterways	—	SGIC
●	Project Infrastructure	□	Cadastre	▭	GSDA
—	Railway Line	—	LGA Boundary		

0 1 2 3 4 km  
 1:50,000 at A3

N

Gladstone Area Water Board

While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.

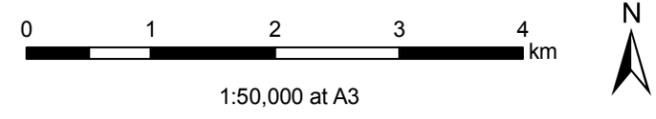


Short Sites - dominant and most common species on-site, located to check vegetation mapping  
 Short Sites (Offsite) - a short site viewed remotely (e.g. over a fence)  
 Detailed sites - all plant species present on-site within sample plot  
 Predicted Short Sites - Access restricted  
 Brief Sites - Dominant and indicator species only

- |                         |                                       |
|-------------------------|---------------------------------------|
| ● Brief Sites           | EPA Remnant Vegetation:               |
| ● Survey Sites:         | (with daily updates as of 26-10-2007) |
| ● Short Sites           | ■ Endangered (dominant)               |
| ▲ Short Sites (Offsite) | ■ Endangered (sub-dominant)           |
| ● Detailed Sites        | ■ Of-Concern (dominant)               |
| ◆ Predicted Short Sites | ■ Of-Concern (sub-dominant)           |
|                         | ■ Not of Concern                      |

Gladstone - Fitzroy Pipeline Project  
**Figure 6.1 - Regional Ecosystem Mapping With Site Locations**  
 Sheet 8 of 8

- |                          |                |        |
|--------------------------|----------------|--------|
| — The Right of Way       | — Waterways    | — SGIC |
| ● Project Infrastructure | □ Cadastre     | □ GSDA |
| — Railway Line           | — LGA Boundary |        |



While every care is taken to ensure the accuracy of this data, the Gladstone Area Water Board (GAWB) makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the plan being inaccurate or incomplete in any way and for any reason. It should also be noted that final survey of the pipeline alignment and SGIC boundary are yet to occur and may result in changes to the alignments depicted here.

Table 6.1 Land Zones of Queensland from EPA (2007b)

Land Zone number	Definition (central concept, followed by lay terminology)
1	Deposits subject to periodic tidal inundation Tidal flats and beaches
2	Quaternary coastal sand deposits Coastal dunes
3	Quaternary alluvial systems Alluvium (river and creek flats)
4	Flat to gently undulating Tertiary clay plains Clay plains not associated with current alluvium
5	Plains and plateaus on Tertiary land surfaces, generally with medium-to- coarse-textured soils Old loamy and sandy plains
6	Quaternary inland dunefields Inland dunefields
7	Exposed or shallowly covered duricrusts Ironstone jump-ups
8	Plains and hills on Cainozoic flood basalts Basalt plains and hills
9	Gently undulating landscapes on more or less horizontally bedded fine grained sedimentary rocks Undulating country on fine grained sedimentary rocks
10	Plateaus, scarps and ledges with shallow soils on more or less horizontally bedded medium-to-coarse-grained sedimentary rocks Sandstone ranges
11	Hills and lowlands on metamorphosed sedimentary rocks Hills and lowlands on metamorphic rocks
12	Hills and lowlands on granitic and other pre-Cainozoic igneous rocks Hills and lowlands on granitic rocks

### Fitzroy to Bajool

The proposed pipeline corridor from the Fitzroy River through to Bajool consists of alluvial country in the Gracemere and Gavial areas, with dark, high clay content soils, commonly referred to as “black soil”. There were a high number of permanent and ephemeral wetlands in these areas. Tree cover was generally sparse as a result of clearing for pasture, and was predominantly scattered Coolabah (*Eucalyptus coolabah*), Blue Gum (*E. tereticornis*), and further south around Bajool, Poplar Box (*E. populnea*).

There were small patches (i.e. less than approximately 1 ha) of remnant scrub within this length of the corridor, with one notable patch in the Gracemere area.

### Bajool to Gladstone

Further south around Marmor, the area was slightly hilly, with areas of scrub and Brigalow (*Acacia harpophylla*), which have mostly been cleared. There were small patches (i.e. less than approximately 1 ha) of remnant scrub within this length of the corridor, plus a number of areas of scrub regrowth.

Hills increased in size further south, indicating a change in geology, and the predominant vegetation type around Raglan, Ambrose and Mt Larcom was Grey Box forest (*Eucalyptus moluccana*). Soils tended to be grey and silty, with a lower clay content, and geological parent material was metamorphic or sedimentary, but not generally alluvial like the northern end of the corridor.

The area from Mt Larcom to Gladstone had substantially larger hills of metamorphic origin, which increased slightly in eucalypt species diversity, with species including Narrow-leafed Ironbark (*Eucalyptus crebra*) and Spotted Gum (*Corymbia citriodora*). There were still alluvial areas, but there was a change around Aldoga from the Brigalow Belt South bioregion in the west, to the Southeast Queensland bioregion in the east. This meant the remaining predominant trees on these alluvial plains tended to be Blue Gum (*E. tereticornis*), and not the others described for the northern (and western) end of the corridor.

In most cases the observed remnant vegetation communities were consistent with REs, but appropriate notes were made where there was disagreement. The RE mapping, with site numbers, is shown in Figure 6.1. Detailed site observations (and also Short sites) are shown in Appendix E2.

The mapped REs which occur along the corridor, and the brief descriptions of each RE (EPA 2007b) are shown in Table 6.2.

Table 6.2 Regional Ecosystems that Occur Along the Corridor

RE code	Vegetation management status	Short description from RE description database (EPA 2007b)	General area	Mapping comments
11.1.2	Not Of Concern	Samphire forbland on marine clay plains	Bajool	
11.1.2a	Not Of Concern	Sub-type of 11.1.2. Bare mud flats on Quaternary estuarine deposits, with very isolated individual stunted mangroves such as Grey Mangrove ( <i>Avicennia marina</i> ) <i>Avicennia marina</i> and/or Spurred Mangrove ( <i>Ceriops tagal</i> ). May have obvious salt crusts on the soil surface	Bajool	
11.1.4	Not Of Concern	Mangrove forest/woodland on marine clay plains	Raglan Creek	
11.1.4d	Not Of Concern	Sub-type of 11.1.4. Occurs on the landward edge of the tidal flats and in the upper tidal reaches of creeks and rivers where there is a high freshwater influence	Inkerman Creek	
11.3.3	Of Concern	Coolabah ( <i>Eucalyptus coolabah</i> ) woodland on alluvial plains	Gracemere	
11.3.4	Of Concern	Blue Gum ( <i>Eucalyptus tereticornis</i> ) and/or <i>Eucalyptus</i> spp. tall woodland on alluvial plains	Gracemere	
11.3.25	Not Of Concern	Blue Gum ( <i>Eucalyptus tereticornis</i> ) or River Red Gum ( <i>E. camaldulensis</i> ) woodland fringing drainage lines	Gavial Creek/ Aldoga	

RE code	Vegetation management status	Short description from RE description database (EPA 2007b)	General area	Mapping comments
11.3.26	Not Of Concern	Grey Box ( <i>Eucalyptus moluccana</i> ) or <i>E. microcarpa</i> woodland to open forest on margins of alluvial plains	Ambrose/Darts Creek	Extensive, but may not always be on Land Zone 3, hence would be a different RE
11.3.27	Not Of Concern	Freshwater wetlands	Gracemere	
11.3.27c	Not Of Concern	Sub-type of 11.3.27. Mixed grassland or sedgeland with areas of open water +/- 1 aquatic species. Dominated by a range of species including Spike Sedge ( <i>Eleocharis</i> spp.), Marsh Wort ( <i>Nymphoides</i> spp.) and sometimes Common Weed ( <i>Phragmites australis</i> ). Occurs on closed depressions on alluvial plains that are intermittently flooded in inland parts of the bioregion	Gracemere	
11.3.29	Not Of Concern	Ironbark ( <i>Eucalyptus crebra</i> ), Bendo ( <i>E. exserta</i> ), Paperbarks ( <i>Melaleuca</i> spp.) woodland on alluvial plains	Yarwun	More the lowlands east of the corridor
11.11.4	Not Of Concern	Ironbark ( <i>Eucalyptus crebra</i> ) woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges.	Aldoga	
11.11.4c	Not Of Concern	Sub-type of 11.11.4. Grey Box ( <i>Eucalyptus moluccana</i> ) dominated woodland. Other tree species listed for 11.11.4 may occur as sub- or co-dominant species	Aldoga	
11.11.5	Not Of Concern	Microphyll vine forest ± Hoop Pine ( <i>Araucaria cunninghamiana</i> ) on old sedimentary rocks with varying degrees of metamorphism and folding	Aldoga	Not on corridor
11.11.15	Not Of Concern	Ironbark ( <i>Eucalyptus crebra</i> ) woodland on deformed and metamorphosed sediments and interbedded volcanics. Undulating plains	Aldoga	
11.11.16	Of Concern	Northern Blackbutt ( <i>Eucalyptus cambageana</i> ), Brigalow ( <i>Acacia harpophylla</i> ) woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	Marmor	
11.11.18	Endangered	Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	Aldoga	Restricted to very small un-mappable area on corridor
12.3.1	Endangered	Gallery rainforest (notophyll vine forest) on alluvial plains	Boat Creek	
12.3.3	Endangered	Blue Gum ( <i>Eucalyptus tereticornis</i> ) woodland to open forest on alluvial plains	Boat Creek	
12.3.7	Not Of Concern	Blue Gum ( <i>Eucalyptus tereticornis</i> ), Weeping Bottlebrush ( <i>Callistemon viminalis</i> ), River Oak ( <i>Casuarina cunninghamiana</i> ) fringing forest	Boat Creek	
12.11.6	Not Of Concern	Spotted Gum ( <i>Corymbia citriodora</i> ), Ironbark ( <i>Eucalyptus crebra</i> ) open forest on metamorphics ± interbedded volcanics	Yarwun	
12.11.14	Of Concern	Ironbark ( <i>Eucalyptus crebra</i> ), Blue Gum ( <i>E. tereticornis</i> ) woodland on metamorphics ± interbedded volcanics	Yarwun	



The known remnant vegetation communities are discussed in two sections, starting from the extraction point at the Fitzroy River, to an approximate halfway point at Bajool, and then from the halfway point at Bajool, finishing near Gladstone. Unless otherwise specified, all sites are within, or partly within, the proposed corridor. Note that where access permission was withheld or restricted, observations were taken from adjacent to the site, with the use of binoculars.

#### 6.6.2.2 Fitzroy to Bajool

This section describes the baseline findings from the field investigation, from the northern end (at the Fitzroy River) and progressing southwards along the project area alignment.

##### **Short site 1**

The extraction point on the Fitzroy River had a narrow strip of remnant riverine forest, consisting mostly of Blue Gum (*Eucalyptus tereticornis*), Coolabah (*Eucalyptus coolabah*) and Carbeen (*Corymbia tessellaris*). The understorey had been removed by grazing and other activities. There was also a Declared Pest Plant (Water Hyacinth (*Eichhornia crassipes*)) seen at this site.

##### **Detailed site 2**

There was an area of wetland mapped on RE mapping (EPA 2005b) past the end of Tyrrel Road, which occurred mainly on Lot 102 LN176. Due to restricted access to this property, the adjacent property to the west was sampled (Lot 3 RP843225), with access from the southern edge of the wetland. Aquatic vegetation at the site was in good general condition (i.e. inundated, native aquatic vegetation with limited aquatic weed infestation). However, approximately 100 m north of this location (the northern edge), sampling by aquatic ecologists (2007), found that the banks were infested by fireweed (*Senecio madagascariensis*).

Although clearing has probably occurred around the lagoon, it is possible that riparian trees were originally sparse or absent close to the edge of the lagoon in this area.

##### **Detailed site 3a**

An area of Blue Gum (*Eucalyptus tereticornis*) and Coolabah (*Eucalyptus coolabah*) was observed near the T-junction of Malchi Nine Mile Road and Fairy Bower Road, conforming with the representation on mapping as Of Concern RE 11.3.3 (EPA 2005b). This area had few trees, indicating the diffuse edge of the very open woodland, and/or selective clearing. Only a few individual trees occurred in the proposed corridor.

##### **Detailed site 3b**

Very large Blue Gum (*Eucalyptus tereticornis*) old growth trees were observed at this site, in conformance with representation on RE mapping as Of Concern RE 11.3.3 (EPA 2005b). Other tree species present included Sally Wattle (*Acacia salicina*) and Coolabah (*Eucalyptus coolabah*). The shrub layer was conspicuously absent, possibly due to clearance for agricultural purposes.

##### **Short site 4**

A small, unmapped remnant of softwood scrub is close to the corridor on Malchi Nine Mile Road. This scrub falls into the category of Endangered "semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions", as defined in the EPBC Protected Matters Report. The property name was "Hillview" (Lot 2 RP611138), and was on the western side of the road. Figs (*Ficus* spp.) were observed at the site and indicate a community consistent with a softwood scrub ecosystem.

##### **Detailed site 5**

There was a small wetland north of Fairy Bower Road, represented on RE mapping as Not Of Concern RE 11.3.27 (EPA 2005a) about 400 m west of Fogarty Road, on Lot 248 LIV401036. The wetland was a highly disturbed lagoon, with a high degree of weed infestation and limited native aquatic vegetation. Weed infestation was unidentifiable, however were known to be weeds due to invasive growth habit. There was also a lagoon several hundred metres to the east, of similar condition, but it had been dammed, and was not of original wetland form (i.e. artificial water level).

##### **Short site 6a**

Large Blue Gum (*Eucalyptus tereticornis*) individuals were observed along the high banks of Gavia Creek. The site was heavily affected by grazing, with a high level of weed infestation.

##### **Short site 6b**

An unmapped remnant of Poplar Box (*Eucalyptus populnea*) and Blue Gum (*Eucalyptus tereticornis*) was observed on the road reserve near the intersection of Roope Road and River Road.

##### **Short sites 6c and 6d**

Unmapped remnants of Poplar Box (*Eucalyptus populnea*) and some Blue Gum (*Eucalyptus tereticornis*) were observed on the road reserves of Georges Road (Site 6c) and Casuarina Road (Site 6d).

### **Short sites 7, 8a and 8b**

Detailed sites were planned for Bob's Creek (on Lot 5 RP604251), Station Creek and Oakey Creek (on Lot 4 RP600951) (Sites 7, 8a and 8b respectively). Due to restricted access, substitute Brief sites were implemented at upstream crossings on the Bruce Highway (upstream of the proposed corridor) with the same site identifiers. Riparian vegetation on these creeks was generally Blue Gum (*Eucalyptus tereticornis*) and River Oak (*Casuarina cunninghamiana*). Weed infestation was high, so native aquatic macrophyte habitat was poor. It is assumed that the vegetation would be similar at the creek crossing locations on the corridor, although there may be some tidal or marine influence, in which case there may be an intergrade into mangrove communities. In this case the River Oak (*Casuarina cunninghamiana*) would be replaced by Swamp Oak (*Casuarina glauca*), and the mangrove species would probably be Grey Mangrove (*Avicennia marina*). Satellite imagery and high resolution aerial photography available at the time of preparation of this chapter suggests that the vegetation away from the riparian zones on these three creeks has been cleared.

### **6.6.2.3 Bajool to Gladstone.**

This section describes the baseline findings from the field investigation, from approximately halfway along the project area alignment, and progressing southwards towards Gladstone.

#### **Short site 9a**

Remnant mangroves dominated by Grey Mangrove (*Avicennia marina*) were observed at this site, on Inkerman Creek, west of the Bajool Port Alma Road. There were also patches of saltmarsh. These observations were in conformance with representation on RE mapping as Not Of Concern RE 11.1.2 (EPA 2005b).

#### **Short site 9d**

Unmapped Brigalow (*Acacia harpophylla*) was observed at this site, with species composition and structure of this community similar to that of site 9c (refer below).

#### **Detailed site 9c**

A 200 m stretch of low-growing Brigalow (*Acacia harpophylla*) with extensive gilgai (a high density of small waterholes or pools, each ranging from about 5 to 10 m in diameter) was observed on the south side of Inkerman Creek on Lot 68 DS141. This patch of vegetation occurred between the tidal interface of Inkerman Creek, and the taller Brigalow further east towards the Toonda Port Alma Road. Brigalow (*Acacia harpophylla*) is a Threatened Ecological Community under the EPBC Act. However, the height of the community on-site averaged approximately 3 m, which does not meet the structural requirements for the definition of remnant Brigalow (11 to 15 m) under the VM Act, and the EPBC Act uses the structural classification of the VM Act (in

this case RE 11.3.1 or 11.4.3). If the Land Zone in this area was interpreted as Land Zone 4 (clay plains rather than the alluvials of Land Zone 3), then the RE for this Brigalow would become RE 11.4.3 (which has a defined height of 10 to 16 m under the VM Act). The vegetation at Site 9c Rarely exceeded three metres in height and its remnant status was uncertain. Site 9c was typical of the whole patch. Regrowth can be considered as remnant if it reaches 70 percent of the height of its remnant height defined under the VM Act, but the 3 m height of this Brigalow at Site 9c was too short for this.

#### **Short site 9b**

An advanced regrowth patch of Brigalow (*Acacia harpophylla*) was observed approximately 100 m west of the Toonda Port Alma Road (on Lot 69 DS141) and adjacent to the proposed corridor. This regrowth was advanced enough to be considered as remnant. The VM Act considers that regrowth that is at least 70 percent of the accepted remnant height, and at least 50 percent of the accepted remnant cover, can be classified as remnant vegetation.

#### **Detailed sites 10a and 10b, and Short site 10c**

RE mapping shows a remnant Of Concern community off the Toonda Port Alma Road of Northern Blackbutt (*Eucalyptus cambageana*) with Brigalow (*Acacia harpophylla*), mosaiced with Grey Box (*Eucalyptus moluccana*) on Lot 98 DS186 and Lot 99 DS186. However, site inspection found that the remnant was mostly low Brigalow (*Acacia harpophylla*) (probably regrowth) and some Belah (*Casuarina cristata*). There was an infestation of Rubber Vine (*Cryptostegia grandiflora*) around much of the edge of the remnant.

#### **Detailed site 11a**

Marine drainages north of the Twelve Mile Road were identified for sampling although vegetation appeared sparse on aerial photos. Site 11b was located on a road reserve between Lot 84 DS185 and Lot 85 DS185, along a minor creek with marine influence. Although mapped as Not Of Concern (EPA 2005b), a eucalypt regeneration area, fenced off from grazing stock, was observed at the site. Blue Gums (*Eucalyptus tereticornis*) in this enclosure were a maximum of about 4 m tall, with some scattered mature individuals.

#### **Short site 11c**

Riverine vegetation along Twelve Mile Creek on Lot 85 DS185 was observed to be mostly cleared and not remnant. It consisted mainly of scattered Blue Gum (*Eucalyptus tereticornis*) and River Oak (*Casuarina cunninghamiana*).

### **Detailed site 12**

Tall open forest of Blue Gum (*Eucalyptus tereticornis*) in good condition was observed on the road reserve on Twelve Mile Road. This community was also representative of the adjacent Lot 29 DS37.

### **Short site 13**

A small patch of remnant softwood scrub in good condition was observed adjacent to the corridor, and was initially observed as Brief site 130 in initial reconnaissance. This scrub falls into the category of Endangered “semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions”, as defined in the EPBC Act Protected Matters Report.

### **Detailed site 14**

This site at Marble Creek is connected to Short site 13, and was observed to have softwood scrub in good condition, in a gallery along the creek banks on Lot 28 DS37. The scrub along this creek was in good condition and was diverse in species composition. Vegetation away from the creek had been cleared.

### **Short sites 16a, 16b and 17**

In the Horrigan Creek (Short sites 16a and 16b) and Raglan Creek (Short site 17) area, RE mapping identifies extensive areas of Of Concern mangroves, observed to be dominated by Blind Your Eyes Mangrove (*Excoecaria agallocha*) and Grey Mangrove (*Avicennia marina*). A large area of mangroves in good condition was observed on Raglan Creek at Site 17, in conformance with representation on mapping as Not Of Concern RE 11.1.4. An adjacent unmapped, disturbed area of Narrow-leafed Ironbark (*Eucalyptus crebra*) was observed to be in poor condition due to heavy recreational use and dumping.

### **Detailed site 18a**

The southern end of a large remnant of Narrow-leafed Ironbark (*Eucalyptus crebra*) on Lot 36 DT40169 was observed to be in good condition and was less than 100 m north of an unmapped wetland, which had waterbirds on it at the time of survey. A dam was constructed on the wetland, but much of the wetland appeared to be in good condition.

### **Short site 18b**

The dominant species observed at a road reserve on Reedy Creek Road was Poplar Box (*Eucalyptus populnea*), and the forest structure was narrow but intact.

### **Brief sites 19 and 21**

Regrowth areas of diverse scrub-related species were observed on the northeastern side of the Toonda Port Alma Road, as part of a former understorey of cleared Ironbark (*Eucalyptus crebra*) on Lot 101 DS185 and Lot 102 DS185. This regrowth Rarely exceeded 2 m in height and was not considered remnant. There is the possibility that the Threatened species, listed as occurring in the project area, occur in this area of regeneration. This area has been cleared, and is not regarded as having significant ecological value, because the regrowth consists mainly of suckers less than 1 m in height. If allowed to regenerate, however, it might be found to contain one or more of the listed Threatened species. Further investigation of this area is not practicable until the ROW is finalised.

### **Approximately 1 km south of Brief sites 19 and 21**

Scattered mature gums (generally Blue Gum (*Eucalyptus tereticornis*)) were observed approximately 1 km south of the area of scrub regrowth (mentioned above) on Lot 8 DS185.

### **Short site 20**

A patch of advanced regrowth with some scattered original trees on Lot 162 DS61 was observed to be predominantly Narrow-leafed Ironbark (*Eucalyptus crebra*) with some Grey Box (*Eucalyptus moluccana*), with an understorey of Brigalow (*Acacia* spp). The general structure of this regrowth was of insufficient height and cover to be considered as remnant vegetation, but it was approaching remnant status.

### **Short site 21 and Detailed sites 22a and 22b**

A general change in this area to Grey Box (*Eucalyptus moluccana*), which continued eastward, was observed at Short site 21 and Detailed site 22b, both adjacent to Darts Creek Road. Narrow-leafed Ironbark (*Eucalyptus crebra*) tended to occur on hills and rises, and was observed at Detailed site 22a. Blue Gum (*Eucalyptus tereticornis*) was also present in lower lying areas, as represented on mapping as Of Concern RE 11.3.4.. This area generally had remnant vegetation in good condition because of its intact structure and general lack of weed infestation. The area on the eastern side of Darts Creek Road (Detailed sites 22a and 22b) was in the best condition.

### **Detailed site 23**

Remnant Grey Box (*Eucalyptus moluccana*) forest in good condition was observed on Lot 114 DS256 and Lot 6 RP214228. Refer to Detailed site 24 and Short site 26 for sampling of other areas of this Gum Topped Box (*Eucalyptus moluccana*) forest.

### **Detailed site 24**

A large lagoon (Horseshoe Lagoon) was observed northwest of Mt Larcom, 300 m north of the Bruce Highway (outside the proposed corridor). The trees on the corridor (and within Site 24) were Grey Box (*Eucalyptus moluccana*). The site was observed to be disturbed on either side due to a power line easement and a railway line. The dominant trees around the nearby undisturbed lagoon were large Blue Gum (*Eucalyptus tereticornis*).

### **Short site 25**

A grassland area of several hectares, observed adjacent to Popenia Road, may possibly be natural grassland rather than cleared forest. The western side of this grassland was cleared, and has no remnant grassland value, regardless of the authenticity of the main body of grassland to the east.

### **Short site 26**

Gum Topped Box (*Eucalyptus moluccana*) forest was observed on the north side of Popenia Road. Partial clearing has fragmented the canopy of this community.

### **Short site 27**

Grey Box (*Eucalyptus moluccana*) forest was observed north of Mt Larcom near Brief sites 52 to 54, which were observed as remnant (south of the corridor). To the north of this remnant, communities were predominantly disturbed and/or regrowth. Due to restricted access, this site was observed at the property boundary of Lot 20 DT40124, from the northeast corner of the showground.

### **Short sites 28a and 28b**

These areas extend from Mt Larcom to the east for several kilometres (to Aldoga). RE mapping indicated that remnants on these sites were Grey Box (*Eucalyptus moluccana*) (RE 11.3.26) and Blue Gum (*Eucalyptus tereticornis*) (RE 11.3.4), with some Narrow-leaved Ironbark (*Eucalyptus crebra*) (RE 11.11.15) further east. This occurrence of Grey Box (*Eucalyptus moluccana*) forest was confirmed from off-site using binoculars.

### **Short sites 29a and 29b**

Short sites 29a and 29b confirmed RE mapping of Not Of Concern Grey Box (*Eucalyptus moluccana*), which was in good condition. Note that access permission for this site was not granted, and it was not visible from off-site.

### **Short Site 29c**

Note that access permission for this site was not granted, and it was not visible from off-site.

### **Short sites 30a and 30b**

Larcom Creek was sampled at Short sites 30a and Short site 30b. Note that access permission for site 30a was not granted, and aerial photo interpretation was necessary. At both sites, riverine forest was observed along the creek, confirming the continuity of the community.

### **Short Site 30c**

Note that access permission for this site was not granted, and it was not visible from off-site.

### **Short Sites 31a and 31b**

Note that access permission for these sites was not granted, and they were not visible from off-site.

### **Short Site 31c**

The edge of the remnant of Site 31c was viewed remotely (approximately 200m with binoculars from fence line). Short site 31c confirmed that the remnant vegetation in this area was greater in extent than represented by the RE mapping (EPA 2005). The mapped remnant of RE 11.3.4 (Blue Gum (*Eucalyptus tereticornis*)) was surrounded by patchy Narrow-leaved Ironbark (*Eucalyptus crebra*) in good condition. It is possible that the RE mapping needs to be revised in this area to account for Narrow-leaved Ironbark (*Eucalyptus crebra*) (most likely RE 11.11.15).

### **Detailed sites 32, 33 and 34**

A large remnant was observed over these three sites, which confirmed that the RE mapping was correct, with predominantly Narrow-leaved Ironbark (*Eucalyptus crebra*) at Site 32 (as Not Of Concern RE 11.11.15), Spotted Gum (*Corymbia citriodora*) at Site 33 (as Not Of Concern RE 11.11.4) and Grey Box (*Eucalyptus moluccana*) at Site 34 (as Of Concern RE 11.2.26).

### **Short site 35**

Vegetation on this site was observed from directly off-site due to restricted access. The RE mapping for the area shows a mosaic of pre-clearing REs. Observations confirmed that only Narrow-leaved Ironbark (*Eucalyptus crebra*) (Not Of Concern RE 11.11.4) occurred at the site (in addition to Spotted Gum (*Corymbia citriodora*)). The mapped Endangered RE was not present at the site, and therefore the only RE observed was Not Of Concern. Access was restricted, so the site data was recorded from off-site observation from a pipeline access track, supported by large-scale (1:10,000) aerial photograph interpretation.

### Detailed sites 36 and 37a, and Short sites 37b and 38

Remnant fragments were observed on these sites, and were in poor condition due to structural disturbance and fragmentation. All vegetation represented by these sites was Not Of Concern, with the exception of Short site 37b, which was a very small and un-mappable patch of softwood scrub species, with no remnant structure that can therefore not be classified as Endangered as RE mapping represents. No Threatened Species were found on this site.

### Detailed site 39a and Short site 39b

A large area of remnant vegetation was observed East of Yarwun. These sites confirmed that Of Concern RE 12.11.14 and Not Of Concern RE 12.11.6 (respectively) were correctly mapped (the change to REs starting with 12 indicates the Southeast Queensland bioregion, rather than the Brigalow Belt South bioregion). These communities were dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*) and Spotted Gum (*Corymbia citriodora*) respectively. *Macrozamia* sp. were seen in the understorey in places (Brief site 134), but not along the proposed corridor itself.

### Short site 40

Endangered RE 12.3.3 composed of riverine Blue Gum (*Eucalyptus tereticornis*), and rainforest on Boat Creek were observed at Short site 40.

## 6.6.3 Rare and Threatened Species

### 6.6.3.1 Database Searches

Results of the searches of Wildlife Online (EPA 2007a) and the EPBC Act Protected Matters Report (DEWHA, 2007) are shown combined in Table 6.3.

Table 6.3 Wildlife Online and EPBC Protected Matters Report

Species records, with reported species from the EPBC Act Protected Matters Report that did not occur on the Wildlife Online List at bottom of table	NC Act*	Wildlife Online records*	EPBC Act*	EPBC Act Protected Matters Report (smaller defined area)*
<i>Acacia pubicosta</i>	R	1	.	
<i>Acacia storyi</i>	R	2	.	
<i>Actephila sessilifolia</i>	R	9	.	
<i>Alyxia magnifolia</i>	R	9	.	
<i>Asplenium pellucidum</i>	V	2	V	
<i>Atalaya calcicola</i>	R	6	.	
<i>Atalaya collina</i>	E	3	E	Reported
<i>Atalaya rigida</i>	R	18	.	
<i>Callicarpa thozetii</i>	R	1	.	
<i>Choricarpia subargentea</i>	R	3	.	
<i>Cossinia australiana</i>	E	4	E	
<i>Cupaniopsis shirleyana</i>	V	10	V	Reported
<i>Cycas megacarpa</i>	E	25	E	
<i>Cycas ophiolitica</i>	E	14	E	Reported

Species records, with reported species from the EPBC Act Protected Matters Report that did not occur on the Wildlife Online List at bottom of table	NC Act*	Wildlife Online records*	EPBC Act*	EPBC Act Protected Matters Report (smaller defined area)*
Dansiea elliptica	R	10	.	
Decaspermum struckoiligum	E	10	.	
Denhamia parvifolia	V	1	V	
Eucalyptus raveretiana	V	2	V	Reported
Graptophyllum excelsum	R	15	.	
Hakea trineura	V	1	V	
Hernandia bivalvis	R	18	.	
Livistona drudei	V	2	.	
Macropteranthes fitzalanii	R	4	.	
Macropteranthes leiocaulis	R	13	.	
Marsdenia brevifolia	V	1	V	
Parsonsia larcomensis	V	4	V	Reported
Parsonsia lenticellata	R	12	.	
Philothea acrolopha	V	1	V	
Quassia bidwillii	V	2	V	Reported
Stackhousia tryonii	R	4	.	
Zieria sp. (Mt Larcum N. Gibson TOI8)	V	4	.	
Reported species from the EPBC Act Protected Matters Report that did not occur on the Wildlife Online List:				
Bosistoa selwynii	NAQ	0	V	Reported
Bosistoa transversa	.	0	V	Reported
Bulbophyllum globuliforme	R	0	V	Reported
Corymbia xanthope	V	0	V	Reported
Leucopogon cuspidatus	.	0	V	Reported

**\* CODES:**

NC Act indicates the conservation status of each taxon under the Nature Conservation Act 1992.

The codes are Presumed Extinct (PE), Endangered (E), Vulnerable (V), Rare (R), Common (C) and Not Protected. NAQ is not an original code used by the NC Act; it has been added here to indicate that this taxon is not held at the Queensland Herbarium according to AVH, and therefore has no status in the NC Act at present.

EPBC Act indicates the conservation status of each taxon under the Environment Protection and Biodiversity Conservation Act 1999.

The codes are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct In The Wild (XW) and Vulnerable (V).

Wildlife Online Records indicates the number of records of the species contained within the database for the area searched.

Reported by the EPBC Act Protected Matters Report means that this particular species is mapped as occurring within the smaller defined area of the EPBC Act Protected Matters Report search area, in addition to Wildlife Online records.



A search of the Wildlife Online database (EPA 2007a) for Rare and Threatened species listed in the NC Act returned a list of 31 plant species, shown in Table 6.3. The original extract is shown in Appendix E2, and is represented in two halves (west and east) due to limitations in longitudinal range of the database search. It should be noted that the search area specified needs to be a rectangle, and the number of different species is highly likely to be over-represented (i.e. some are not likely to be present in the project area). A total of five species were listed as Endangered, 11 species as Vulnerable, and 15 as Rare (as shown in Table 6.3).

An EPBC Act Protected Matters Report (DEWHA 2007) was generated from a similar search, but with a more narrowly defined search area (search area and results from original extract are shown in Appendix E2) and reported a list of eleven plant species and their conservation status (nine Vulnerable and two Endangered, as shown in Table 6.3). Five species were reported that did not occur on the Wildlife Online list, indicating that these species are expected to occur, but have not been recorded in the search area. For these species, refer to the last five entries in Table 6.3.

### 6.6.3.2 Investigation Results

No targeted Rare or Threatened plant species were observed during surveys in either section of the corridor. However, one non-target species was observed, although it was a sterile specimen and absolute confirmation of identification was not possible. This was a Vulnerable species (listed under the EPBC Act and the NC Act), and was one individual of (probably) Ooline (*Cadellia pentastylis*) found at Detailed Site 14 (Marble Creek). This constitutes an EPBC Act referral trigger.

Almost all of the species listed as Endangered or Vulnerable under the NC Act, and Threatened under the EPBC Act, are scrub species (i.e. species typically found in scrub). These species were assumed to be most likely to occur within remnant patches of softwood scrub or vine thicket, so targeted survey for these species was restricted to these remnant patches. Partially cleared, or regrowth, areas of scrub were also surveyed as part of the vegetation survey. None of the listed scrub species were found during the surveys. If they were present, they are nevertheless protected by virtue of their habitat (*viz.* scrub), which is protected under the NC Act and EPBC Act.

Black Ironbox (*Eucalyptus raveretiana*) was listed in both databases as Vulnerable (see Table 6.3) and is known to occur in riverine areas that are likely to be intersected by the corridor (see Table 6.4, and Appendix E2 for original Wildlife Online extract). It was not found during the survey, despite being specifically searched for at each of the creek crossings.

*Corymbia xanthope* is listed under the EPBC Act as Vulnerable (see Table 6.10 Summary of Significant Impact Criteria for Reported EPBC Threatened flora species) and is known to occur north of Rockhampton. It is considered unlikely that this species occurs in the study area, based on collection label details of this species (Botanic Gardens Trust 2004), which indicate it occurs on skeletal soils in association with *Hakea* sp. and *Triodia* sp. This type of habitat was not observed in the project area.

The two cycads *Cycas megacarpa* and *Cycas ophiolitica* were listed in both databases as Endangered, but are not reported in the EPBC Act Protected Matters Report for the project area. They are known to occur in the project area (see Table 6.4, and Appendix E2 for original Wildlife Online extract) and are likely to be in forested areas intersected by the corridor. However, neither of these species was observed during field assessments. It is possible that a young *Cycas* sp. without a trunk may be confused with *Macrozamia* sp., but nothing that looked like either genus was seen within the corridor (except, at a distance, for the marginally similar *Xanthorrhoea johnsonii*).

The overall findings of survey were also generally in accordance with those of previous survey work in the same general area by HLA Envirosciences (2006). A notable difference is that the two Threatened species found by HLA Envirosciences survey (*Macrozamia serpentina* and Black Ironbox (*Eucalyptus raveretiana*)) were not found in the corridor, but occur in the broader study area used in the HLA survey.

### 6.6.3.3 Threatened Species and Likelihood of Occurrence

Mt Morgan Myrtle (*Decaspermum struckoilicum*) was listed as Endangered in Wildlife Online, but it occurs in the Mt Morgan area only (AVH search, Centre for Plant Biodiversity Research, Council of Heads of Australian Herbaria (2007) and Harden *et al.* (2006)), and is considered unlikely to occur within the proposed corridor. Struck Oil is the name of the locality where this species was found.

There are many species listed in Wildlife Online as Vulnerable or Rare that are known to occur in the project area or surrounds, most of which were not reported by the EPBC Act Protected Matters Report. These include a variety of species that occur in a variety of habitats. These species are listed in Table 6.4, with their likely habitat or area and likelihood of occurrence within the corridor.

Table 6.4 Threatened Species and Likelihood of Occurrence

Species records, with unrecorded species from EPBC Act Protected Matters Report at bottom of list	Likely habitat or area (rows in this table with scrub species are shaded)	Likelihood of occurrence of habitat
Acacia pubicosta	Mt Morgan area	Low
Acacia storyi	Sandstone plateaux	Low
Actephila sessilifolia	Scrub	Fair*
Alyxia magnifolia	Scrub	Fair*
Asplenium pellucidum	Rainforest	Low
Atalaya calcicola	Scrub	Fair*
Atalaya collina	Scrub	Fair*
Atalaya rigida	Scrub	Fair*
Callicarpa thozetii	Rainforest	Low
Choricarpia subargentea	Scrub	Fair*
Cossinia australiana	Scrub	Fair*
Cupaniopsis shirleyana	Scrub	Fair*
Cycas megacarpa	Coastal ranges	Fair
Cycas ophiolitica	Coastal ranges	Fair
Dansiea elliptica	Scrub	Fair*
Decaspermum struckoilocum	Scrub - Mt Morgan area	Fair*
Denhamia parvifolia	Scrub	Fair*
Eucalyptus raveretiana	Riverine	Fair
Graptophyllum excelsum	Scrub	Fair*
Hakea trineura	Well-drained soils	Low
Hernandia bivalvis	Scrub	Fair*
Livistona drudei	Stream banks on coastal plains	Low
Macropteranthes fitzalanii	Scrub	Fair*
Macropteranthes leiocaulis	Scrub	Fair*
Marsdenia brevifolia	Scrub	Fair*
Parsonsia larcomensis	Scrub	Fair*
Parsonsia lenticellata	Scrub	Fair*
Philotheca acrolopha	Heath	Low
Quassia bidwillii	Scrub	Fair*

Species records, with unrecorded species from EPBC Act Protected Matters Report at bottom of list	Likely habitat or area (rows in this table with scrub species are shaded)	Likelihood of occurrence of habitat
Stackhousia tryonii	Serpentinite	Low
Zieria sp. (Mt Larcom N. Gibson TO18)	Scrub	Fair*
Bosistoa selwynii	Scrub	Fair*
Bosistoa transversa	Scrub	Fair*
Bulbophyllum globuliforme	Rainforest	Low
Corymbia xanthope	Skeletal soils	Low
Leucopogon cuspidatus	Heath	Low

\*Likelihood of occurrence of habitat **only** within remaining scrub remnants.

#### 6.6.4 EPBC Act Referral Triggers Identified from Existing Information

Several EPBC Act referral triggers were identified from preliminary data. Those triggers, based on likelihood of occurrence from habitat and distribution data, were:

- The presence of “semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions” (referred to as *scrub* in this chapter), as defined in the EPBC Act Protected Matters Report as Threatened Ecological Communities. A small, unmapped patch of this scrub was observed on the Malchi Nine Mile Road at Brief site 177 (see Short site 4, in Section 6.5.2.2), and is an EPBC Act referral trigger. Also, there is the possible presence of Whitewood (*Atalaya collina*, Endangered under the EPBC Act) in this scrub. This scrub remnant may also contain the EPBC Act-listed scrub species *Quassia bidwillii*, *Cossinia (Cossinia australiana)*, *Cupaniopsis shirleyana* and *Denhamia parvifolia*
- Whitewood (*Atalaya collina*, Endangered under the EPBC Act) could occur in the patch of scrub at Brief site 30 on the Twelve Mile Creek Road, which is closer to Yarwun. Brief site 30 is approximately 200 m to the northeast of the corridor, so a search for this species was made for at least 2 km either side of that patch along the corridor in likely areas of habitat. A simultaneous search was made for the EPBC Act-listed scrub species *Quassia bidwillii*, *Cossinia (Cossinia Australiana)*, *Cupaniopsis shirleyana* and *Denhamia parvifolia*

- The forest communities east of Yarwun, (sampled by Detailed site 39a, Short site 39b, and Brief sites 133 to 136) dominated by Spotted Gum (*Corymbia citriodora*) and Narrow-leafed Ironbark (*Eucalyptus crebra*), had *Macrozamia* sp. in the understorey in places. As mentioned previously, young Endangered cycads *Cycas megacarpa* or *C. ophiolitica* (i.e. without trunks) could appear to be *Macrozamia* spp. *Cycas megacarpa* or *C. ophiolitica* are Endangered under the EPBC Act and this is a referral trigger
- Riverine crossings along the corridor may possibly have Black Ironbox (*Eucalyptus raveretiana*) in places, which is listed as Vulnerable under the EPBC Act, and is a referral trigger. All river crossings within the ROW (approximately 12 crossings from the extraction point to Yarwun) were inspected for this species where access was granted. This species was not observed in the ROW, but could possibly occur within the corridor.

#### 6.6.5 Biodiversity Planning Assessment Mapping

Biodiversity Planning Assessment (BPA) (EPA 2005c) mapping was used to identify significant areas of biodiversity. These areas are summarised in Table 6.5. BPA mapping is prepared by the EPA using the Biodiversity Assessment Mapping Methodology (BAMM). BAMM provides a consistent approach for assessing biodiversity values at the landscape scale in Queensland using vegetation mapping data generated or approved by the Queensland Herbarium as a fundamental basis.

Table 6.5 Biodiversity Planning Assessment Mapping Summary

Area/Location	Level of significance	Description of criteria*	Sample site if applicable
Gracemere	State	Significant wetland (criteria B1)	2
Area near Bajool	State	Significant wetland (criteria B1)	9a
	Regional	Remnant contains at least one Of Concern RE (criteria B1)  Remnant contains Special Biodiversity Values (criteria I). <i>Note: this criterion is not based on the RE mapping (on Inkerman Creek near Bajool) – instead, it is a condensed area of about 100 ha approximately 2.5 km northwest of Inkerman Creek, along the corridor. Special Biodiversity Values (criteria I) relate to Yellow Chat habitat</i>	Refer to Chapter 7, Terrestrial Fauna, and discussion on Yellow Chat habitat
	Local	Wetland	
Raglan Creek	State	Significant Wetland (criteria B1)	17
	Regional	Contains at least one RE with < 10% extent remaining or naturally Rare in the sub-region (criteria B2)	
	Local	Remnant contains Special Biodiversity Values (criteria I): Wetland	
Darts Creek area	Regional	Remnant contains at least one RE with 10-30% extent remaining (criteria B2) and remnant is part of a Tract that is one of the largest of its type in the bioregion (criteria C)	22 (a, b)
DIP land southeast of Mt Larcom: 1st remnant south of the highway (proposed flora site 28)	Regional	Remnant contains at least one RE with 10–30% extent remaining (criteria B2) and remnant is part of moderately large tract (criteria C) and vegetation condition is natural (criteria E)	28 (a, b)
DIP land southeast of Mt Larcom: remnant near Larcom Creek (proposed flora site 29)	Regional	Remnant contains at least one Of Concern RE (criteria B1) (in this case 11.3.4)	29 (a, b)
DIP land southeast of Mt Larcom: finger of remnant poking out to the west of main remnant (proposed flora site 31)	Regional	Remnant contains at least one RE with 10–30% extent remaining (criteria B2) and remnant is part of a tract that is one of the largest of its type in the bioregion (criteria C)	31 (a, b, c)
Central Queensland Ports land: near the entrance to the Comalco property (flora sites 32, 33, 34)	Local and or Other Values	Remnant contains Core Habitat for Priority Taxa (criteria H)  <i>Diagnostic data</i> for additional information,: Non-core habitat for EVR species	32, 33, 34
Rio Tinto land: end of existing overland pipeline (flora site 35)	State	Remnant contains at least one Endangered RE (criteria B1), remnant contains Core Habitat for Priority Taxa (criteria H)	35
Central Queensland Ports land: near the quarry (flora site 38)	Regional	Remnant is part of a tract that is one of the largest of its type in the bioregion (criteria C) and vegetation condition is natural (criteria E) and remnant has Ecosystem diversity in the top quartile (criteria F), remnant contains Core Habitat for Priority Taxa (criteria H) (note that these remnants come in from the north)	38



Area/Location	Level of significance	Description of criteria*	Sample site if applicable
Yarwun area near the crossroads: (westernmost end of remnant)	Local and/or Other Values, and State	Remnant forms part of a bioregional corridor (criteria J)	39a
Yarwun area: (higher part of remnant)	Regional	Contains at least one Of Concern RE (criteria B1)	39a
	State	Remnant forms part of a bioregional corridor (criteria J)	
Yarwun area (easternmost end of remnant)	Local and or Other Values	Remnant contains Core Habitat for Priority Taxa (criteria H)	39a

\* BPA Criteria are environmental values that are used internally by EPA for planning purposes. They are explained in Appendix E2.

The summary of BPA (EPA 2005c) mapping in Table 6.5 is consistent with field observations. Each sample site was located within areas of remnant vegetation identified as homogenous by the BPA.

The consistent values within the Description of Criteria (as outlined in the BPA) for the study area were:

- Wetland
- Significant RE (Of Concern or Endangered present, or RE is poorly represented in the sub-region<sup>3</sup>)
- Large tract of vegetation
- Bioregional corridor
- Core Habitat for Priority Taxa.

Note that Core Habitat for Priority Taxa in Table 6.5, that were listed for land belonging to Gladstone Ports Corporation (formerly Central Queensland Ports Authority) and Rio Tinto (as sampled by Sites 32, 33, 34, 35, 38) were scrub species as part of softwood scrub REs (in this case RE 11.11.5 and RE 11.11.18) which were not present within the ROW or the corridor. This is an artefact of the RE mapping, where large pre-clearing vegetation polygons are a mosaic of different REs, and in this case the scrub REs are present elsewhere within other remnant polygons.

The Raglan Creek area, represented by Site 17, had Special Biodiversity Values (Table 6.5), and these relate to wildlife habitat.

The Yarwun area (easternmost end of remnant) represented by Site 39a, has Core Habitat for Priority Taxa (see Table 6.5). This refers to the tree cycads, which may be present in the area (*Cycas megacarpa* and *C. ophiolitica*).

### 6.6.6 Crops

A variety of crops, particularly annuals, were observed on the “black soil” in the Gracemere area. This land is Vulnerable to weed infestation particularly by Parthenium and Fireweed. Land east and south of Gracemere, as far south as Darts Creek, was predominantly used for grazing. Land south of Darts Creek was hillier and more heavily forested. The cleared areas were used mainly for grazing. There was no intensive forestry industry in the immediate area (except plantation areas southeast of Mt Larcom), and much of the forested areas were observed to be used for residential acreage lots and hobby farms. There was some horticultural activity (e.g. avocados southeast of Mt Larcom) but this was not within the corridor.

### 6.6.7 Weeds

Significant weeds known to occur within the project area and their impacts and management issues are listed in Table 6.6. These are not the only weeds likely to be present in the project area.

<sup>3</sup> A sub-region is a subset of a bioregion.

Table 6.6 Significant Weeds within the Project Area

Common name	Botanical name	Declared class*	Problems caused	Distribution and likelihood of occurrence
Parthenium	<i>Parthenium hysterophorus</i>	2	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery	Northern areas on black soil. Heavy infestations around Gracemere
Giant Rats-tail Grass	<i>Sporobolus</i> spp. including <i>S. pyramidalis</i> , <i>S. jacquemontii</i> , <i>S. fertilis</i>	2	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery	South of Mt Larcom, especially Larcom Creek. Heavy infestations around Larcom Creek
Rubber Vine	<i>Cryptostegia grandiflorus</i>	3	Restricts access. Generally spread by wind	Widespread along corridor, especially in riverine areas and near Brigalow. Bad infestations in the Darts Creek area
Fireweed	<i>Senecio madagascariensis</i>	2	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery	Northern areas on black soil. Heavy infestations around Gracemere
Harrisia	<i>Harrisia</i> spp.	2	Injures stock. Mainly spread by fragments	Widespread along corridor, especially in riverine areas and near Brigalow
Prickly Pear	<i>Opuntia</i> spp. other than <i>O. ficus-indica</i>	2	Restricts access. Mainly spread by fragments	Widespread along corridor, especially in riverine areas and near Brigalow
Mother of Millions	<i>Bryophyllum</i> spp.	2	Toxic to stock. Mainly spread by fragments.	Widespread along corridor, often on poorer soils, and often with Grey Box forest
Lantana	<i>Lantana camara</i>	3	Restricts access. Mainly spread by birds	Widespread along corridor, but particularly in forested areas and in riverine areas. Bad infestations in the Darts Creek area
Leucaena	<i>Leucaena leucocephala</i>	n/a	Out-competes pasture and crops, spread by wind and also mud on vehicles and machinery. Restricts access	More common in northern areas on black soil. Some infestations around Gracemere

\*Declared Pest Plant listed in the Land Protection (Pest and Stock Route Management) Act 2002: Class 3 plants only need to be controlled if adjacent to an environmentally significant area.

All significant weeds (as listed in Table 6.6), except one, known to occur within the project area, are Declared Pest Plants as listed in the *Land Protection Act*.

Severe weed infestations were not generally observed on the corridor, although Rubber Vine (*Cryptostegia grandiflora*) was observed to be widespread, particularly from Bajool to Ambrose. Fireweed (*Senecio madagascariensis*) was dense and widespread at the time of the second survey in August/September 2007, in the "black soil" country around Gracemere. Parthenium (*Parthenium hysterophorus*) was observed occasionally around the northern end of the corridor. Giant Rats-tail Grass (a number of *Sporobolus* spp.) occurred in particularly large and dense infestations in low-lying areas around Larcom Creek.

Leucaena (*Leucaena leucocephala*) is grown as a crop in the Gracemere area, and small weed occurrences were occasionally seen in that area, including roadsides. Although not a Declared Pest Plant, Leucaena could pose a threat to wetlands in the area, because of the level of disturbance associated with water bodies (Walton 2003). In its early growth stage Leucaena has a general resemblance to two or more native species frequently encountered in wetlands (*viz.* Budda Pea (*Aeschynomene indica*) and Sesbania (*Sesbania cannabina*)) hence assessment of infestation, and planning for control measures, need to be done with appropriate care.

### 6.6.8 Summary of Ecological Values

The following key vegetation and floristic features of the corridor are those that are of ecological concern due to conservation status under State or Commonwealth legislation, or other value. All sample sites were located on, or as close as possible, to the ROW (generally 30 m width).

### 6.6.8.1 Fitzroy to Bajool

A wetland of good condition was observed on Lot 105 LN176 (see Figure 6.1, detailed site 2). The wetland was inundated at the time of survey, with waterbirds present, and limited weed infestation. An area of mapped wetland also occurred on Lot 102 LN176.

### 6.6.8.2 Bajool to Gladstone

- A 200 m stretch of low-growing Brigalow (*Acacia harpophylla*) with extensive gilgai (small waterholes) on the south side of Inkerman Creek on Lot 68 DS141 (refer to Detailed site 9c)
- An advanced regrowth patch of Brigalow (*Acacia harpophylla*) approximately 100 m west of the road (on Lot 69 DS141) may be intersected by the corridor but is likely to be outside of the ROW by approximately 80 m (refer to Brief site 9b)
- A remnant of mostly low Brigalow (*Acacia harpophylla*) (probably regrowth) and some Belah (*Casuarina cristata*) off the Toonda Port Alma Road, on Lot 98 DS186 and Lot 99 DS186 (refer to Detailed sites 10a and 10b, and Short site 10c)
- Marble Creek had softwood scrub in good condition, with diverse species composition, in a gallery along the creek banks on Lot 28 DS37 (refer to Detailed site 14). There was one individual found here, identified as probably Ooline (*Cadellia pentastylis*). As a Vulnerable species (listed under the EPBC Act and the NC Act), this constitutes an EPBC Act referral trigger
- Extensive areas of mangroves occur at Horrigan Creek (refer to Short sites 16a and 16b) and Raglan Creek (refer to Short site 17)
- Land extending from Mt Larcom to the east for an extensive distance (to Aldoga) had restricted access. It is possible that the RE mapping needs to be revised in this area to account for unmapped Narrow-leaved Ironbark (*Eucalyptus crebra*) (most likely RE 11.11.15) (refer to proposed Detailed site 31)
- Riverine Blue Gum (*Eucalyptus tereticornis*) and rainforest on Boat Creek (refer to Short site 40)
- Individual tree cycads (*Cycas megacarpa* and *C. ophiolitica*) may be encountered in the coastal ranges around Yarwun (in the vicinity of Detailed site 39a).

## 6.7 Description of Impacts

### 6.7.1 Main Potential Impacting Processes

#### 6.7.1.1 Main Potential Impacting Processes

The main potential impacting processes to terrestrial flora associated with the clearing of the (generally) 30 m wide ROW and construction of the pipeline are:

- Clearing of vegetation remnants
- Reduction of flora species habitat
- Removal of individual species of significance
- Reduction of wildlife corridor functionality
- Remnant vegetation edge effects
- Riparian vegetation disturbance
- Weed introduction.

#### 6.7.1.2 Activities Causing Impacts

The activities which may cause the impacts listed in Section 6.6.1.1 are:

- Felling of individual trees
- Clear-felling of stands of trees, and increasing edge effects such as wind and weed penetration
- Bulldozing of shrubby areas
- Trenching across ephemeral wetlands and creeks, specifically including clearing either side of the trench
- Digging pits on either side of wet creeks for entry and exit of underground boring
- Possible accidental introduction of weeds to a site.

### 6.7.2 Remnant Vegetation Communities

#### 6.7.2.1 Fitzroy to Bajool

The potential impacts on vegetation remnants along the corridor are listed in Table 6.7.

#### 6.7.2.2 Bajool to Gladstone

With reference to the site numbers in Section 6.6.2.3, the impacts on vegetation remnants along the corridor are listed in Table 6.8.

Table 6.7 Impacts on Vegetation Remnants Along the Corridor (Fitzroy to Bajool section)

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Impact prior to mitigation (not residual impact)
1	Extraction point on the Fitzroy River	Removal of several trees on bank
Brief 160, 161 and 163	Northwest of Rockhampton: Rockhampton Ridgeland Road and Alton Downs Nine Mile Road	Clearing of trees on two road reserves
2	Wetland past the end of Tyrrell Road	Trenching across part of the wetland is likely to cause temporary loss of aquatic plants, and possibly turbidity
3a	Very open woodland near the T-junction of Malchi Nine Mile Road and Fairy Bower Road	Possible removal of several trees
Short 4	Softwood scrub close to the corridor on Malchi Nine Mile Road	Partial clearing of scrub would only occur if the ROW were extended across existing road. If the corridor is located on the other side of the road, and this is the current intention, then no scrub will need to be cleared
Brief 185	Unmapped areas of mostly cleared riverine rainforest on Fairy Bower Road	Possible removal of several trees
5	Small wetland north of Fairy Bower Road off Fogarty Road	Trenching across part of the wetland would cause temporary loss of aquatic plants, and possibly turbidity
Brief 191 and 192	Other wetlands in the Fairy Bower area, just south of the Capricorn Highway	Trenching across part of the wetland, is likely to cause temporary loss of aquatic plants, and possibly turbidity
6a	Gavial Creek	Trenching may involve clearing of some riverine vegetation, mostly trees (Blue Gum ( <i>Eucalyptus tereticornis</i> ) and River Oak ( <i>Casuarina cunninghamiana</i> ))
Short 6b	Road reserve near the intersection of Roope Road and River Road	Possible removal of several trees
Short 6c and 6d	Road reserves of Georges Road and Casuarina Road	Clearing of trees on two road reserves
Brief 10, 11 and 12	Very open woodlands of Poplar Box <i>Eucalyptus populnea</i> may be intersected north of Bajool	Possible removal of several trees
Short 7, 8a and 8b (all upstream)	Bob's Creek, Station Creek and Oakey Creek	Trenching may involve clearing of some riverine vegetation, mostly trees (Blue Gum ( <i>Eucalyptus tereticornis</i> ) and River Oak ( <i>Casuarina cunninghamiana</i> ))

Table 6.8 Impacts on Vegetation Remnants Along the Corridor (Bajool to Gladstone section)

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Impact prior to mitigation (not residual impact)
Short 9a	Inkerman Creek	Micro-tunnelling will be undertaken at this site due to clay substrate, tidal drainage and presence of mangrove species. Some vegetation may need to be removed at tunnel entry and exit points, but most or all mangroves will be retained
Short 9b	Brigalow approximately 100 m west of the Toonda Port Alma Road	Pipeline and ROW will not interfere with remnant, but associated construction activities could damage remnant
9c	Low-growing Brigalow on the south side of Inkerman Creek	Complete clearing of vegetation within area needed for pipeline and ROW
Short 10a, 10b, and 10c	Brigalow-belah off the Toonda Port Alma Road, on Lot 98 DS186 and Lot 99 DS186	Pipeline and ROW will probably require clearing at southern end of remnant (mostly low regrowth and Rubber Vine), but associated construction activities could damage remnant
Brief 19 and 21	Regrowth areas of diverse scrub-related species on Lot 101 DS185 and Lot 102 DS185	Complete clearing of vegetation within area needed for pipeline and right-of-way.
Approx. 1 km south of Brief 19 and 21	Scattered mature gums south of the area of scrub regrowth (mentioned above) on Lot 8 DS185	Possible removal of several trees
11b	Eucalypt regeneration area along a marine drainage north of the Twelve Mile Road	Possible removal of several mature trees, and removal of a number of planted juvenile trees in regeneration area
Short 11c	Twelve Mile Creek	Open trenching at this crossing may require the removal of several trees
12	Road reserve on Twelve Mile Road	Possible removal of several trees
13 (Short)	Patch of remnant softwood scrub in good condition on the same road, but adjacent to the corridor	Pipeline and ROW will not interfere with remnant, but associated construction activities could damage remnant
14	Marble Creek	Open trenching at this crossing may require the removal of several trees. (Note: crossing point will be limited to gap in remnant vegetation. This point has been surveyed and no Rare or Threatened species were encountered). Significant vegetation occurs in adjacent areas
Short 16a, 16b and 17	Raglan and Horrigan Creeks	Micro-tunnelling will be undertaken at this site due to clay substrate, tidal drainage and presence of mangrove species. Some vegetation may need to be removed at tunnel entry and exit points, but most or all mangroves will be retained
18a	Corridor runs between southern end of large remnant of Narrow-leaved Ironbark on Lot 36 DT40169, and northern end of wetland	Possible removal of several trees from edge of remnant
Short 18b	Road reserve on Reedy Creek Road	Clearing of trees on road reserve
Short 20	Advanced regrowth with some scattered original trees on Lot 162DS61	Complete clearing of vegetation within area needed for pipeline and ROW
Short 21, Detailed 22a and 22b	Remnant forest around Darts Creek Road	Clearing is proposed to occur at the edge of this remnant, causing further reduction and fragmentation of a large remnant. This would reduce its ecological value in terms of size. Widening of existing fence-line access track, involving complete clearing of vegetation within area needed for pipeline and ROW

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Impact prior to mitigation (not residual impact)
23	Grey Box on Lot 114 DS256 and Lot 6 RP214228	This is a new cleared easement, so the initial damage to an otherwise large intact vegetation remnant is noteworthy. Complete clearing of vegetation within area needed for pipeline and ROW
24	Horseshoe Lagoon	Only affected if corridor follows this optional route, and only then if adjoining forest is cleared, thus reducing buffer and possibly introducing weeds
Short 25	Cleared extension of what could possibly be a natural grassland	No clearing needed, but weeds could be introduced from earthworks
Short 27	Grey Box regrowth northeast of the showground at Mt Larcom	Complete clearing of vegetation within area needed for pipeline and ROW
Short 28a and 28b	Two Grey Box remnants between Mt Larcom Gladstone Road and Larcom Creek	Possible removal of several trees or small clumps from edge of remnant
Short 29a and 28b	Large Grey Box remnant north of Larcom Creek – this one closer to the creek	Possible removal of several trees or small clumps from edge of remnant
Short 29c	Minor tributary on northern side of Larcom Creek	Possible removal of some trees (probably <i>Eucalyptus tereticornis</i> and <i>Casuarina cunninghamiana</i> )
Short 30a, 30b and 30c	Larcom Creek and minor tributaries	Open trenching at this crossing may require the removal of several trees (probably Blue Gum and River Oak)
Short 31a, 31b and 31c	Remnant Blue Gum, Ironbark and minor tributaries	Complete clearing of vegetation within area needed for pipeline and ROW. Much is already cleared for existing services
32, 33 and 34	Large intact remnant of eucalypt forest	Complete clearing of vegetation within area needed for pipeline and ROW. Much is already cleared for existing services
Short 35	Not Of Concern remnant of eucalypt forest (other parts of remnant elsewhere include Endangered RE)	Complete clearing of vegetation within area needed for pipeline and ROW. Some is already cleared for existing services
Detailed 36, 37a and 37b and Short 38	Eucalypt woodland and very small patch of scrub species northwest of quarry	Complete clearing of vegetation within area needed for pipeline and ROW. Some is already cleared for existing services. Vegetation is in poor condition and group of scrub species does not constitute a community, nor are there any Threatened species present
Detailed 39a and Short 39b	Large eucalypt remnant east of Yarwun	Complete clearing of vegetation within area needed for pipeline and ROW. Some is already cleared for existing services. It is possible that the Endangered tree cycads ( <i>Cycas megacarpa</i> and/or <i>C. ophiolitica</i> ) occur within the area proposed to be cleared
Short 40	Boat Creek	No proposals for crossing this creek, but removal of adjacent vegetation would remove buffer

### 6.7.2.3 Summary of Significant Impact Criteria for EPBC Act Endangered Ecological Communities

Table 6.9 lists those relevant Ecological Communities which are classified as Endangered under the EPBC Act and responses to the Significant Impact Criteria as described within the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance (May 2006)*. None of the Significant Impact Criteria will be met as a result of the project, but the reduction in area of a low-growing patch of Brigalow may occur. The structural form of this patch of Brigalow does not meet the requirements for classification as remnant under the VM Act, nor the EPBC Act, which uses the structural classification of the VM Act.

### 6.7.3 Rare and Threatened Species

#### 6.7.3.1 Whole of Right of Way

Endangered (under the NC Act and EPBC Act) scrub species are of greatest concern in regard to the impact of the corridor. These scrub species are most likely to occur in RE 11.11.18, as this defines lowland scrub on metamorphic sediments. Scrub in the project area is not necessarily restricted to this RE, depending on geological substrate and species assemblage. Table 6.4 shows the likelihood of occurrence of targeted Threatened species along the corridor, of which the most likely species are scrub species. Due to the species diversity within scrub remnants, it is not possible to assess the relative likelihood of impact to specific scrub species, without exact knowledge of the proposed location of the pipeline (i.e. within a few metres)<sup>4</sup>, and extensive survey of all scrub species along that line. It is considered unlikely that adult (mature) scrub species will be disturbed in the ROW. Scrub on Marble Creek had the greatest likelihood of impact, but the crossing point was surveyed and no Rare or Threatened species were observed at that point. There are areas of scrub regrowth within the ROW that will be cleared, but these species are not advanced in growth (i.e. usually less than 1 m high), and it is unlikely that these will be of sufficient growth form to warrant avoiding.

Black Ironbox (*Eucalyptus raveretiana*) is considered unlikely to occur in riverine locations along the corridor, but it is still possible that individuals may be encountered. These individuals are therefore at risk of removal or damage if not identified before trenching, boring or clearing operations take place.

#### 6.7.3.2 Fitzroy to Bajool

Wetlands are the ecosystems which will be most impacted along this section of the corridor. All wetlands in this area are to be trenched through, rather than bored under, because of their ephemeral nature (and size, in some cases). The wetlands impacted are identified in Table 6.7. No Threatened wetland species were identified for the project area from the EPBC Act Protected Matters Report, nor from Wildlife Online (see Table 6.3).

Scrub species could potentially be impacted along this section of the corridor. Refer to Section 6.7.3.1 for impacts to these species.

#### 6.7.3.3 Bajool to Gladstone

Although Brigalow (*Acacia harpophylla*) regrowth may occur immediately south of Inkerman Creek, it constitutes a Threatened Ecological Community under the EPBC Act (if of sufficient structure), but the species as an individual is not listed as Threatened.

Two tree cycads (*Cycas megacarpa* and *C. ophiolitica*) are known to occur in areas that may be intersected by the proposed corridor. They are Endangered under the NC Act and EPBC Act, and could be impacted through removal and/or disturbance of vegetation.

Scrub species could potentially be impacted along this section of the corridor, through removal and/or disturbance of vegetation. Refer to Section 6.7.3.1 for impacts to these species.

<sup>4</sup> Note that Table 6.4 identifies the likelihood of occurrence of habitat for specific scrub species as fair, but only within remaining scrub remnants.

Table 6.9 Summary of Significant Impact Criteria for EPBC Act Endangered Ecological Communities

Endangered Ecological Communities		Response to Significant Impact Criteria						
		#1	#2	#3	#4	#5	#6	#7
Brigalow ( <i>Acacia harpophylla</i> dominant and co-dominant)		No*	No	No	No	No	No	No
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions		No	No	No	No	No	No	No
*refer to discussion on the classification of Brigalow structure for Site 9c in Section 6.5.2.3								
Significant Impact Criteria								
Criterion 1	Reduce the extent of an ecological community							
Criterion 2	Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines							
Criterion 3	Adversely affect habitat critical to the survival of an ecological community							
Criterion 4	Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns							
Criterion 5	Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting							
Criterion 6	Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: <ul style="list-style-type: none"> <li>Assisting invasive species that are harmful to the listed ecological community, to become established</li> <li>Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community</li> </ul>							
Criterion 7	Interfere with the recovery of an ecological community							

Table 6.10 Summary of Significant Impact Criteria for Reported EPBC Threatened Flora Species

Threatened Species	Status	Response to Significant Impact Criteria								
		#1	#2	#3	#4	#5	#6	#7	#8	#9
Atalaya collina	E	No	No	No	No	No	No	No	No	No
Bosistoa selwynii	V	No	No	No	No	No	No	No	No	No
Bosistoa transversa	V	No	No	No	No	No	No	No	No	No
Bulbophyllum globuliforme	V	No	No	No	No	No	No	No	No	No
Corymbia xanthope	V	No	No	No	No	No	No	No	No	No
Cupaniopsis shirleyana	V	No	No	No	No	No	No	No	No	No
Eucalyptus raveretiana	V	No	No	No	No	No	No	No	No	No
Leucopogon cuspidatus	V	No	No	No	No	No	No	No	No	No
Parsonsia larcomensis	V	No	No	No	No	No	No	No	No	No
Quassia bidwillii	V	No	No	No	No	No	No	No	No	No
Cadellia pentastylis*	V	No	No	No	No	No	No	No	No	No
Significant Impact Criteria										
Criterion 1	Lead to a long-term decrease in the size of an important population of a species									
Criterion 2	Reduce the area of occupancy of an important population									
Criterion 3	Fragment an existing important population into two or more populations									
Criterion 4	Adversely affect habitat critical to the survival of a species									
Criterion 5	Disrupt the breeding cycle of an important population									
Criterion 6	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline									
Criterion 7	Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat									
Criterion 8	Introduce disease that may cause the species to decline									
Criterion 9	Interfere substantially with the recovery of the species									
* This species was not originally targeted, but was observed (identified as probably Ooline) during the survey.										

#### **6.7.3.4 Summary of Significant Impact Criteria for EPBC Threatened Flora Species**

Table 6.10 lists those relevant flora species which are classified as Endangered or Vulnerable under the EPBC Act and responses to the Significant Impact Criteria as described within the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (May 2006). None of the Significant Impact Criteria will be met as a result of the project.

#### **6.7.3.5 Summary of Rare and Threatened Species Impacts**

It is unlikely that Rare and Threatened species will be encountered along the corridor, during removal and/or disturbance of vegetation with the possible exception of Ooline (*Cadellia pentastylis*). Table 6.10 shows that none of the Significant Impact Criteria (under the EPBC Act) will be met as a result of the project.

#### **6.7.4 Cultural Impacts**

##### **6.7.4.1 Crops**

In the Alton Downs easement there are irrigated crops on a property that is crossed by the alignment. Cropping areas around Gracemere may also be adversely impacted in the short term. Cropping will be disrupted over part of each affected property. The majority are annual crops, so cropping within the corridor should return to normal in the following season.

##### **6.7.4.2 Recreational areas**

Raglan Creek has a public access area which appears to be heavily utilised. The anticipated loss of a section of mangroves may have adverse medium-term effects on recreational use in terms of aesthetic amenity. The Fitzroy River, however, does not have a public access area in the ROW.

## **6.8 Mitigation and Residual Impacts**

This section discusses the mitigation measures that will be implemented to minimise the potential impacts identified in Section 6.6, including aspects such as design (e.g. pipeline alignment), seeking advice on the construction method from an environmental advisor, and the use of offsets. Further mitigation measures are identified in the Planning Environmental Management Plan (EMP) in Chapter 20, Planning Environmental Management Plan. Residual impacts and the severity of impacts are also identified.

### **6.8.1 Assessment of Impact Severity**

Table 6.11 defines the significance criteria used for assessing impacts and is specifically adapted here to assess impacts on terrestrial flora.

### **6.8.2 Remnant Vegetation Communities**

#### **6.8.2.1 Fitzroy to Bajool**

The impacts on vegetation remnants along the corridor are listed in Table 6.12. The severity of the impact on each remnant is also listed, based on the significance criteria in Table 6.11.

Table 6.11 Significance Criteria for Residual Impacts

Significance	Criteria
Major adverse	Extensive or acute disturbance (major impact) occurring at a site of national importance, which results in the lowering of its ecological value. Also, direct or indirect adverse impact on an area (e.g. national park, Threatened Ecological Community under the EPBC Act etc.) to the extent that its designation is potentially compromised, or the populations it supports or represents are materially reduced. Adverse effects on nationally or internationally protected species endangering their conservation status (e.g. Threatened species under the EPBC Act)
High adverse	Irreversible loss or damage to a substantial part of the regional distribution, or the majority of the local distribution of a habitat type, community or population of flora (e.g. Threatened Ecological Community under the EPBC Act, Endangered RE under the VM Act etc.). Long-term disturbance effects to populations or plant species protected by national or state legislation (e.g. Threatened species under the EPBC Act or the NC Act)
Moderate adverse	Extensive or acute disturbance (major impact) to a significant site in a Local Government Authority or equivalent area, resulting in its loss or the permanent lowering of its ecological value. Limited disturbance (moderate impact) to a regional (or equivalent) site where recovery is anticipated following completion of the works concerned. Lesser effects than major adverse on nationally Rare or protected species where mitigation measures are anticipated to alleviate adverse impacts
Minor adverse	Lesser loss or disturbance than moderate adverse (moderate impact) to a locally important site. Limited or temporary effects (minor impact) on National or Regional sites. Minor impacts on protected species, effects on plant communities without special protection, or nationally scarce plant species where mitigation measures are anticipated to alleviate adverse impacts
Negligible	Any impacts on resources considered to be of negligible ecological value, or effects on species or resources of value the effects of which, when they occur, are likely to be imperceptible. For example, loss of recently created artificial habitats (e.g. landfill sites, amenity grassland, intensive farmland, verge planting). Loss of an exotic species of flora
Beneficial	Any measures that are expected to result in an improvement of the quality of ecological resources following their completion. These can, for example, include creation of new habitat features or introduction of measures that would achieve improvements in quality at an existing ecological site. Design features or management activities, which would make a long-term contribution to ecological objectives, or measures to ensure the long-term protection of Threatened species, which may not be adversely affected by the project, are also included in this category

Table 6.12 Residual Impact Severity on Vegetation Remnants Along the Corridor (Fitzroy to Bajool section)

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Mitigation (Refer to Table 6.7 for impacts prior to mitigation)	Residual impact severity
1	Extraction point on the Fitzroy River	Trees cleared from the bank with DBH* greater than 15 cm will be replaced in nearby areas within the same Lot by advanced planting stock of the same or similar species, a minimum of 1 m tall	Minor adverse
Brief 160, 161 and 163	Northwest of Rockhampton: Rockhampton Ridgeland Road and Alton Downs Nine Mile Road	Trees cleared on two road reserves with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse
2	Wetland past the end of Tyrrel Road	When trenching across part of the wetland, topsoil will be stockpiled offsite from the wetland or within the ROW (i.e. not adjacent to the ROW), and replaced after works to enable ground layer species to re-establish. Unnecessary removal of trees with DBH* greater than 15 cm will be avoided, or replaced with tube stock** adjacent to corridor. If the trench is located far enough upstream, or if construction occurs when the wetland is dry in that area, then there may be negligible impact	Minor adverse
3a	Very open woodland near the T-junction of Malchi Nine Mile Road and Fairy Bower Road	Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible

Site number (as per Section 6.5.2.2) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.2 for detailed description)	Mitigation (Refer to Table 6.7 for impacts prior to mitigation)	Residual impact severity
Short 4	Softwood scrub close to the corridor (to the west) on Malchi Nine Mile Road	The ROW is located on east side of the road so it does not impact on the area	Negligible
Brief 185	Unmapped areas of mostly cleared riverine rainforest on Fairy Bower Road	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming no large trees such as figs are removed
5	Small wetland north of Fairy Bower Road off Fogarty Road	Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming the ROW is not extended into wetland
Brief 191 and 192	Other wetlands in the Fairy Bower area, just south of the Capricorn Highway	When trenching across the wetland topsoil will be stockpiled and replaced after works to enable ground layer species to re-establish. Unnecessary removal of trees with DBH* greater than 15 cm will be avoided or replaced with tube stock** adjacent to corridor	Minor adverse
6a	Gavial Creek	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Minor adverse
Short 6b	Road reserve near the intersection of Roope Road and River Road	Any trees cleared on road reserve with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Negligible
Short 6c and 6d	Road reserves of Georges Road and Casuarina Road	Trees cleared on two road reserves with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse
Brief 10, 11 and 12	Very open woodlands of Eucalyptus populnea may be intersected north of Bajool	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible
Short 7, 8a and 8b (all upstream)	Bob's Creek, Station Creek and Oakey Creek	Any trees greater than 15 cm DBH* will be replaced with tube stock** in same paddock but adjacent to corridor	Minor adverse

\*DBH tree trunk Diameter at Breast Height (approx. 1.3 m from ground). The outer bark is included.

\*\*Where tube-stock is available and suitable planting areas are available. Tube-stock are small containers chosen for cost effectiveness and their ability to rapidly catch up in growth to larger stock. They are only suitable in areas where they cannot be disturbed, i.e. by cattle trampling or weed overgrowth. They are protected by tree guards for at least the first year (normally three stakes and a plastic tube-bag).

The impacts shown in Table 6.12 are mostly of **negligible** or **minor adverse** significance, and further mitigation measures are outlined in Chapter 20, Planning Environmental Management Plan.

### 6.8.2.2 Bajool to Gladstone

The impacts on vegetation remnants along the corridor are listed in Table 6.13. The severity of impact on each remnant is also listed, based on the significance criteria in Table 6.11.

Table 6.13 Residual Impact Severity on Vegetation Remnants Along the Corridor (Bajool to Gladstone section) See Figure 6-1 for Site Locations and Appendix E2- Terrestrial Flora for further detail of locations.

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
Short 9a	Inkerman Creek	Commence boring/drilling outside of mangrove vegetation zone Minimise clearing width through adjacent vegetation (Brigalow immediately south) Trees (mangroves at this location) will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor. Mangrove removal will be minimised and/or avoided as much as possible	Negligible assuming bore/drill entry points are located away from trees
Detailed 9c	Low-growing Brigalow on the south side of Inkerman Creek	Minimise width of clearing of vegetation within area needed for pipeline and ROW. There is an existing old narrow vehicle track that will be used for the ROW if possible. Total length of clearing is approximately 200 m, so it will be possible to reduce the clearing width so that two vehicles can pass during construction. Clearing to be strictly kept to a maximum of 15 m, with boundaries clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. If EPA determines that this community is of remnant status, hence Endangered, then all Brigalow plants that are removed will be partially buried in an adjacent waterlogged area to allow suckering and consequent regrowth	Minor adverse, but could be moderate adverse if EPA determines that this community is of remnant status, hence Endangered
Short 9b	Brigalow approximately 100 m west of the Toonda Port Alma Road	Pipeline and ROW are not likely to interfere with remnant. Access will be prohibited to the edge of this remnant to minimise the impact. Boundary of Brigalow ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted	Negligible
10a, 10b and Short 10c	Brigalow-belah off the Toonda Port Alma Road, on Lot 98 DS186 and Lot 99 DS186	It is likely that the pipeline and ROW will only interfere with edge of remnant, which is mostly fragmented or infested with Rubber Vine. Any clearing at the edge of this remnant will need to be minimised. The edge of the area to be cleared will be clearly marked, and access prohibited to the remaining area with poly-web fencing	Minor adverse
Brief 19 and 21	Regrowth areas of diverse scrub-related species on Lot 101 DS185 and Lot 102 DS185	Topsoil will be stockpiled, and replaced after works to help regrowth species to re-establish. Unnecessary removal of trees with DBH* greater than 15 cm will be avoided, or replaced with tube stock** adjacent to corridor	Negligible
Approx. 1 km south of Brief sites 19 and 21	Scattered mature gums south of the area of scrub regrowth (mentioned above) on Lot 8 DS185.	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible
11b	Eucalypt regeneration area along a marine drainage north of the Twelve Mile Road	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor. Any previously-planted juvenile trees in regeneration area that need to be removed will be replaced with tube stock of as similar a native species as possible	Minor adverse
Short 11c	Twelve Mile Creek	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming mature trees are avoided

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
12	Road reserve on Twelve Mile Road	The environmental officer (an appropriately qualified member of the construction team, refer to Chapter 20, Planning Environmental Management Plan) will supervise exact trench location here if possible, to eliminate the need for unnecessary tree removal. Any trees cleared on road reserve with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse
Short 13	Patch of remnant softwood scrub in good condition on the same road, but adjacent to the corridor	Pipeline and ROW are not likely to interfere with remnant. Boundary of scrub will be clearly marked along existing fence-line with continuous length of high-visibility poly-web fencing. Access to the areas will be prohibited to prevent risk of fire or other damage	Negligible
14	Marble Creek	Site inspection at the pipeline crossing point found that no significant vegetation would be affected by trenching, although significant vegetation occurs in adjacent areas. Site surveys by a suitably qualified botanist will occur prior to construction commencement. Removal of trees and shrubs will be minimised. Trenching will be confined to already-cleared or open areas wherever possible. Sediment and erosion control measures will be implemented to prevent impacts downstream (if construction occurs in the wet) Weed management plan will be implemented If Rare or Threatened sapling species are identified from samples taken on-site, these will be translocated with a permit from EPA. ROW will be narrowed to a maximum 10 m width across creek and creek banks. Any trees cleared with DBH* greater than 10 cm will be replaced with five tube stock** along same creek bank but in disturbed sections adjacent to corridor. Tube stock will be sourced from a local native nursery to maintain local provenance. Any trees with DBH* greater than 10 cm earmarked for removal will require identification by the environmental officer prior to removal. If the resulting species is EVR status, the pipeline will be slightly diverted to protect the tree. If the resulting species is not EVR, but not available from native nurseries, Greening Australia and local native nurseries will be contacted to be given the opportunity of using the removed tree as a source of propagation material.	Negligible assuming the continuity of the riverine gallery forest is preserved and EVR species are not damaged
Short 16a, 16b and 17	Raglan and Horrigan Creeks	Micro-tunnelling will be done under Raglan and Horrigan Creeks (Sites 16a and 17) due to aquatic ecology values, tidal drainage and presence of mangrove species. Drilling/boring will be commenced outside the riparian zone to avoid removal of mangroves. Open trenching will be done in the Site 16b area between the two creeks, as this is higher ground without mangroves.	Minor adverse
18a	Corridor runs between southern end of large remnant of Narrow-leafed Ironbark on Lot 36 DT40169, and northern end of wetland	Pipeline and ROW are not likely to interfere with remnant, except possibly a few trees at the edge. Boundary of remnant at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage.	Negligible to Minor adverse
Short 18b	Road reserve on Reedy Creek Road	Trees cleared on road reserve with DBH* greater than 15 cm will be replaced with tube stock** on road reserve adjacent to corridor	Minor adverse

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
Short 20	Advanced regrowth with some scattered original trees on Lot 162 DS61	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Minor adverse
Short 21 and Detailed 22a and 22b	Remnant forest around Darts Creek Road	Clearing at the edge of this remnant will be minimised and the clearing edge will be clearly marked using poly-web fencing to prohibit access. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas. Additional replanting on eastern side cannot reduce impact from moderate to minor because ROW increases the width of the existing dissection of the remnant.	Minor adverse on western side of Darts Creek Road Moderate adverse on eastern side because remnant is in very good condition
23	Grey Box on Lot 114 DS256 and Lot 6 RP214228	Clearing at the edge of this remnant will be minimised, and the clearing edge will be clearly marked using poly-web fencing to prohibit access. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas. Additional replanting on eastern side cannot reduce impact from moderate to minor because ROW dissects the remnant	Moderate adverse
24	Horseshoe Lagoon	If final corridor alignment traverses this area or adjoining forest is cleared, buffer would be reduced and possibly weeds introduced. However, the corridor is not currently planned through this area. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Negligible
Short 25	Cleared extension of what could possibly be a natural grassland	Weed management plan to be implemented. Backfilled trench will be monitored to ensure that weeds do not establish along that section of the ROW to a point where they could spread into the grassland	Negligible
Short 27	Grey Box regrowth northeast of the showground at Mt Larcom	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Minor adverse
Note: GSDA begins here			
Short 28a and 28b	Two Grey Box remnants between Mt Larcom Gladstone Road and Larcom Creek on DIP land	Pipeline and ROW are not likely to interfere with remnant, except possibly a few trees at the edge. Boundary of remnant at the edge of the ROW will be clearly marked will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Negligible to Minor adverse
Short 29a, 29b and 29c	Second of two Grey Box remnants north of Larcom Creek – this one closer to the creek	Pipeline and ROW are not likely to interfere with remnant, except possibly a few trees at the edge. Boundary of remnant at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor	Negligible to Minor adverse
Short 29c	Minor tributary on northern side of Larcom Creek	Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor	Negligible assuming trees can be avoided

Site number (as per Section 6.5.2.3) Sites are Detailed unless otherwise specified	Brief remnant description (see Section 6.5.2.3 for detailed description)	Mitigation (Refer to Table 6.8 for impacts prior to mitigation)	Residual impact severity
Short 30a, 30b and 30c	Larcom Creek and minor tributaries on DIP land	Open trenching to be done here, as riparian vegetation can be avoided to some extent. Trenching will be confined to previously cleared or open areas wherever possible. Trees will be avoided wherever possible. Any trees cleared with DBH* greater than 15 cm will be replaced with tube stock** in same paddock but adjacent to corridor. Weed management plan will be implemented to ensure spread or establishment of Giant Rats-tail Grass does not occur on terraces surrounding creek.	Negligible assuming mature trees are avoided and Giant Rats-tail Grass infestations do not occur
Short 31a, 31b and 31c	Remnant Blue Gum, Ironbark and minor tributaries at eastern edge of DIP land	Pipeline and ROW are likely to interfere with edge of remnants only. Boundary of remnants at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. No entry to the remnant area will be permitted, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
32, 33 and 34	Large intact remnant of eucalypt forest on Ports Corporation land	Pipeline and right-of-way are likely to interfere with edge of remnants only. Boundary of remnants at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
Short 35	Not Of Concern remnant of eucalypt forest on Rio Tinto land (other parts of remnant elsewhere include Endangered RE)	Pipeline and ROW are likely to interfere with edge of remnants only. Boundary of remnants at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
Detailed 36, 37a and 37b and Short 38	Eucalypt woodland and very small patch of scrub species northwest of quarry	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Minor adverse
Detailed 39a and Short 39b	Large eucalypt remnant east of Yarwun	Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas. If individuals of the Endangered tree cycads ( <i>Cycas megacarpa</i> and/or <i>C. ophiolitica</i> ) are encountered, they will be translocated adjacent to corridor (with a permit from EPA), according to translocation protocols in the EMP. The environmental officer will be on-site during construction to ensure that these plants are not damaged or removed	Minor adverse
Short 40	Boat Creek	The riverine forest community will be avoided wherever possible. Boundary of remnant at the edge of the ROW will be clearly marked with 2 m lengths of high-visibility poly-web fencing, with 10 m gaps permitted. Access to the remnant area will be prohibited, to prevent risk of fire or other damage. Trees cleared with DBH* greater than 15 cm will be replaced with tube stock** adjacent to corridor in disturbed areas	Negligible to Minor adverse

\*DBH is tree trunk Diameter at Breast Height (approx. 1.3 m from ground). The outer bark is included.

\*\*Tube stock are small containers chosen for cost effectiveness and their ability to rapidly catch up in growth to larger stock. They are only suitable in areas where they cannot be disturbed by cattle trampling, weed overgrowth etc. They are protected by tree guards for at least the first year (normally three stakes and a plastic tube-bag).

The impacts shown in Table 6.13 are mostly of **negligible** or **minor adverse** significance, and can be offset by appropriate rehabilitation procedures which are outlined above for specific sites. Further measures are described in the Planning EMP in Chapter 20, Planning Environmental Management Plan, and will be elaborated in the Construction EMP to be developed by the contractor prior to construction.

### 6.8.3 Rare and Threatened Species

#### 6.8.3.1 General

As discussed in Section 6.6.3, construction (and operation) of the pipeline may impact on Endangered (under the NC Act and the EPBC Act) scrub species that may occur within the proposed corridor, but it is not possible to assess the relative likelihood of impact to specific scrub species without exact knowledge of the pipeline location (i.e. within a few metres)<sup>5</sup>. Mitigation measures that will be implemented to minimise the potential impact to Endangered scrub species include:

- A pre-construction survey of all scrub communities at the time the ROW is surveyed, focusing on the identification of Threatened Species along the proposed ROW (see Chapter 20, Planning Environmental Management Plan, for proposed vegetation clearing practices)
- Areas of remnant vegetation impacted by the alignment will be highlighted on all drawings and clearly marked in the field
- Potential minor realignment of the ROW where possible (i.e. a few metres to go around trees or shrubs)
- Clearing boundaries will be clearly delineated on all drawings and in the field to define the extent of authorised clearing, which will not exceed the construction area.

Where these mitigation measures are implemented, along with the requirements in Chapter 20, Planning Environmental Management Plan, there is likely to be a **negligible** impact to scrub species along the corridor.

Black Ironbox (*Eucalyptus raveretiana*) is considered unlikely to occur in riverine locations along the corridor, but it is still possible that individuals may be encountered. Mitigation measures to minimise the impact will include a pre-construction survey for Black Ironbox individuals, and potential minor realignment of the ROW (i.e. a few metres to go around individual). There is likely to be a **negligible** impact to this species with the implementation of the above mitigation measures.

<sup>5</sup> Note that Table 6.4 identifies the likelihood of occurrence of habitat for specific scrub species as fair, but only within remaining scrub remnants.

#### 6.8.3.2 Fitzroy to Bajool

Wetlands that potentially provide habitat for Threatened wetland species and are likely to be impacted by the construction of the proposed pipeline are identified in Table 6.7 (refer to Table 6.4 for likelihood of occurrence of Threatened species). While trenching is proposed for wetlands in this area because of their ephemeral nature (and size, in some cases), the implementation of the following mitigation measures will minimise the potential impact:

- When trenching across part of the wetland, topsoil will be stockpiled, and replaced after works to enable ground layer species to re-establish; and
- Wetlands will be restored, particularly for Site 2 (refer Table 6.12).

Where these mitigation measures are implemented, along with the requirements outlined in the Planning EMP (see Chapter 20, Planning Environmental Management Plan), there is likely to be a **negligible** impact to Threatened wetland species.

#### 6.8.3.3 Bajool to Gladstone

Section 6.6.3.3 outlines the potential occurrence of, and impact to, Brigalow (*Acacia harpophylla*) regrowth (or possibly stunted remnant) immediately south of Inkerman Creek. While the species (as an individual) is not listed as Threatened, the community may constitute a Threatened Ecological Community under the EPBC Act (if of sufficient structure). Mitigation measures and residual impacts for this community (located at Site 9c) are identified in Table 6.13.

Two tree cycads (*Cycas megacarpa* and *C. ophiolitica*, Endangered under the NC Act and EPBC Act), known to occur within the proposed corridor, may be impacted through removal and/or disturbance of vegetation in the ROW. Mitigation measures to minimise the potential impact on these species includes the avoidance of clearing in remnant vegetation, or where this is not possible, translocation of impacted individuals (as per Forster (2007)). Requirements outlined in the EMP (Section 6.7.5) would also be implemented. Refer also to Sites 39a and 39b in Table 6.13. There is likely to be a **negligible** impact to Threatened cycad species through implementation of these measures.

#### 6.8.3.4 Summary of Rare and Threatened Species Impacts

While it is considered unlikely that Rare and Threatened species along the corridor will be impacted by the proposed project, pre-construction surveys will be conducted. When any Rare or Threatened individuals remain within the construction footprint, these can be translocated (or replacements planted, depending on species) in consultation with EPA, resulting in a **negligible** residual impact.

## 6.8.4 Cultural Impacts

### 6.8.4.1 Crops

Cropping areas around Gracemere and in Alton Downs are likely to be adversely impacted in the short term. Cropping will be disrupted over part of each affected property. The majority are annual crops, so cropping within the corridor should return to normal in the following season. There may be a **minor adverse** impact to cropping, but this would more likely be **negligible** subject to financial license arrangements in the SGIC.

No areas of horticulture were observed within the ROW.

### 6.8.4.2 Recreational areas

Raglan Creek has a public access area and a boat ramp, which both appear to be heavily utilised. Construction activity, and any vegetation rehabilitation barriers that might be necessary, may have adverse short to medium-term effects on recreational use in terms of aesthetic amenity. High-visibility poly-web fencing will be used to discourage public access to these areas, during any revegetation following clearing, with appropriate signage (e.g. "revegetation area, please keep out").

GAWB's priority will be to ensure that restriction of access to the boat ramp at Raglan Creek is minimised, and that the boat ramp will be returned to its original condition or better.

While the Raglan Creek recreation area is currently degraded (there is a large amount of rubbish in the area, and partial clearing of vegetation) this does not appear to deter users. GAWB will ensure that the area is not degraded further.

There is likely to be a **negligible to minor adverse** impact to recreational areas in general.

## 6.8.5 Environmental Offsets

Environmental offsets are a mechanism that can be used in environmental management to compensate for the impacts of developments on ecologically significant features. Offsets are usually available through an environmental impact and approvals process. They are a relatively recent requirement that have been written into several Federal, State and Local Governmental policies. The Federal Government released a 'Draft Environmental Offsets Policy for the *Environment Protection and Biodiversity Conservation Act 1999*' for public consultation in August 2007 (Appendix E2). The Queensland EPA also released a draft offsets policy for review at this time. This has now been made into a policy and came into effect on 1 July 2008. Currently there are three 'specific-issues offsets policies' that sit under the Queensland Government Environmental Offset Policy, these are focussed on remnant vegetation, fisheries and koalas. Other policies are planned for the near future and will include a 'Biodiversity Offsets Policy'. This may be relevant to the project

at the time when approvals for operational works are sought, but at this stage the implications of such a policy is not known. Certainly, the offsetting initiative has been in operation prior to the release of the Queensland Government Environmental Offsets Policy and is regularly used to ameliorate impacts of clearing and habitat destruction. The following represents a description of clearing impacts that currently are not obligatory to offset, but may be considered under the pending Federal or State offset policies:

- Approximately 0.6 ha (based on 30 m wide x 200 m long) of low-growing Brigalow immediately south of Inkerman Creek. The stunted Brigalow does not feature on RE mapping, but could possibly be classified as RE 11.3.1 (Endangered), depending on interpretation by EPA. A suitable offset area could be negotiated with the property owner, since the cleared area of the ROW would become useable as pastoral land
- Trenching at Marble Creek will be restricted in width to a maximum of approximately 10 m. The width of the vegetation is approximately 30 m from bank to bank (based on the outer drip-line of the trees). This would result in a maximum area of disturbance of 300 m<sup>2</sup>. Bank vegetation may need to be rehabilitated either on the ROW or outside of the corridor. The riverine scrub vegetation is too narrow to feature on RE mapping, but would normally be classified as RE 11.3.11 (Endangered). A suitable offset area further upstream could be negotiated with the landowner, probably without any net loss in agricultural productivity
- Up to 60 m of the length of two tributaries of Larcom Creek (2 m x 30 m of bank vegetation) may need to be rehabilitated either on the ROW, or outside of the corridor. The riverine vegetation is too narrow to feature on RE mapping, but would normally be classified as RE 11.3.25 (Not Of Concern). A suitable offset area further upstream could be negotiated with the landowner, probably without any net loss in agricultural productivity. Larcom Creek is proposed to be crossed by underground boring, so its fringing vegetation will not be affected
- Approximately 2.7 ha of Ironbark, Grey Box and Spotted Gum forest (RE 11.11.4 and RE 11.11.15, both Not Of Concern) in the Aldoga area (based on 30 m wide x 900 m long). A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation
- Approximately 10.5 ha of Spotted Gum and Ironbark forest (RE 12.11.6 Not Of Concern, and RE 12.11.14 Of Concern) in the Yarwun area (based on 30 m wide x 3.5 km long). The Not Of Concern component does not require offsetting under the VM Act, but the Of Concern component does. A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation.

In Queensland, the VM Act is associated with one of the specific issues offsets policies and is administered by DNRW (Appendix E2). The offsets policy allows some areas of remnant vegetation to be cleared for relevant purposes, providing an ecologically equivalent<sup>6</sup> area can be obtained and protected indefinitely elsewhere. The offsets policy can assist to address elements of the assessment code related to Endangered REs, Of Concern REs, threshold REs<sup>7</sup>, wetlands, waterways and areas of essential habitat. An offset must be able to satisfy the following criteria:

- It must not be currently protected (i.e. mapped as remnant vegetation, within conservation reserve or protected as a condition of another development approval)
- It must have the same RE or at least have the same conservation status as the area proposed for clearing
- It must be a minimum of 2 ha or capable of being mapped by DNRW as remnant vegetation
- It must demonstrate ecological equivalence
- It must be capable of achieving remnant status within 20 years (maximum).

It is also required that the proponent legally secure the offset, so that the vegetation is protected in perpetuity, and provide DNRW with a copy of a management plan that details how the offset will be managed to achieve remnant status.

Based on the assessment of impacts vegetation offsets may be necessary for the following areas, if they are cleared or significantly disturbed:

- Up to approximately 1.3 ha (nominally 30 m wide x 430 m long) of mangroves (RE 11.1.4 Not Of Concern) at Raglan Creek. The offset ratio will be 1:2 or 1:3 depending on ecological equivalence factors

- Approximately 7.5 ha of Grey Box forest (RE 11.3.26, Not Of Concern) in the Dart Creek to Mt Larcom area. This is based on the following lengths of ROW at 30 m wide. The offset ration will be 1:2 or 1:3 depending on ecological equivalence factors:
  - 670 m at Site 22a (x 30 m = 2 ha)
  - 80 m of minor remnant between Sites 22a and 23 (x 30 m = 0.24 ha)
  - 780 m at Site 23 (x 30 m = 2.3 ha)
  - 500 m at Site 26 (x 30 m = 1.5 ha of partly cleared remnant). Undisturbed remnant equivalent probably about 1 ha
  - 1,000 m at Site 27 (x 30 m = 3 ha of partly cleared remnant). Undisturbed remnant equivalent probably about 1.5 ha.
- A small amount (approximately 0.5 ha) of Blue Gum (RE 11.3.4 Of Concern) in the Aldoga area. The offset ration will be 1:2 or 1:3 depending on ecological equivalence factors. A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation
- Approximately 10.5 ha of Spotted Gum and Ironbark forest (RE 12.11.6 Not Of Concern, and RE 12.11.14 Of Concern) in the Yarwun area (based on 30 m wide x 3.5 km long). The Not Of Concern component does not require offsetting under the VM Act, but the Of Concern component does. The offset ration will be 1:1 or 1:2.5 depending on ecological equivalence factors. A suitable offset area could be negotiated with the landowners, since the cleared area of the ROW could be utilised as accessible and productive pastoral land, and there are currently disused areas in need of rehabilitation.

The arrangements for offsets would be finalised following successful completion of the EIS process and in the context of vegetation clearing applications under the VM Act.

<sup>6</sup> Ecological equivalence is measured by considering the following factors: location (proximity to clearing), strategic position (e.g. corridor, core habitat), area, vegetation community, vegetation condition (e.g. species diversity, weed invasion), regaining remnant status (e.g. stage of regrowth) and landscape context attributes (i.e. how it fits ecologically within locality).

<sup>7</sup> Threshold REs are those that are close to changing status (e.g. Of Concern to Endangered) because their total remnant percentage is close to the threshold of two different conservation status levels.

## 6.9 Cumulative and Interactive Impacts

The ROW is part of a larger corridor which will accommodate more services in the form of pipelines or cables. GAWB does not have control over these future additional services, and their potential impacts.

It is considered unlikely that impacts on Rare and Threatened flora species will accumulate over time due to additional services being installed. The corridor has been investigated as part of this assessment, and significant new findings are unlikely.

The key problems introduced by the installation of additional services are likely to be:

- Clearing of more vegetation in the form of another ROW, effectively widening the cleared part of the corridor. This will reduce remnant sizes and increase remnant fragmentation
- Introduction of more weeds, either in terms of quantity, or diversity, because of increased activity from construction and subsequent maintenance.

Many of the environmental pressures generated by subsequent services may be greater than the current proposed project because they may occur during the rehabilitation period of this project, when damage could occur more easily to replanted areas. It is beyond the scope of this chapter to assess the cumulative impacts of these subsequent ROWs, but it is recommended that this report be used as a key source of baseline information, and as a guide to further impacts. EMPs developed by other parties for additional services should be aware of the existing EMP proposed by this chapter, so that management practices are coordinated between service operators. For example, a weed management plan including measures such as vehicle inspection and wash down should be coordinated to increase effectiveness, particularly in areas infested by Parthenium and Giant Rats-tail Grass. Chapter 11, Waste, addresses the spread of weeds through testing, operations and maintenance.

## 6.10 Summary and Conclusions

The construction of the pipeline and clearing of the ROW is likely to have an overall **negligible** to **minor adverse** impact. A trained ecologist will conduct a walkover of the ROW to identify areas where negative impacts on flora communities (in general) and Threatened species are possible. This will occur during pre-construction and this information will be documented in the Construction EMP.

Occasional traffic and other activity that could potentially disturb vegetation are likely to occur infrequently in the ROW during the operational phase of this project. There may be ongoing monitoring of vegetation rehabilitation, and a weed management plan will be implemented. EMPs have been proposed which address these issues.

A summary of key impacts and mitigation measures is shown in Table 6.14.

Table 6.14 Summary of Key Impacts and Mitigation Measures

Refer to key at foot of table for terminology and codes.

EIS Area: Ecology	Current value + Substitutable Y:N	Description of impact		
		Feature/Activity	Description in words	Mitigation inherent in design/standard practice mitigation
Possibly an Endangered Ecological Community (Commonwealth EPBC Act)  Also possibly Endangered RE (State NC Act)	Natural ecosystems; Wildlife habitat  Not substitutable	Clearing of 0.69 ha of possibly Endangered RE, depending on interpretation by EPA. Stunted Brigalow south of Inkerman Creek	Minimise clearing by adjusting location and width of ROW. Possible provision of offset, or rehabilitation of adjacent area if necessary, depending on requirements of vegetation clearing permit under the VM Act	Negligible to Minor -ve, D, T, MT
Endangered RE (State NC Act)  Also possibly an Endangered ecological community (Commonwealth EPBC Act)	Natural ecosystems; Wildlife habitat  Not substitutable	Slight possibility of need to clear 350 m <sup>2</sup> (10 m wide trench) through unmapped Endangered RE along creek bank (Marble Creek)	Minimise clearing by adjusting location and width of ROW. Possible provision of offset, or rehabilitation of adjacent area if necessary, depending on requirements of vegetation clearing permit under the VM Act	Negligible to Minor -ve, D, T, MT
Of Concern REs (State NC Act)	Natural ecosystems; Wildlife habitat  Not substitutable	Clearing approximately 12 ha of Of Concern RE in the Yarwun area. Also approximately 0.5 ha in the Aldoga area	Minimise clearing by adjusting location and width of ROW. Possible provision of offset, or rehabilitation of adjacent area if necessary, depending on requirements of vegetation clearing permit under the VM Act	Negligible to Minor -ve, D, T, MT
Not Of Concern REs (State NC Act)	Natural ecosystems; Wildlife habitat; Biodiversity  Not substitutable	Clearing of approximately 8 ha of Not Of Concern RE	Minimise clearing by adjusting location and width ROW, avoiding trees, and supervising clearing. Rehabilitation planting where possible.	Negligible to Minor -ve, D, T, MT
Clearing of remnant vegetation	Wildlife corridors. Not substitutable in short term	Clearing of approximately 8 ha of remnant vegetation as above	Minimise clearing by adjusting location and width ROW, avoiding trees, and supervising clearing. Rehabilitation planting where possible.	Negligible to Minor -ve, D, T, MT
Clearing of remnant vegetation	Visual amenity. Not substitutable in short term	Clearing of approximately 8 ha of remnant vegetation as above	Minimise clearing by adjusting location and width ROW, avoiding trees, and supervising clearing. Rehabilitation planting where possible.	Negligible to Minor -ve, D, T, MT
Clearing of remnant vegetation	Weed-free ecosystems. Substitutable	Possible introduction or increase in weeds along the ROW	Weed Management practices during clearing and during pipeline trenching and backfilling	Negligible to Minor -ve, D, T, MT
Clearing of remnant vegetation	EPBC Threatened species, and NC Act Rare and Threatened species.  Not substitutable	Clearing of critical sections of remnant vegetation, or unsupervised removal of individual plants	Using the environmental officer to inspect the finalised ROW for EVR species, and to supervise clearing.  Translocate EVR species if encountered, with a permit from EPA.	Negligible to Minor -ve, D, T, MT

EIS Area: Ecology	Current value + Substitutable Y:N	Description of impact		
		Feature/Activity	Description in words	Mitigation inherent in design/standard practice mitigation
Trenching through minor creek tributaries with fringing forest	Natural ecosystems; Wildlife habitat Not substitutable	Clearing of 10 to 30 m of each of two unmapped minor tributaries of Larcom Creek	Minimise clearing by adjusting location and width of ROW. Provision of offset, or rehabilitation of adjacent area	Negligible to Minor -ve, D, T, MT
Trenching through wetlands or creek beds	Natural ecosystems; Wildlife habitat. Substitutable	Excavation of sections of wetland vegetation, and possible resulting erosion and turbidity	Optimise and minimise time taken to do pipeline trenching and backfilling, so as to prevent erosion and turbidity	Negligible to Minor -ve, D, T, ST
Trenching through wetlands or creek beds	Weed-free ecosystems. Substitutable	Possible introduction or increase in weeds	Hygiene practices during pipeline trenching and backfilling	Negligible to Minor -ve, I, T, ST
<b>Key:</b> Significance Criteria: Major, High, Moderate, Minor, Negligible +ve = positive; -ve =negative impacts D = direct; I =indirect C = cumulative; P = permanent; T = temporary ST = short-term; MT = medium-term; LT = long-term.		<b>Relative Duration of Environmental Effects</b> Temporary: Up to one year Short-term: From one to seven years Medium-term: From seven to 20 years Long-term: From 20 to 50 years Permanent: Period in excess of 50 years.		

## 6.11 References

- Bostock, P. D. and Holland, A. E. (eds.) (2007) *Census of the Queensland Flora*. Queensland Herbarium, Queensland Environmental Protection Agency
- Botanic Gardens Trust (2004). *Eucalink: A Web Guide to the Eucalypts* in PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <http://plantnet.rbgsyd.nsw.gov.au>
- Centre for Plant Biodiversity Research, Council of Heads of Australian Herbaria. (2007) *Australia's Virtual Herbarium*. Viewed 30 January 2007, <<http://www.cpbr.gov.au/cgi-bin/avh.cgi>>
- DEWHA: Department of the Environment and Water Resources (2007) *EPBC Protected Matters Report*. Viewed 30 January 2007, <<http://www.deh.gov.au/erin/ert/epbc/index.html>>
- EPA: Environmental Protection Agency (2005a). *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 3.1. Updated September 2005. Queensland Herbarium, Brisbane
- EPA: Environmental Protection Agency (2005b). *Regional Ecosystem Mapping*. Version 5.0. Maintained by Queensland Herbarium, Brisbane
- EPA: Environmental Protection Agency (2005c). *Southeast Queensland Biodiversity Planning Assessment*, Version 3.4. Resource Assessment Unit (Biodiversity) Planning Services Branch, Brisbane
- EPA: Environmental Protection Agency (2007a) *Wildlife Online*. Viewed 7 August 2007 <[http://www.epa.qld.gov.au/nature\\_conservation/wildlife/wildlife\\_online](http://www.epa.qld.gov.au/nature_conservation/wildlife/wildlife_online)>
- EPA: Environmental Protection Agency (2007b). *Regional Ecosystem Description Database*. Maintained by Queensland Herbarium, Brisbane. [http://www.epa.qld.gov.au/nature\\_conservation/biodiversity/regional\\_ecosystems](http://www.epa.qld.gov.au/nature_conservation/biodiversity/regional_ecosystems)
- Forster, P. I. (2007) *A Translocation Protocol For Cycads in Queensland*. Unpublished electronic document. Queensland Herbarium, Queensland Environmental Protection Agency
- Harden, G. J. McDonald, W. J. F. and Williams, J. B. (2006) *Rainforest Trees and Shrubs: A field guide to their identification*. Gwen Harden Publishing
- HLA Envirosciences Pty Ltd (2006) *Flora and Fauna Assessment: Gladstone Pacific Nickel Slurry Pipeline*. A report prepared for RLMS
- Sattler, P. S. and Williams, R. (1999) *The Conservation Status of Queensland's Bioregional Ecosystems*. Queensland Environmental Protection Agency

## 6.12 Bibliography

- Archaeo Cultural Heritage Services (2007) *Initial Advice Statement, Rockhampton to Gladstone Pipeline*. Unpublished report prepared for Arup
- Australian Pipeline Industry Association (APIA) (2005). *Code of Environmental Practice - Onshore Pipelines*. APIA, Canberra
- BMT WBM (2007) *Rockhampton to Gladstone Pipeline Corridor: Preliminary Flora and Fauna Assessment*, prepared for Arup P/L, Brisbane, April 2007
- Department of Natural Resources and Mines (2005) *Central Queensland Regional Water Supply Strategy and Report*
- Enertrade EIS (2007): <http://www.enertrade.com.au/>
- Ecoserve (2007) *Preliminary Assessment of Terrestrial Fauna and Fauna Habitat Values - GAWB Water Pipeline Project*. Unpublished report prepared for Arup
- Gladstone Area Water Board (2004) *Securing the Gladstone Region's Future: Water. Final Report of Gladstone Area Water Board's Strategic Water Planning Project*
- Gladstone Pacific Nickel EIS (2007): <http://www.gladstonepacific.com.au/index.php?src=gendocs&link=environmental%20impact%20statement&category=environment>
- HLA Envirosciences Pty Ltd (2006) *Flora and Fauna Assessment. Gladstone Pacific Nickel Project Slurry Pipeline*. Prepared for RLMS
- HLA Envirosciences Pty Ltd (2006) *Soil, Geology and Topography Report. Gladstone Pacific Nickel Project Slurry Pipeline*. Prepared for RLMS
- Resource and Land Management Services (RLMS) (2006) *Rockhampton to Gladstone Corridor. Infrastructure Corridor Investigation*. Report for the Department of State Development
- Resource and Land Management Services (RLMS) (2006). *Rockhampton to Gladstone Corridor – Infrastructure Corridor Investigation Report*. Report for the Gladstone Area Water Board
- Walton, C.S. (2003) *Leucaena (Leucaena leucocephala) in Queensland. Pest Status Review Series – Land Protection*. Queensland Department of Natural Resources and Mines.

(Footnotes)

- 1 +/- means 'with / without'.