

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

Terrestrial Fauna



Gladstone Area
Water Board



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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.



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7. Terrestrial Fauna

7.1 Introduction

This chapter presents a description of existing (baseline) conditions within the project area with respect to terrestrial fauna, an assessment of potential project impacts, and an outline of strategies that will be employed to mitigate these potential impacts.

This chapter was prepared in accordance with Section 3.3.3 of the Gladstone-Fitzroy Pipeline EIS Terms of Reference (ToR) (October 2007).

In this report, the *project area* refers to the land within the Gladstone-Fitzroy Pipeline corridor (i.e. generally a 30 m wide construction corridor plus infrastructure sites) extending from the Fitzroy River (west of Rockhampton) south to Gladstone (see Figure 1.3). The term *surrounding area* refers generally to the lands within 2 km of the project area.

The majority of the project area is located within the eastern extent of the *Brigalow Belt* bioregion. The southern portion of the project area (south of about Yarwun) is located within the extreme northern part of the Southeast Queensland bioregion. These bioregions represent two of a suite of 13 biogeographical areas of Queensland (see Sattler and Williams 1999).

7.2 Methodology

7.2.1 Nomenclature and Terminology

7.2.1.1 Vertebrate Fauna and Habitat

Fauna refers to all vertebrate fauna (excluding fish; see Chapter 8, Aquatic Flora and Fauna) and the nomenclature used in this chapter follows Strahan (2000) for non-flying mammals, Churchill (1998) for bats, Christidis and Boles (1994) for birds and Cogger (2000) for reptiles and amphibians. Common names for frogs follow the nomenclature of Ingram *et al.* (1993). The terms *shorebirds* and *waders* are generic terms used to describe both resident and Migratory species from the following families: Scolopacidae; Burhinidae; Haematopodidae; Recurvirostridae; Charadriidae; and Glareolidae.

7.2.1.2 Conservation Status

Within this chapter, the conservation status of a species may be described as Rare, Endangered (also Critically Endangered), Vulnerable, Near Threatened and/or Migratory. These terms are used in accordance with the provisions of the Queensland *Nature Conservation Act 1992* (Qld) (NC Act) and its regulations and amendments, and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

With regards to Migratory shorebirds/waders, the terms CAMBA and JAMBA refer to the following:

- JAMBA - the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1974
- CAMBA - the Agreement between the Government of Australia and the Government of China for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1986.

The term used in this chapter, *species of conservation significance*, embraces fauna whose status is Critically Endangered, Endangered, Vulnerable, Regionally Vulnerable, Rare, Near Threatened and/or Migratory (as described above). Threatened is a common term used to collectively describe Endangered and Vulnerable species.

7.2.1.3 Habitat Elements

General vegetation type descriptions used (e.g. forest and grassland) are based on the structural types described by Specht (1970). Where reference is made to a *Regional Ecosystem* (RE), this follows the meaning provided by Sattler and Williams (1999), i.e. a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. *Regrowth vegetation* means woody vegetation that is not remnant as defined under the Queensland *Vegetation Management Act 1999* (Qld) (VM Act). A *declared plant* refers to a species declared as a pest under the *Land Protection (Pest and Stock Route Management) Regulation 2002*. An *environmental weed* refers to any plant that survives in a natural area where its presence is undesirable, harmful or troublesome to native biodiversity. *Weeds of national significance* (WONS) are those weeds that have been identified as already causing significant environmental damage (DEWHA 2005).

7.2.2 Existing Information Review

Existing information regarding the fauna of the project area and surrounding area was collated and reviewed. The following documents and database information were considered in the preparation of this chapter:

- Fauna databases of the Commonwealth Government (EPBC Protected Matters database), the Queensland Museum, Birds Australia and Queensland Environment Protection Agency's (EPA) Wildlife Online database. Note: search area based on a 30 km buffer from the extent of the project area
- Fauna data and background information derived from relevant studies for the wider area (e.g. Longmore 1978, Driscoll 1997, Sattler and Williams 1999, Young *et al.* 1999, McFarland *et al.* 1999, CZEWM CRC 2003a and 2003b, DEH 2005d, Houston *et al.* 2004a and b, Jaensch *et al.* 2004, RLMS 2006a and 2006b, HLA 2006, Houston *et al.* 2006, Houston 2006)
- Queensland EPA RE mapping and Essential Habitat mapping
- Aerial photography to identify vegetation in the local area, comparing patterns observed with existing vegetation mapping
- Queensland EPA Brigalow Belt Biodiversity Planning Assessment mapping and database
- Commonwealth Government's Directory of Important Wetlands database.

7.2.3 Target Species

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. Target species considered as part of these investigations for the project area are listed in Table 7.2 and Table 7.3.

7.2.4 Field Survey Program

The review of existing information assisted in prioritising the variety of habitats and locations for field surveys (e.g. HLA 2006, Houston *et al.* 2006, and Houston 2006). These primarily assisted in the consideration of priority habitat areas for field surveys for Threatened species.

The field survey program was initiated in April 2007 and comprised of the following survey events:

- A preliminary biodiversity investigation undertaken between 1 and 5 April 2007 by Lindsay Agnew and Dr. Ed Meyer
- A series of monthly surveys to monitor known and potential habitat areas for the Threatened Yellow Chat (*Epthianura crocea macgregori*). The program began in June 2007 and continued through until the final monitoring event undertaken in December 2007. These surveys were conducted by Lindsay Agnew and Dr. Ed Meyer
- A spring-season avifauna survey conducted on 2 to 6, 27 and 28 September 2007 by Lindsay Agnew
- A comprehensive target species and biodiversity survey undertaken between 18 and 31 November 2007 by Lindsay Agnew and Dr. Ed Meyer.

The field investigators for this study have had extensive experience in surveying the suite of target species and applying the relevant survey methodologies.

7.2.4.1 Preliminary Biodiversity Surveys

The preliminary biodiversity field survey was conducted between 1 and 5 April 2007 by Lindsay Agnew and Dr. Ed Meyer. The latter part of the program was undertaken in conjunction with the project botanist, Derek Johnson (WBM). This work involved morning and afternoon area searches for avifauna, active ground searches for reptiles and amphibians, census of wetlands for waterbirds, and general searches for indirect evidence of fauna occurrence (e.g. scats, tracks, nests, etc.). The full extent of the project area (including several route options) was covered. The location of each survey site is shown in Figure 7.1 and Figure 7.2.

7.2.4.2 Monthly Yellow Chat Habitat Monitoring

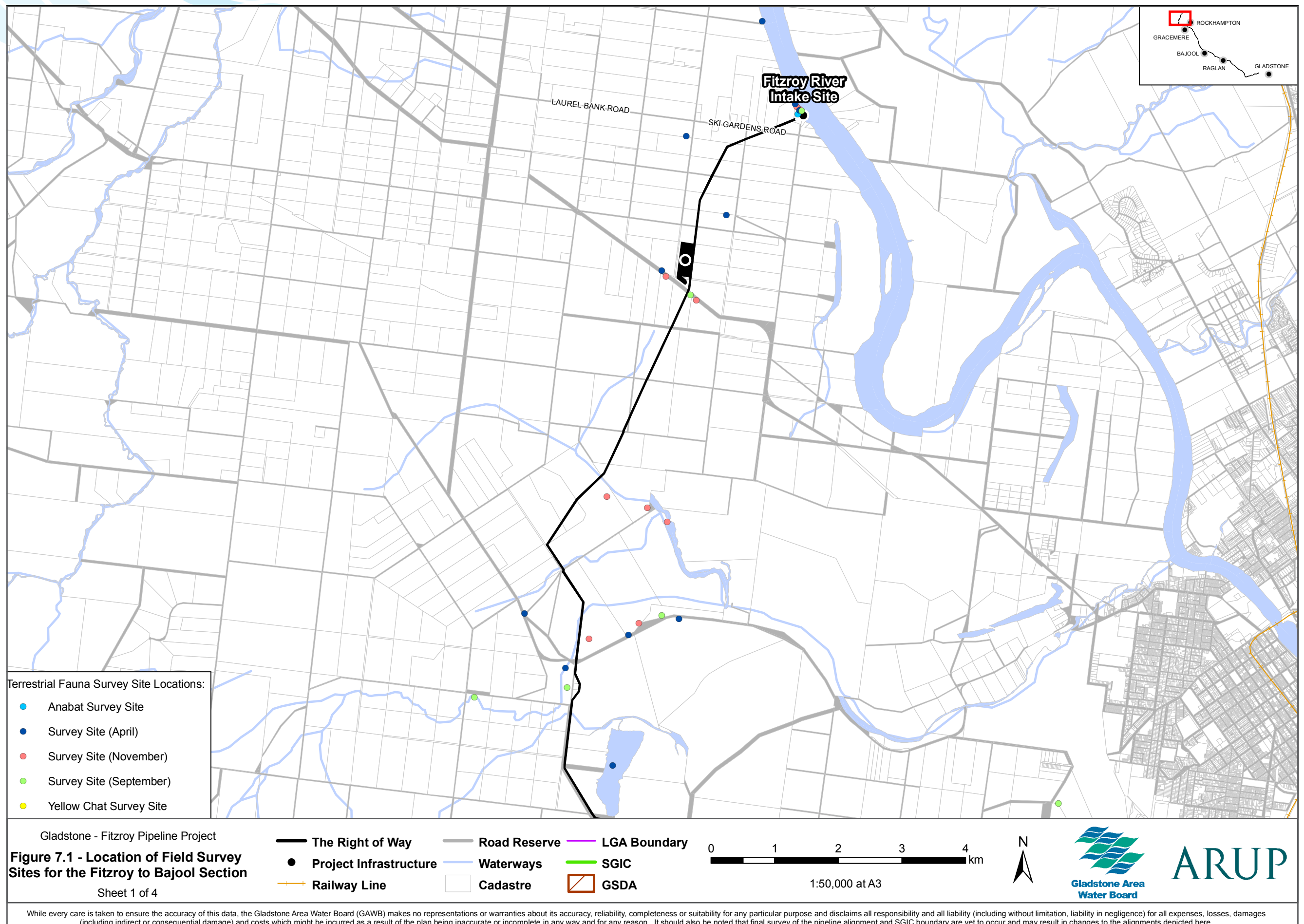
As a result of the existing information review and an initial ground-truthing exercise (April 2007), a number of areas were selected to investigate for the presence of the Threatened Yellow Chat (*Epthianura crocea macgregori*). The areas were either part of a wider area of known Yellow Chat habitat, or were considered as potentially suitable habitat (within the species' known range) based on reference to habitat characteristics and local studies (e.g. Houston (2006) and HLA (2006)).

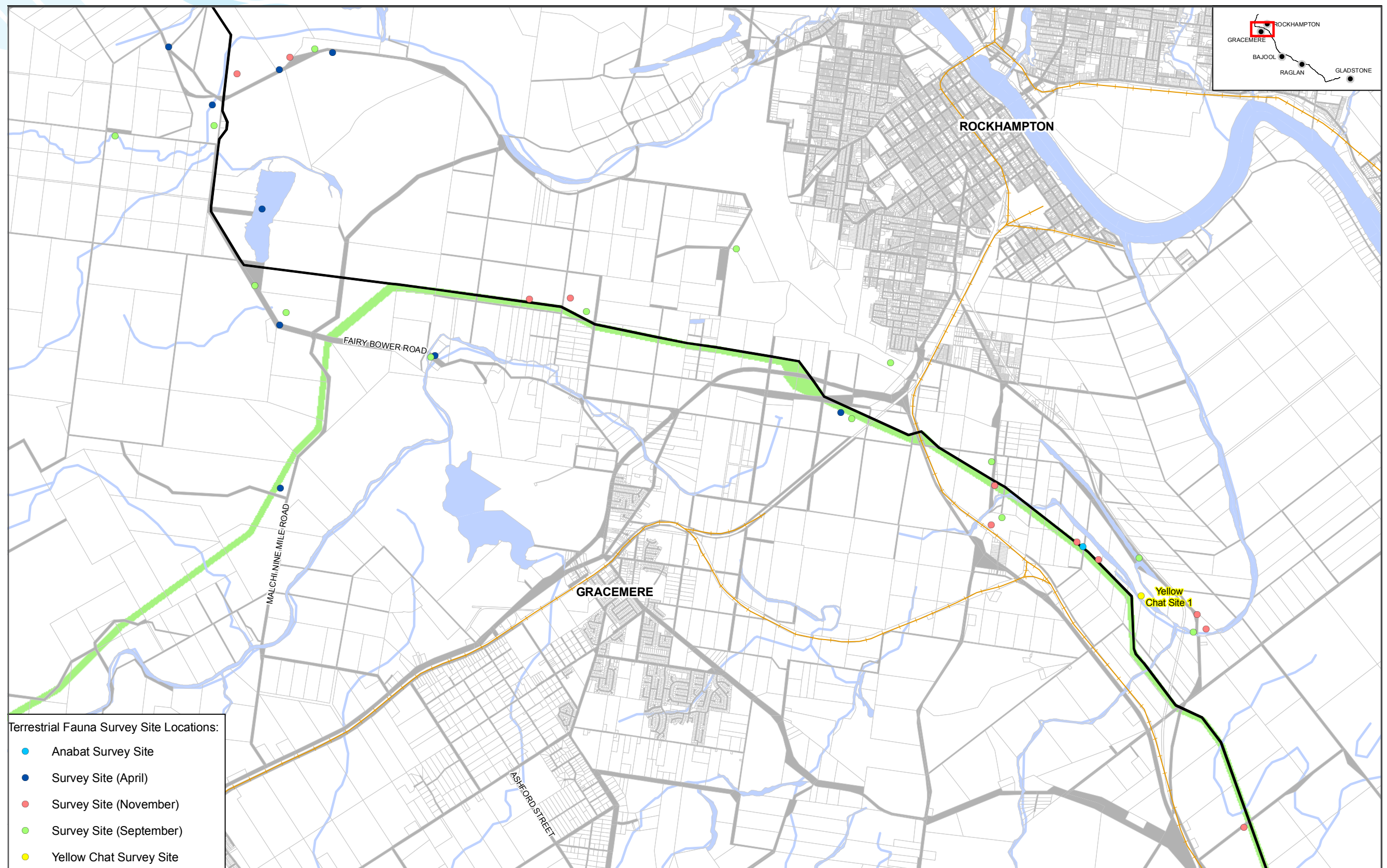
The monitoring program was undertaken over a period of two to three days each month from June 2007 through to December 2007 (inclusive) to assess any seasonal pattern of habitat usage. The amount of time dedicated to surveying each area varied according to the size of the area, though typically ranged from 30 to 90 minutes. These areas were surveyed using either binoculars and/or a spotting scope. The full extent of each area was surveyed during each monitoring event. These surveys were conducted by Lindsay Agnew and Dr. Ed Meyer.

Table 7.1 identifies each area monitored and the frequency and timing of the monitoring events. A variety of other fauna species were recorded incidental to the survey for Yellow Chat. Those records have been incorporated within the main fauna database results. The location centroid for each monitoring site is provided in Figure 7.1 and Figure 7.2. In addition, areas considered potentially suitable as habitat for the Yellow Chat are provided in Figure 7.1 and 7.2.

Table 7.1 Summary of Yellow Chat Investigation Sites

| Site # | Central GPS reference | Summary description | Monitoring events |
|--------|-------------------------------------|---|---|
| 1 | 248120E 7404586S | Seasonal wetlands associated with Gavial Creek in the vicinity of Roope and Port Curtis Roads. Adjacent to eastern side downstream of corridor | April, August, September, October, November, December |
| 2 | 248938E 7403192S - 250173E 7400309S | Seasonal wetlands associated with Serpentine Creek. Adjacent to eastern side and downstream of corridor | No property access granted. |
| 3 | 253008E 739693S | Seasonal wetland habitat to the near south of Casuarina Road, Midgee. Eastern sectors transected by corridor. The majority of this site is adjacent and to east of corridor. Downstream of corridor | April, August, September, October, November, December |
| 4a | 250763E 7395925S | A small, semi-permanent constructed wetland. Approximately 1 km to west and upstream of corridor | April, June, July, August, September, October, November, December |
| 4b | 251453E 7394380S | A small, semi-permanent constructed wetland. Approximately 1 km to west and upstream of corridor | April, June, July, August, September, October, November, December |
| 5 | 256251E 7389205S | Seasonal and semi-permanent wetland habitats associated with Station Creek and its tributary Oakey Creek. Includes constructed and semi-natural wetland features. Adjacent and to east of corridor. Downstream of corridor | No property access granted |
| 6a | 261091E 73848155S | Seasonal wetland habitats comprised of a series of swales and depressions to the near north of disused Port Alma rail link. Part of the Six and Eight Mile Creek systems. Corridor transects area, though largest part is east of corridor. | April, June, July, August, September, October, November, December |
| 6b | 262895E 7384194S | Seasonal wetland habitats comprising of a series of swales and depressions to the near south of disused Port Alma rail link. Corridor transects habitat area, though largest part is east of corridor | April, June, July, August, September, October, November, December |
| 7 | 265744E 7384554S | Cheetham drain area comprising estuarine/saltmarsh/clay pan habitat complex. Extends to north and south of Toonda Port Alma Road. Approximately 1.3 to 2 km east and downstream of corridor | April, June, July, August, September, October, November, December |
| 8a | 270679E 7379990S | Twelve Mile Creek Reserve. An extensive mosaic of large seasonal pools, clay pans and saltmarsh. Adjacent and to east of corridor. Downstream of corridor | April, June, July, August, September, October, November, December |





Terrestrial Fauna Survey Site Locations:

- Anabat Survey Site
- Survey Site (April)
- Survey Site (November)
- Survey Site (September)
- Yellow Chat Survey Site

Gladstone - Fitzroy Pipeline Project
Figure 7.1 - Location of Field Survey Sites for the Fitzroy to Bajool Section
 Sheet 2 of 4

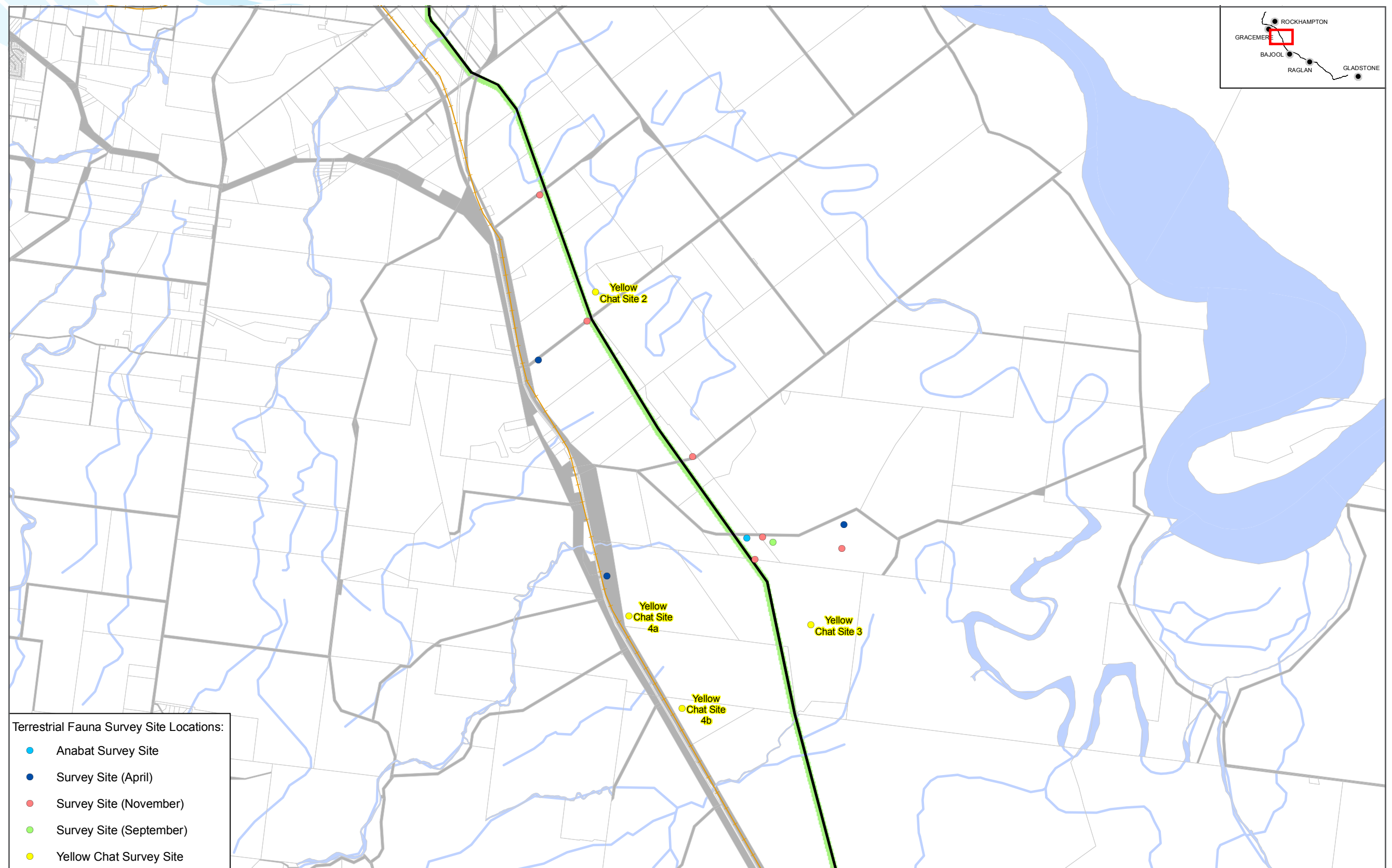
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| — The Right of Way | — Road Reserve | — LGA Boundary |
| ● Project Infrastructure | — Waterways | — SGIC |
| — Railway Line | Cadastre | GSDA |

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- Terrestrial Fauna Survey Site Locations:
- Anabat Survey Site
 - Survey Site (April)
 - Survey Site (November)
 - Survey Site (September)
 - Yellow Chat Survey Site

Gladstone - Fitzroy Pipeline Project

Figure 7.1 - Location of Field Survey Sites for the Fitzroy to Bajool Section

Sheet 3 of 4

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

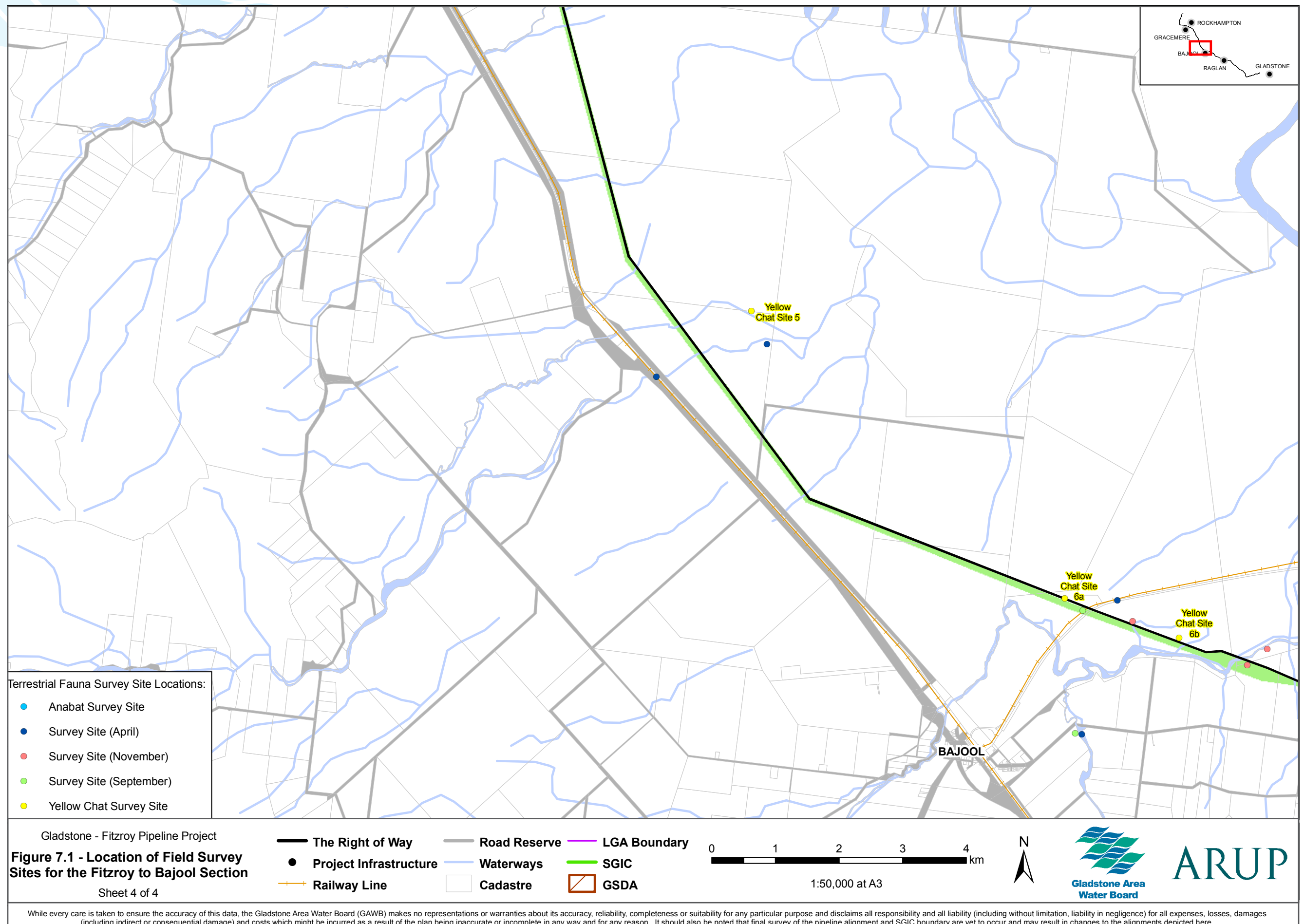
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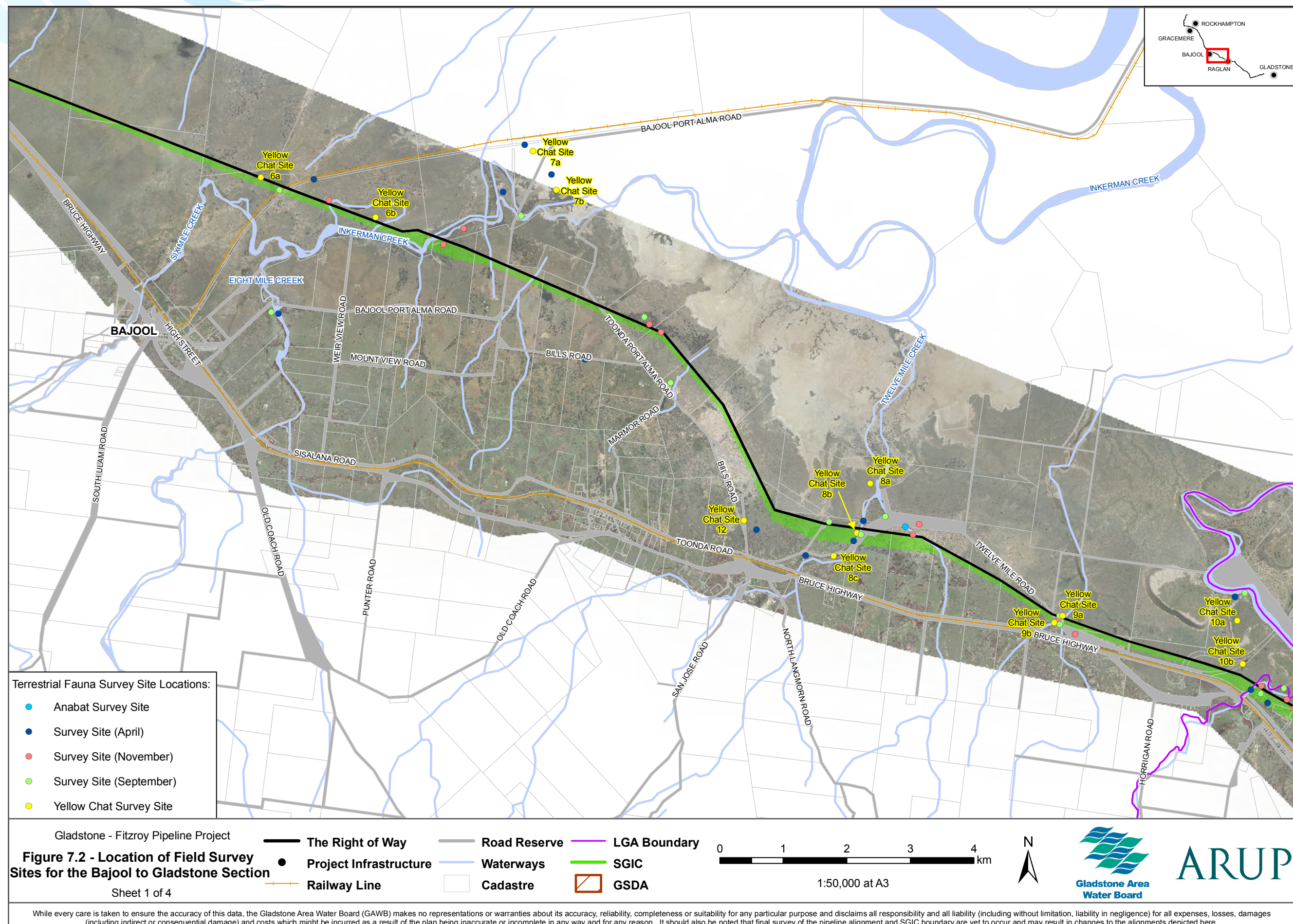
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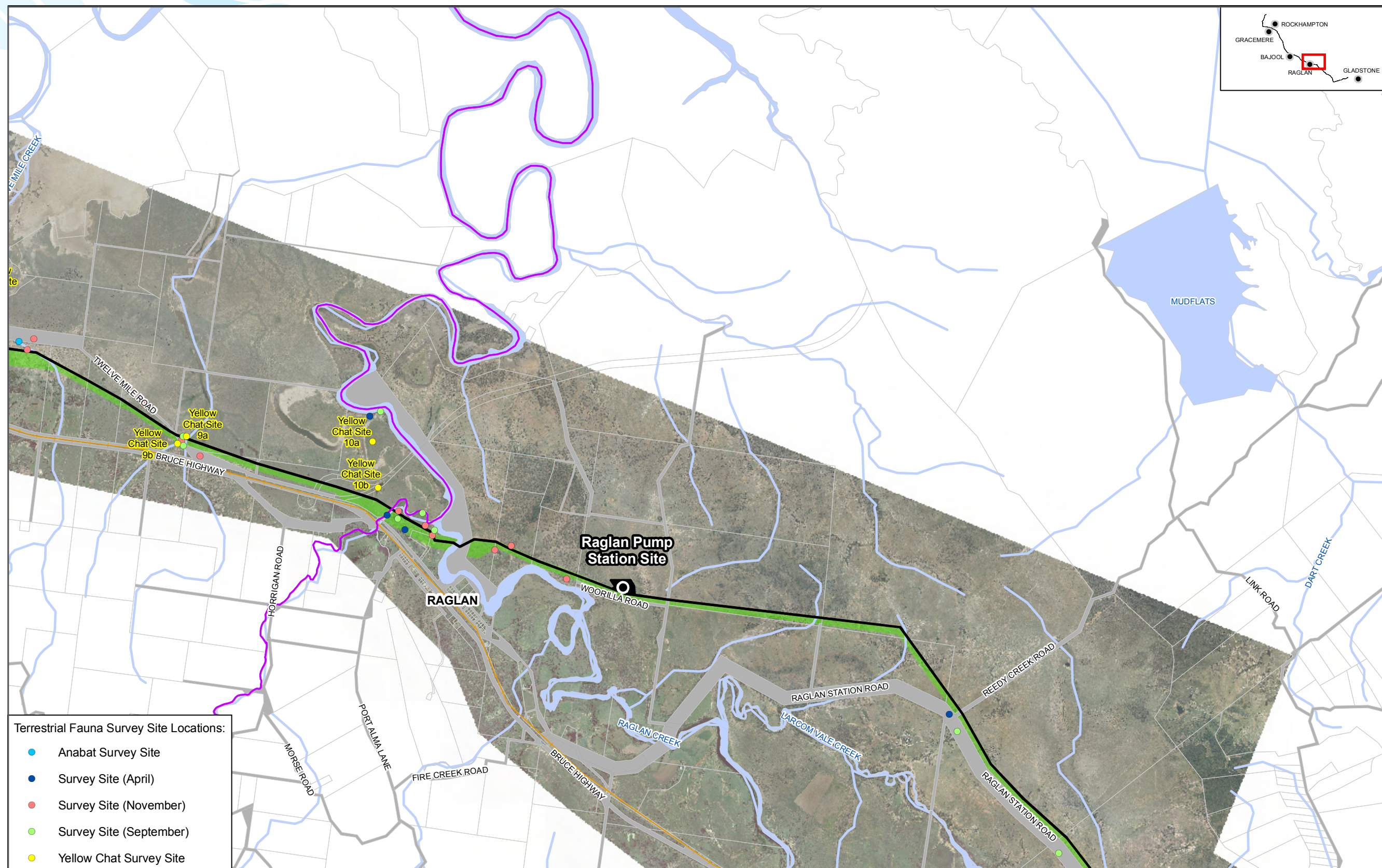
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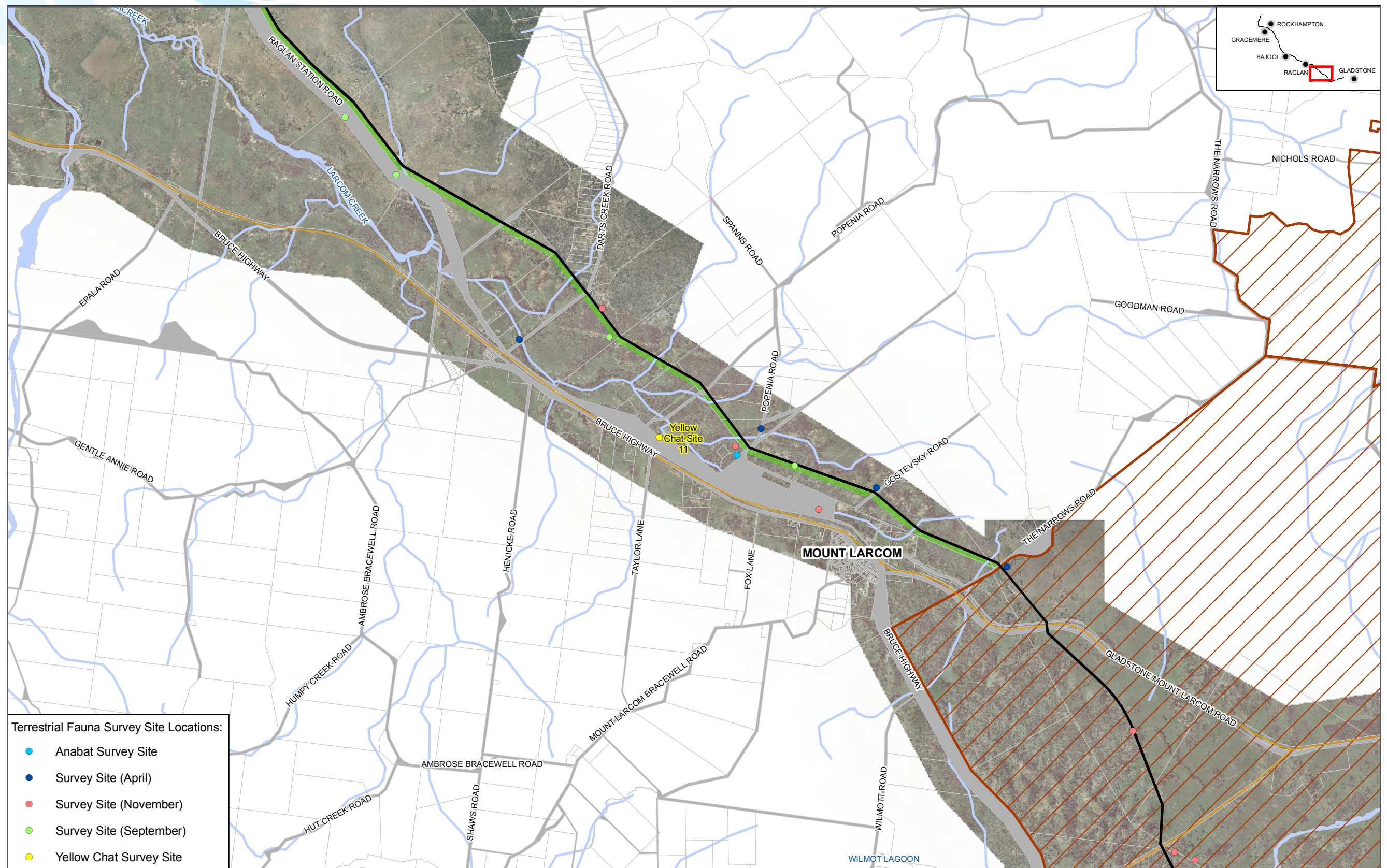


Gladstone - Fitzroy Pipeline Project

Figure 7.2 - Location of Field Survey Sites for the Bajool to Gladstone Section

Sheet 2 of 4

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- Terrestrial Fauna Survey Site Locations:
- Anabat Survey Site
 - Survey Site (April)
 - Survey Site (November)
 - Survey Site (September)
 - Yellow Chat Survey Site

Gladstone - Fitzroy Pipeline Project

Figure 7.2 - Location of Field Survey Sites for the Bajool to Gladstone Section

Sheet 3 of 4

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

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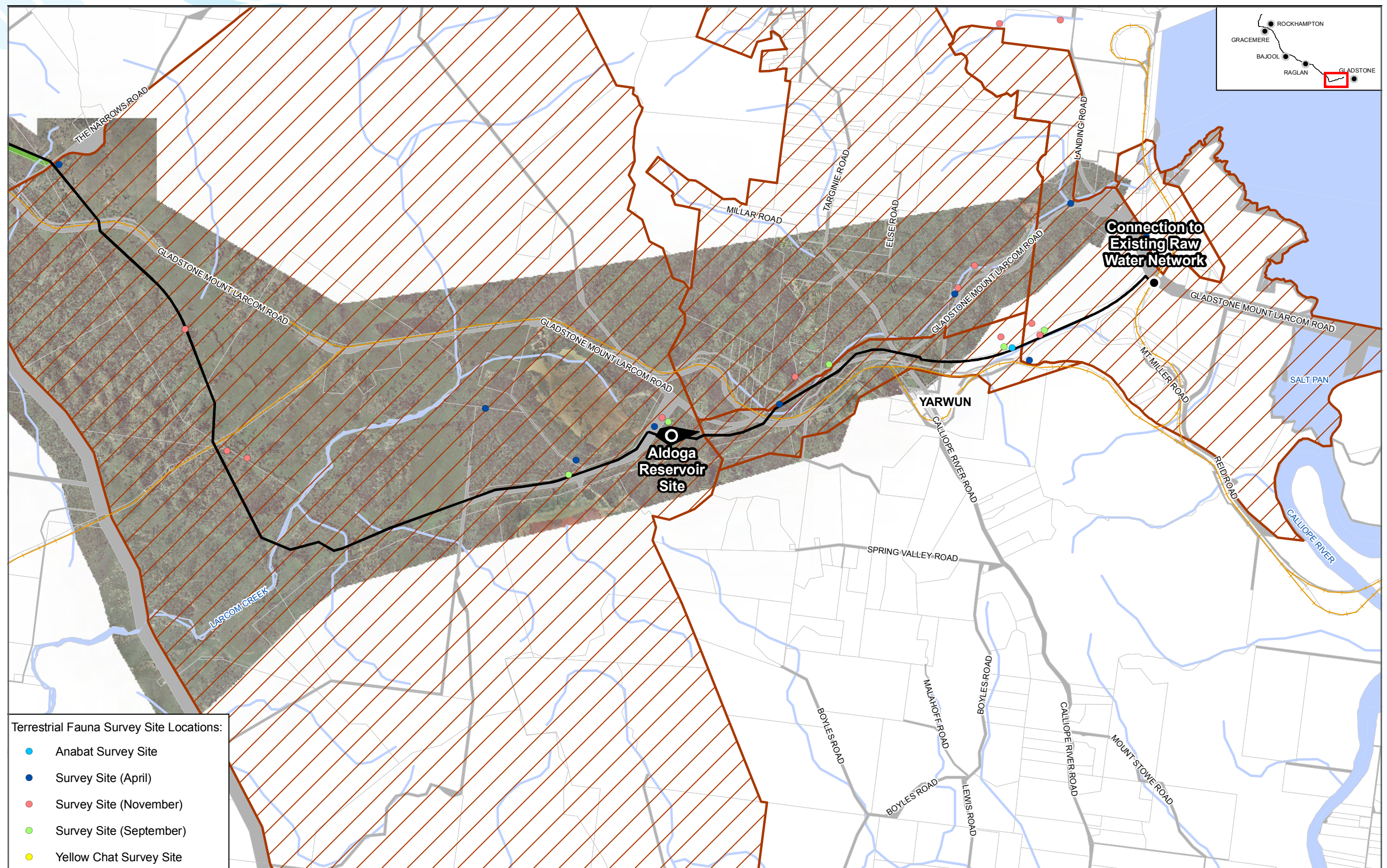
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- Terrestrial Fauna Survey Site Locations:
- Anabat Survey Site
 - Survey Site (April)
 - Survey Site (November)
 - Survey Site (September)
 - Yellow Chat Survey Site

Gladstone - Fitzroy Pipeline Project

Figure 7.2 - Location of Field Survey Sites for the Bajool to Gladstone Section

Sheet 4 of 4

The Right of Way

Project Infrastructure

Railway Line

Road Reserve

Waterways

Cadastre

LGA Boundary

SGIC

GSDA

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| Site # | Central GPS reference | Summary description | Monitoring events |
|--------|-----------------------|---|---|
| 8b | 270530E 7379259S | Bulrush-lined freshwater section Twelve Mile Creek downstream of Twelve Mile Road and contiguous with Twelve Mile Creek Reserve. A series of large pools fringed with Typha and Eleocharis sp. Corridor traverses this habitat area | April, June, July, August, September, October, November, December |
| 8c | 270111E 7378801S | Freshwater section Twelve Mile Creek upstream of Twelve Mile Road. Includes pools fringed with Typha and Eleocharis sp. Approximately 800 m upstream of corridor crossing of Twelve Mile Creek | April, June, July, August, September, October, November, December |
| 9a | 273668E 7377863S | Seasonal wetlands (both artificial and natural) associated with Pelican Creek. Corridor transects upstream section of wetland. The majority of wetland habitat extends to east | April, June, July, August, September, October, November, December |
| 9b | 273585E 7377768S | Small, semi-permanent constructed wetland fringed with Typha and Eleocharis sp. On western side of Twelve Mile Road and approximately 100 m west and upstream of corridor | April, June, July, August, September, October, November, December |
| 10a | 276457E 7377847S | Saltmarsh environs associated with the Raglan Creek oxbow. Also includes semi-permanent constructed wetlands, adjacent and to the south and southwest. This site is directly to the north of site 10b. Approximately 600 m north and downstream of corridor | April, June, July, August, September, October, November, December |
| 10b | 276551E 7377043S | A series of seasonal wetlands associated with Hourigan Creek. Includes natural saltmarshes and shallow, seasonal natural and constructed wetlands and levees. Corridor traverses eastern edge of area. Downstream of corridor | April, June, July, August, September, October, November, December |
| 11 | 291225E 7366997S | A large, vegetated semi-permanent billabong associated with Darts Creek. Remnant vegetation surrounds site and includes Eucalyptus tereticornis | April, June, July, August, September and December |
| 12 | 268699E 7379374S | Two small vegetated freshwater dams adjacent and to the east and west of the Toonda Port Alma Road. Approximately 500 m to west and upstream of corridor | April, June, July, August, September, October, November, December |

7.2.4.3 Spring-season Avifauna Surveys

For terrestrial habitats, surveys were undertaken on foot along transects through selected areas representative of the variety of habitat types along the corridor. At each location, surveys were undertaken for a minimum of 30 minutes and the time spent at a location was determined by factors including habitat extent and level of bird activity at the time. Birds were identified from either direct observation and/or their vocalisation. Target species included: Squatter Pigeon (*Geophaps scripta*), Square-tailed Kite (*Lophoictinia isura*), Red Goshawk (*Erythrotriorchis radiatus*), Glossy Black Cockatoo (*Calyptrohynchus lathamii*), and Black-chinned Honeyeater (*Melithreptus gularis*).


A variety of wetlands were surveyed for waterbirds. Each census was undertaken using binoculars and/or a tripod mounted spotting scope (25 to 60 times magnification). In the main, visual coverage of the full extent of the site was completed at least once with the survey duration dependent on factors

like size of waterbody and number of birds present. At each location, surveys were conducted for a minimum of 20 minutes. Target species included: Black-necked Stork (*Ephippiorhynchus asiaticus*), Cotton Pygmy-goose (*Nettapus coromandelianus*), Radjah Shelduck (*Tadorna radjah*), Yellow Chat (*Epthianura crocea macgregori*) and Migratory waders.

These surveys were conducted by Lindsay Agnew on 2 to 6, 27 and 28 September 2007. The location of each survey site is provided in Figure 7.1 and Figure 7.2.

7.2.4.4 Target Species and Biodiversity Survey

A series of rapid biodiversity assessments and target species surveys were undertaken in a range of representative and/or distinctive habitat types throughout the project area. The survey program was undertaken between 18 and 31 November 2007 and implemented by Lindsay Agnew and Dr. Ed Meyer. Greg Ford provided assistance with Anabat call recording analysis.



The timing of the survey program was designed to coincide with warmer conditions when bioactivity is typically higher for all vertebrate fauna groups. The timing was considered particularly important as it enhanced the ability to detect target species, especially reptiles.

The field survey targeted a full suite of remnant, remnant regrowth and cleared habitats representative of those occurring throughout the extent of the project area. These areas were determined from the results of a review of aerial photography and vegetation mapping and field observations from the previous survey activities (i.e. preliminary biodiversity surveys, monthly Yellow Chat monitoring and spring-season avifauna surveys). The variety of field methodologies deployed and the survey effort applied at each survey area was influenced by the following:

- The presence, extent and condition of preferred habitat types for species of conservation significance
- The potential of an area to support higher biodiversity values, e.g. those areas forming part of a notably larger wetland or forested habitat area
- The potential of an area to support higher fauna movement values, e.g. riparian environments.

Survey activities undertaken to assess target species and biodiversity were applied on each survey night and survey day and included:

- *Diurnal ground searches.* These dedicated searches were undertaken for reptiles at selected sites (of approximately 2 ha (0.02 km²) in area) and surveyed for a minimum of one survey per hour. Surveys were undertaken mid-morning to mid-afternoon of each survey day. Active ground searches were undertaken to locate active/inactive reptiles. Ground searches included rolling logs and rocks, raking soil at the base of trees and shrubs, searching under exfoliating bark on logs and standing dead or live trees and examination under debris
- *Morning and afternoon bird surveys.* Surveys were undertaken along foot transects through selected habitats, typically for a minimum of a 30 minutes. Surveys were conducted within three hours of sunrise and sunset of each survey day. Birds were identified from either direct observation and/or their vocalisation
- *Call playback surveys.* These surveys were undertaken for owls and a variety of cryptic wetland birds. For nocturnal birds, the procedure included playback of calls in a specified order with each species' call separated by several minutes of listening for responses and visual scanning (in the dark) of the immediate surrounds for birds. After all calls were broadcast, the call site and close vicinity were scanned by spotlight for approximately five to ten minutes. Calls were broadcast through a vehicle's stereo system. Target species included Rufous Owl (*Ninox queenslandica*), Powerful Owl (*Ninox strenua*), Grass Owl (*Tyto capensis*) and Barking Owl (*Ninox connivens*). Once a species was detected, no further calls of that species were broadcast for the remainder of the survey program. For wetland sites, target species included Lewin's Rail (*Rallus pectoralis*), Buff-banded Rail (*Gallirallus philippensis*), Spotless Crake (*Porzana tabuensis*) and Bush Hen (*Amaurornis olivaceus*). The procedure included playback of calls for three to five minutes per species. Each species call was separated by several minutes of listening for responses and visual scanning of the immediate surrounds of the call site. Call recordings for wetland avifauna were sourced from Stewart (1999) and those for nocturnal birds were sourced from Stewart (1998)
- *Anabat ultrasonic call detection surveys.* The survey program for insectivorous bat fauna was undertaken using electronic bat detectors. Remote detection techniques with Anabat II detectors were used to record the ultrasonic signals of active bats. Remote detection (i.e. equipment programmed for unattended, fixed point, overnight detection of microbat calls) was conducted on six survey nights (dusk to dawn)
- *Walking spotlight surveys.* These surveys were undertaken at a variety of potentially suitable forested and wetland sites. Spotlighting surveys on foot were undertaken using 30-Watt spotlights and low-wattage headlamps. Depending on the habitat characteristics, approximately half of the search effort was dedicated to arboreal searches with the remaining time spent on ground searches for nocturnal herpetofauna and ground mammals (e.g. bandicoots). Where applicable, arboreal surveys targeted mammals (e.g. possums and gliders), nocturnal birds (e.g. owls and nightjars), reptiles (e.g. snakes and geckos) and flying mammals (e.g. flying foxes).
- *Driving spotlight surveys.* Driving spotlight searches were undertaken from a four-wheel drive vehicle along the track system within the project area (i.e. driver plus one observer with 100-Watt spotlight). These were conducted for a minimum of 30 minutes on each of the survey nights. Driving spotlight searches were undertaken primarily to survey for larger arboreal and ground mammals (e.g. macropods, foxes, cats and dogs). Additional road transects were also conducted specifically to survey for herpetofauna
- *Waterbody/wetland surveys.* A variety of waterbodies/wetlands were surveyed for waterbirds, waders and freshwater turtles. For avifauna, a census was undertaken using binoculars and/or a tripod mounted spotting scope (25 to 60 times magnification). Visual coverage of the full extent of the site was completed at least once with the census duration dependent on factors like the size of the waterbody and number of birds present. At each site, an additional inspection of the waterbody surface and margins was undertaken to assess the presence of freshwater turtles. Binoculars and/or a tripod mounted spotting scope were used to confirm turtle identification

- *Inferential evidence.* Inferential evidence of fauna occurrence was sought and found throughout the project area. This included: visual inspections of trees for trunk scratches/rubbings; searches for both predator and non-predator scats; fauna tracks; and other signs of fauna occurrence (e.g. feeding debris, shed skins and nests). Only evidence, which could be categorised as definitive, was used to record a species occurrence on the study site. Scats or pellets found were either identified in the field (using Triggs 1996) or collected and sent for identification and content analysis by Barbara Triggs, 'Dead Finish', Victoria (faeces analyst). Results were subsequently categorised into one of three reliability classes: definite; probable; or possible.

The location of each survey site and associated survey activities (e.g. call playback and Anabat surveys) is provided in Figure 7.1 and Figure 7.2.

Queensland EPA was consulted regarding the abovementioned survey program and considered it suitable (including specifically the non-trapping approach) given the nature and condition of habitat within the project area and the nature of the project. Consultation with Queensland EPA was undertaken through the Central Region Planning Division, Queensland EPA Rockhampton.

7.3 Assumptions and Limitations

All habitat assessments and fauna surveys were conducted during the period April to November 2007. Although there were moderate amounts of rainfall in late winter and early November 2007, rainfall coverage was patchy, and only the early November rainfall promoted reasonable vegetative growth (particularly in relation to diversity and biomass of grasses) in areas where rainfall was heaviest. Much of the region still exhibited the effects of having experienced drought conditions for an extended period (more than five years).

Consequently, there was a scarcity of permanent to semi-permanent waterbodies within the project area at the time of sampling and conditions sampled here should not be considered as representative of conditions at other times. In respect of water birds, whilst aquatic habitats were restricted in number and size, recorded species diversity was considered sound, though abundance was considered depressed.

Several native fauna groups were poorly represented within the recorded assemblage and/or in low abundance. These were the arboreal mammals, bats, frogs (arboreal, ground-dwelling and burrowing taxa) and elapid snakes. A variety of factors may be linked to these results and include:

- The effect of prolonged dry conditions on the presence and/or extent of favourable conditions and resources (e.g. very limited areas of surface water and depressed frog activity)
- The condition, absence or scarcity of certain key structural habitat resources in parts of the project area, e.g. suitable tree hollows (arboreal mammals), fallen timber (mainly herpetofauna) and sparse ground cover conditions (small ground mammals and skinks).

Several target species for the field investigations are cryptic and difficult to detect (e.g. crakes, rails, Grey Snake (*Hemiaspis damelii*), Yakka Skink (*Egernia rugosa*)). Under optimal conditions, surveys undertaken at multiple time periods would be required to confirm the absence (or otherwise) of these species from a site. This survey limitation has been minimised by the use of previous records, in conjunction with habitat assessment, to predict which species are likely to occur.

It is probable that additional species would be detected with more survey effort, particularly those species whose activity (and thus chances of detection) is higher during wetter periods. Potential limitations of the fauna survey were primarily associated with:

- Several years of dry to very dry (drought) field conditions prior to survey period. Such conditions are likely to have resulted in generally lower abundance of most fauna groups overall and significantly constrained the opportunity to determine the occurrence of a number of cryptic amphibian and reptile species that are more readily detected at other times of the year or weather conditions
- A low abundance of flowering plants throughout the project area, in particular canopy trees which is linked to the above point. Blossom provides an important source of food (e.g. nectar and pollen) and invertebrate prey for birds, microbats, flying foxes and small glider species. The diversity and abundance of small insectivorous birds (e.g. honeyeaters) are likely to be lower than could be expected as a result.

There were no notable or permanent impediments to accessing the extent of the project area, and where individual property access was not granted, surveys were undertaken at adjacent sites or public areas.

7.4 Relevant Legislation and Policy

Commonwealth and State (Queensland) legislation and policies relevant to this assessment include the following:

- *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
- *National Strategy for the Conservation of Australia's Biological Diversity 1996* (Commonwealth)
- *Nature Conservation Act 1992* and regulations (Queensland)
- *Vegetation Management Act 1999* (Queensland) and QEPA Essential Habitat Maps
- *Land Protection (Pest and Stock Route Management) Act 2002* (Queensland)
- *Coastal Protection and Management Act 1995* and *State Coastal Management Plan* (Queensland)

Australia is committed to a variety of international conventions, which apply generally to the construction and operation of the proposed project and are relevant through the administration of the *EPBC Act*. These are:

- JAMBA: the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1974
- CAMBA: the Agreement between the Government of Australia and the Government of China for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1986
- *Ramsar Convention*: the Convention on Wetlands of International Importance 1971
- *Bonn Convention*: the Convention on the Conservation of Migratory Species of Wild Animals 1979
- *Convention on Biological Diversity 1993*.

The Australian Pipeline Industry Association (APIA) *Code of Environmental Practice – Onshore Pipelines (2005)* identifies a range of best practice techniques and methods presently available to mitigate or eliminate the environmental impact of pipeline construction and operation on the receiving environment. The code aims to provide guidance and direction in the management of the environmental aspects of pipeline planning, design, construction, operation and decommissioning.

See Chapter 6, Section 6.1 for a summary, and Appendix G for an assessment specifically dealing with the project's relevant matters of National Environmental Significance (Threatened Species and Ecological Communities) under the *EPBC Act*.

7.5 Baseline

7.5.1 Existing Information Review

7.5.1.1 Matters of National Environmental Significance

Matters of National Environmental Significance (NES) are protected under the *EPBC Act* and include:

- World Heritage properties, i.e. Australian property on the World Heritage List kept under the World Heritage Convention or a property declared to be a World Heritage property by the Commonwealth Environment Minister
- National Heritage places, i.e. a place identified on the National Heritage List, including natural, historic and Indigenous places that are of outstanding national heritage value to the Australian nation
- Ramsar wetlands of international importance, i.e. either an Australian wetland on the List of Wetlands of International Importance kept under the Ramsar Convention or a wetland declared to be a Ramsar wetland by the Commonwealth Environment Minister
- Threatened species and ecological communities;
- Migratory species
- Commonwealth marine areas, i.e. any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, which are not State or Northern Territory waters. Generally, the Commonwealth Marine area stretches from three nautical miles to two hundred nautical miles from the coast
- Nuclear actions.

7.5.1.2 Protected Places

No World Heritage properties, National Heritage places or Commonwealth Marine areas are directly associated with, or adjacent to, the project area and the proposed pipeline does not involve any nuclear action. The Great Barrier Reef (World Heritage property) and Shoalwater and Corio Bays (Ramsar wetlands) are at least 40 km to the east of the project area.

Threatened and Migratory Fauna

The review of existing information sources (including an *EPBC Protected Matters* database search) for the wider area within 30 km of the project area provided records for a variety of Threatened and/or Migratory species as listed under the *EPBC Act*. These species, with relevant conservation status and notes on habitat and distribution are provided in Table 7.2 and Table 7.3.

Protected Area Management, Species Recovery and Conservation Plans

The EPBC Protected Matters database search found a number of protected areas, though all are distant to the project area. These include:

- World Heritage Properties: Great Barrier Reef QLD
- Wetlands of International Significance (Ramsar Sites):
 - Shoalwater and Corio Bays Area (Shoalwater Bay Training Area, in part – Corio Bay). The southern boundary is approximately 50 km north of Rockhampton and the majority of the area falls within the Shoalwater Bay Military Training Area (SWBTA)
- Register of the National Estate (Australian Heritage Database):
 - Great Barrier Reef QLD
 - Curtis Island (part), Curtis Island, QLD, Australia. The National Estate area occupies the eastern half of Curtis Island, which is separated from the mainland by a narrow passage
 - Garden Island Environmental Park, Curtis Island, QLD, Australia. A small area of the southern extremity of Curtis Island, 5km north of Gladstone.

There are management plans for the Great Barrier Reef and Curtis Island. In addition, the Southeast Queensland Regional Coastal Management Plan provides management guidelines for these areas.

As at October 2007, there are no recovery plans adopted under the EPBC Act, or any draft recovery plans open for public comment, which are relevant to Threatened or Migratory fauna species known or likely to occur within the project area. Currently, there is a recovery plan in preparation for the Yellow Chat (*Epthianura crocea macgregori*) (August 2007).

In August 2008, a recovery plan for the Yellow Chat (*Epthianura crocea macgregori*) was released by the Commonwealth and Queensland governments (Houston and Melzer 2008). The recovery plan lists the following as threats to Yellow Chats:

1. Lack of knowledge regarding key aspects of Capricorn Yellow Chat ecology and habitat requirements.
2. Construction of barriers such as extensive levee banks for ponded pasture development or road works within tidal areas.
3. Construction of impoundments (weirs and dams or ponded pastures) upstream of areas supporting Yellow Chats.
4. Spread of exotic pasture grasses, particularly aleman grass and Olive hymenachne.
5. Increase in cattle stocking densities where chats currently occur.
6. Uncontrolled fire.

Field survey work undertaken to investigate potential Yellow Chat habitat within the project area will contribute to the understanding of Yellow Chat occurrence and habitat usage (thus support resolution of threat #1). In relation to threats 2 and 3, the project does not involve development of levee banks or impoundments and is supported by a extensive range of impact avoidance and mitigation strategies in relation to construction works within or near wetlands, thus the project will not exacerbate the effects of threats 2 and 3. In relation to threat 4, a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of environmental weeds within the project area (see Chapter 20, Planning Environmental Management Plan). Likewise, there are a suite of project controls designed to eradicate and environmental weeds which may establish within the project area and adjoining land. In relation to threat 5, the project does not involve the introduction of cattle and a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of introduced fauna within the project area (see Chapter 20, Planning Environmental Management Plan). In relation to threat 6, protocols have been prepared to ensure minimal risk of fire emanating from the project area (See Chapter 16, Hazard and Risk; and Chapter 20, Planning Environmental Management Plan).

The Commonwealth has produced a series of Action Plans for mammals (Maxwell *et al.* 1996), reptiles (Cogger *et al.* 1993), frogs (Tyler 1997) and birds (Garnett and Crowley 2000) which include information on a variety of species known or likely to occur within the project area. These are strategic documents review the conservation status of major Australian taxonomic groups against World Conservation Union (IUCN) categories, identify threats and recommend actions to minimise those threats. They are intended to assist government and non-government organisations to establish national priorities for Threatened species conservation.

7.5.1.3 State Matters of Significance

Essential Habitat

Essential habitat is an area of vegetation in which a Rare or Threatened species is known to occur. Essential habitat areas are identified by the Queensland Environment Protection Agency (QEPA) as being crucial for the survival of a species of wildlife which has been listed as Endangered, Vulnerable, Near-Threatened or Rare under the NC Act. Essential habitat is a major constraint and all areas should be avoided in order to minimise any potential disturbance to areas of known ecological value.

Essential habitat mapping was sought from the Department of Natural Resources and Water (DNRW; i.e. the *VM Act* Essential Habitat Map) for an area within 20 km of the project area. There are no areas of essential habitat mapped within or adjacent to the project area. There are two areas of essential habitat mapped within 20 km of the project area. These areas are

upstream and well beyond any direct influence of project area, being approximately 10 km to the west of project area and 4 km south of Bouldercombe.

Wildlife Corridors

State wildlife corridors are areas of vegetation that have been identified by the QEPA as vital habitat for Migratory species in Queensland. Data on the location of wildlife corridors that occur within the project area was obtained from QEPA. Data is provided in Chapter 6, Terrestrial Flora.

Rare and Threatened Fauna

The review of existing information sources (including a QEPA Wildlife Online database extract) for the area within a 30 km radius of the project area provided records for a variety of Rare and Threatened species as listed under the NC Act. These species, with relevant conservation status and notes on habitat and distribution are provided in Table 7.2 and Table 7.3.

Protected Area Management, Species Recovery and Conservation Plans

There are a variety of protected areas in the region, though all are distant to the project area. These include:

- Limestone Creek Conservation Park
- Mount Archer National Park
- Garden Island Conservation Park
- Mackay/Capricorn Marine Park
- Rodds Bay Dugong Protection Area.

Whilst there are no management plans for the specific areas, the Southeast Queensland Regional Coastal Management Plan provides management guidelines for coastal protected areas.

As at October 2007, the *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 – 2016* is the only QEPA management plan relevant to Rare or Threatened fauna species known or likely to occur within the project area.

Table 7.2 List of Rare and Threatened Fauna Derived from Review of Existing Information

| Status: | CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory | | |
|---|--|------------|--|
| Legislation: | EPBC = <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) NCA = <i>Nature Conservation Act 1992</i> (Qld) | | |
| Primary Sources: | QEPA Wildlife Online Extract and EPBC Online Protected Matters Report (August 2007) | | |
| Species | EPBC status | NCA status | Species profile notes and regional context |
| Koala (Southeast Qld) (<i>Phascolarctos cinereus</i>) | | RV | Arboreal folivore occurring in low density in <i>Eucalyptus</i> woodland and forest. Riparian habitats likely to be important both as foraging habitat and as movement corridors. |
| Ghost Bat (<i>Macroderma gigas</i>) | | V | Highly restricted regional distribution which is influenced by availability of large complex caves or mine adits as roost sites (Churchill 1998). |
| Semon's Leaf-nosed Bat (<i>Hipposideros semoni</i>) | E | V | Core distribution from Cape York Peninsula to Cooktown, though tentative records suggest that it may also occur in disjunctive populations further south in the Mt. Windsor Tableland area, Kroombit Tops National Park, or even as far south as St. Mary's State Forest near Maryborough (Thomson <i>et al.</i> 2002, Schulz and de Oliveira 1995, de Oliveira and Pavey 1995, and Coles <i>et al.</i> 1996 cited in Thomson <i>et al.</i> 2002). Roosts in cavernous sites and may be an obligate cave dweller, though recorded from other man-made structures, e.g. abandoned mines (Hall 1995). May favour rock escarpment country where it roosts under rock overhangs and in shallow caves (Thomson <i>et al.</i> 2002). North Queensland habitats described as rainforest, forest, open woodland and vine thickets (Hall <i>et al.</i> 2000). |
| Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) | V | | Occurs along the east coast of Australia, from Gladstone to southwest Victoria and within sub-tropical and temperate forests, including rainforest, tall sclerophyll forest and woodlands, heath, paperbark swamps and also occurs within urban and agricultural areas where food trees are cultivated (Churchill 1998, Duncan <i>et al.</i> 1999). Favours fruits of rainforest trees, nectar and pollen of <i>Myrtaceae</i> , <i>Proteaceae</i> and rainforest tree species, though also feeds on fruit from introduced species (Eby 1991 Tidemann 2002). Roost sites (camps) are usually traditional, regularly used and occupied when suitable food resources are available in the surrounding area (Hall and Richards 2000). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|---|-------------|------------|--|
| Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>) | V | R | Northern range limits to about Blackdown Tableland/Rockhampton (Hoye and Dwyer 2000). In region, only recorded from extensive areas dry and wet sclerophyll forest, i.e. Carnarvon Gorge National Park (<i>pers comm.</i> G. Ford 2004). Cave dwelling species, though also known to roost in mine tunnels and abandoned Fairy Martins nests (Hoye and Dwyer 2000). |
| Greater Long-eared Bat (<i>Nyctophilus timoriensis</i>) | V | V | Known current northern range limits in Theodore/Moura district. Few records in southern Brigalow Belt, mainly from shrubby open forest and woodland habitats (McFarland <i>et al.</i> 1999). Roost in tree hollows, fissures in branches, and under sheets of bark (Churchill 1998, Parnaby 2000). |
| Little Pied Bat (<i>Chalinolobus picatus</i>) | | R | Occurs in a variety of woodland and shrubland habitats and roosts in caves, mines, rocky outcrops, buildings and tree hollows (Churchill 1998). |
| Coastal Sheath-tail Bat (<i>Taphozous australis</i>) | | V | Distributed along a thin coastal band (including some off-shore islands) from Shoalwater Bay to Torres Strait (Clague <i>et al.</i> 1999). Believed to be unevenly distributed throughout its range due to a reliance on coastal roosts (e.g. sea caves) resulting in a distribution extending no more than a few kilometres inland (Richards 1995a, Churchill 1998, Clague <i>et al.</i> 1999). Within its southern distribution, i.e. Shoalwater Bay area, it is has been regarded as abundant to uncommon (Catling <i>et al.</i> 1994 in Clague <i>et al.</i> 1999). Known to forage in vegetation of sand dune scrub, mangroves, <i>Melaleuca</i> swamps, coastal heathlands, open <i>Eucalyptus</i> forest and grasslands (Richards 1995a, Clague <i>et al.</i> 1999, Hall <i>et al.</i> 2000). |
| Estuarine Crocodile (<i>Crocodylus porosus</i>) | | R | Inhabits coastal rivers, estuaries and wetlands along Queensland coast south to about Rockhampton (Queensland Museum 2000). |
| Fitzroy River Turtle (<i>Rheodytes leukops</i>) | V | V | Restricted to Fitzroy River catchment. Prefers combination of deep pools connected by shallow riffles, high water quality and extensive beds of Ribbon Weed (<i>Vallisneria</i> sp.) on which it feeds (Legler and Cann 1980, Cogger <i>et al.</i> 1993). |
| Collared Delma (<i>Delma torquata</i>) | V | V | Endemic to SEQ. Highly restricted, disjunct populations from outer Brisbane western suburbs to Blackwater, central Qld (DEH 2005b). A cryptic reptile known from mainly open, rocky terrain on basalt and lateritic soils with open <i>Eucalyptus</i> and <i>Acacia</i> woodland with a sparse cover of tussock grass and shrubs or semi-evergreen vine thicket (Wilson 2005a, Ryan 2006). |
| Brigalow Scaly-foot (<i>Paradelma orientalis</i>) | V | V | Endemic to region. Brigalow forest and <i>Eucalyptus</i> woodland with tussock grass ground cover (Cogger <i>et al.</i> 1993). Ground micro-habitat diversity appears to be an important habitat attribute (Wilson and Knowles 1998). |
| <i>Anomalopus brevicollis</i> (no common name) | | R | Endemic to region. Open sclerophyll forest, vine thicket, rainforest habitats on sandy or cracking clay-based soils and rock outcrops (Cogger 2000, Wilson 2005a). |
| Yakka Skink (<i>Egernia rugosa</i>) | V | V | Lives in communal burrows within dry open forest and woodland, often featuring coarse gritty soils near low rocky outcrops (Cogger 2000, Wilson 2005a). |
| Common Death Adder (<i>Acanthophis antarcticus</i>) | | R | Formerly abundant in parts of the Brigalow Belt, though numbers have declined dramatically (Wilson 2005a). In a wide variety of habitats including wet and dry sclerophyll forest, woodland, shrublands and heaths (Wilson and Knowles 1998). |
| Ornamental Snake (<i>Denisonia maculata</i>) | V | V | Endemic to region. Specialist frog predator (Shine 1983). Seasonally inundated areas (esp. gilgai in Brigalow) with deep cracking soils of woodland, shrubland and natural levees (Ehmann 1992, Wilson 2005a, DEH 2005c). |
| Yellow-naped Snake (<i>Furina barnardi</i>) | | R | Endemic to region. Taxonomy status and ecology uncertain. A skink predator from dry woodlands and rock outcrops (Wilson 2005a). |
| Dunmall's Snake (<i>Furina dunmali</i>) | V | | Few records in region (e.g. Expedition Range National Park; DEH 2005a). Open forest and woodland (including brigalow, belah and cypress pine) on cracking black clay and clay loam soils (Cogger <i>et al.</i> 1993, Wilson 2005a). <i>Eulamprus</i> skinks may form an important component of diet (Shine 1981). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|---|-------------|------------|---|
| Grey snake (<i>Hemiaspis damelii</i>) | | E | Restricted distribution extending from central inland NSW, northeast to coastal districts near Rockhampton (Wilson and Swan 2003). Potentially a frog specialist with crepuscular habits (Shine 1987). Known from floodplains and woodlands, usually on heavier, cracking clay soils (Cogger 2000, Wilson and Swan 2003). May favour woodlands on heavier, cracking clay soils, in association with waterbodies (Wilson and Swan 2003). |
| Ornamental Snake (<i>Denisonia maculata</i>) | V | V | Endemic to region (Cogger <i>et al.</i> 1993). Specialist frog predator diet (Shine 1981). Seasonally inundated areas (especially gilgai in Brigalow) with deep cracking soils of woodland, shrubland and natural levees (Ehmann 1992, Cogger 2000, Wilson 2005a). |
| Tusked Frog (<i>Adelotus brevis</i>) | | V | Known from a variety of rain forest, wet sclerophyll forest, and occasionally from dry forest communities (Czechura 1995a, Meyer <i>et al.</i> 2001). It is also known to persist in heavily disturbed sites e.g. pasture land (Czechura 1995a), though the viability of these populations is unknown (Hines <i>et al.</i> 1999). |
| Radjah Shelduck (<i>Tadorna radjah</i>) | M | R | Inhabits shallow, freshwater and saline wetlands of coastal and near-coastal areas north from about Maryborough (Marchant and Higgins 1990). Know to use both natural and artificial wetlands and feeds on invertebrates and seeds along shallow wetland margins (Frith 1982b). |
| Cotton Pygmy-goose (<i>Nettapus coromandelianus</i>) | M | R | Wholly aquatic small duck on deeper permanent freshwater wetlands (natural or artificial) which support patches of abundant growth of floating and submerged macrophytes (e.g. pondweeds and waterlilies) in combination with areas of open water (Frith 1982b). Occurs throughout coastal areas of Queensland from about Brisbane to Princess Charlotte Bay, though also on inland waterbodies of Central Queensland (Marchant and Higgins 1990). |
| Black-necked Stork (<i>Ephippiorhynchus asiaticus</i>) | | R | Prefers large terrestrial wetlands (though also smaller waterbodies nearby) and forages in shallow water (<0.5m) for a variety of fish and other small vertebrates (Marchant and Higgins 1990). |
| Square-tailed Kite (<i>Lophoictinia isura</i>) | M | R | Extensive areas of open forest and woodland, particularly those on fertile soils with abundant populations of passerine birds (Debus and Czechura 1989, Marchant and Higgins 1993). |
| Grey Goshawk (<i>Accipiter novaehollandiae</i>) | M | R | Secretive predator of small birds in forest habitats that provide the preferred dense shaded tree canopies including rainforests, gallery and wet sclerophyll forest (Marchant and Higgins 1993). |
| Red Goshawk (<i>Erythrotriorchis radiatus</i>) | V & M | E | These raptors require a very large home range. Distribution uncertain in region, though known from the eastern sector. Very large home ranges (e.g. 50 to 220 km ² (Debus 2001)) including open forests and woodlands, tropical savannas traversed by riverine vegetation (Garnett and Crowley 2000). In partially cleared areas of eastern Queensland associated with gorge and escarpments (Czechura and Hobson 2000). |
| Grey Falcon (<i>Falco hypoleucos</i>) | M | R | Reaches eastern distribution limits within region and likely to only occur as a very Rare, non-breeding visitor (Marchant and Higgins 1993). |
| Black-breasted Button-quail (<i>Turnix melanogaster</i>) | | V | Inland to Palm Grove National Park, with records throughout both Dawson and Fitzroy River catchments (Hamley <i>et al.</i> 1997). Variety of dry closed forests, particularly semi-evergreen vine thickets, though also recorded from softwood scrubs in the brigalow belt (Hamley <i>e. al.</i> 1997). Requires a largely closed canopy, permanent, usually damp leaf litter layer (25 to 35 mm), and annual rainfall (800–1200mm) (Boorsboom and Smith 1997, Garnett and Crowley 2000). |
| Beach stone-curlew (<i>Esacus neglectus</i>) | | V | Occurs exclusively within coastal environments using a variety of sheltered and open beaches (sandy, muddy or rocky), often around mouths of rivers and beaches associated with mangroves (Marchant and Higgins 1993, Geering <i>et al.</i> 2007). Forages within exposed inter-tidal areas, with nest sites (September to February) typically located landward side of sandy beaches (Marchant and Higgins 1993). |
| Painted Snipe (<i>Rostratula benghalensis</i>) | V & M | V | Occurrence erratic and unpredictable, seldom remaining long in any locality (Marchant and Higgins 1993). Well-vegetated shallow, permanent or seasonal wetlands where it forages on soft muds and in shallow water for invertebrates (Marchant and Higgins 1993, Geering <i>et al.</i> 2007). |
| Squatter Pigeon (sth. subsp.) (<i>Geophaps scripta scripta</i>) | V | | Ground-dweller of drier <i>Eucalyptus</i> woodland with sparse grass cover in close proximity to permanent water (Frith 1982a). Known to use improved pasture, though always near permanent water (Garnett and Crowley 2000, Higgins and Davies 1996). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|--|-------------|------------|--|
| Glossy Black Cockatoo (<i>Calyptrohynchus lathamii</i>) | | V | Highly restricted distribution in eastern parts of region (Barrett <i>et al.</i> 2003). Dependent on seeds of <i>Allocasuarina/Casuarina</i> and hollow-bearing trees for breeding in <i>Eucalyptus</i> forest and woodlands (Higgins 1999). |
| Powerful Owl (<i>Ninox strenua</i>) | | V | Favours large intact remnants of wet or dry sclerophyll forest, and dependent on large tree hollows for breeding and arboreal mammals are favoured prey (though their diet may vary regionally according to local availability of prey species) (Debus and Chafer 1997, Pavey 1994). |
| Rufous Owl (<i>Ninox rufa queenslandica</i>) | | V | Occurs in a variety of forest types including gallery rainforest and paperbark thickets along creeks, rainforest and mangrove edges and vine thickets north of Rockhampton (Garnett and Crowley 2000, Queensland Museum 2000). Requires extensive home ranges and large tree hollows to nest (Higgins 1999). |
| White-rumped Swiftlet (<i>Collocalia spodiopygius</i>) | | R | An aerial insectivore, spending most of the time feeding and sleeping on the wing over most habitat types, including cleared lands (Pizzey and Knight 2003). Southern range limits to about Mackay (Queensland Museum 2000). May occur as a casual visitor in coastal areas of southern Queensland (Pizzey and Knight 2003). |
| Painted Honeyeater (<i>Grantiella picta</i>) | | R | Nomadic and occurring in low densities throughout its range across eastern and central Australia (Garnett and Crowley 2000). A breeding migrant to inland slopes of the Great Dividing Range in NSW, Victoria, and southern Queensland (October to March), with a higher likelihood of being recorded in the northern parts of its distribution during winter (September to February) (Higgins 1999, Pizzey and Knight 2003). A specialist frugivore, favouring fruits of mistletoe (especially <i>Amyema</i> spp.) which parasitize <i>Eucalyptus</i> and <i>Acacia</i> within a wide variety of woodland habitats (Oliver <i>et al.</i> 1998, Higgins 1999). |
| Black-chinned Honeyeater (<i>Melithreptus gularis</i>) | | R | Distributed throughout eastern Australia to about Rockhampton and known from dry <i>Eucalyptus</i> woodland within an annual rainfall range of 400 to 700 mm, particularly associations with ironbark and box eucalypts (Garnett and Crowley 2000, Higgins <i>et al.</i> 2001). May also favour timbered watercourses with sparse understorey (Pizzey and Knight 2003). Feeding territories are large making it locally nomadic and research in the southern parts of range indicates that birds tend to occur in the largest woodland patches in the landscape and do not persist in remnants smaller than 200 ha (NSW SC 2001). |
| Yellow Chat (<i>Epthianura crocea macgregori</i>) | CE | E | Endemic to area and known from Curtis Island, the Torilla Plain and Fitzroy River delta, though seasonally mobile and possibly also occurs in other localities (Jaensch <i>et al.</i> 2004, Houston <i>et al.</i> 2004a). Known from freshwater and saline wetlands on marine plains including swampy grassland, saline hermland, saltmarshes, <i>Cyperus</i> sedgeland (Houston <i>et al.</i> 2004b). All sites where the Yellow Chat has are known to persist year-round are associated with drainage channels on coastal marine plains connected to tidally influenced wetlands (Houston <i>et al.</i> 2004a, Houston 2004). Typical breeding habitat is a network of braided channels flanked by rank vegetation (rushes, sedges or grass) that provides shelter adjacent to muddy substrates for foraging (Houston <i>et al.</i> 2004b). Dry season habitat requirements are under investigation and may be critical to the Chat's conservation (Houston <i>et al.</i> 2004b, QEPA 2005). |
| Black-throated Finch (sth. subsp.) (<i>Poephila cincta cincta</i>) | E | V | Currently only considered to be locally common near Townsville and Charters Towers (DEC and QWPS 2004). A seedeater known from a variety of grassy savannah woodland habitats dominated by <i>Eucalyptus</i> and/or <i>Corymbia</i> , though also woodlands dominated by <i>Melaleuca</i> and/or <i>Acacia</i> tree species (DEC and QWPS 2004, Higgins <i>et al.</i> 2006). On the coastal plains, grassy <i>Pandanus</i> savannah is also used (Pizzey 1991 in TSSC 2005). An open understorey of seeding perennial and annual grasses and available surface water are essential resources (Zann 1976, Higgins <i>et al.</i> 2006). Riparian woodland habitat is thought to be of particular importance (DEC and QWPS 2004, TSSC 2005). Nests in trees, sometimes in hollows (Zann 1976). |
| Star Finch (sth. subsp.) (<i>Neochmia ruficauda ruficauda</i>) | E | E | A seedeater of grassy woodlands and grasslands close to fresh water, though also recorded in cleared or suburban areas such as along roadsides and in towns (Holmes 1996 and 1998). Sites where recent records have been obtained have been dominated by grasses or have been in areas where the native vegetation has been partially cleared (DEWHA 2007a). Studies at nine former sites found that the habitat consisted mainly of woodland and dominated by trees that are typically associated with permanent water or areas that are regularly inundated; the most common species being <i>Eucalyptus coolabah</i> , <i>E. tereticornis</i> , <i>E. tessellaris</i> , <i>Melaleuca leucadendra</i> , <i>E. camaldulensis</i> and <i>Casuarina cunninghamii</i> (Holmes 1996). Population estimates of about 50 mature individuals in four confirmed sub-populations scattered across central Queensland (e.g. Wowan and Aramac districts) (Garnett and Crowley 2000, DEWHA 2007a). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|---|-------------|------------|--|
| Crimson Finch (<i>Neochmia phaeton</i>) | | V | Inhabits tall grassland with pandanus trees near watercourses on coastal plains, usually in the vicinity of water (Immelman 1982). <i>Neochmia phaeton</i> subsp. is the nominate sub-species and distributed from the Kimberley (WA) to the Barkly Tableland (northwest Queensland) and on the east coast of Queensland from Princess Charlotte Bay and Broad Sound to the drainage basins of the lower Dawson and Mackenzie Rivers (Dorricott and Garnett 2006, DEWHA 2007b). Race <i>iredalei</i> reaches southern coastal limits around Mackay (Pizze and Knight 2003). Race <i>evangelinae</i> occurs on Cape York Peninsula and listed as Vulnerable under the EPBC Act. <i>Neochmia phaeton</i> is listed as Vulnerable at the species level in Queensland under the NC Act, where both occur. Under the NC Act, sub-species that are not listed separately are considered to have the same conservation status as the species (QEPA 2007). |
| Pictorella Mannikin (<i>Heteromunia pectoralis</i>) | | R | Woodlands with a grassy understorey, spinifex grassland, grassy riverine flats near water (Immelman 1982). Can be locally common inland during suitable wet season conditions, then may move over long distances coastward during the dry season (Pizze and Knight 2003). |

Table 7.3 List of Migratory fauna derived from review of existing information

| | |
|-------------------------|--|
| Status: | CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory |
| Legislation: | EPBC = <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) NCA = <i>Nature Conservation Act 1992</i> (Qld) |
| Primary Sources: | QEPA Wildlife Online Extract and EPBC Online Protected Matters Report (August 2007) |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|---|-------------|------------|--|
| Maggie Goose (<i>Anseranas semipalmata</i>) | M | | A variety of wetland habitat types may be used depending on seasonal characters, including artificial waterbodies (Frith 1982b). Typically large wetlands, though also dams which are well-vegetated (particularly rushes and sedges), flood plains and wet grasslands (Frith 1982b, Marchant and Higgins 1990). |
| Hardhead (<i>Aythya australis</i>) | M | | A widespread and relatively common duck of permanent freshwater lakes and swamps (natural or artificial), typically on deep, still reaches of open water (Frith 1982b, Marchant and Higgins 1990). |
| Musk Duck (<i>Biziura lobata</i>) | M | | Widely distributed in southern Australia, though uncommon in northern parts of distribution, i.e. southern Queensland to Fraser Island (Marchant and Higgins 1990). Favours deep, permanent water with a combination of dense vegetation and open water (Frith 1982b). |
| Australian Wood Duck (<i>Cheonetta jubata</i>) | M | | A widespread and relatively common duck of lightly timbered areas near water (natural or artificial wetlands) where there is short grass or herbage beneath trees (Frith 1982b). Highly dispersive in ephemeral habitat with movements localised in better-watered areas (Marchant and Higgins 1990). |
| Wandering Whistling Duck (<i>Dendrocygna arcuata</i>) | M | | A widespread and relatively common duck of tropical (though also sub-tropical) regions and associated with natural and artificial wetlands (Frith 1982b). Favours extensive freshwater lagoons and swamps, though also estuarine and littoral habitats (Marchant and Higgins 1990). |
| Plumed Whistling Duck (<i>Dendrocygna eytoni</i>) | M | | A widespread and relatively common duck of northern and eastern Australia (Marchant and Higgins 1990). Favours tropical coastal and inland grasslands and occurs on both natural and artificial wetlands (Frith 1982b). |
| Radjah Shelduck (<i>Tadorna radjah</i>) | M | R | Inhabits shallow, freshwater and saline wetlands of coastal and near-coastal areas north from about Maryborough (Marchant and Higgins 1990). Known to use both natural and artificial wetlands and feeds on invertebrates and seeds along shallow wetland margins (Frith 1982b). |
| Black Swan (<i>Cygnus atratus</i>) | M | | A widespread and relatively common swan of found on almost any wetland habitat, though more numerous on large permanent waterbodies, either fresh or brackish, natural or artificial (Frith 1982b). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|--|-------------|------------|--|
| Cotton Pygmy-goose (<i>Nettapus coromandelianus</i>) | M | R | Wholly aquatic small duck on deeper permanent freshwater wetlands (natural or artificial) which support patches of abundant growth of floating and submerged macrophytes (e.g. pondweeds and waterlilies) in combination with areas of open water (Frith 1982b). Occurs throughout coastal areas of Queensland from about Brisbane to Princess Charlotte Bay, though also on inland waterbodies of Central Queensland (Marchant and Higgins 1990). |
| Green Pygmy-goose (<i>Nettapus pulchellus</i>) | M | | Distributed throughout tropical coastal and near-coastal areas north from about Gladstone (Marchant and Higgins 1990). Wholly aquatic and prefers deeper, more permanent freshwater lagoons and waterbodies (either natural or artificial) which support waterlilies and sub-emergent aquatic vegetation (Frith 1982b). |
| Chestnut Teal (<i>Anas castanea</i>) | M | | Relatively common and widespread within southern range, though less common in north, i.e. northern NSW and southern Queensland to about Rockhampton (Marchant and Higgins 1990). Occurs on terrestrial wetlands (natural and artificial) and saline habitats including estuaries, mangrove swamps and saltmarsh (Frith 1982b, Marchant and Higgins 1990). |
| Grey Teal (<i>Anas gracilis</i>) | M | | A widely distributed and common duck and highly dispersive in response to climatic changes (Marchant and Higgins 1990). Occurs on almost any fresh, brackish, or saline wetland (either natural or artificial), though prefers billabongs, lagoons and floodwaters of inland rivers (Frith 1982b). |
| Australasian Shoveler (<i>Anas rhynchos</i>) | M | | A widely distributed duck of mainly temperate zone terrestrial wetlands of eastern Australia and less common in sub-tropics and tropics (Marchant and Higgins 1990). Known from a wide variety of wetland habitats (natural or artificial), though favours large, deep, permanent lakes and swamps (Frith 1982b). Specialist filter feeder, using open water and soft muds in fertile wetlands with abundant prey (Marchant and Higgins 1990). |
| Pacific Black Duck (<i>Anas superciliosa</i>) | M | | A very common waterfowl, widely distributed throughout Australia within most fresh, brackish and sometime saline wetland habitats, either natural or artificial (Frith 1982b, Marchant and Higgins 1990). |
| Pink-eared Duck (<i>Malacorhynchus membranaceus</i>) | M | | A widely distributed duck of mainly temperate zone terrestrial wetlands of eastern Australia, though uncommon to scarce in sub-tropics and tropics (Marchant and Higgins 1990). Almost entirely aquatic and specialist filter-feeder requiring open water and soft muds. Favours shallow, turbid inland terrestrial wetlands, though regularly coastal where mean annual rainfall <400 mm (Frith 1982b). |
| Great Egret (<i>Ardea alba</i>) | M | | Estuaries and littoral habitats, permanent terrestrial wetlands and nearby flooded grasslands (Marchant and Higgins 1990). |
| Cattle Egret (<i>Ardea ibis</i>) | M | | Typically associated with grazing cattle. Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats and drains (Pizze and Knight 2003). |
| Glossy Ibis (<i>Plegadis falcinellus</i>) | M | | Feeds in shallow water or on grassy or muddy verges of coastal and inland freshwater wetlands, also wet grasslands (Marchant and Higgins 1990). Avoids dry ground (Marchant and Higgins 1990). |
| Pacific Baza (<i>Aviceda subcristata</i>) | M | | A relatively common raptor of forest, woodland, and treed urban environments in the tropics and sub-tropics (Debus 2001). |
| Black-shouldered Kite (<i>Elanus axillaris</i>) | M | | A relatively common small raptor of open woodland, grassland, and farmland with scattered trees and probably benefits from fragmentation of continuous forest as it prefers forest edges (Debus 2001). |
| Brahminy Kite (<i>Haliastur indus</i>) | M | | A relatively common, medium-sized raptor of inshore coastal and estuarine waters and adjacent terrestrial habitats, though occasionally occurring over forest or inland rivers in the tropics and sub-tropics (Debus 2001). |
| Whistling Kite (<i>Haliastur spenurus</i>) | M | | A relatively common medium-sized raptor of most terrestrial habitats, except denser forests, and often around water, including estuaries, coastlines and inland drainages (Debus 2001). |
| Square-tailed Kite (<i>Lophoictinia isura</i>) | M | R | Extensive areas of open forest and woodland, particularly those on fertile soils with abundant populations of passerine birds (Debus and Czechura 1989, Marchant and Higgins 1993). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|---|-------------|------------|---|
| Little Eagle (<i>Hieraaetus morphnoides</i>) | M | | A relatively common medium-sized raptor of most wooded habitats, though typically avoiding denser forests (Debus 2001). Favoured habitats include woodland of rough hilly landscapes or of river gums in the inland (Debus 2001). |
| Collared Sparrowhawk (<i>Accipiter cirrhocephalus</i>) | M | | A relatively common small, solitary and secretive raptor of most well-woodland habitats, including farmland and well-treed urban areas (Debus 2001). |
| Brown Goshawk (<i>Accipiter fasciatus</i>) | M | | A relatively common medium-sized solitary and secretive raptor of most woodland habitats, including farmland and well-treed urban areas (Debus 2001). |
| Grey Goshawk (<i>Accipiter novaehollandiae</i>) | M | R | Secretive predator of small birds in forest habitats that provide the preferred dense shaded tree canopies including rainforests, gallery and wet sclerophyll forest (Marchant and Higgins 1993). |
| Red Goshawk (<i>Erythroriorchis radiatus</i>) | V & M | E | These raptors require a very large home range. Distribution uncertain in region, though known from the eastern sector. Very large home ranges e.g. 50 to 220 km ² (Debus 2001) including open forests and woodlands, tropical savannas traversed by riverine vegetation (Garrett and Crowley 2000). In partially cleared areas of eastern Qld. associated with gorge and escarpments (Czechura and Hobson 2000). |
| Osprey (<i>Pandion haliaetus</i>) | M | | Mainly coastal, using a variety of Marine and littoral habitats (e.g. bays, estuaries, rivers) and terrestrial wetlands, though may also extend inland along larger river systems (Marchant and Higgins 1993). Prefers to forage in shallow water (of low turbidity) which contains sufficient fish stocks (prefers size class of 20 to 40 cm), although small terrestrial vertebrates, seabirds and crustacea have also taken (Clancey 1991, Marchant and Higgins 1993). |
| White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>) | M | | Prefers to hunt over large open waterbodies, though also over adjacent/nearby terrestrial habitats (Marchant and Higgins 1993). |
| Wedge-tailed Eagle (<i>Aquila audax</i>) | M | | A relatively common large-sized raptor of most terrestrial habitats except intensively urbanised or cultivated areas (Debus 2001). |
| Swamp Harrier (<i>Circus approximans</i>) | M | | A relatively common large-sized solitary raptor of lakes, swamps, grassland, coastal heath and tall crops (Debus 2001). |
| Spotted Harrier (<i>Circus assimilis</i>) | M | | A relatively common large-sized solitary raptor of croplands, grasslands, low shrubland and open woodland in inland and northern Australia, though also occurs over coastal grassland, heath or swamps in southern parts of range (Debus 2001). |
| Brown Falcon (<i>Falco berigora</i>) | M | | A relatively common, typically solitary medium-sized raptor of most open habits, though avoids denser forests (Debus 2001). |
| Nankeen Kestrel (<i>Falco cenchroides</i>) | M | | A relatively common small raptor of most open habitats, though particularly farmland with scattered trees, inland shrublands and woodlands (Debus 2001). |
| Grey Falcon (<i>Falco hypoleucos</i>) | M | R | Reaches eastern distribution limits within region and likely to occur as a very Rare, non-breeding visitor (Marchant and Higgins 1993). |
| Australian Hobby (<i>Falco longipennis</i>) | M | | A relatively common, solitary, small-sized raptor of most open habitats, including vegetated urban areas and is characteristic of open woodland and watercourses (Debus 2001). |
| Peregrine Falcon (<i>Falco peregrinus</i>) | M | | A small-sized solitary and aggressive raptor occurring in most habitats, though characteristic of cliffs, escarpments and wetlands (Debus 2001). |
| Brolga (<i>Grus rubicundus</i>) | M | | Widely distributed throughout northern and southeastern Australia and occurring on shallow vegetated wetlands, floodplains, grasslands, pasture and croplands (Pizzey and Knight 2003). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|--|-------------|------------|--|
| Beach stone-curlew (<i>Esacus neglectus</i>) | | V | Occurs exclusively within coastal environments using a variety of sheltered and open beaches (sandy, muddy or rocky), often around mouths of rivers and beaches associated with mangroves (Marchant and Higgins 1993, Geering <i>et al.</i> 2007). Forages within exposed inter-tidal areas, with nest sites (September to February) typically located landward side of sandy beaches (Marchant and Higgins 1993). |
| Latham's Snipe (<i>Gallinago hardwickii</i>) | M | | Non-breeding summer migrant occurring in a variety of freshwater and brackish wetlands and feeds on soft wet ground or in shallow water for invertebrates, seeds and vegetation (Higgins and Davies 1996, Geering <i>et al.</i> 2007). This secretive wader is usually found close to dense ground cover (Garrett and Crowley 2000). |
| Little Curlew (<i>Numenius minutus</i>) | M | | Non-breeding summer migrant. Coastal and inland habitats, occurring in a variety of drier, open grassland habitats including airfields and sports fields (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Whimbrel (<i>Numenius phaeopus</i>) | M | | Non-breeding summer migrant. Prefers mudflats within mangrove habitats, though also forage at low tide on open tidal mudflats, on sandy beaches, and along banks of tidal rivers and creeks (Higgins and Davies 1996, Geering <i>et al.</i> 2007). Roost in mangrove trees, though also on muddy, sandy or rocky beaches (Geering <i>et al.</i> 2007). |
| Marsh Sandpiper (<i>Tringa stagnatilis</i>) | M | | Non-breeding summer migrant. Forages for aquatic invertebrates in shallow waters of fresh and brackish wetlands (Geering <i>et al.</i> 2007). Often highly dispersive, with movements associated with seasonal changes in rainfall and availability of wetlands (Higgins and Davies 1996). |
| Common Greenshank (<i>Tringa nebularia</i>) | M | | Non-breeding summer migrant. Forages for aquatic invertebrates in shallow waters of fresh and brackish wetlands (Geering <i>et al.</i> 2007). |
| Wood Sandpiper (<i>Tringa glareola</i>) | M | | Non-breeding summer migrant, relatively uncommon, occurring mainly on inland freshwater wetlands and Rarely on inter-tidal mudflats (Geering <i>et al.</i> 2007). |
| Common Sandpiper (<i>Actitis hypoleucos</i>) | M | | Non-breeding summer migrant. Wide range of coastal and inland habitats of varying salinities (Higgins and Davies 1996). Preferred coastal habitats include muddy inter-tidal zones of mangrove-lined estuaries, tidal rivers and creeks (Geering <i>et al.</i> 2007). Also muddy margins or rocky shores of wetlands, though large coastal mudflats apparently not favoured (Higgins and Davies 1996). |
| Red-necked Stint (<i>Calidris ruficollis</i>) | M | | Non-breeding summer migrant. Occurs in a wide variety of coastal and inland wetland habitats from salt lakes, freshwater swamps, inter-tidal mudflats and sandy ocean beaches (Higgins and Davies 1996, Geering <i>et al.</i> 2007). More abundant coastally where it mainly feeds wet or drying mud near waterline on inter-tidal mudflats and roosts on sandy beaches (e.g. spits) (Lane 1987). |
| Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) | M | | Non-breeding summer migrant. Coastal and inland habitats, feeding for invertebrates in mud or shallow water along edges of shallow wetlands, lagoons, dams and sewage farms (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Curlew Sandpiper (<i>Calidris ferruginea</i>) | M | | Non-breeding summer migrant. Occurs on both coastal and inland wetland habitats, though not as widespread as Red-necked Stint and Sharp-tailed Sandpiper (Higgins and Davies 1996). Prefers bare, wet, muddy surfaces and adjoining shallow water margins of fresh, saline, or brackish open waterbodies and wetlands (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Painted Snipe (<i>Rostratula benghalensis</i>) | V & M | V | Occurrence erratic and unpredictable, seldom remaining long in any locality (Marchant and Higgins 1993). Well vegetated shallow, permanent or seasonal wetlands where it forages on soft muds and in shallow water for invertebrates (Marchant and Higgins 1993, Geering <i>et al.</i> 2007). |
| Black-winged Stilt (<i>Himantopus himantopus</i>) | M | | A widespread and relatively common breeding resident occurring on coastal and inland fresh and saline wetlands and on inter-tidal mudflats (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Red-necked Avocet (<i>Recurvirostra novaehollandiae</i>) | M | | A widespread breeding resident occurring on fresh and saltwater wetlands, though also on inter-tidal mudflats of sheltered bays and inlets (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Red-capped Plover (<i>Charadrius ruficapillus</i>) | M | | A widespread and common breeding resident on a variety of natural or artificial wetland habitats including sandy beaches, inter-tidal mudflats, shorelines of brackish lakes, saltmarshes, though also along margins of freshwater lakes and rivers (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|--|-------------|------------|--|
| Black-fronted Dotterel (<i>Euseyonis melanops</i>) | M | | A widespread and common breeding resident on a variety of habitats including margins of freshwater swamps and dams, either natural or artificial (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Red-kneed Dotterel (<i>Erythronyctes alba</i>) | M | | A widespread breeding resident on a variety of habitats including margins of shallow, fresh or brackish inland and coastal wetlands (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Masked Lapwing (<i>Vanellus miles</i>) | M | | A widespread and common breeding resident on a wide variety of habitats ranging from ocean beaches and mangrove-lined claypans to grasslands, pastures and urban open spaces, though usually close to water (Higgins and Davies 1996, Geering <i>et al.</i> 2007). |
| Banded Lapwing (<i>Vanellus tricolor</i>) | M | | A widespread and relatively common breeding resident associated with drier grasslands and pastures of coastal and inland regions (Higgins and Davies 1996, Geering <i>et al.</i> 2007). Favours areas of very short grass or bare ground, including recently cultivated lands, either close to or distant to waterbodies (Geering <i>et al.</i> 2007). |
| White-winged Black Tern (<i>Chlidonias leucopterus</i>) | M | | Surface feeds for small fish on open waters of Marine and estuarine habitats, freshwater lakes, reservoirs and rivers (Higgins and Davies 1996). |
| Oriental Cuckoo (<i>Cuculus saturatus</i>) | M | | Highly restricted distribution (eastern parts of region) (Barrett <i>et al.</i> 2003). Prefers open forest habitat and woodland with a diverse, thick understorey. Occurrence is strongly linked to the outbreaks of caterpillars during summer (Pizzey and Knight 2003). |
| White-throated Needletail (<i>Hirundapus caudacutus</i>) | M | | An aerial insectivore, spending almost most of the time feeding and sleeping on the wing (Pizzey and Knight 2003). Usually gliding ahead of weather changes, particularly rising air masses that precede summer thunderstorms and low pressure systems. |
| Fork-tailed Swift (<i>Apus pacificus</i>) | M | | Non-breeding summer migrant (Pizzey and Knight 2003). As for White-throated Needletail. |
| Rainbow Bee-eater (<i>Merops ornatus</i>) | M | | Aerial insectivore in a variety of treed habitats, low woody vegetation and adjacent cleared areas in which they forage aerially for mainly insects (Higgins 1999). Usually close to suitable breeding habitat, i.e. sandy substrates in which to excavate nest chambers (Pizzey and Knight 2003). |
| Clamorous Reed-warbler (<i>Acrocephalus stentoreus</i>) | M | | A widespread and relatively common breeding resident of denser vegetation fringing waterbodies and wetlands, including reeds, bulrushes and occasionally crops near irrigation channels (Pizzey and Knight 2003). |
| Little Grassbird (<i>Megalurus grammurus</i>) | M | | A widely distributed species within eastern Australia which may be locally common in habitats including dense vegetation (e.g. cumbungi, reeds, cane grass and lignum) associated with terrestrial wetlands, tidal marshes and mangroves, and along drainage lines (Pizzey and Knight 2003). |
| Tawny Grassbird (<i>Megalurus timoriensis</i>) | M | | A relatively common breeding resident of densely vegetated habitats including coastal heaths, rank grasslands, cumbungi swamps, grassy dunes and crops (Pizzey and Knight 2003). |
| Brown Songlark (<i>Cincloramphus cruralis</i>) | M | | A breeding resident widely distributed across central and southern Australia, and occurring in drier habitats, including pastures, cereal crops, and grassy open woodlands (Pizzey and Knight 2003). Highly nomadic, with numbers increasing coastally during inland drought (Pizzey and Knight 2003). |
| Rufous Songlark (<i>Cincloramphus mathewsi</i>) | M | | A breeding resident widely distributed across mainland Australia and favouring open grassy woodlands and scrublands with dead and live trees (Pizzey and Knight 2003). |
| Golden-headed Cisticola (<i>Cisticola exilis</i>) | M | | Common and widely distributed throughout coastal regions and to about 300km inland in suitable habitat (Pizzey and Knight 2003). Occurs in a wide variety of habitats including tall grasslands, rank herbage around wetlands, sewerage farms, overgrown margins of irrigation channels, irrigated pastures, grain crops, etc. (Pizzey and Knight 2003). |

| Species | EPBC status | NCA status | Species profile notes and regional context |
|---|-------------|------------|--|
| Zitting Cisticola (eastern sub-species) (<i>Cisticola juncidis laveryi</i>) | M | | Distribution restricted to three coastal regions within northern Australia, including Queensland eastern sub-species distribution from Townsville south to about Curtis Island, Gladstone area (Pizzey and Knight 2003). Inhabits tall grasslands on temporarily inundated coastal plains, margins of mangroves, and saltmarshes (Pizzey and Knight 2003). |
| Black-faced Monarch (<i>Monarcha melanopsis</i>) | M | | Favours denser vegetation associated with rainforest, riparian forest, and nearby scrubs and open forest with a dense understorey (Boles 1988). |
| Spectacled Monarch (<i>Monarcha trivirgatus</i>) | M | | Favours denser vegetation, though often more dimly lit habitats than Black-faced Monarchs (Boles 1988). |
| Satin Flycatcher (<i>Myiagra cyanoleuca</i>) | M | | An uncommon summer visitor within the bioregion where it mainly frequents coastal scrubs and open forest (Storr 1984). |
| Rufous Flycatcher (<i>Rhipidura rufifrons</i>) | M | | Tends to be more often recorded from dimmer, thickly vegetated forest (Pizzey and Knight 1998). |

7.5.1.4 Regional Context for Biodiversity and Threatening Processes

Queensland has been sub-divided into 13 biogeographical areas to identify biodiversity features at a regional level (Sattler and Williams 1999). This approach attempts to differentiate biodiversity characteristics at a broad and ecologically meaningful level, where differences are considered to be typically most apparent (Thackway and Creswell 1995).

The majority of the project area is located within the eastern extent of the Brigalow Belt bioregion. This includes sections of the project area extending from the Fitzroy River, south to about Yarwun. The section of the project area extending further south to Gladstone is located within the extreme northern part of the Southeast Queensland bioregion.

The Brigalow Belt bioregion extends from the Queensland-New South Wales border to Townsville and encompasses approximately 36.4 million ha (364,000 km²) of sub-humid and semi-arid environments supporting a diversity of 174 different regional ecosystems (Sattler and Williams 1999, Queensland Government 2007). It is characterised by flora and fauna species of open woodland, including the widespread leguminous tree Brigalow (*Acacia harpophylla*). Other vegetation communities include grassland, dry rainforest, cypress pine woodland, eucalypt woodlands and forests, and riparian and semi-deciduous vine thicket ecosystems (Sattler and Williams 1999).


The *Southeast Queensland Bioregion* extends from the Queensland-New South Wales border, west from the coast and islands to Toowoomba and north to the near Gladstone and encompasses approximately 6.2 million ha (62,000 km²) supporting a diversity of 151 different regional ecosystems (Sattler and Williams 1999, Queensland Government 2007). A high floristic diversity, in combination with a diversity of regional

ecosystems and the Bioregion's unique combination of landform, soil and climate, supports high fauna diversity. Despite this, endemism among vertebrates is relatively low (approximately 3 percent of species largely restricted to the bioregion) (Sattler and Williams 1999).

These bioclimatic zones influence the characteristics of the region's terrestrial biodiversity, resulting in a unique assemblage of temperate, tropical, semi-arid and coastal species (Coastal CRC 2003). The review of existing information for the wider area provides records for 505 vertebrate fauna species. This assemblage includes 89 mammal species, 100 reptile species, 30 frog species, 306 bird species, and a variety of species of conservation significance. The extreme limit of the northern or southern distribution for many of these species occurs within the region and for a few endemic species, central Queensland represents the entire limit of their distribution (Young *et al.* 1999).

The region between Rockhampton and Gladstone has a long history of pastoralism and agriculture (since the 1850s) and is currently dominated by extensive cattle grazing activities. Clearance of native vegetation, pasture improvement and cattle grazing is a land use sequence that has significantly influenced fauna habitat values and the characteristics of the fauna assemblage. The ability of native fauna to adapt to changes in habitat extent and condition varies considerably, and for a variety of taxa, there has been a notable decline in their local and regional distribution and abundance.

The review of existing information indicates that the greatest threats to the native fauna of both bioregions remain grazing by domestic animals, land clearance and the invasion of feral animals and exotic weed taxa (particularly following fire or overly intensive grazing impacts) (Coastal CRC 2003, Christensen and Rodgers 2004, Cook *et al.* 2006, Woinarski *et al.* 2006). Of the introduced fauna and flora known to occur within the wider area,



there is a variety of species either known to, or have a potential to, pose a significant threat to the maintenance of terrestrial biodiversity values (Christensen and Rodgers 2004).

In regards to flora, many species are identified as Weeds of National Significance (WONS, see Thorp and Lynch (2000)). WONS are those weeds which have been identified as already causing significant environmental damage (DEWHA 2005). Relatively widespread and/or abundant weed species (including a variety of WONS) are Parkinsonia (*Parkinsonia aculeate*), Parthenium Weed (*Parthenium hysterophorus*), Rubber Vine (*Cryptostegia grandiflora*), Bellyache Bush (*Jatropha gossypifolia*), Mother of Millions (*Bryophyllum tubiflorum*), Athel Pine (*Tamarix aphylla*), Hymenachne (*Hymenachne amplexicaulis*), Lantana (*Lantana camara*), Mesquite (*Prosopis* spp.), Prickly Acacia (*Acacia nilotica* subsp. *indica*), Salvinia (*Salvinia molesta*), Water Hyacinth (*Eichornia crassipes*), Water Lettuce (*Pistia stratiotes*), Cat's Claw (*Macfadyena unguisati*), Madeira Vine (*Anredera cordifolia*), and Para Grass (*Brachiaria mutica*).

Buffel Grass (*Cenchrus ciliaris*), is regarded as a very significant production plant for the central Queensland beef industry, though is also a major environmental weed of northern Australia (CSIRO 2007). Impacts include increased biomass and fuel load, potential competition with and displacement of native flora and fauna and potential long-term reduction of soil fertility (Ludwig *et al.* 2000, Franks *et al.* 2000, Franks 2002, Jackson 2004). Whilst a common pasture plant, it also dominates the ground layer of many areas of remnant native vegetation in the Brigalow Bioregion. Leucaena (*Leucaena leucocephala*) is another species regarded as an important production plant in the region (cultivated for cattle fodder), though also regarded as a highly invasive environmental weed in tropical and sub-tropical Australia that forms dense thickets excluding other plants (Walton 2003).

The review of existing information identifies a number of introduced fauna species. The majority of these species have been widely acknowledged as implicit in the degradation of habitat values for both native fauna biodiversity and species of conservation significance through:

- Predation of native taxa, e.g. foxes, cats, pigs and cane toads
- Competition with native fauna for food and shelter, e.g. cattle, goats, rabbits, cane toads and pigs;
- Physical degradation of native fauna habitat through impedance of native vegetation regeneration, disruption of soil structure and soil erosion, changes in plant community composition, and/or facilitation of environmental weed invasion, e.g. cattle, goats, pigs and rabbits
- Transmission of pathogens, e.g. pigs and cats.

Of the introduced species recorded in the region, foxes, feral pigs, goats and rabbits are identified as declared Class 2 pest animals under the *Land Protection (Pest and Stock Route Management) Regulation 2003* (Qld). Furthermore, the EPBC Act lists predation (foxes, feral pigs and cats), competition and land degradation (feral goats, pigs and rabbits) and disease transmission (feral pigs and cats) as key threatening processes to a variety of faunal groups (Environment Australia 1999a,b,c,d and e, and DEH 2005e). Currently, the biological effects, including lethal toxic ingestion, caused by Cane Toads is being considered as an amendment to the List of Key Threatening Processes under the EPBC Act (DEH 2005f).

The most widespread introduced species within the region are cattle. Cattle grazing can result in a loss of understorey vegetation and ground microhabitat diversity, poor recruitment of native plants and provide favourable conditions for weeds to gain dominance over native flora. As effected through changes to soil conditions, native plant diversity and vegetation community structure, habitat modification can result in the decline in habitat suitability for a variety of native fauna species, including species of conservation significance.

These species, to varying extents, wether individually or collectively, add pressure to the maintenance of local biodiversity and species of conservation concern.

7.5.2 Field Survey Results

7.5.2.1 Project Area Overview

The field survey recorded 266 terrestrial fauna species, including 32 mammals, 39 reptiles, 16 frog and 179 birds (see Appendix E3). A large proportion of this recorded fauna assemblage was comprised of species regarded as relatively common and widespread within either bioregion, i.e. the Southeast Queensland and Brigalow Belt bioregions (see Longmore 1978, Roberts 1979, Storr 1984, Czechura 1995a and 1995b, Covacevich and Wilson 1995, Wilson and Czechura 1995, Hall and Martin 1995, Cannon *et al.* 1995, Van Dyck 1995a and 1995b, Agnew *et al.* 2003, Wilson 2005a, and Ecoserve and LAMR 2006). The characteristics of the fauna assemblage and the species diversity are not unexpected given the relatively limited diversity of habitat types, the restricted extent of remnant habitats and the comparatively higher extent of disturbed habitats that do not have the capacity to support a diverse fauna assemblage.

Fauna habitat values within the project area have been strongly influenced by a history of cattle grazing and agriculture. This has resulted in a significant simplification of fauna habitat structure. This is manifest in large, cleared areas and within smaller nodes that support native vegetation. Within the latter, more open ground cover conditions and a poor recruitment of shrubs and trees are common characteristics.

The decline in the structural integrity of the original, more complex habitat is likely to have affected all native fauna groups, though particularly native small ground-dwelling mammal fauna, reptiles and small passerine avifauna. The current, more simple-structured habitats allow greater access and provide more favourable conditions for introduced species as toads, cats and foxes. The presence of these introduced taxa results in increased pressures on native wildlife that find the current habitat structure suitable.

Where native vegetation remains, tree hollows (either trunk or limb hollows) are either absent or Rare. It is apparent in many of these areas, that cattle have had a history of unrestricted access. This has resulted in further simplification of ground cover microhabitat (e.g. fallen timber, native tussock grasses, and to a lesser extent, leaf litter) required by a wide variety of ground-dwelling fauna.

There is also widespread evidence of modifications to local drainage systems through the construction of levees and dams. The extent and prevalence of such work is more evident within lands to the north of Raglan Creek. Whilst continuing to provide habitat for a variety of waterbirds, and waders to a lesser degree, the removal of native flora typically associated with local natural waterways and wetlands has resulted in lower habitat values for a variety of other native fauna (e.g. reptiles, amphibians, some birds such as crakes and rails, and some smaller ground-dwelling mammals).

The results of the survey program provided records for 13 introduced fauna species (nine mammal, one reptile, one amphibian and two bird species). Evidence of these taxa was widespread throughout the project area. These results were not unexpected given the level of landscape disturbance and habitat types present.

Despite widespread habitat disturbance within the project area and surrounding lands, these lands do support habitat areas of value to various species of conservation significance, for fauna movement and maintenance of local biodiversity.

Nine species recorded in the current surveys are listed as Rare, Threatened, or otherwise significant under the provisions of the Commonwealth and/or State legislation. All locations where these species were recorded, with other relevant information, are provided in Table 7.4 and Table 7.6. Locations and descriptions of habitats of higher fauna habitat value are provided in Table 7.5 and Table 7.7

7.5.2.2 Fitzroy to Bajool

The field investigation program provided records for 185 terrestrial vertebrate fauna species either recorded within the mapped corridor and/or recorded from similar habitats within approximately one kilometre either side of the project area corridor. The recorded assemblage comprises:

- Native fauna: 10 mammal, 19 reptile, 10 frog, and 135 bird species
- Introduced fauna: seven mammal, one reptile, one amphibian and two bird species
- Species of conservation significance:
 - Vulnerable: Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*) and Ornamental Snake (*Daenisonia maculata*)
 - Rare: Cotton Pygmy-goose (*Nettapus coromandelianus*) and Black-chinned Honeyeater (*Melithreptus gularis*).

A summary of each species of conservation significance record is provided in Table 7.4 and locations identified in Figure 7.3. The location of each fauna survey site is provided in Figure 7.1.

A large proportion of this section of the project area, and surrounding land is subject to grazing activities. Within these areas, native fauna habitat values have been greatly reduced. Key habitat resources such as hollow-bearing trees are Rare.

Habitats, which exhibit lower levels of disturbance and/or support higher values to the widest cross-section of the fauna assemblage of this section of the project area, are primarily associated riparian vegetation along the Fitzroy River and smaller waterways, small and scattered patches of native remnant and regrowth vegetation, and wetlands (including variety of large swales and depressions). Key habitat resources and areas of ecological sensitivity are listed in Table 7.5 and depicted in Figure 7.4.


Table 7.4 Rare, Threatened and Migratory Survey Records for Fitzroy to Bajool Section

| Status: | CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory | | | | | |
|---|--|------------|---------------------|-----------------------|-----------|--|
| Legislation: | EPBC = <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) NCA = <i>Nature Conservation Act 1992</i> (Qld) | | | | | |
| Species | EPBC status | NCA status | GPS location | Number of individuals | Month | Comments |
| Ornamental Snake (<i>Daenisonia maculata</i>) | V | V | 253155E 7397039S | 1 | November | Sub-adult located under large ground log. Large ground logs common in area; large hollow-bearing <i>E. coolabah</i> trees common; cracking clays; adjoining seasonal wetland (southern side of Casuarina Road). |
| Ornamental Snake | V | V | 252815E 7397005S | 1 | November | Adult foraging within large hollow ground log. Large ground logs common in area; large hollow-bearing <i>E. coolabah</i> trees common; cracking clays; adjoining seasonal wetland (southern side of Casuarina Road). |
| Cotton Pygmy-goose (<i>Nettapus coromandelianus</i>) | M | R | 235951E 7413617S | 13 | April | Billabong adjacent to Nine Mile Road. |
| Cotton Pygmy-goose | M | R | 250763E 7395925S | 4 | April | Small dam adjacent and east of Bruce Highway. |
| Cotton Pygmy-goose | M | R | 264984E 7382627S | 2 | April | Small dam adjacent to Bajool Port Alma Road. |
| Cotton Pygmy-goose | M | R | 236083E 7413582S | 7 | September | Vegetated wetland to near north of Nine Mile Road. |
| Cotton Pygmy-goose | M | R | 235618E 7409506S | 2 | September | Small dam to near north of Fairy Bower Road. |
| Cotton Pygmy-goose | M | R | 250785E 7395964S | 5 | November | Man-made dam fringed with tall grass and emergent sedges and reeds and lily pads. |
| Cotton Pygmy-goose | M | R | 251303E 7394934S | 3 | December | Man-made dam east of McLean Road. |
| Cotton Pygmy-goose | M | R | 261108E 7384359S | 4 | December | Swale with water and sedges to near north of Bajool Port Alma Rail line. |
| Squatter Pigeon (sth. subsp.) (<i>Geophaps scripta scripta</i>) | V | | 255069E 7397139S | 2 | April | <i>Eucalyptus coolibah</i> grassy open woodland. |
| Squatter Pigeon | V | | 255737E 7388795S | 2 | April | Open grassland. |
| Squatter Pigeon | V | | 261132E 7384477S | 3 | June | Railway through grazing country with scattered forest red gums and poplar box. |
| Squatter Pigeon | V | | 253184E 7396940S | 16 | June | Seasonal wetland to south of Casuarina Road, fringed with mature hollow-bearing eucalypts. Dry when pigeons sighted. Ground cover sparse, predominantly <i>Salsola</i> . |
| Squatter Pigeon | V | | 243424E 7408131S | 2 | September | Pasture to south of Capricorn Highway. |

| Species | EPBC status | NCA status | GPS location | Number of individuals | Month | Comments |
|---|-------------|------------|---------------------|-----------------------|----------|---|
| Squatter Pigeon | V | | 249529E 7399792S | 2 | November | Alongside bush track in dry swale in open grassland (east of Kime Road). |
| Squatter Pigeon | V | | 249137E 7401882S | 2 | November | <i>E. coolabah</i> remnant within road reserve; sparse understorey and grass cover (east of Kime Road). |
| Squatter Pigeon | V | | 251647E 7397168S | 4 | December | Along side dirt Casuarina Road; open paddock adjoins, near homestead. |
| Squatter Pigeon | V | | 252947E 7396951S | 1 | December | Poplar Box remnant fringe along Casuarina Road. |
| Squatter Pigeon | V | | 249529E 7399792S | 3 | November | Alongside bush track; scattered trees along track; open grassland adjoining (east of Kime Road). |
| Black-chinned Honeyeater (<i>Melithreptus gularis</i>) | | R | 235626E 7413532S | > 2 | April | Linear remnant bordering Nine Mile Road. |
| Black-chinned Honeyeater | | R | 235735E 7414987S | 2 | November | <i>E. tereticornis</i> woodland bordering wetland (end of Stracey Road). |

Table 7.5 Areas of fauna habitat sensitivity associated with the Fitzroy to Bajool section

| Area # | GPS reference | Comments | Primary values |
|--------|---------------------|---|---|
| 1 | 237768E 7421569S | Fitzroy River riparian habitats. | Fauna movement; habitat for forest birds and microbats; and hollow-bearing trees. |
| 2 | 235180E 7415401S | Northwestern extension of a series of semi-permanent vegetated billabongs to north of Nine Mile Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 3 | 234490E 7413765S | Western end of a series of semi-permanent vegetated billabongs. Extends south to Nine Mile Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 4 | 234227E 7411350S | Western end of a large semi-permanent constructed wetland. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 5 | 235178E 7410276S | Corridor traverses centre of semi-permanent wetland. Largely natural form though surrounds cleared of remnant vegetation. North of Malchi Nine Mile Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 6 | 238744E 7409836S | Billabong of natural form though surrounds cleared of remnant vegetation. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 7 | 239640E 7409567S | Billabong of largely natural form though surrounds cleared of remnant vegetation. North of Titman Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 8 | 247726E 7405458S | Adjacent to Gavial Creek wetlands. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 9 | 250022E 7400559S | Small open seasonal wetland – part of Serpentine Creek wetland system. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 10 | 251112E 7398611S | Shallow seasonal wetland and part of the Serpentine Creek wetland system – north of Georges Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 11 | 251788E 7397765S | Shallow seasonal wetland and part of the Serpentine Creek wetland system – south of Georges Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |



| Area # | GPS reference | Comments | Primary values |
|--------|---------------------|---|---|
| 12 | 252472E 7396841S | Seasonal wetland and part of the Serpentine Creek wetland system – south of Casuarina Road. | Habitat for waterbirds and waders, including Rare and Migratory species. |
| 13 | 253143E 7394318S | Dingo Creek riparian vegetation. | Fauna movement; locally significant habitat corridor. |
| 14 | 255015E 7389095S | Station Creek riparian vegetation. | Fauna movement; locally significant habitat corridor. |
| 15 | 255346E 7388666S | Oakey Creek riparian vegetation. | Fauna movement; locally significant habitat corridor. |
| 16 | 261106E 7384693S | Seasonal wetland system comprising of natural form broad swales. Part of Inkerman Creek wetland system. | Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. |

7.5.2.3 Bajool to Gladstone

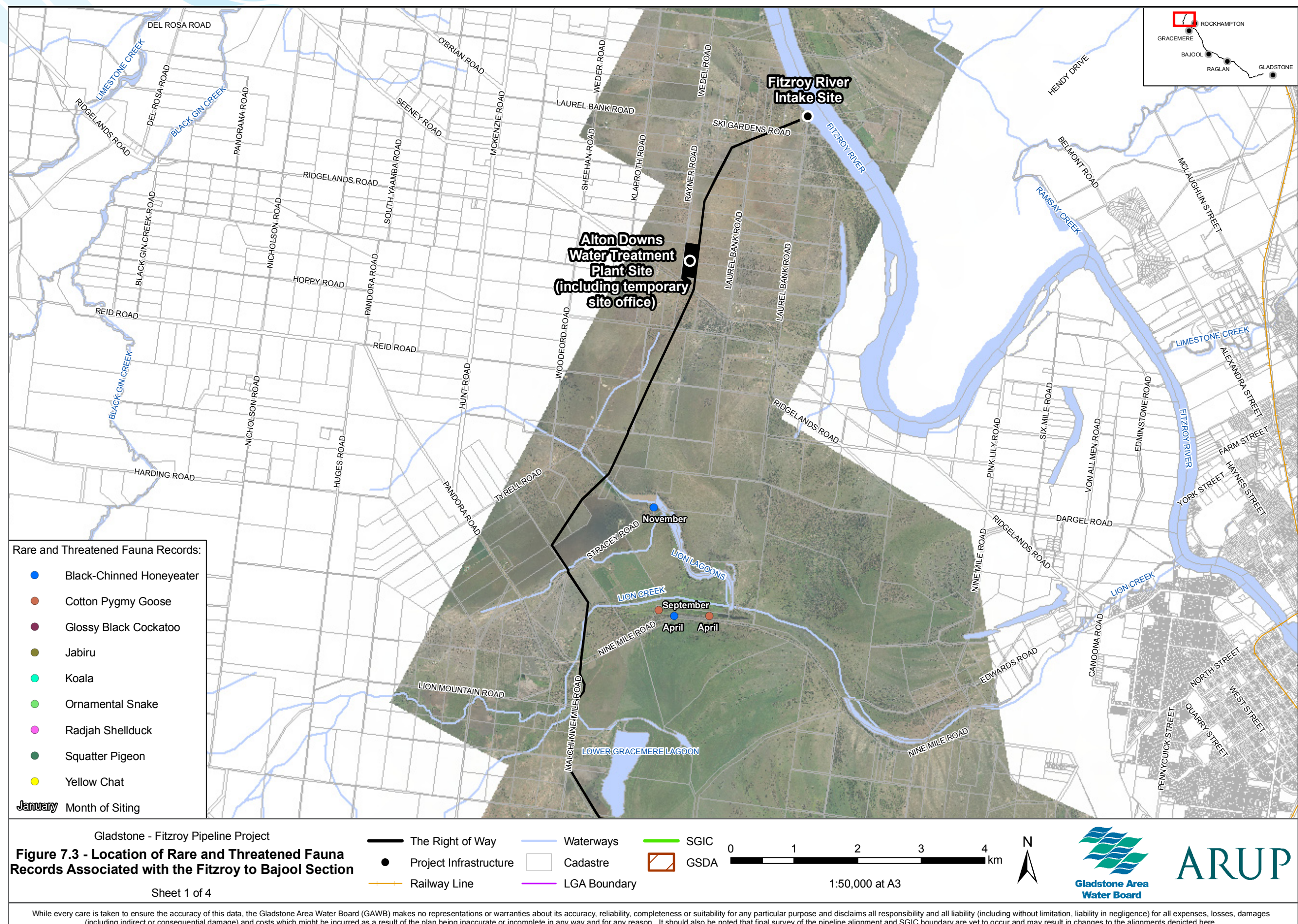
The field investigation program provided records for 245 terrestrial vertebrate fauna species either recorded within the mapped corridor and/or recorded from similar habitats within approximately 1 km either side of the project area corridor. The recorded assemblage comprises:

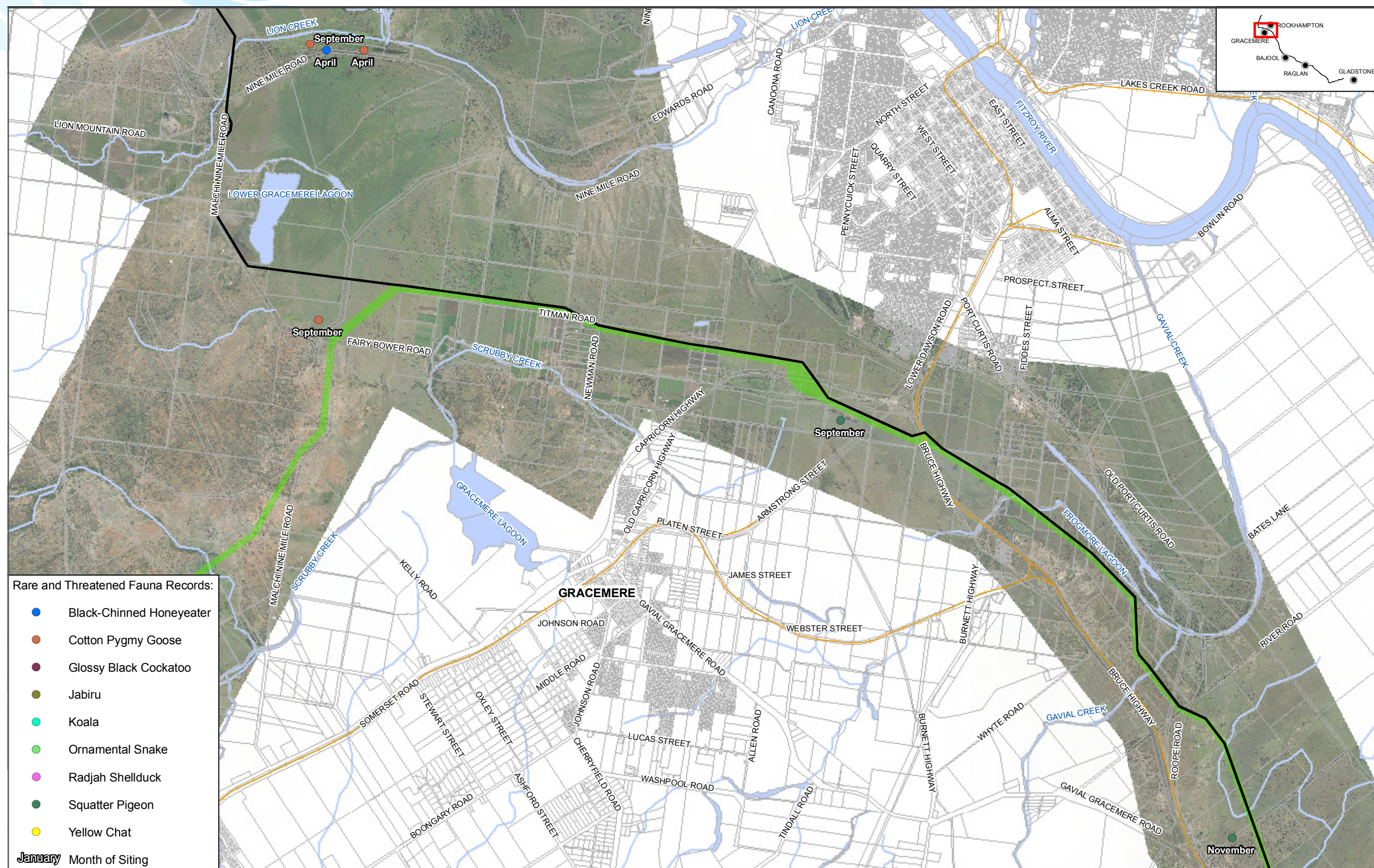
- Native fauna: 27 mammal, 32 reptile, 13 frog, and 164 bird species
- Introduced fauna: six mammal, one reptile, one amphibian and one bird species
- Species of conservation significance:
 - Critically Endangered: Yellow Chat (*Epthianura crocea macgregori*)
 - Vulnerable: Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*) and Glossy Black Cockatoo (*Calyptorhynchus lathami*)
 - Regionally Vulnerable: Koala (Southeast Qld) (*Phascolarctos cinereus*)
 - Rare: Cotton Pygmy-goose (*Nettapus coromandelianus*), Radjah Shelduck (*Tadorna radjah*), Jabiru (*Ephippiorhynchus asiaticus*) and Black-chinned Honeyeater (*Melithreptus gularis*).

A summary of each species of conservation significance record is provided in Table 7.6 and locations identified in Figure 7.5. The location of each fauna survey site is provided in Figure 7.2.

A large proportion of this section of the project area, and surrounding land is subject to grazing activities. Within these areas, native fauna habitat values have been greatly reduced. This section of the project area supports a greater extent of remnant vegetation in comparison to that recorded for the Fitzroy to Bajool section. The comparatively higher species richness recorded for the Bajool to Gladstone relates to both a wider range of habitat types and the greater extent of remnant vegetation in comparison to that recorded for the Fitzroy to Bajool section.

Habitats, which exhibit lower levels of disturbance and/or support higher values to the widest cross-section of the fauna assemblage of this section of the project area, are primarily associated with riparian vegetation (e.g. Raglan Creek), areas of native remnant and regrowth vegetation, and wetlands including variety of freshwater, brackish, saline habitats. Key habitat resources and areas of ecological sensitivity are listed in Table 7.7 and shown in Figure 7.6.



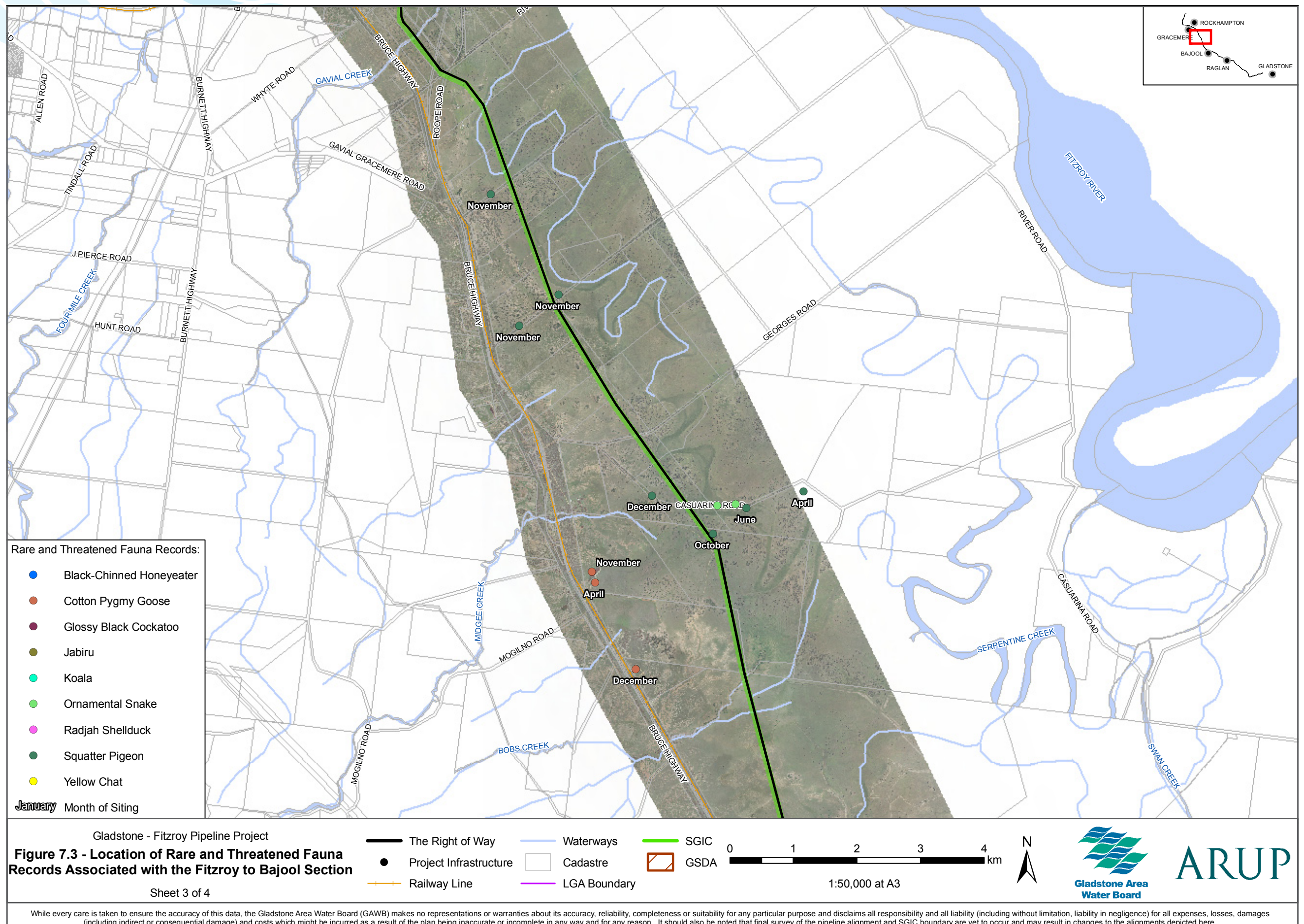


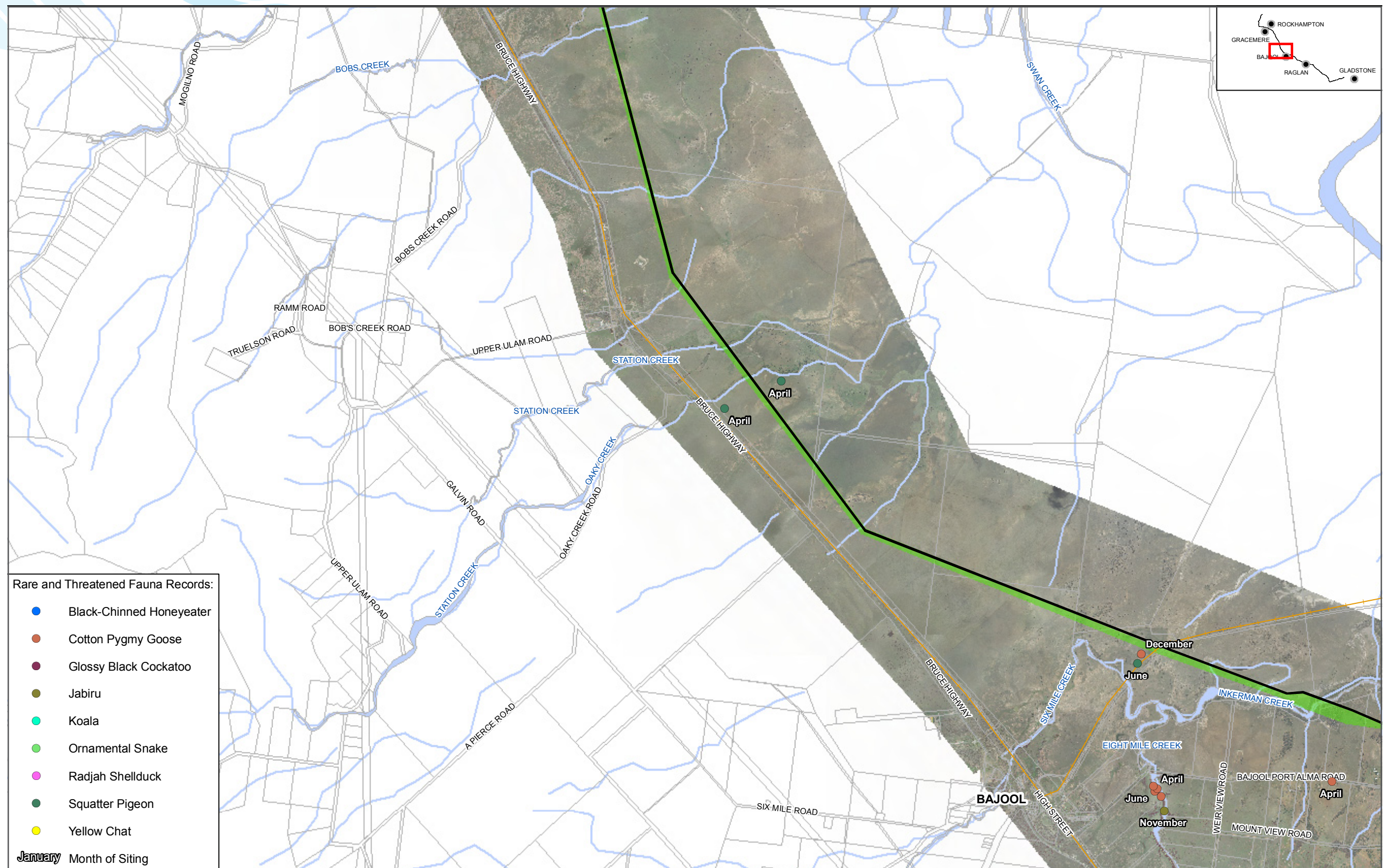
Gladstone - Fitzroy Pipeline Project

Figure 7.3 - Location of Rare and Threatened Fauna Records Associated with the Fitzroy to Bajool Section

Sheet 2 of 4

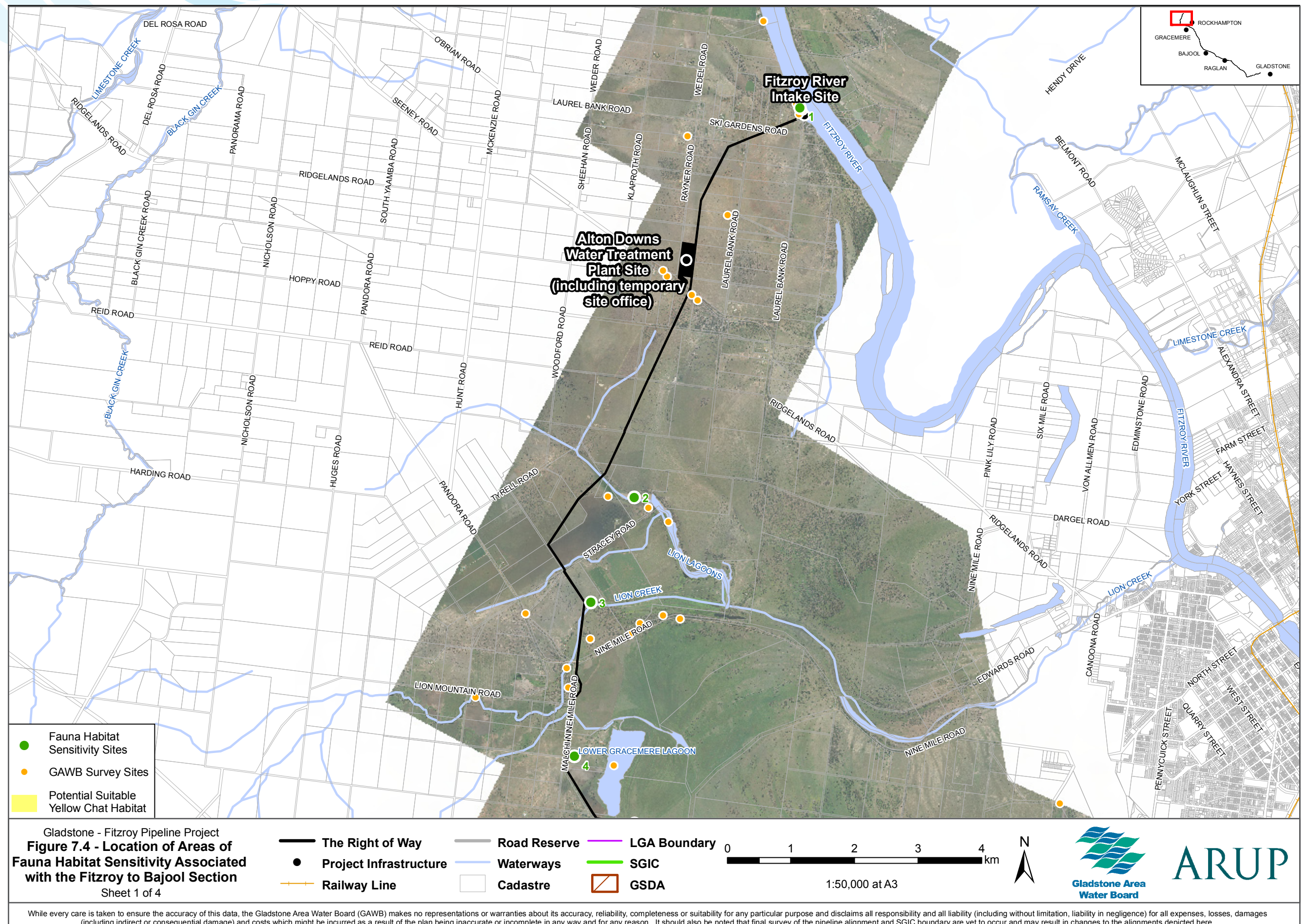
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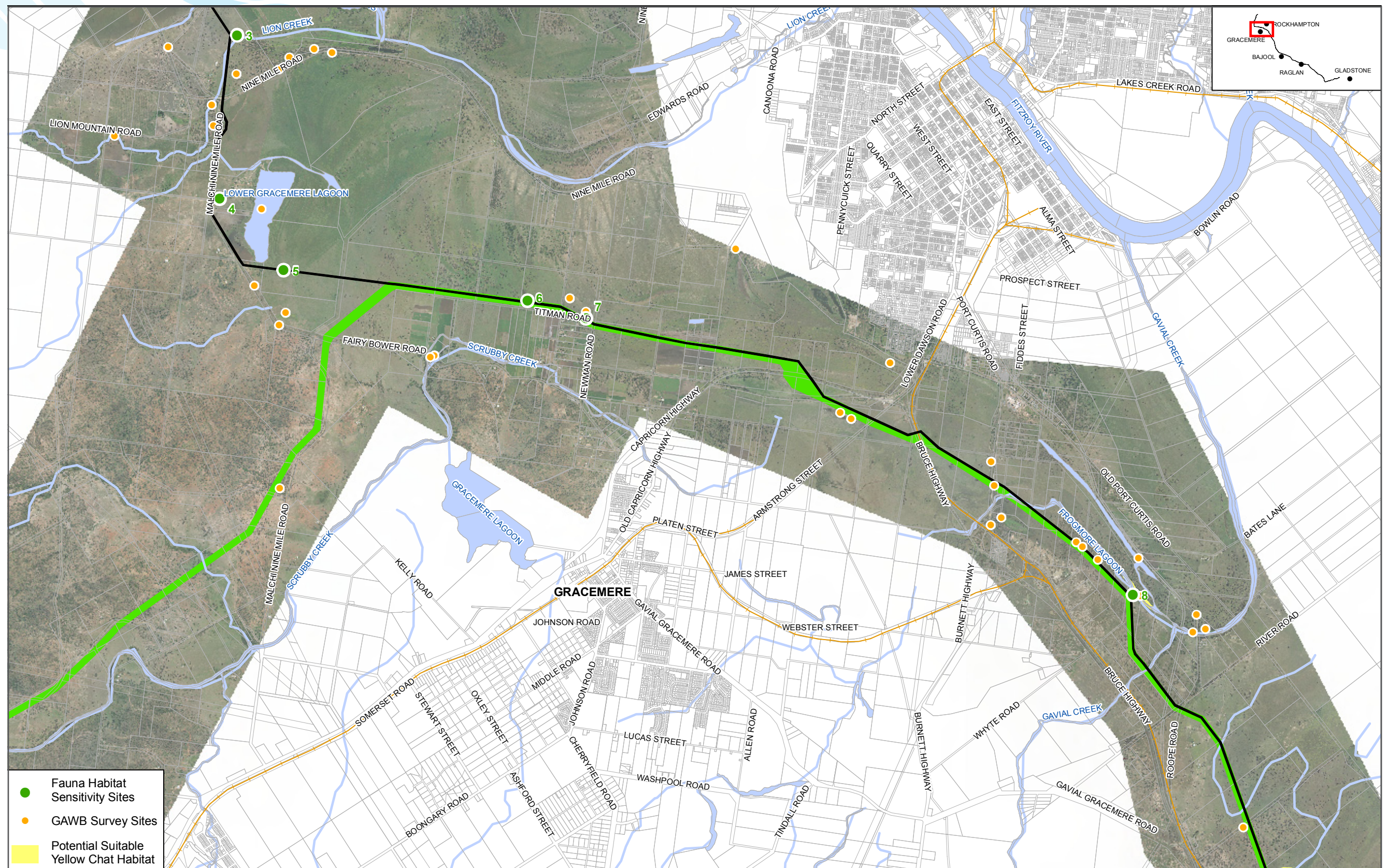




Gladstone - Fitzroy Pipeline Project
Figure 7.3 - Location of Rare and Threatened Fauna Records Associated with the Fitzroy to Bajool Section
 Sheet 4 of 4

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Gladstone - Fitzroy Pipeline Project
Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section
 Sheet 2 of 4

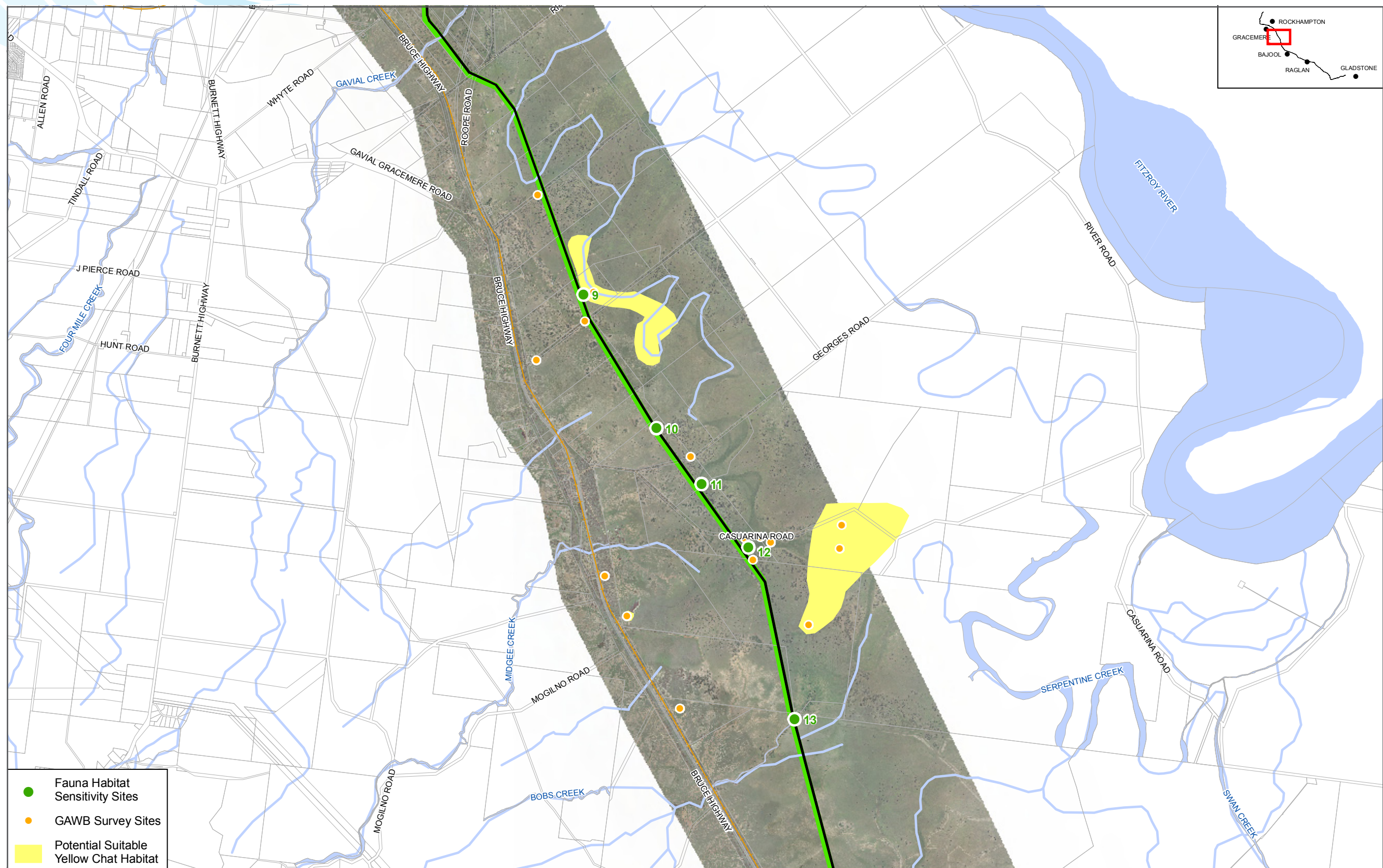
| | | | |
|--|------------------------|--------------|--------------|
| Fauna Habitat Sensitivity Sites | The Right of Way | Road Reserve | LGA Boundary |
| GAWB Survey Sites | Project Infrastructure | Waterways | SGIC |
| Potential Suitable Yellow Chat Habitat | Railway Line | Cadastre | GSDA |

0 1 2 3 4 km

1:50,000 at A3

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Gladstone - Fitzroy Pipeline Project

Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section

Sheet 3 of 4

| | | | |
|--|---|---|---|
| ● Fauna Habitat Sensitivity Sites | — The Right of Way | — Road Reserve | — LGA Boundary |
| ● GAWB Survey Sites | ● Project Infrastructure | — Waterways | — SGIC |
| Potential Suitable Yellow Chat Habitat | — Railway Line | Cadastre | GSDA |

0 1 2 3 4 km

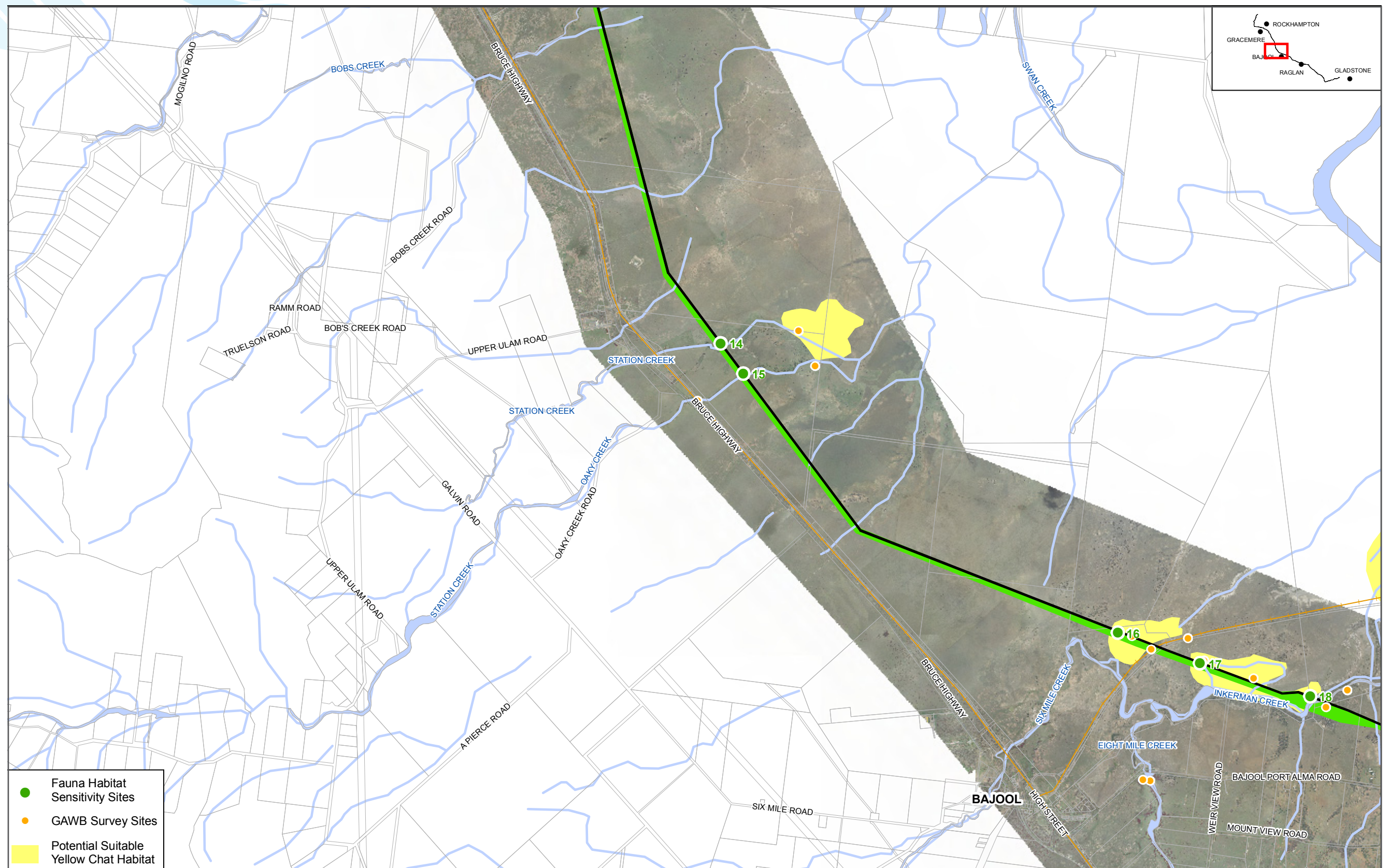
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Gladstone - Fitzroy Pipeline Project

Figure 7.4 - Location of Areas of Fauna Habitat Sensitivity Associated with the Fitzroy to Bajool Section

Sheet 4 of 4

| | | |
|------------------------|--------------|--------------|
| The Right of Way | Road Reserve | LGA Boundary |
| Project Infrastructure | Waterways | SGIC |
| Railway Line | Cadastre | GSDA |

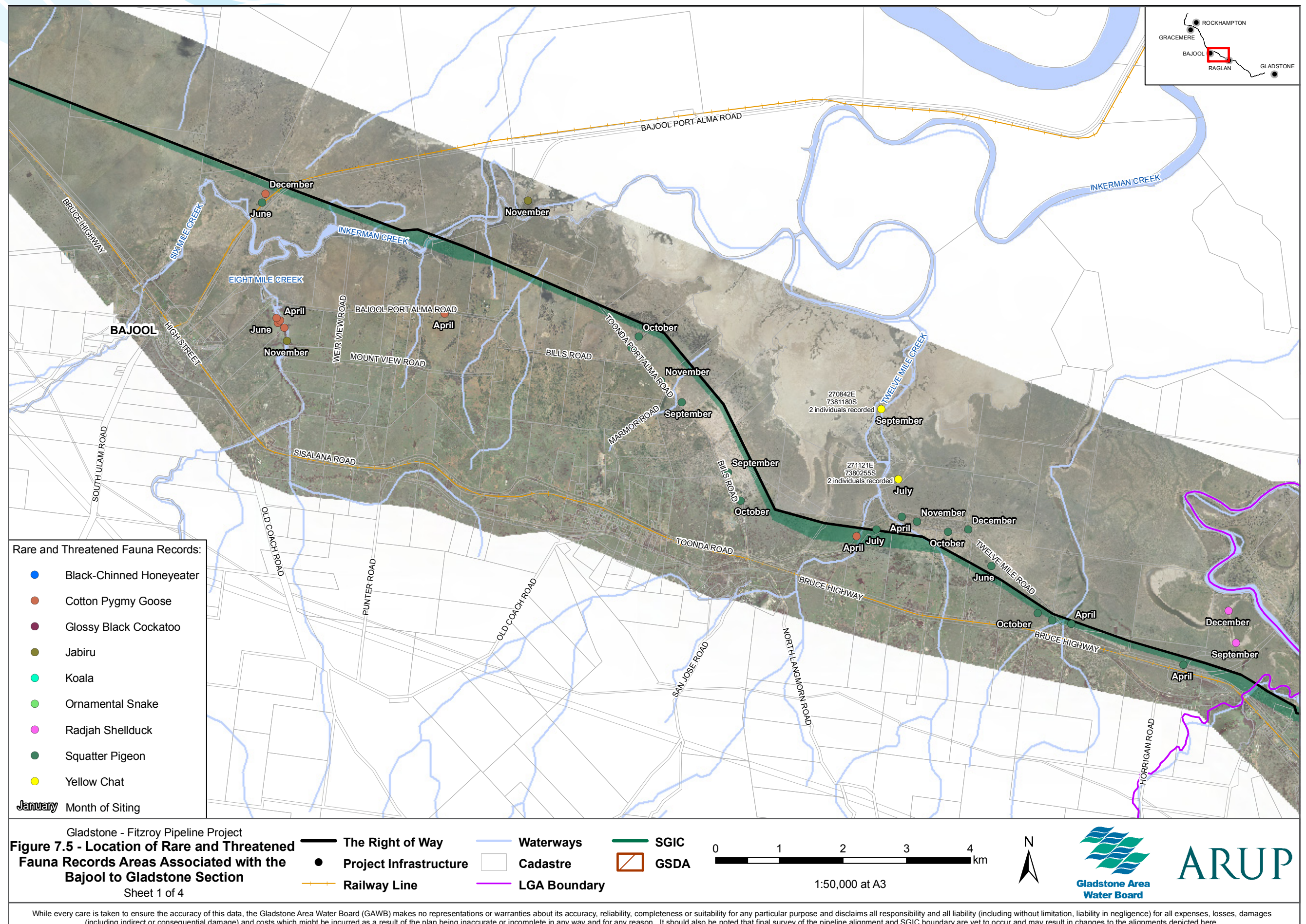
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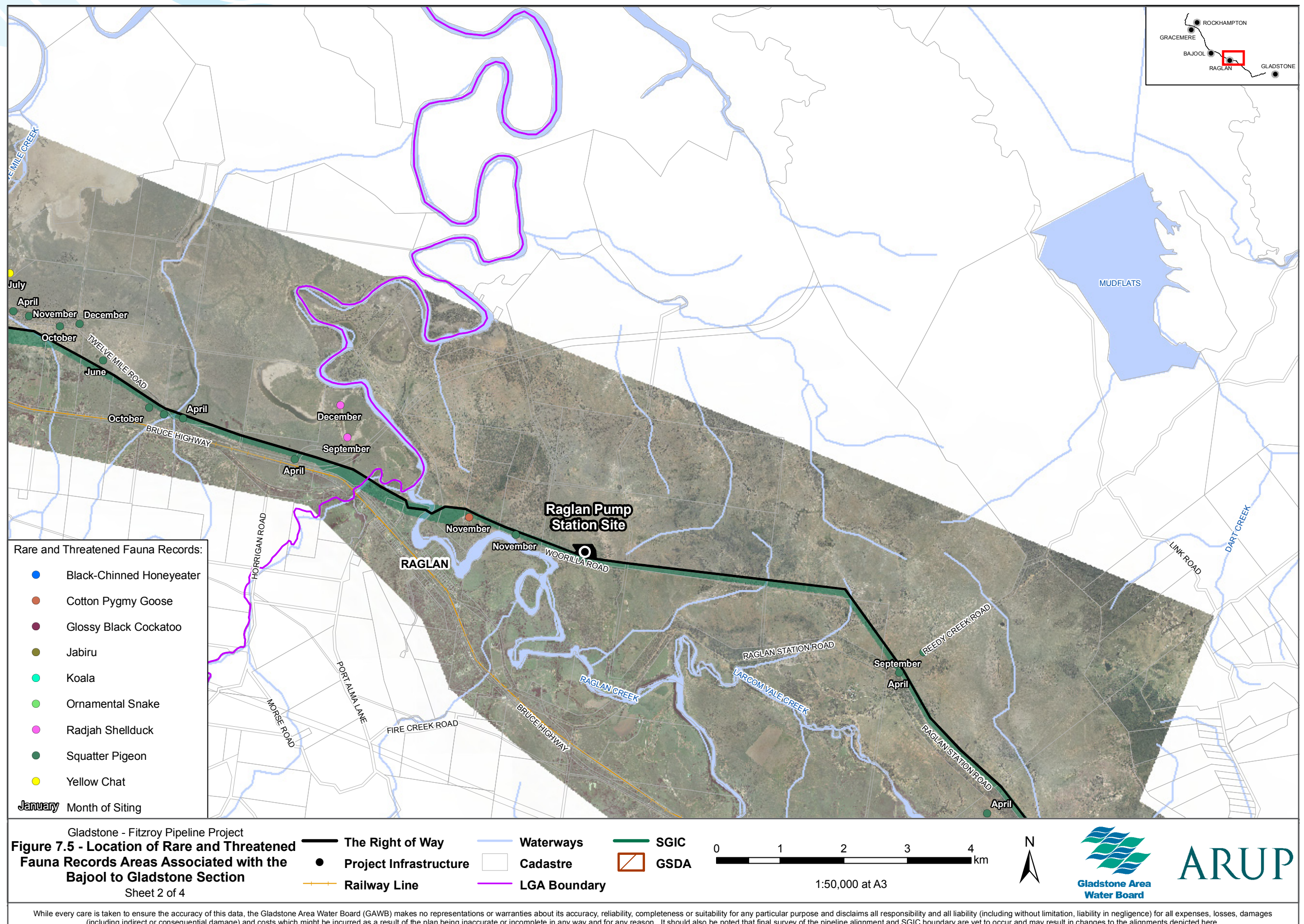
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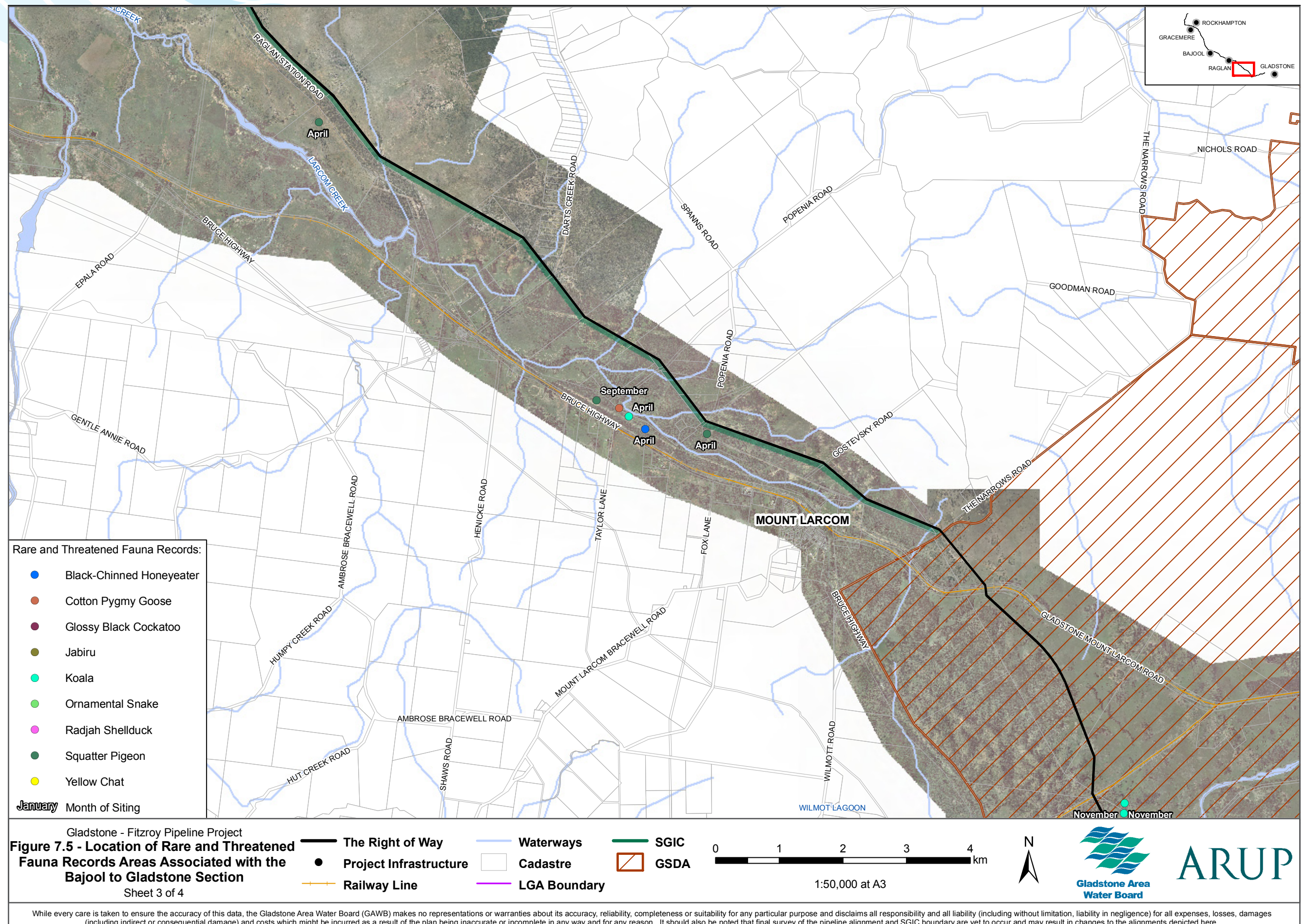
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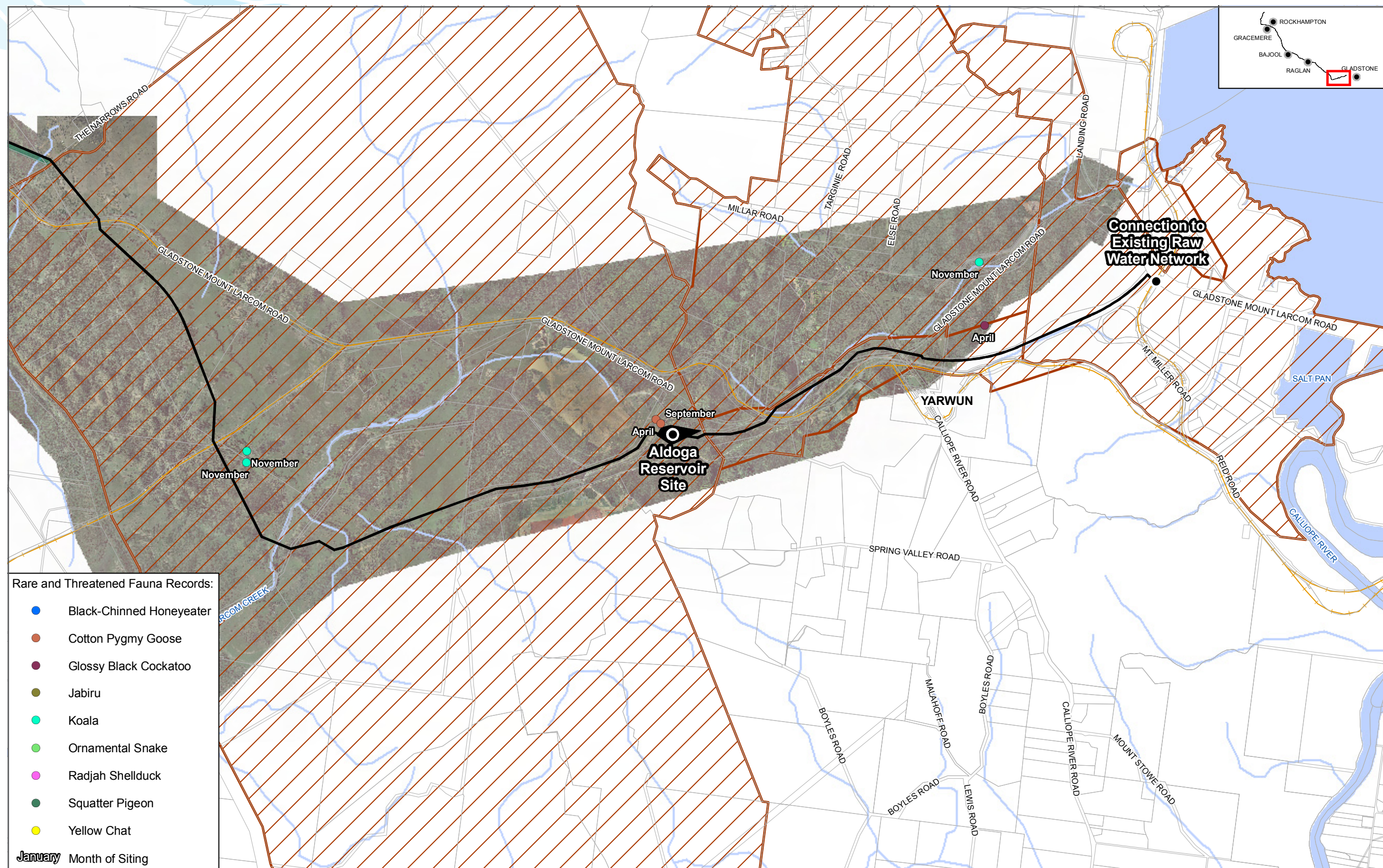
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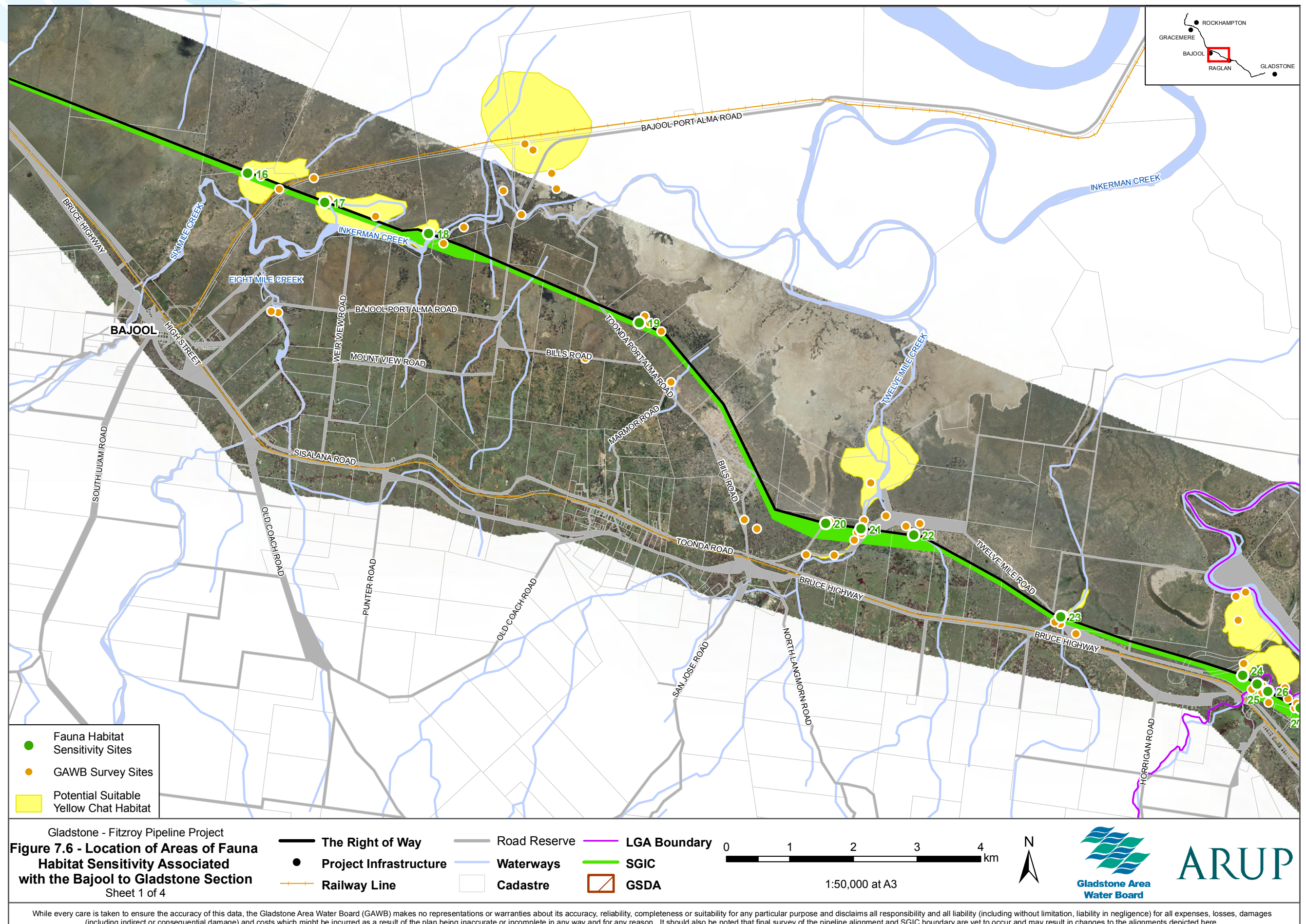


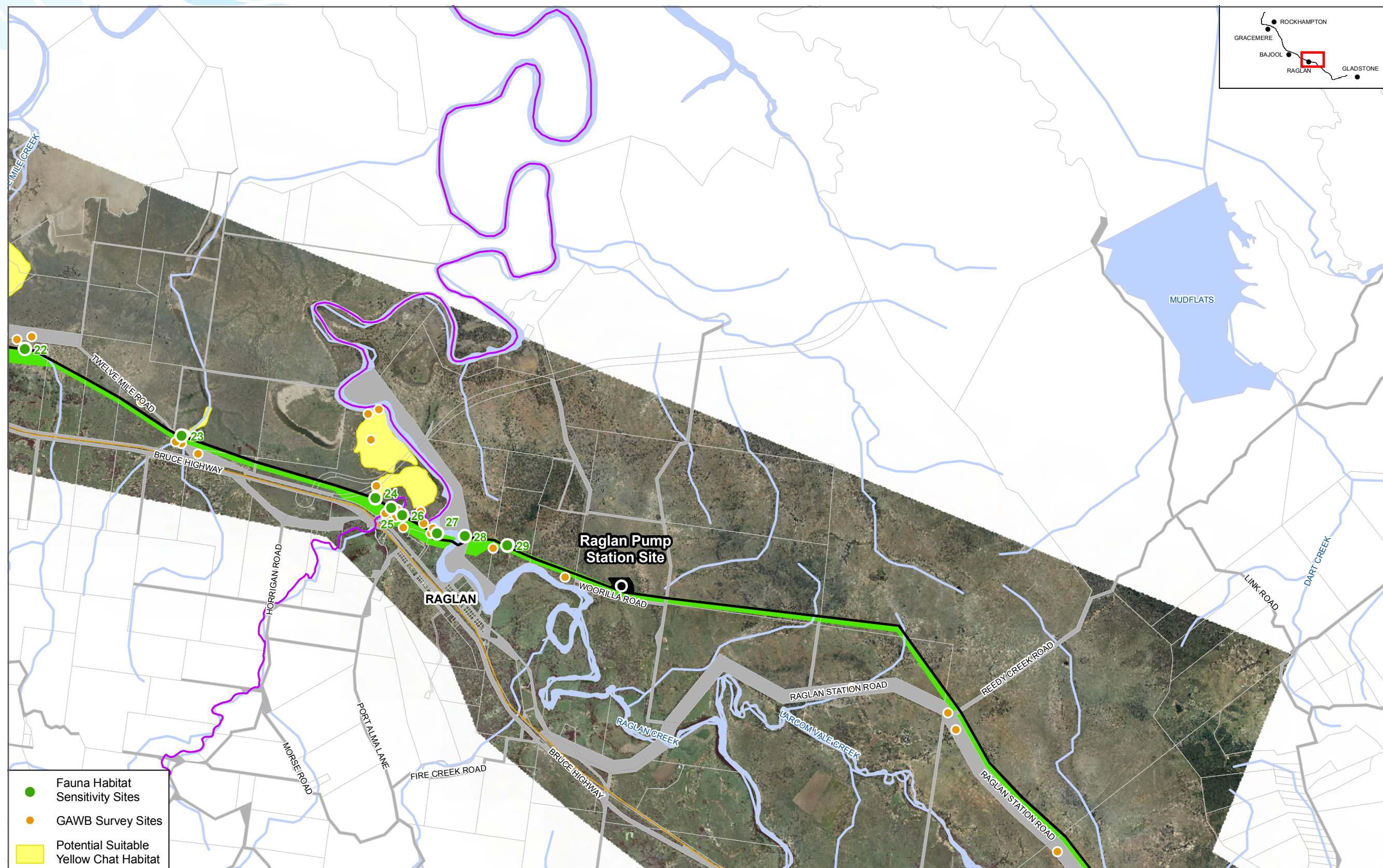




Gladstone - Fitzroy Pipeline Project
Figure 7.5 - Location of Rare and Threatened Fauna Records Areas Associated with the Bajool to Gladstone Section
 Sheet 4 of 4

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Gladstone - Fitzroy Pipeline Project
Figure 7.6 - Location of Areas of Fauna Habitat Sensitivity Associated with the Bajool to Gladstone Section
 Sheet 2 of 4

● Fauna Habitat Sensitivity Sites
 ● GAWB Survey Sites
 ■ Potential Suitable Yellow Chat Habitat

— The Right of Way
 ● Project Infrastructure
 — Railway Line

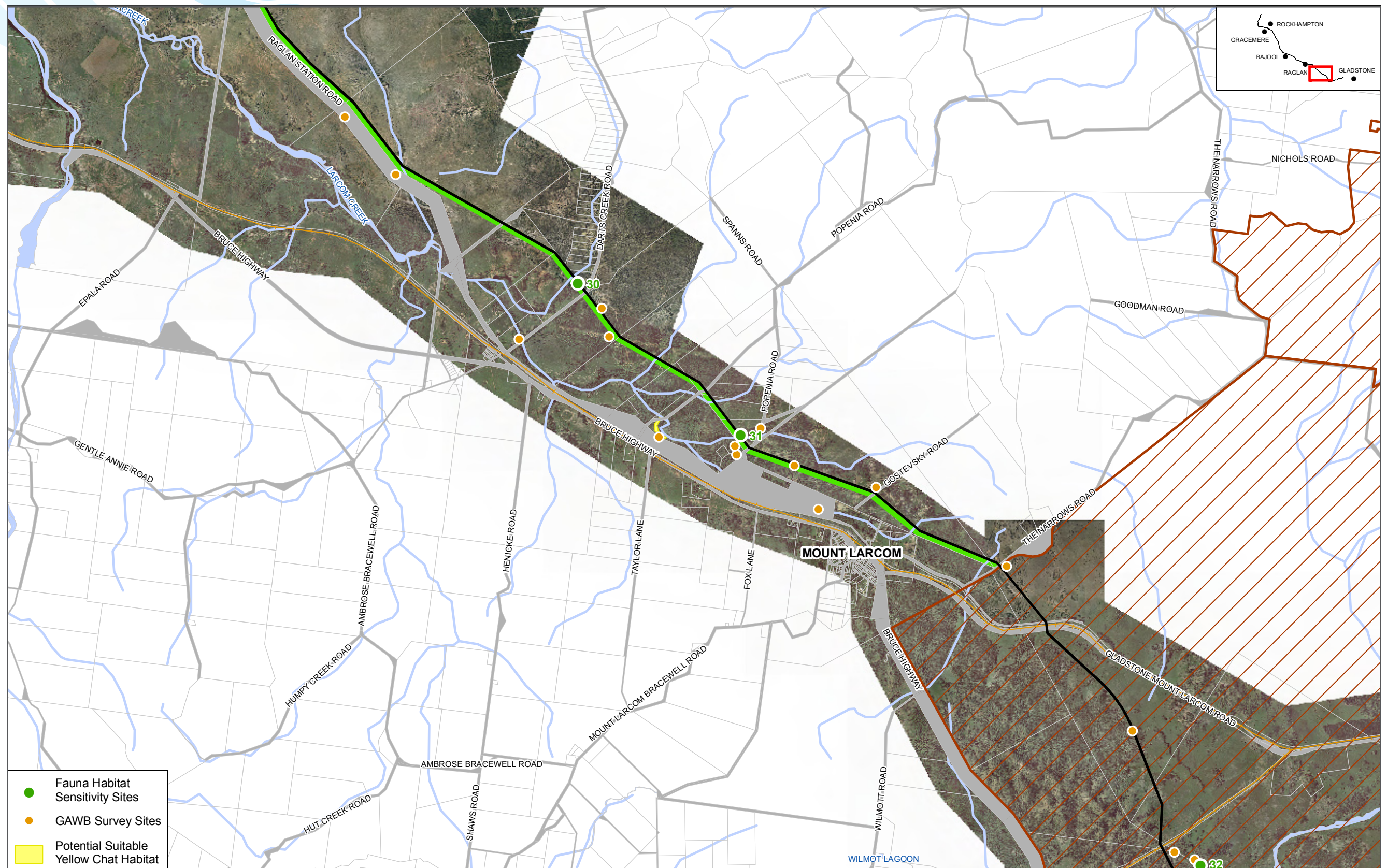
— Road Reserve
 — Waterways
 — Cadastre

— LGA Boundary
 — SGIC
 ■ GSDA

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 Gladstone Area Water Board
 ARUP

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Gladstone - Fitzroy Pipeline Project
**Figure 7.6 - Location of Areas of Fauna
 Habitat Sensitivity Associated
 with the Bajool to Gladstone Section**
 Sheet 3 of 4

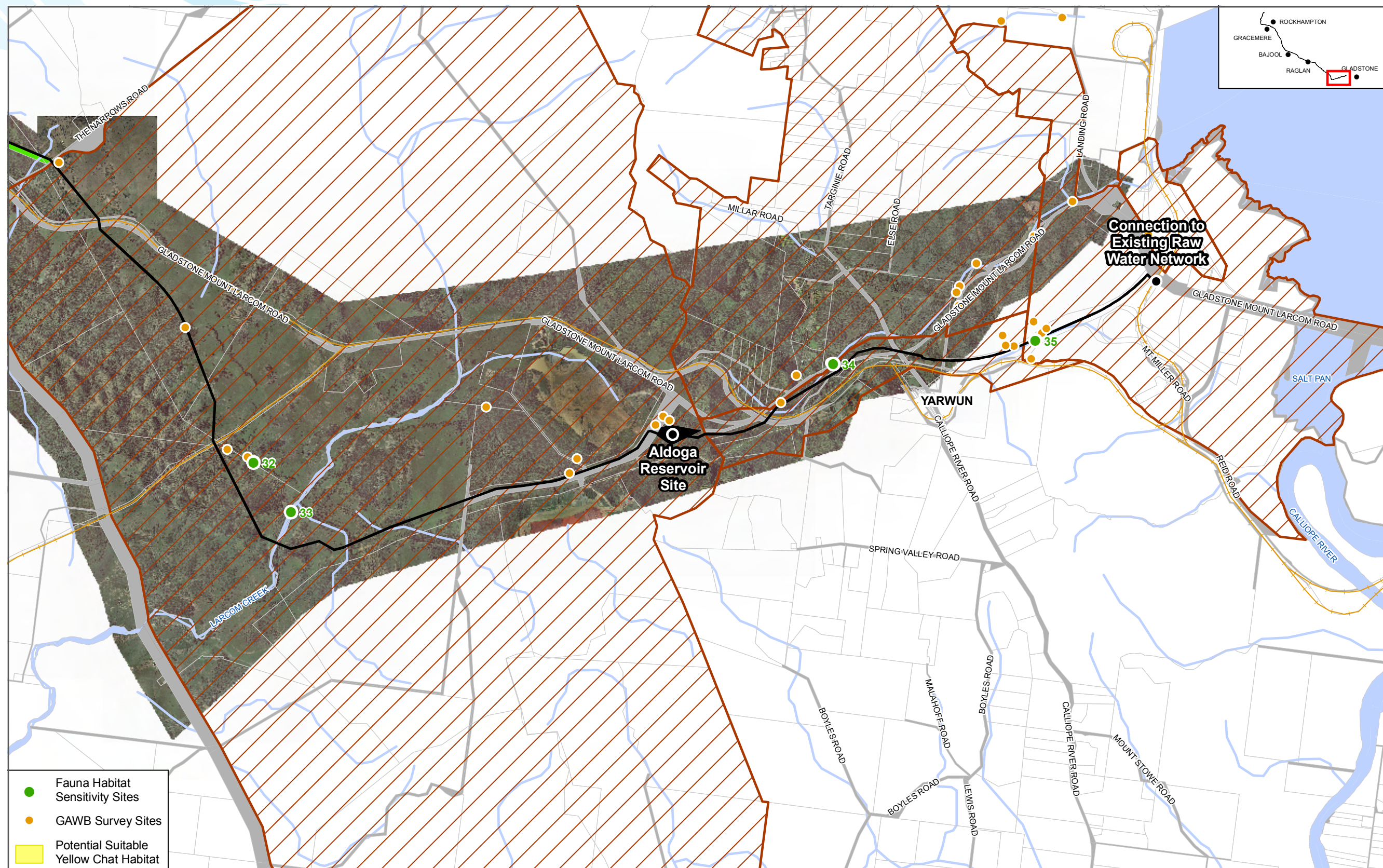
- | | | |
|------------------------|--------------|--------------|
| The Right of Way | Road Reserve | LGA Boundary |
| Project Infrastructure | Waterways | SGIC |
| Railway Line | Cadastre | GSDA |

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



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Gladstone - Fitzroy Pipeline Project
**Figure 7.6 - Location of Areas of Fauna
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 Sheet 4 of 4

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0 1 2 3 4 km

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Table 7.6 Rare, Threatened and Migratory Survey Records for Bajool to Gladstone Section

| Status: | CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory | | | | | |
|--|--|------------|---------------------|-----------------------|-----------|--|
| Legislation: | EPBC = <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) NCA = <i>Nature Conservation Act 1992</i> (Qld) | | | | | |
| Species | EPBC status | NCA status | GPS location | Number of individuals | Month | Comments |
| Koala (Southeast Qld) (<i>Phascolarctos cinereus</i>) | | RV | 291216E 7366973S | n/a | April | Tree trunk scratches and scats at Horseshoe Lagoon wetland complex on Darts Creek |
| Koala (Southeast Qld) | | RV | 299142E 7360825S | n/a | April | Tree trunk scratches and scats on <i>E. tereticornis</i> within riparian vegetation of unnamed waterway to near south of rail line. |
| Koala (Southeast Qld) | | RV | 299130E 7360661S | n/a | April | Tree trunk scratches and scats on <i>E. tereticornis</i> within riparian vegetation of unnamed waterway to near south of rail line. |
| Koala (Southeast Qld) | | RV | 310079E 7363586S | n/a | April | Tree trunk scratches and scats on mature, hollow-bearing <i>E. tereticornis</i> adjacent to Boat Landing Creek (to near north of Mt. Larcom Gladstone Road). |
| Jabiru (<i>Ephippiorhynchus asiaticus</i>) | M | R | 261299E 7382736S | 1 | November | Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road. |
| Jabiru | M | R | 265205E 7384412S | 1 | December | Clay pan to north of Cheetham drain wetlands. |
| Radjah Shelduck (<i>Tadorna radjah</i>) | M | R | 276393E 7377414S | 2 | September | Large constructed wetland to near north of Hourigan Creek. Partially filled and wide bare earth margins. |
| Radjah Shelduck | M | R | 276241E 7377941S | 1 | December | Large constructed wetland to near north of Hourigan Creek. Partially filled and wide bare earth margins. |
| Cotton Pygmy-goose (<i>Nettapus coromandelianus</i>) | M | R | 261299E 7382736S | 7 | April | Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road. |
| Cotton Pygmy-goose | M | R | 270530E 7379259S | 2 | April | Billabongs along Twelve Mile Creek. |
| Cotton Pygmy-goose | M | R | 305381E 7361325S | 6 | April | Aldoga Reservoir. |
| Cotton Pygmy-goose | M | R | 261299E 7382736S | 5 | June | Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road. |
| Cotton Pygmy-goose | M | R | 261299E 7382736S | 8 | September | Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road. |
| Cotton Pygmy-goose | M | R | 305381E 7361325S | 4 | September | Aldoga Reservoir. |
| Cotton Pygmy-goose | M | R | 291210E 7367065S | 2 | September | Large billabong with aquatic vegetation (Horseshoe Lagoon wetland complex) on Darts Creek. |
| Cotton Pygmy-goose | M | R | 261299E 7382736S | 5 | November | Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road. |



| Species | EPBC status | NCA status | GPS location | Number of individuals | Month | Comments |
|--|-------------|------------|---------------------|-----------------------|-----------|---|
| Cotton Pygmy-goose | M | R | 278241E 7376165S | 5 | November | Freshwater wetland – Eight Mile Creek reservoir off Bajool Port Alma Road. |
| Squatter Pigeon (sth. subsp.) (<i>Geophaps scripta scripta</i>) | V | | 271008E 7379403S | 5 | April | <i>Eucalyptus tessellaris</i> grassy woodland. |
| Squatter Pigeon | V | | 275732E 7377015S | 2 | April | Open grassland. |
| Squatter Pigeon | V | | 269852E 7378839S | 2 | April | Open grassland. |
| Squatter Pigeon | V | | 284971E 7373708S | 6 | April | <i>Eucalyptus coolibah</i> grassy open woodland. |
| Squatter Pigeon | V | | 288112E 7369756S | 2 | April | <i>Eucalyptus mollucana</i> grassy woodland. |
| Squatter Pigeon | V | | 291210E 7367065S | 4 | April | <i>Eucalyptus tereticornis</i> / <i>E. mollucana</i> grassy open woodland. |
| Squatter Pigeon | V | | 284994E 7373613S | 4 | April | <i>Eucalyptus coolibah</i> grassy open woodland adjacent to Reedy Creek Road. |
| Squatter Pigeon | V | | 273188E 7378272S | 4 | June | Grazing land (cleared poplar box woodland) with narrow linear remnant adjoining dirt road. |
| Squatter Pigeon | V | | 270947E 7379412S | 2 | July | Woodland patch adjacent to Twelve Mile Creek Road. |
| Squatter Pigeon | V | | 291210E 7367065S | 2 | September | Large billabong with aquatic vegetation (Horseshoe Lagoon wetland complex) on Darts Creek. |
| Squatter Pigeon | V | | 267674E 7381179S | 1 | September | Grassy verge of Toonda Port Alma Road. Narrow linear woodland remnant adjoining. |
| Squatter Pigeon | V | | 268408E 7380069S | 1 | September | Grassy verge of Toonda Port Alma Road. Narrow linear woodland remnant adjoining. |
| Squatter Pigeon | V | | 272750E 7378616S | 2 | September | Grassy verge of Twelve Mile Creek Road. Narrow linear woodland remnant adjoining. |
| Squatter Pigeon | V | | 273527E 7377745S | 2 | September | Open grassland adjoining constructed wetland – west of Twelve Mile Road. |
| Squatter Pigeon | V | | 273558E 7377878S | 1 | October | Mixed <i>Eucalyptus</i> woodland with grassy/shrubby understorey. |
| Squatter Pigeon | V | | 271964E 7379217S | 2 | October | Poplar box remnant woodland with grassy understorey. |
| Squatter Pigeon | V | | 268523E 7379656S | 4 | October | On unsealed road through mixed <i>Eucalyptus</i> woodland with grassy/ shrubby understorey. |
| Squatter Pigeon | V | | 267395E 7381524S | 1 | October | Open grassland alongside unsealed road. |

| Species | EPBC status | NCA status | GPS location | Number of individuals | Month | Comments |
|--|-------------|------------|---------------------|-----------------------|-----------|---|
| Squatter Pigeon | V | | 252558E 7397024S | 2 | October | In dry swale with mid-dense to sparse cover of <i>Salsola</i> spp. |
| Squatter Pigeon | V | | 267360E 7381568S | 2 | November | Grassy open drain alongside Marmoor/Toonda Port Alma Road intersection. |
| Squatter Pigeon | V | | 271356E 7379366S | 2 | November | Poplar box woodland remnant with grassy understorey alongside Twelve Mile Road. |
| Squatter Pigeon | V | | 270363E 7378971S | 2 | December | Dirt track through grazed open grassland. |
| Squatter Pigeon | V | | 266045E 7381959S | 1 | December | Road fringed with <i>Eucalyptus camabageana</i> and; understorey grassy. |
| Glossy Black Cockatoo (<i>Calyptrohynchus lathamii</i>) | | V | 309443E 7362434S | 1 | April | Forested ridgeline within a large remnant near the existing slurry pipeline easement. |
| Black-chinned Honeyeater (<i>Melithreptus gularis</i>) | | R | 291342E 7366828S | 6 | April | Patch of flowering <i>Eucalyptus mollucana</i> adjacent to the power easement to the near north of Mt Larcom township. |
| Yellow Chat (<i>Epthianura crocea macgregori</i>) | CE | E | 271121E 7380255S | 2 | July | Saline wetlands at Twelve Mile Creek. Birds seen in close proximity to one another, out on saline flats; amidst saltwater couch and saltbush fringing inundated clay pan. |
| Yellow Chat | CE | E | 270842E 7381180S | 2 | September | Twelve Mile Creek Reserve. Saltmarsh adjoining inundated clay pan. |

Table 7.7 Areas of Fauna Habitat Sensitivity Associated with the Bajool to Gladstone Section

| Area # | GPS reference | Comments | Primary values |
|--------|---------------------|--|---|
| 17 | 262098E 7384738S | Seasonal wetland system comprising of natural form broad swales – south of Port Alma railway. Part of Inkerman Creek wetland system. | Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. |
| 18 | 263729E 7383889S | Inkerman Creek and associated wetlands. | Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. |
| 19 | 267056E 7382452S | Node of <i>Eucalyptus moluccana</i> woodland. | Habitat node in largely cleared landscape. |
| 20 | 269977E 7379303S | Southern extent of saline wetlands of Twelve Mile Creek Reserve. | Adjacent to potential Yellow Chat habitat. |
| 21 | 270526E 7379266S | Freshwater section of Twelve Mile Creek – adjacent and upstream of Twelve Mile Creek Reserve. | Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. |
| 22 | 271347E 7379141S | Twelve Mile Creek tributary – riparian vegetation. | Wildlife movement corridor. |
| 23 | 273562E 7377895S | Broad seasonal wetland – part of Pelican Creek. | Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. |
| 24 | 276522E 7376943S | Southern extent of the Hourigan Creek wetland complex. | Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. |



| Area # | GPS reference | Comments | Primary values |
|--------|----------------------|--|--|
| 25 | 276750E 7376802S | Hourigan Creek riparian vegetation. | Wildlife movement corridor. |
| 26 | 276882E 7376737 | Hourigan Creek riparian vegetation. | Wildlife movement corridor. |
| 27 | 277447E 7376420S | Raglan Creek riparian vegetation (western extent). | Wildlife movement corridor. |
| 28 | 277783E 7376382S | Raglan Creek riparian vegetation (eastern extent). | Wildlife movement corridor. |
| 29 | 278466E 7376245S | Remnant vegetation. Also large wetland approximately 100 m to south. | Habitat node in largely cleared landscape. |
| 30 | 2900029E 7369279S | Darts Creek riparian vegetation – north of Darts Creek Road. | Wildlife movement corridor. |
| 31 | 292431E 7367021S | Darts Creek riparian vegetation – north of Popenia Road. | Wildlife movement corridor. |
| 32 | 299229E 7360674S | Larcom Creek tributary riparian vegetation. | Wildlife movement corridor. |
| 33 | 299783E 7359955S | Larcom Creek riparian vegetation. | Wildlife movement corridor. |
| 34 | 307772E 7362081S | Boat Landing Creek riparian vegetation. | Wildlife movement corridor. |
| 35 | 310784E 7362439S | Remnant vegetation to near north of railway line. | Large bushland node. |

7.6 Assessment of Impacts

7.6.1 Potential Impacts to Fauna

The alignment of the Gladstone-Fitzroy pipeline was designed to minimise impact to native fauna habitats. In particular, alignment has been strongly influenced by the requirement to avoid traversal of as many wetland habitats (albeit seasonal or semi-permanent) and large and connected areas of native vegetation habitat as possible. This has largely been achieved, though given the length of the pipeline and topographic constraints, it is not possible to avoid all areas that may support fauna habitat.

The potential impacts to fauna species are likely to be limited to direct impacts associated with construction of the proposed pipeline. These impacts may 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.

The following provides a summary of each of these potential impacts. Where relevant to specific locations or areas, further discussion is provided in Sections 7.6.3 and 7.6.4.

7.6.1.1 Vegetation Clearing and Habitat Disturbance

Structural habitat heterogeneity is an important determinant of terrestrial fauna diversity (e.g. Beattie 1995, Agnew *et al.* 2003). Features that enhance habitat heterogeneity include hollow-bearing trees, a shrubby understorey, ground logs and fallen timber (Gilmore 1985, Bennett *et al.* 1994, Barrett 2000). Generally, greater structural and floristic diversity is associated with areas of remnant native vegetation. The removal of remnant vegetation cover results in the loss of feeding resources and shelter/breeding sites for native fauna and reduced faunal diversity.

The pipeline alignment has been designed to avoid or, where this has not been practicable (e.g. due to topographic constraints), minimise impacts to areas of remnant vegetation. Therefore, the vast majority of the construction footprint traverses cleared and highly disturbed environments and avoids as many areas of regrowth native vegetation as possible.

As a result, impacts to areas of remnant vegetation would not be substantial and the proposed loss of remnant vegetation will be minimal. It is recommended that management practices be implemented that further reduce the loss of vegetation and habitat disturbance associated with the proposed pipeline and disturbance to native fauna (see Section 7.7, Mitigation for details).

As described previously, a large proportion of the project area and surrounding land is subject to grazing and agricultural activities. Within this production landscape, native fauna habitat values have been greatly reduced through either complete clearing of native vegetation cover (and replacement with exotic pasture grasses) or through associated disturbances to remaining patches of native vegetation. Disturbance through simplification of habitat structure (selective clearing, grazing and inappropriate fire regimes) reduces suitable resources and conditions for native fauna and ultimately results in significant reduction in faunal diversity. Often, these simplified habitats support environments more favourable to aggressive, opportunistic native species and introduced predators and/or competitors (e.g. feral cat and cane toad) to the disadvantage of native fauna species that prefer more structurally complex habitats.

A significant threat to a variety of fauna is the potential loss of hollow-bearing trees (Bennett *et al.* 1994). A wide range of vertebrate fauna species are dependent on tree hollows for shelter and breeding, including gliders, possums, microbats, owls, parrots, ducks, and reptiles (Bennett *et al.* 1994, Phillips 2001, Gibbons and Lindenmayer 2002).

Throughout the region, the removal of mature remnant vegetation cover for the development of a production landscape has resulted in a significant reduction in the abundance of hollow-bearing trees. Throughout the project area, mature trees with either limb or trunk hollows were found to be uncommon

to Rare. Such trees are generally associated with patches of remnant vegetation, though also as isolated individuals within pastoral land. Those specimens within strips of riparian vegetation (surrounded by cleared lands) are considered to be particularly important in regards to their potential contribution to both habitat values and support for fauna dispersal. Even single or widely scattered mature hollow-bearing trees within a largely cleared landscape can be important habitat (Lumsden and Bennet 2003).


Although native regrowth vegetation occurs within and adjacent to the project area, most trees are too young to form hollows. The majority of this tree cover would require many decades of further growth to reach suitable maturity for hollow formation (e.g. >120 years old to form hollows suitable for occupancy of vertebrate fauna; see data in Gibbons and Lindenmayer (2002)).

All mature hollow-bearing trees will be considered a priority for retention and it is not expected that the construction of the pipeline will require removal of any individuals. A variety of the management strategies are recommended specifically to minimise any potential impacts to hollow-bearing trees within the vicinity of the construction zone (see Section 7.7, Mitigation for details).

As identified previously, ground logs and fallen timber contribute to habitat heterogeneity and species diversity. Ground debris such as fallen logs and timber provide shelter and habitat for a wide range of taxa including native rodents, dasyurid marsupials, bandicoots, snakes, lizards, frogs, and birds (Barrett 2000, Nichols and Reynolds 2000, Grant *et al.* 2001, MacNally and Horrocks 2002, Michael *et al.* 2004). These resources also support suitable habitat for colonising plants and animals (e.g. insects and fungi) which are a source of food for many of these vertebrate species (e.g. Greenslade and Majer 1993, Majer and Nichols 1998).

Impacts to fauna from removal of dead timber will generally diminish over time with natural re-accumulation. Where the pipeline route transects areas of remnant or remnant regrowth vegetation, post-construction management practices will be implemented to minimise impact to ground fauna (e.g. collecting dead timber and redistribution over the alignment after construction) (see Section 7.7, Mitigation for details).

Clearing for infrastructure within areas of remnant vegetation will increase the boundary to area ratio of these communities and therefore increase the potential for edge effects. Edge effects can significantly influence the characteristics of a fauna assemblage. Processes associated with habitat edges may extend well into a habitat area, thus allowing impacts to reach deep into a habitat area (e.g. displacement of small-sized avifauna resulting from the presence of aggressive/competitive birds (Catterall *et al.* 1991)). Edge effects can include the establishment of weeds and alteration to micro-climatic conditions (e.g. greater light intensity, more wind



penetration, lower humidity). A variety of the management strategies are recommended specifically to minimise edge effects on areas of remnant vegetation (see Section 7.7, Mitigation for details).

7.6.1.2 Habitat Fragmentation and Disturbance to Wildlife Movement Corridors

Habitat fragmentation is a reduction in the continuity of a habitat through disturbance or loss. Isolation of fauna populations in small remnants increases their vulnerability to local extinction as a result of stochastic events (e.g. fire, drought and disease) and can decrease their genetic viability in the long-term (Soule *et al.* 1988, Laurence 1990). The capacity of a habitat area to support a range of fauna is also influenced by its extent. Very small habitat areas may be unable to sustain animals with large territories/home ranges, whilst fauna restricted to these and relatively narrow/linear habitats, which support high edge to area relationship, may be exposed to increased predation and competition from species in adjoining areas (Brooker *et al.* 1999).

Throughout the region, habitat areas have been fragmented by vegetation clearing in support of pastoral and agricultural activities. The alignment of the corridor has been designed to avoid large and connected habitat areas and where this has not been possible, to minimise the impact of fragmenting habitat areas.

The survival of species within habitat patches (whether small, large and/or isolated) depends, in part, on their ability to disperse and the capacity to disperse is not equal among species. Discontinuity of suitable habitat linkages may present physical and psychological barriers that can impede or even prevent movement between habitats (Andrews 1990, Catterall *et al.* 1991, Burnett 1992, Brooker *et al.* 1999). The most important and strategically effective initiative in regards to the maintenance of habitat connectivity will be the protection and rehabilitation of native vegetation cover associated with waterways (seasonal or otherwise). Riparian vegetation generally provides a higher diversity of plant species (and therefore feeding resources for fauna) and often denser cover which encourages fauna movement.

Whilst waterway crossings are unavoidable, the pipeline alignment avoids higher quality areas of riparian vegetation. It is recommended that management practices be implemented that further reduce the loss of vegetation and habitat disturbance at these crossing points (see Section 7.7, Mitigation for details). Where it has not been practicable to avoid higher quality riparian vegetation and/or where other habitat sensitivities exist, trenchless creek crossing methods have been selected where possible to avoid impacts to fauna habitats.

Disturbance to Wetlands and Waterways

With the exception of habitats associated with Eight Mile/Inkerman Creek and Twelve Mile Creek Reserve, natural wetlands throughout the project area have been highly modified by a combination of earth works and/or native vegetation clearing. Bunding works to enhance their capacity to act as ponded pastures under wet summer conditions have significantly altered many of these formerly natural systems. The majority of these wetlands are subject to ongoing disturbance by cattle. Other wetlands have been constructed and are typically small dams.

Despite these disturbances, a variety of these wetlands support habitat values for a wide variety of waterbirds and waders, including Rare and Migratory species. South of Midgee, a number of these sites have been monitored monthly over a seven month period in respect to their potential to serve as seasonal refuges for the Critically Endangered Yellow Chat (*Epthianura crocea macgregori*).

As a result of the findings of the field survey program, wetland habitats were identified and the pipeline route adjusted to avoid these whenever possible. In several instances where this was not possible, trenchless crossing methods will be used to reduce the impact to flora and fauna habitat values. Where complete avoidance or trenchless construction methods were not possible, mitigation measures will be adopted that will aim to minimise disturbance to these areas (see Section 7.8, Residual Impact for details). It should be noted that, a distinctly precautionary approach has been adopted in relation to considerations of the pipeline alignment and potential Yellow Chat habitat.

Riparian vegetation generally provides a higher diversity of plant species and often supports mature vegetation and important resources including hollow-bearing trees. Consequently, these areas typically support habitat for a diversity of species and facilitate fauna movement. A characteristic of production landscapes, as is the case within the project area and surrounds, riparian vegetation remains as relatively linear habitats within an otherwise cleared landscape.

Clearing of riparian vegetation should be kept to the minimum required to safely construct the pipeline and meet other environmental requirements (e.g. erosion control, spoil storage). Where possible, construction of waterway crossings should only take place during the dry season (June to September). To avoid impacts to riparian communities, trenchless methods are preferred to cutting an open trench and filling as this reduces the amount of clearing of riparian vegetation. Where trenchless methods are not possible, a variety of other impact mitigation strategies will be implemented, e.g. minimising clearing widths for construction and post-construction rehabilitation (see Section 7.7, Mitigation).

7.6.1.3 Trench Fall

The pipeline will be located underground and trenching is required to accommodate the pipeline. Whilst the pipeline instatement will be progressive (in order to minimise the length of open trenching at any one time), sections of open trench will be present and unavoidable. Open trenching has the potential to form a temporary barrier to fauna movement. In addition, there is the potential for small ground dwelling fauna to fall into the open trench and become trapped and exposed to overheating, dehydration, predation and/or drowning.

Research associated with a variety of major Australian pipeline projects has demonstrated that pipeline trenches can entrap significant numbers of a diverse range of native fauna (including species of conservation significance), particularly reptiles, frogs and small mammals, with the potential for high levels of mortality (Ayers and Wallace 1997, Woinarski *et al.* 2000, Doody *et al.* 2003, Wilson and Swan 2004, and Wilson 2005b). The potential for fauna entrapment and mortality is significant and has been acknowledged as a key environmental issue by the *Australian Pipeline Industry Association Code of Environmental Practice* (APIA 2005).

To help reduce potential impacts from trench fall, the length of open trench will be the minimum practicable at any one time. It is recommended that management practices be implemented that reduce the potential for fauna to enter open trenches and prevent mortality of any individuals which may become entrapped (see Section 7.8, Residual Impact for details).

7.6.1.4 Introduced Fauna and Flora

Vertebrate Fauna

The review of existing information and the findings of field surveys has identified a suite of introduced fauna species which are known or likely to occur within the project area and surrounds. The majority of these species have been widely acknowledged as implicit in the degradation of habitat values for both native fauna biodiversity and species of conservation significance. Threats include predation of native taxa, competition with native fauna, physical degradation of native fauna habitat, and transmission of pathogens to native fauna.

Evidence drawn from field surveys indicates that the occurrence of a variety of pest species was widespread throughout the project area and most are assumed to have resident populations, though their abundance is likely to vary throughout the project area.

As part of the operation of the project, no pest species will be deliberately introduced to the project area and measures will be implemented to reduce accidental introduction.

Invertebrate Fauna

The invertebrate pests of most concern are introduced ants. Red Imported Fire Ants (*Solenopsis invicta*) were first recorded from Australia in 2001 when colonies were found in Brisbane. In 2006, fire ant colonies were found at Yarwun, just west of Gladstone. By September 2006, the Yarwun ants had been eradicated, but the possibility remains that other fire ant colonies may exist around Gladstone or elsewhere in central Queensland.


CSIRO climate model analysis shows that fire ants have the potential to inhabit vast areas of coastal Australia, including natural areas such as world heritage areas and national parks (DPI&F 2007). Fire ants are very aggressive and are voracious feeders and these attributes indicate that fire ants have the potential to impact on native fauna biodiversity, particularly native ground fauna, including invertebrates, skinks, frogs, birds and mammals (DPI&F 2007). There is evidence of these impacts in some fire ant infested bushland in Brisbane's southwest (DPI&F 2007). Fire ants also have the potential effect long-term changes to vegetation communities in natural areas as a result of their habit of eating or damaging native plant seeds and predated/disturbing insects and animals which pollinate native plants (DPI&F 2007).

Red Imported Fire Ants have been declared a notifiable pest under the *Plant Protection Act 1989* (Qld). Landholders are legally obliged to inform the DPI&F if they suspect they have fire ants, and the withholding of this information can result in fines.

The National Fire Ant Eradication Program commenced in 2002 to eradicate the red imported fire ant from Queensland and is part of a nationally coordinated program involving a cooperative approach between the Commonwealth and Queensland Governments (DAFF 2007). Part of the National Fire Ant Eradication Program strategy aims to reduce the spread of fire ants through movement controls, i.e. restrictions on the disturbance or movement of high-risk materials. High-risk materials include soil, mulch, hay, turf and earth-moving machinery/vehicles/equipment.

The extreme southern extent of the project area is included within the area declared as the Yarwun Fire Ant Restricted Area (DPI&F 2007). Regulations apply to commercial activities which involve moving high-risk materials within and out of a fire ant restricted area (e.g. movement of high risk materials must be accompanied by a movement certificate or fire ant declaration form).

Red Imported Fire Ants are very small, only 2 to 6 mm long, coppery brown in colour like beer bottles. They live mainly in dome-shaped nests with no visible entry holes. The nests can be up to 40 cm tall (see illustrations at http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/4790_4549_ENA_HTML.htm), although new nests are often concealed underground or beneath debris with no mound present. Fire ants readily nest in



industrial sites such as outdoor depots, where they can easily be transported along with containers or pipes that have been stored on the ground, especially if soil adheres to the base. They are easily overlooked because they often remain concealed within their nests for long periods, but will storm out when disturbed and sting fiercely. The worker ants vary greatly in size, and this characteristic, plus the lack of visible entry holes in nests, and the stinging behaviour, provides good indications that ants are fire ants. Illustrations can be found on the Department of Primary Industries and Fisheries (DPI&F) website (<http://www2.dpi.qld.gov.au/fireants/8294.html>). Construction personnel; should not try to identify ants themselves, but should mail samples of any suspicious ants to the Queensland Fire Ant Control Centre. The ants should be killed with insect spray or frozen in a fridge, then sent in a dry condition.

Another invasive ant of concern is the Yellow Crazy Ant *Anoplolepis gracilipes*. Crazy ants have been recorded at various sites along the Queensland coast, including Cairns, Hervey Bay, Brisbane and Logan City. Although crazy ants are not known from the region between Cairns and Hervey Bay, it is considered possible by experts at Biosecurity Queensland that undetected infestations exist (*pers comm.* T. Low, 2007).

Where high populations or super-colonies form, crazy ants can directly impact on a range of native vertebrate and invertebrate fauna and flora (including Threatened taxa), resulting in considerable losses of biodiversity, changes in habitat structure and alterations to the ecosystem processes (DECC 2005, TSSC 2005).

The Yellow Crazy Ant is declared a Class 1 pest under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld). A Class 1 pest is one that is not commonly present in Queensland, and if introduced would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the State. Landowners must take reasonable steps to keep their land free of Class 1 pests. Declaration under state legislation imposes a legal responsibility for control by all landowners on land under their management and without a permit, it is an offence under the *Land Protection Act* to:

- introduce a pest animal to the State
- feed a declared pest animal
- keep a declared pest animal
- release a declared pest animal.

The declaration establishes responsibility with landholders, and gives QNR&M power to take emergency control action, including issuing emergency quarantine notices.

As with fire ants, crazy ants can be transported on vehicles, especially among soil or green waste. A lump of earth attached to a grader, truck or section of pipe could carry a queen ant and enough workers to found a new colony. Vehicle hygiene is thus important. Construction personnel will be trained to report any unusual ants detected around depots or camps.

Yellow imported crazy ants are yellowish tan, about 5 mm long, with long antennae and long legs (see DPI&F website at http://www.nrw.qld.gov.au/pests/pest_animals/declared/crazy_ant.html). Crazy ants do not sting but will spray irritating formic acid from their abdomens when disturbed. This is unlikely to have serious medical consequences. Crazy ants can be spread through transportation with timber and other products, and they have been found inside kitchens on industrial premises in Queensland.

Environmental Weeds

As identified in both this chapter and Chapter 6, Terrestrial Flora, there are a variety of exotic weed taxa within the project area and surrounds. Many of are either known to, or have the potential to pose a significant threat to the maintenance of terrestrial biodiversity values. Weed hygiene and control protocols will be developed and implemented through a construction weed management plan (see Section 7.8, Residual Impact and Chapter 6, Terrestrial Flora).

7.6.2 Potential Impacts to Species of Conservation Significance

As a result of the review of existing information sources, a wide variety of Rare, Threatened and/or Migratory species were initially considered in regards to potential occurrence within the project area (see Table 7.2 and Table 7.3). Habitat suitability assessments and a series of targeted field surveys undertaken for this chapter have provided further assistance to refining the list of taxa to include those known to occur within the project area and close surrounds or those, which have a potential to occur within the project area, and close surrounds.

The findings of that work also indicate that that the project area does not support high quality preferred habitat for the any of those species, though the project area does support areas of comparatively lower quality habitat in which species of conservation significance have been recorded and/or could potentially occur.

In consideration of these issues, it is generally concluded that there is minimal prospect that the development and operation of the project will result in a significant impact to local populations if appropriate impact mitigation measures are implemented (refer to mitigation measures described in Section 7.7, Mitigation).

The following sections identify those species of conservation significance considered in the final analysis and a summary of the potential impact on these species.

7.6.2.1 Rare and Threatened Fauna

The field survey program has detected a suite of Rare and Threatened taxa which have been recorded within the project area or on adjacent land. They are:

- Critically Endangered: Yellow Chat (*Epthianura crocea macgregori*)
- Vulnerable: Squatter Pigeon (sth. subsp.) (*Geophaps scripta scripta*) and Ornamental Snake (*Denisonia maculata*)
- Regionally Vulnerable: Koala (Southeast Qld) (*Phascolarctos cinereus*)
- Rare: Cotton Pygmy-goose (*Nettapus coromandelianus*), Jabiru (*Ephippiorhynchus asiaticus*), Radjah Shelduck (*Tadorna radjah*) and Black-chinned Honeyeater (*Melithreptus gularis*).

The review of fauna databases and local studies identified a variety of Rare and Threatened species that have been recorded in, or have the potential to occur in, the broader area encompassing the project area. As determined through field surveys, habitat suitability assessments, and knowledge of habitat requirements, the project area does not support examples of quality preferred habitat for many of these species. Whilst the likelihood of occurrence within the project area for many of these taxa was determined to be possible, though highly unlikely, a conservative precautionary approach has been adopted and those species have been included in the assessment of potential impacts.

The primary potential impacts to Rare and Threatened taxa 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.

Table 7.8 provides a summary of occurrence status and potential impacts and mitigation responses for Rare and Threatened fauna that are known to occur, or have the potential to occur, within habitats of the project area and/or land immediately adjacent.

Table 7.8 Summary of Occurrence Status and Mitigation Responses for Rare and Threatened Fauna

| Status: | CE = Critically Endangered; E = Endangered; V = Vulnerable; RV = Regionally Vulnerable; R = Rare; M = Migratory | | |
|--|--|------------|--|
| Legislation: | EPBC = Environment Protection and Biodiversity Conservation Act 1999 (Cth) NCA = Nature Conservation Act 1992 (Qld) | | |
| Species | EPBC status | NCA status | Occurrence status and summary of key impact mitigation strategies |
| Koala (Southeast Qld) (<i>Phascolarctos cinereus</i>) | | RV | Known. Minimise impacts to remnant woodlands and forest and minimise clearing widths through riparian communities. Note: Regionally Vulnerable status only applies to Southeast Queensland bioregion and thus only to the section of the project area south of about Mt. Larcom. |
| Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) | V | | No record, possible. Northern extent of distribution around Gladstone, though may occur in southern parts of project area. Minimise tree clearing and impacts to remnant woodlands and forest. |
| Greater Long-eared Bat (<i>Nyctophilus timoriensis</i>) | V | V | No record, possible. Northern extent of distribution around Gladstone/Mt. Larcom. Minimise impacts to remnant vegetation communities (especially those with a shrubby understorey), micro-tunneling or restricted clearing widths through riparian communities, protection of hollow-bearing trees, and post-construction habitat rehabilitation. |
| Little Pied Bat (<i>Chalinolobus picatus</i>) | | R | No record, possible. Minimise impacts to remnant vegetation communities (especially Brigalow communities), microtunneling or restricted clearing widths through riparian communities, post-construction habitat rehabilitation and protection of hollow-bearing trees. |
| Collared Delma (<i>Delma torquata</i>) | V | V | No record, possible. Minimise impacts to remnant woodland and open forest communities (especially those associated with cracking clays), open trench exclusion fencing, and trench fall rescue protocols. |
| Brigalow Scaly-foot (<i>Paradelma orientalis</i>) | V | V | No record, possible. Minimise impacts to remnant vegetation communities (especially those with rocky outcrops at the southern end of the project area), open trench exclusion fencing and trench fall rescue protocols. |
| Anomalopus brevicollis | | R | No record, possible. Minimise impacts to remnant vegetation communities (especially those with rocky outcrops at the southern end of the project area), open trench exclusion fencing, trench fall rescue protocols, and post-construction habitat rehabilitation. Species ecology is poorly known. |
| Yakka Skink (<i>Egernia rugosa</i>) | V | V | No record, possible. Minimise impacts to remnant woodland and open forest communities (especially those with rocky outcrops at the southern end of the project area), trench fall rescue protocols, and post-construction habitat rehabilitation. |
| Common Death Adder (<i>Acanthophis antarcticus</i>) | | R | No record, possible. Minimise impacts to remnant woodland and open forest communities (especially those with rocky outcrops at the southern end of the project area), trench fall rescue protocols, and post-construction habitat rehabilitation. Formerly abundant in parts of the Brigalow Belt, though numbers have declined dramatically. |
| Yellow-naped Snake (<i>Furina barnardi</i>) | | R | No record, possible. Minimise impacts to remnant woodland and open forest communities (especially those with rocky outcrops at the southern end of the project area), trench fall rescue protocols, and post-construction habitat rehabilitation. Taxonomy status and ecology uncertain. |
| Grey snake (<i>Hemiaspis damieli</i>) | | E | No record, possible. May occur in remnant or native regrowth vegetation, especially patches on heavier, cracking clay soils, in association with waterbodies (northern and central sectors of project area). Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, post-construction habitat rehabilitation, open trench exclusion fencing, trench fall rescue protocols, and trench fall rescue protocols, and post-construction habitat rehabilitation. Species ecology is poorly known. |
| Ornamental Snake (<i>Denisonia maculata</i>) | V | V | Known. Recorded from woodland adjacent to wetland (near south of Midgee). May occur in similar habitats to north and south, especially patches on heavier, cracking clay soils, in association with waterbodies. Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, post-construction habitat rehabilitation, open trench exclusion fencing, trench fall rescue protocols, and trench fall rescue protocols, and post-construction habitat rehabilitation. |

| Species | EPBC status | NCA status | Occurrence status and summary of key impact mitigation strategies |
|---|-------------|------------|--|
| Radjah Shelduck (<i>Tadorna radjah</i>) | M | R | Known. Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, and post-construction habitat rehabilitation. |
| Cotton Pygmy-goose (<i>Nettapus coromandelianus</i>) | M | R | Known. Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, and post-construction habitat rehabilitation. |
| Black-necked Stork (<i>Ephippiorhynchus asiaticus</i>) | | R | Known. Minimise impacts to wetland areas through micro-tunneling, minimal clearing paths, and post-construction habitat rehabilitation. |
| Square-tailed Kite (<i>Lophoictinia isura</i>) | M | R | No record, possible. Minimise impacts to remnant woodland and forest (particularly larger patches in southern sector of project area), minimise clearing widths through riparian communities, and post-construction habitat rehabilitation. |
| Grey Goshawk (<i>Accipiter novaehollandiae</i>) | M | R | No record, possible. Minimise clearing widths within shrubby remnant forest and denser riparian communities (particularly in the southern extent of project area, e.g. Boat Landing Creek area) and post-construction habitat rehabilitation. Possible seasonal visitor to remnant vegetation of southern extent of project area. |
| Red Goshawk (<i>Erythrotriorchis radiatus</i>) | V/M | E | No record, possible. Minimise impacts to remnant woodland and forest (particularly larger patches in southern sector of project area), and post-construction habitat rehabilitation. Distribution uncertain in region and these raptors require a very large home range. |
| Painted Snipe (<i>Rostratula benghalensis</i>) | V/M | V | No record, possible. Occurrence erratic and unpredictable, seldom remaining long in wetlands at any locality. Minimise impacts to wetland areas through microtunneling, minimal clearing paths, and post-construction habitat rehabilitation. |
| Squatter Pigeon (sth. subsp.) (<i>Geophaps scripta scripta</i>) | V | | Known. Recorded from a variety of locations, though mainly within the central sector of the project area. Known to occur in highly disturbed cleared landscapes. Minimise impacts to drier eucalypt woodland and areas where native grasses predominate, and post-construction habitat rehabilitation. |
| Glossy Black Cockatoo (<i>Calyptrohynchus lathamii</i>) | | V | Known. Potentially suitable habitat only occurs within the extreme southern part of project area (to near north of smelter). Minimise impacts to remnant woodland and open forest (particularly those with <i>Allocasuarina/Casuarina</i> trees), protection of hollow-bearing trees, and post-construction habitat rehabilitation. |
| Powerful Owl (<i>Ninox strenua</i>) | | V | No record, possible. Potentially suitable habitat only occurs within the extreme southern part of project area. Favours large intact remnants. Minimise impacts to remnant open forest, protection of hollow-bearing trees, and post-construction habitat rehabilitation. Requires an extensive home range. |
| Rufous Owl (<i>Ninox rufa queenslandica</i>) | | V | No record, possible. Potentially suitable habitat only occurs within the extreme southern part of project area (i.e. riparian forest along Boat Landing Creek), though also mangrove communities along Raglan Creek. Requires an extensive home range. Microtunneling or restricted clearing widths through riparian communities, protection of hollow-bearing trees, and post-construction habitat rehabilitation. |
| Black-chinned Honeyeater (<i>Melithreptus gularis</i>) | | R | Known. Known from two locations and associated with flowering eucalypts. Minimise impacts to remnant woodland and forest (particularly larger patches), minimal clearing widths through riparian communities, and post-construction habitat rehabilitation. Distribution uncertain in region, locally nomadic and tend to tend to occur in the largest woodland patches in the landscape. |



| Species | EPBC status | NCA status | Occurrence status and summary of key impact mitigation strategies |
|---|-------------|------------|---|
| Yellow Chat (<i>Epthianura crocea macgregori</i>) | CE | E | <p>Known. Recorded within one kilometre of project area though not recorded within adjacent areas along ROW (despite a seven-month monitoring program). Five areas of potentially suitable Yellow Chat habitat are traversed by the ROW (see figure 7.4 and 7.6). These include potential Yellow Chat habitat at:</p> <p>Fauna Habitat Sensitivity Site 16 (see Table 7.11), north of Inkerman Creek</p> <p>Fauna Habitat Sensitivity Site 17 (see Table 7.12), at the Inkerman Creek crossing</p> <p>Fauna Habitat Sensitivity Site 21 (see Table 7.12) at the Twelve Mile Creek crossing</p> <p>Fauna Habitat Sensitivity Site 23 (see Table 7.12), at the Pelican Creek crossing</p> <p>Fauna Habitat Sensitivity Site 24 (see Table 7.12), to the west of Raglan Creek</p> <p>Minimise impacts to wetland areas through microtunneling (see Table 7.1 for all monitoring sites), minimal clearing paths, sediment and pollutant controls, rehabilitation of pre-construction drainage patterns, dry season construction scheduling, post-construction habitat rehabilitation, measures to protect rehabilitation such as feral animal controls and weed eradication.</p> |

Table 7.9 lists those relevant taxa which are classified as Threatened (i.e. 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). As a result of the analysis summarised in the following table, it is considered that the proposed action will not have a real chance or possibility of occurring as per the Guidelines noted above.

Table 7.9 Summary of Significant Impact Criteria for EPBC Threatened Fauna

| Significant impact criteria |
|---|
| Criteria 1: Lead to a long-term decrease in the size of the population. |
| Criteria 2: Reduce the area of occupancy of the species. |
| Criteria 3: Fragment an existing population into two or more populations. |
| Criteria 4: Adversely affect habitat critical to the survival of the species. |
| Criteria 5: Disrupt the breeding cycle of a population. |
| Criteria 6: Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. |
| Criteria 7: Result in invasive species that are harmful to an Endangered species becoming established in the species' habitat. |
| Criteria 8: Introduce disease that may cause the species to decline. |
| Criteria 9: Interfere with the recovery of the species. |
| Criteria Source: <i>EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance</i> (May 2006). |

| Threatened species | Status | Response to significant impact criteria | | | | | | | | |
|---|--------|---|----|----|----|----|----|----|----|----|
| | | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 |
| Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) | V | No | No | No | No | No | No | No | No | No |
| Greater Long-eared Bat (<i>Nyctophilus timoriensis</i>) | V | No | No | No | No | No | No | No | No | No |
| Ornamental Snake (<i>Denisonia maculata</i>) | V | No | No | No | No | No | No | No | No | No |
| Collared Delma (<i>Delma torquata</i>) | V | No | No | No | No | No | No | No | No | No |
| Brigalow Scaly Foot (<i>Paradelma orientalis</i>) | V | No | No | No | No | No | No | No | No | No |
| Yakka Skink (<i>Egernia rugosa</i>) | V | No | No | No | No | No | No | No | No | No |
| Red Goshawk (<i>Erythrorhynchus radiatus</i>) | V | No | No | No | No | No | No | No | No | No |
| Painted Snipe (<i>Rostratula benghalensis</i>) | V | No | No | No | No | No | No | No | No | No |
| Squatter Pigeon (sth. subsp.) (<i>Geophaps scripta scripta</i>) | V | No | No | No | No | No | No | No | No | No |
| Yellow Chat (<i>Epthianura crocea macgregori</i>) | CE | No | No | No | No | No | No | No | No | No |

7.6.2.2 Alignment with the Yellow Chat Recovery Plan

In August 2008, a recovery plan for the Yellow Chat (*Epthianura crocea macgregori*) was released by the Commonwealth and Queensland governments (Houston and Melzer 2008). The recovery plan lists the following as threats to Yellow Chats:

1. Lack of knowledge regarding key aspects of Capricorn Yellow Chat ecology and habitat requirements.
2. Construction of barriers such as extensive levee banks for ponded pasture development or road works within tidal areas.
3. Construction of impoundments (weirs and dams or ponded pastures) upstream of areas supporting Yellow Chats.
4. Spread of exotic pasture grasses, particularly aleman grass and Olive hymenachne.
5. Increase in cattle stocking densities where chats currently occur.
6. Uncontrolled fire.

Field survey work undertaken to investigate potential Yellow Chat habitat within the project area will contribute to the understanding of Yellow Chat occurrence and habitat usage (thus support resolution of threat 1). In relation to threats 2 and 3, the project does not involve development of levee banks or impoundments and is supported by a extensive range of impact avoidance and mitigation strategies in relation to construction works within or near wetlands, thus the project will not exacerbate the effects of threats 2 and 3. In relation to threat 4, a comprehensive suite of measures are to be implemented (and

continually monitored) in relation to preventing the introduction of environmental weeds within the project area (see Chapter 20, Planning and Environmental Management Plan). Likewise, there are a suite of project controls designed to eradicate and environmental weeds which may establish within the project area and adjoining land. In relation to threat 5, the project does not involve the introduction of cattle and a comprehensive suite of measures are to be implemented (and continually monitored) in relation to preventing the introduction of introduced fauna within the project area (see Chapter 20, Planning and Environmental Management Plan). In relation to threat 6, protocols have been prepared to ensure minimal risk of fire emanating from the project area (See Chapter 16, Hazard and Risk; and Chapter 20, Planning Environmental Management Plan).

7.6.2.3 Migratory Fauna

Table 7.10 lists those species, scheduled as Migratory under the EPBC Act, which are known or likely to occur within the project area. The majority of these are regarded as relatively common and widespread species within the region. Generally, these species can be grouped according their key habitat requirements. The primary ecological groupings are:

- Avifauna associated with freshwater and brackish wetlands e.g. waterfowl, egrets and shorebirds
- Avifauna of remnant woodlands, open forest, remnant regrowth and open timbered country e.g. raptors, cuckoos, flycatchers, bee-eaters and songlarks.


As identified previously, the vast majority of the construction footprint traverses cleared and highly disturbed environments and avoids as many areas of remnant vegetation as possible. Likewise, the alignment has been informed by ecological assessments and has been aligned to avoid as many wetland habitats as possible. Where this has not been possible, impacts will be minimised through the implementation of a wide variety of specific management strategies (see Section 7.7).

Table 7.10 lists those relevant taxa which are classified as Migratory 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). Through the implementation of a wide variety of specific management strategies recommended herein, it is considered that the proposed action will not have a real chance or possibility of occurring as per the Guidelines noted above.

Table 7.10 Summary of Significant Impact Criteria for EPBC Migratory Fauna

| Significant impact criteria | | | | | | |
|---|---------------------|----|----|----|----|--|
| Criteria 1: Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles). | | | | | | |
| Criteria 2: Destroy or isolate an area of important habitat for a Migratory species. | | | | | | |
| Criteria 3: Result in an invasive species that is harmful to the Migratory species becoming established in an area of important habitat for the Migratory species. | | | | | | |
| Criteria 4: Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a Migratory species. | | | | | | |
| Criteria Source: <i>EPBC Act Policy Statement 1.1 Significant Impact Guidelines-Matters of National Environmental Significance</i> (May 2006). | | | | | | |
| Migratory species | Occurrence status | #1 | #2 | #3 | #4 | |
| Black-necked Stork (<i>Ephippiorhynchus asiaticus</i>) | Known | No | No | No | No | |
| Magpie Goose (<i>Anseranas semipalmata</i>) | Known | No | No | No | No | |
| Hardhead (<i>Aythya australis</i>) | Known | No | No | No | No | |
| Musk Duck (<i>Biziura lobata</i>) | No record, possible | No | No | No | No | |
| Australian Wood Duck (<i>Chenetta jubata</i>) | Known | No | No | No | No | |
| Wandering Whistling Duck (<i>Dendrocygna arcuata</i>) | Known | No | No | No | No | |
| Plumed Whistling Duck (<i>Dendrocygna eytoni</i>) | No record, likely | No | No | No | No | |
| Radjah Shelduck (<i>Tadorna radjah</i>) | Known | No | No | No | No | |
| Black Swan (<i>Cygnus atratus</i>) | Known | No | No | No | No | |
| Cotton Pygmy-goose (<i>Nettapus coromandelianus</i>) | Known | No | No | No | No | |
| Green Pygmy-goose (<i>Nettapus pulchellus</i>) | No record, possible | No | No | No | No | |
| Chestnut Teal (<i>Anas castanea</i>) | No record, possible | No | No | No | No | |
| Grey Teal (<i>Anas gracilis</i>) | Known | No | No | No | No | |
| Australasian Shoveler (<i>Anas rhynchotis</i>) | No record, likely | No | No | No | No | |
| Pacific Black Duck (<i>Anas superciliosa</i>) | Known | No | No | No | No | |
| Pink-eared Duck (<i>Malacorhynchus membranaceus</i>) | Known | No | No | No | No | |

| Migratory species | Occurrence status | #1 | #2 | #3 | #4 |
|---|---------------------|----|----|----|----|
| Great Egret (<i>Ardea alba</i>) | Known | No | No | No | No |
| Cattle Egret (<i>Ardea ibis</i>) | Known | No | No | No | No |
| Glossy Ibis (<i>Plegadis falcinellus</i>) | No record, possible | No | No | No | No |
| Pacific Baza (<i>Aviceda subcristata</i>) | No record, likely | No | No | No | No |
| Black-shouldered Kite (<i>Elanus axillaris</i>) | Known | No | No | No | No |
| Brahminy Kite (<i>Haliastur indus</i>) | No record, possible | No | No | No | No |
| Whistling Kite (<i>Haliastur spenurus</i>) | Known | No | No | No | No |
| Square-tailed Kite (<i>Lophoictinia isura</i>) | No record, possible | No | No | No | No |
| Little Eagle (<i>Hieraaetus morphnoides</i>) | No record, possible | No | No | No | No |
| Collared Sparrowhawk (<i>Accipiter cirrhocephalus</i>) | Known | No | No | No | No |
| Brown Goshawk (<i>Accipiter fasciatus</i>) | Known | No | No | No | No |
| Grey Goshawk (<i>Accipiter novaehollandiae</i>) | No record, possible | No | No | No | No |
| Red Goshawk (<i>Erythrotriorchis radiatus</i>) | No record, possible | No | No | No | No |
| White-bellied Sea-Eagle (<i>Haliaeetus leucogaster</i>) | Known | No | No | No | No |
| Wedge-tailed Eagle (<i>Aquila audax</i>) | Known | No | No | No | No |
| Swamp Harrier (<i>Circus approximans</i>) | No record, possible | No | No | No | No |
| Spotted Harrier (<i>Circus assimilis</i>) | No record, likely | No | No | No | No |
| Brown Falcon (<i>Falco berigora</i>) | Known | No | No | No | No |
| Nankeen Kestrel (<i>Falco cenchroides</i>) | Known | No | No | No | No |
| Australian Hobby (<i>Falco longipennis</i>) | Known | No | No | No | No |
| Peregrine Falcon (<i>Falco peregrinus</i>) | No record, possible | No | No | No | No |
| Brolga (<i>Grus rubicundus</i>) | Known | No | No | No | No |
| Latham's Snipe (<i>Gallinago hardwickii</i>) | No record, likely | No | No | No | No |
| Little Curlew (<i>Numenius minutus</i>) | No record, possible | No | No | No | No |
| Marsh Sandpiper (<i>Tringa stagnatilis</i>) | No record, likely | No | No | No | No |
| Red-necked Stint (<i>Calidris ruficollis</i>) | No record, possible | No | No | No | No |
| Sharp-tailed Sandpiper (<i>Calidris acuminata</i>) | No record, likely | No | No | No | No |
| Curlew Sandpiper (<i>Calidris ferruginea</i>) | No record, likely | No | No | No | No |
| Painted Snipe (<i>Rostratula benghalensis</i>) | No record, possible | No | No | No | No |
| Black-winged Stilt (<i>Himantopus himantopus</i>) | Known | No | No | No | No |




| Migratory species | Occurrence status | #1 | #2 | #3 | #4 |
|--|---------------------|----|----|----|----|
| Red-necked Avocet (<i>Recurvirostra novaehollandiae</i>) | No record, likely | No | No | No | No |
| Red-capped Plover (<i>Charadrius ruficapillus</i>) | Known | No | No | No | No |
| Black-fronted Dotterel (<i>Euseyonis melanops</i>) | Known | No | No | No | No |
| Red-kneed Dotterel (<i>Erythronys cinctus</i>) | No record, likely | No | No | No | No |
| Masked Lapwing (<i>Vanellus miles</i>) | Known | No | No | No | No |
| Banded Lapwing (<i>Vanellus tricolor</i>) | No record, likely | No | No | No | No |
| White-winged Black Tern (<i>Chlidonias leucopterus</i>) | No record, possible | No | No | No | No |
| Oriental Cuckoo (<i>Cuculus saturatus</i>) | No record, possible | No | No | No | No |
| White-throated Needletail (<i>Hirundapus caudacutus</i>) | No record, likely | No | No | No | No |
| Fork-tailed Swift (<i>Apus pacificus</i>) | No record, likely | No | No | No | No |
| Rainbow Bee-eater (<i>Merops ornatus</i>) | Known | No | No | No | No |
| Clamorous Reed-warbler (<i>Acrocephalus stentoreus</i>) | Known | No | No | No | No |
| Little Grassbird (<i>Megalurus grammurus</i>) | No record, possible | No | No | No | No |
| Tawny Grassbird (<i>Megalurus timoriensis</i>) | Known | No | No | No | No |
| Brown Songlark (<i>Cincloramphus cruralis</i>) | Known | No | No | No | No |
| Rufous Songlark (<i>Cincloramphus mathewsi</i>) | Known | No | No | No | No |
| Golden-headed Cisticola (<i>Cisticola exilis</i>) | Known | No | No | No | No |
| Zitting Cisticola (east. subsp.) (<i>Cisticola juncidis laveryi</i>) | No record, possible | No | No | No | No |
| Black-faced Monarch (<i>Monarcha melanopsis</i>) | No record, possible | No | No | No | No |
| Spectacled Monarch (<i>Monarcha trivirgatus</i>) | No record, possible | No | No | No | No |
| Satin Flycatcher (<i>Myiagra cyanoleuca</i>) | No record, possible | No | No | No | No |
| Rufous Flycatcher (<i>Rhipidura rufifrons</i>) | Known | No | No | No | No |

7.6.3 Fitzroy to Bajool

During the field survey program, habitats of comparatively higher value were identified and the pipeline route adjusted to avoid these whenever possible. However, where impacts are unavoidable, mitigation measures will be adopted that will aim to minimise disturbance to these areas (see Section 7.7, Mitigation). Table 7.11 lists and describes the areas of fauna habitat sensitivity (see also Figure 7.4) and for each area, a summary of the key impact mitigation strategies which should be implemented.

Table 7.11 Potential Impacts and Primary Mitigation Strategies for Key Locations Within the Fitzroy to Bajool Section

| Area # | Habitat and comments | Potential impacts and primary mitigation strategies |
|--------|--|--|
| 1 | Fitzroy River riparian habitats. Fauna movement; habitat for forest birds and microbats; and hollow-bearing trees. | Removal of mature hollow-bearing trees; disruption to wildlife movement corridor. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; trench fall management protocols. |
| 2 | Northwestern extension of a series of semi-permanent vegetated billabongs to north of Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; measures to protect rehabilitation such as feral animal controls and weed eradication. |
| 3 | Western end of a series of semi-permanent vegetated billabongs. Extends south to Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; measures to protect rehabilitation such as feral animal controls and weed eradication. |
| 4 | Western end of a large semi-permanent constructed wetland. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; measures to protect rehabilitation such as feral animal controls and weed eradication. |
| 5 | Corridor traverses centre of semi-permanent wetland. Largely natural form though surrounds cleared of remnant vegetation. North of Malchi Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 6 | Billabong of natural form though surrounds cleared of remnant vegetation. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 7 | Billabong of largely natural form though surrounds cleared of remnant vegetation. North of Titman Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 8 | Adjacent to Gavial Creek wetlands. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; weed control protocols; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 9 | Small open seasonal wetland – part of Serpentine Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; weed control protocols; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |



| Area # | Habitat and comments | Potential impacts and primary mitigation strategies |
|--------|---|--|
| 10 | Shallow seasonal wetland and part of the Serpentine Creek wetland system – north of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 11 | Shallow seasonal wetland and part of the Serpentine Creek wetland system – south of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; weed control protocols; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 12 | Seasonal wetland and part of the Serpentine Creek wetland system – south of Casuarina Road. Habitat for waterbirds and waders, including Rare and Migratory species | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling. |
| 13 | Dingo Creek riparian vegetation. Fauna movement; locally significant habitat corridor. | Removal of remnant vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. Strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns. |
| 14 | Station Creek riparian vegetation. Fauna movement; locally significant habitat corridor. | Removal of remnant vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. Strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns. |
| 15 | Oakey Creek riparian vegetation. Fauna movement; locally significant habitat corridor. | Removal of remnant vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. Strict vegetation clearance protocols; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns. |
| 16 | Seasonal wetland system comprising of natural form broad swales. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Removal of mature hollow-bearing trees; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |

7.6.4 Bajool to Gladstone

During the field survey program, habitats of comparatively higher value were identified and the pipeline route adjusted to avoid these whenever possible. However, where impacts are unavoidable, mitigation measures will be adopted that will aim to minimise disturbance to these areas (see Section 7.8).

Table 7.12 lists and describes the areas of fauna habitat sensitivity and for each area, a summary of the key impact mitigation strategies which will be implemented.

These mitigation measures will include minimising disturbance widths, microtunnelling, and adopting practices for restoring areas of high habitat values.

Table 7.12 Potential impacts and primary mitigation strategies for key locations within the Bajool to Gladstone section

| Area # | Habitat and comments | Potential impacts and primary mitigation strategies |
|--------|--|---|
| 17 | Seasonal wetland system comprising of natural form broad swales – south of Port Alma railway. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |
| 18 | Inkerman Creek and associated wetlands. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Removal of remnant vegetation; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; post-construction area-specific restoration; microtunneling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |
| 19 | Node of <i>Eucalyptus moluccana</i> woodland. Habitat node in largely cleared landscape. | Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; introduction of exotic flora and fauna. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; measures to protect rehabilitation such as feral animal controls and weed eradication; trench fall management protocols. |
| 20 | Southern extent of saline wetlands of Twelve Mile Creek Reserve. Adjacent to potential Yellow Chat habitat. | Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; minimal construction clearing path; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |
| 21 | Freshwater section of Twelve Mile Creek – adjacent and upstream of Twelve Mile Creek Reserve. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; microtunneling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies. |
| 22 | Twelve Mile Creek tributary – riparian vegetation. Wildlife movement corridor. | Removal of remnant vegetation; removal of mature hollow-bearing trees; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora. Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |
| 23 | Broad seasonal wetland – part of Pelican Creek. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |
| 24 | Southern extent of the Hourigan Creek wetland complex. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage. Refine the ultimate pipeline alignment during final surveying; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols. |



| Area # | Habitat and comments | Potential impacts and primary mitigation strategies |
|--------|--|--|
| 25 | Hourigan Creek riparian vegetation. Wildlife movement corridor. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 26 | Hourigan Creek riparian vegetation. Wildlife movement corridor. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 27 | Raglan Creek riparian vegetation (western extent). Wildlife movement corridor. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 28 | Raglan Creek riparian vegetation (eastern extent). Wildlife movement corridor. | <p>Removal of remnant vegetation; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; post-construction area-specific restoration; microtunnelling; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 29 | Remnant vegetation. Also large wetland approximately 100m to south. Habitat node in largely cleared landscape. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; introduction of exotic flora and fauna.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; measures to protect rehabilitation such as feral animal controls and weed eradication; trench fall management protocols.</p> |
| 30 | Darts Creek riparian vegetation – north of Darts Creek Road. Wildlife movement corridor. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |

| Area # | Habitat and comments | Potential impacts and primary mitigation strategies |
|--------|--|--|
| 31 | Darts Creek riparian vegetation – north of Popenia Road. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 32 | Larcom Creek tributary riparian vegetation. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 33 | Larcom Creek riparian vegetation. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 34 | Boat Landing Creek riparian vegetation. | <p>Removal of remnant vegetation; removal of mature hollow-bearing trees; habitat fragmentation; disruption to wildlife movement corridor; alteration to surface hydrology; introduction of exotic flora; disturbance to wildlife during key seasonal habitat usage.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; weed control strategies; trench fall management protocols.</p> |
| 35 | Remnant vegetation to near north of railway line. | <p>Removal of remnant vegetation; introduction of exotic flora.</p> <p>Refine the ultimate pipeline alignment during final surveying; strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; weed control strategies; trench fall management protocols.</p> |

7.7 Mitigation

The following section identifies the management measures which are recommended in relation to mitigation of the potential impacts to fauna described previously in this chapter. The management requirements listed in this section are common to a number of construction activities. The following guidelines are also included in Chapter 20, Planning Environmental Management Plan.

Specific mitigation measures for EPBC Act listed Threatened species are given in Chapter 6, Section 6.1 (in summary) and Appendix G (in detail).

7.7.1 General Requirements

All personnel shall attend environmental training prior to entering the work site. As part of this training, all personnel will be briefed about their obligations to protect fauna.

- Fauna shall not be fed and direct contact with fauna is to be avoided. This includes both native and introduced species.



7.7.2 Vegetation Clearing and Habitat Disturbance

- Where possible, minor refinements or narrowing of the ROW that reduce impacts to areas of remnant vegetation, waterway crossings and hollow bearing trees are to be investigated and adopted where possible during final surveying
- No vegetation removal shall occur until relevant approvals have been obtained. All permit approval conditions will be followed
- Clearing boundaries will be delineated on all drawings and in the field to define the extent of authorised clearing
- Installation of vegetation clearance markers (e.g. high visibility poly-web fencing) prior to the commencement of vegetation clearance. No flagged vegetation shall be removed
- Identify and peg out intended vehicle access tracks to and along the right of way (ROW) at the commencement of the construction phase, to prevent the development of multiple access tracks
- Vegetation clearing will be limited to within the construction footprint (ie. the generally 30 m ROW and infrastructure sites). Construction equipment and personnel will not be permitted outside the surveyed areas. Impact to vegetation outside the ROW will be avoided
- Cleared vegetation is to be stockpiled so as not to impede wildlife, surface drainage and avoid damage to adjacent live vegetation
- Locating features such as fill stockpiles, access tracks, site facilities, etc. in areas of existing disturbances
- Within areas of remnant vegetation, limiting clearing along access tracks (except for the access tracks themselves) within the ROW to slashing to a minimum height of 200mm, to allow for the retention of ground layer and understorey vegetation elements in all areas not directly utilised for infrastructure construction or access track purposes
- Where possible, lopping of trees within the clearing zone, in preference to completely removing them
- If required, trimming of branches overhanging the easement will be undertaken using a chainsaw
- All mature hollow-bearing trees are to be retained and protected wherever practicable. Where this cannot be achieved, hollow limbs and/or trunks should be left on the ground adjacent to the ROW (or relocated to within areas of remnant vegetation) to provide habitat for ground-dwelling fauna
- Clearance of ground cover vegetation shall be minimised as much as possible in the construction easement. Cleared or trimmed vegetation shall be stockpiled separately from topsoil

- Where practical timber is to be chipped or stick raked into stock piles for use in revegetation and erosion control
- Prescribed burning will only be undertaken with fire authority approval and only when it is not possible to respread the cleared vegetation (e.g. where material includes a major component of woody weed infestation)
- Construction activities shall be scheduled to minimise the time between clearing and rehabilitating the ROW
- Topsoil and vegetation will be respread as soon as practicable after the completion of construction works
- The surface profile shall be reinstated to ensure maintenance of local surface conditions
- The topsoil shall be stockpiled in a manner so that it can be easily returned during reinstatement (i.e. not placed on uncleared vegetation or against tree trunks). Soil and vegetation stripped from the ROW will be stored immediately adjacent to the site where it originated. No soil or vegetation material is to be transported along the corridor
- Trench spoil is to be stockpiled separately from topsoil. Where practicable, deep top soil from the trench will be stockpiled separately from the subsoil
- A reseeding plan based on soil type and existing local ground layer vegetation characteristics (i.e. native or improved pastures) along the alignment will be implemented
- Local provenance native plant seed is to be used for rehabilitation within any areas of remnant or remnant regrowth vegetation that supports a ground cover of native grasses. Where this is not possible, seed from other parts of central Queensland would be acceptable.
- Monitoring of vegetation reestablishment is to be conducted by a suitably qualified ecologist.

7.7.3 Habitat Fragmentation and Disturbance to Wildlife Movement Corridors

- Constraining corridor clearing widths to the minimum necessary to allow construction of infrastructure (i.e. the minimum required to safely construct the infrastructure and fulfil environmental management requirements, e.g. erosion control)
- Avoiding additional clearing of remnant vegetation for construction vehicle access tracks, truck turning areas and extra workspaces
- Logs and fallen vegetation will be replaced post construction to provide habitat for native fauna
- Where required, trees adjacent to working areas are to be lopped, with complete-to-ground clearing being avoided
- Avoid construction of separate crossings for access tracks, as access would be able to be gained to the crossing area from both sides of all creeks

- Any fencing necessary along the outer ROW boundary should allow passage of fauna from either side of such fencing. For new fencing, the design should incorporate a 30 cm gap between ground level and the first rail or wire strand. A chain-wire fence should also incorporate a 30 cm gap between the bottom of the chain-wire and ground level and the overall height of a chain-wire fence should be limited to maximum of 1.5 m or less. The use of barbed wire should be avoided and used only where essential to exclude stock from adjoining pastoral activities.

7.7.4 Disturbance to Wetlands and Waterways

- Construction in wetlands and waterways should be undertaken during the dry season (i.e. June to September) wherever possible
- Water quality protection measures (e.g. sediment and pollutant controls) are to be installed prior to the main construction works (i.e. trenching and pipeline instatement)
- Disturbance to habitat values have been minimised where possible through trenchless construction methods
- The construction corridor and the clearing of wetland vegetation cover (native or introduced) is to be kept to the minimum required to safely construct the pipeline and comply with other environmental management safeguards (e.g. erosion control, pollutant controls, spoil storage, etc.)
- Surface drainage is to be returned to pre-construction patterns
- Areas disturbed by construction activities are to be rehabilitated to closely reflect pre-construction vegetation floristics and structure where possible
- Monitoring of vegetation reestablishment is to be conducted by a suitably experienced ecologist.

7.7.5 Trench Fall

- Where practical, construction should be timed to take place in the coolest and driest months (i.e. June to September), when activity levels of reptiles and amphibians are lowest and when conditions are most favourable for minimising fauna mortality in open trenching
- Construction activities will be planned so that the excavated trench will be open for the minimum practicable amount of time. Trenching should occur progressively to minimise the period of time the trench is open and the length of open trench

- Specific requirements to minimise fauna entrapment and mortality include:
 - Minimising the length of trench open at any one time
 - Minimising length of trench to be left open over night
 - The ends of an open trench left open outside working hours will be ramped to a gentle incline (< 50%) so as to allow any fauna to escape
 - Escape ramps and trench plugs (with slopes < 50%) are to be established for every 500 m of open trench. Additional methods may be adopted to create 'ladders' at regular intervals to assist small fauna to exit the trench (e.g. branches, ramped gangplanks) see APIA (2005))
 - In addition, two damp, sawdust filled hessian bags (shelter sites) are to be placed intermediate to the escape ramps. Provision of fauna refuge areas should be guided by methods successfully employed during construction of the North Queensland Gas Pipeline (NQGPP) (see Wilson and Swan (2004))
- Construction personnel will inspect the entire open length of the trench daily from sunrise. If required, wildlife handlers (spotter catchers) will be called to site to attend to fauna issues
- Wildlife handlers will remove wildlife from the trenches, identify, record data and release the captures into nearby vegetated areas. Personnel will be legally permitted, trained in appropriate handling protocols, and will possess the necessary Personal Protection Equipment (PPE) for the handling of animals
- Wildlife handlers must be licensed to euthanase badly injured fauna that are found within the trench. The *Australian National Health and Medical Research Council's Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (2004)* are to be followed when dealing with injured fauna
- A permit to interfere with wildlife from the Queensland Environment Protection Agency will be required for the wildlife handling activities as will the appropriate Animal Ethics Permit from the Department of Primary Industries
- Protocols for extracting fauna with minimal harm from open trenches should follow guidelines provided in Woinarski *et al.* (2000).

7.7.6 Introduced Flora and Fauna

7.7.6.1 Vertebrate Fauna

- The proposed development will not deliberately introduce any invasive species. Companion animals are to be banned from all pipeline construction activities to ensure that no pest species are introduced
- Measures to protect rehabilitation efforts will be implemented as required on specialist advice. For example, measures may include design and implementation of an ongoing systematic monitoring program to detect the occurrence of feral animals and/or weeds
- Implementation of a program to ensure strict litter control throughout the construction site. This is to be supported by: site-wide signage; an adequate number of litter bins (which by design exclude birds and vermin); bin clearance on a regular basis; daily maintenance of crib rooms to ensure cleanliness; educational signage within crib rooms on the linkage between poor waste management practices, increases in pest animal populations and subsequent impacts to native fauna.

7.7.6.2 Invertebrate Fauna

The extreme southern extent of the project area is included within the area declared as the Yarwun Fire Ant Restricted Area (DPI&F 2007). Regulations apply to commercial activities which involve moving high risk materials within and out of a fire ant restricted area (e.g. movement of high risk materials must be accompanied by a movement certificate or fire ant declaration form).

To comply with these regulations, an Approved Risk Management Plan (ARMP) will be developed in consultation with DPI&F. The ARMP will set out strategies to be implemented to reduce the risk of spreading fire ants, including measures to reduce the potential facilities and/or equipment becoming infested with fire ants. The ARMP will include, but not be limited to, the following strategies (after DPI&F 2007):

- A site inspection will be conducted as required by a DPI&F inspector or approved person prior to moving or disturbing any soil
- Vehicles, equipment and pipes will be inspected at depots before they are taken into the field to ensure they are not carrying live ants, and not carrying clods of earth that could conceivably contain ants
- Construction activities will not move fire ant infested material outside the restricted area without the approval of a DPI&F inspector and only to approved disposal sites within a restricted area. Infested soil may only be moved to a DPI&F approved disposal site.

- All high risk materials will be treated before being moved out of the restricted area
- Materials not infested with fire ants may be disposed within the restricted area using approved disposal sites only
- Where the ARMP is not applicable to sub-contractor activities, a Fire Ant Declaration (FAD) form to move high risk materials will be required
- All materials moved from within the restricted area will be accompanied by a movement certificate or Fire Ant Declaration Form.

Whilst there are no known populations of crazy ants within the region, the suite of mitigation measures to address the potential for the introduction of these pests forms a sub-set of those to be applied in respect to fire ants. As such, prevention and control strategies for crazy ants will be incorporated within the Approved Risk Management Plan outlined above, and applied throughout the project area.

7.7.6.3 Flora

- Weed eradication programs will be implemented as required, and a weed management plan will be implemented during construction
- Equipment and material introduced to the region, especially those from interstate, will be screened for pest species
- Workers undertaking the following tasks will be required to fulfil all washdown requirements: surveying; fencing / gating; clearing and grading; and reinstating. The remainder of the workforce will be required to stay on project approved roads or on the construction corridor, where they will not come into contact with weeds
- Ensure all vehicles and machinery that will access the ROW are free from soil/organic matter prior arrival on site
- Identify on drawings and to personnel, entry and exit points to the ROW at which hygiene protocols become effective
- Establish and maintain weed wash down bays where required at designated entry and exit points
- Clean down of machinery when moving from disturbed areas to undisturbed areas during clear, grade and rehabilitation.

7.7.7 Animal Welfare

- Construction personnel to check vegetation prior to clearing and where necessary to engage wildlife assessment/rescue services to relocated wildlife
- Wildlife handlers will follow the *Environmental Protection Agency's Code of Practice - Care and Responsibilities of Orphaned, Sick or Injured Protected Animals by Wildlife Care Volunteers (Nature Conservation Act 1992)* when dealing with injured fauna
- A permit to interfere with wildlife from the Queensland Environment Protection Agency will be required for the wildlife handling activities as will the appropriate Animal Ethics Permit from the Department of Primary Industries
- Development and implementation of protocols for any displaced fauna to be relocated to more suitable similar habitat within the surrounding area
- Establishment of fauna exclusion fences to prevent fauna inadvertently re-entering the construction areas
- Where possible, the timing of vegetation clearance (particularly areas of remnant vegetation) will be selected in order to minimise impacts (direct and indirect disturbances) to affected fauna habitats during optimum breeding periods (e.g. May to September is the breeding season for Yellow Chat as per the Development Scheme for the Stanwell – Gladstone Infrastructure Corridor State Development Area)
- Establishment of habitat enhancements to retained remnant habitat within the project area (e.g. artificial roost boxes for microbats)

7.8 Residual Impact

As previously described, 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 terrestrial fauna.

An assessment of the residual impact, after mitigation measures have been implemented, has been undertaken for all key locations described previously. Table 7.13 describes the impact significance criteria employed in that assessment. Table 7.14 and Table 7.15 describe the residual impact significance for each of the key locations (refer to Figures 7.4 and 7.6 for mapping).

That assessment indicates that the residual impact ranges from **negligible** to **minor adverse** for the vast majority of the habitat areas described. The only area which may sustain a higher residual impact is associated with the Raglan Creek crossings (**moderate adverse**). Whilst there is scope to reduce the level of residual impact, the extent to which this can be achieved can only be determined following post-construction rehabilitation. Nonetheless, with the implementation of the mitigation strategies outlined above, it is considered that the development and operation of the project overall, will result in an adverse impact of low significance on terrestrial fauna.

Table 7.13 Project Impact Significance Criteria for Terrestrial Fauna

| Significance | Impact significance criteria for terrestrial fauna |
|------------------|---|
| Major adverse | Extensive or acute disturbance (major impact) upon a matter of national importance. These effects are generally, but not exclusively, associated with sites, species and/or communities described as matters of national significance under the EPBC Act. The effects, whether direct or indirect, have the potential to result in the designation of a matter of national significance being permanently compromised. Mitigation measures and detailed design for construction work are unlikely to remove all of the impacts upon the affected communities or interests. Significant residual impacts would predominate. |
| High adverse | These effects (major impact) are likely to be important considerations at a state or bioregional scale but, if adverse, are potential concerns to the project, depending upon the relative importance attached to the issue during the decision making process. Effects are likely to manifest as irreversible loss or damage to a substantial part of the state or bioregional distribution, or the majority of the local distribution of a Threatened habitat type, community or population of flora or fauna as listed under either the EPBC or NC Acts. Mitigation measures and detailed design for construction work are unlikely to remove all of the effects upon the affected communities or interests. Residual impacts would predominate. |
| Moderate adverse | These effects (major impact) are likely to be important at a sub-regional or local scale, resulting in an extensive or acute disturbance resulting in the loss or the permanent lowering of the area's biodiversity values. In some situations, the impact will result in limited disturbance (moderate impact) to a feature or site of regional importance where recovery is anticipated following completion of the works concerned. The cumulative effects of such issues may lead to an increase in the overall effects upon a particular area or species population. They represent issues where effects will be experienced but mitigation measures and detailed design for construction work may ameliorate/enhance some of the consequences upon affected communities or interests. Some residual effects will still arise. |

| Significance | Impact significance criteria for terrestrial fauna |
|---------------|---|
| Minor adverse | These effects (moderate impact) are likely to be important at a local scale. Lesser loss or disturbance than moderate adverse (major impact) to a locally important site or local biodiversity values. Limited or temporary effects (minor impact) on national, bioregional or regional values. Relatively minor impacts to protected species and/or biodiversity generally, where mitigation measures are anticipated to alleviate short-term adverse impacts. Mitigation and compensation measures are generally effective in ameliorating the consequences upon affected communities or interests. |
| Negligible | Any impacts on resources considered to be of negligible ecological value, or effects on species, habitats or resources of value are likely to be imperceptible. Effects that result in minimal change or that which is beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. |
| Beneficial | Any effects that are expected to result in an improvement of the quality of ecological resources following completion of works. These can, for example, include creation of new or additional habitat features which are beneficial to native fauna, or introduction of measures that would achieve improvements in quality of existing habitat. Design features or management activities, which would make a long-term contribution to ecological objectives, or measures to ensure the long-term protection of species under threat which may not be adversely affected by the project per se (e.g. measures to protect rehabilitation such as feral animal controls and weed eradication). |

Table 7.14 Residual impact significance for key locations within the Fitzroy to Bajool section of the project area

| Area # | Habitat and comments | Residual impacts following implementation of mitigation measures |
|--------|--|--|
| 1 | Fitzroy River riparian habitats. Fauna movement; habitat for forest birds and microbats; and hollow-bearing trees. | Minor adverse |
| 2 | Northwestern extension of a series of semi-permanent vegetated billabongs to north of Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Minor adverse |
| 3 | Western end of a series of semi-permanent vegetated billabongs. Extends south to Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species | Minor adverse |
| 4 | Western end of a large semi-permanent constructed wetland. Habitat for waterbirds and waders, including Rare and Migratory species. | Negligible |
| 5 | Corridor traverses centre of semi-permanent wetland. Largely natural form though surrounds cleared of remnant vegetation. North of Malchi Nine Mile Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Negligible |
| 6 | Billabong of natural form though surrounds cleared of remnant vegetation. Habitat for waterbirds and waders, including Rare and Migratory species. | Minor adverse |
| 7 | Billabong of largely natural form though surrounds cleared of remnant vegetation. North of Titman Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Negligible |
| 8 | Adjacent to Gavial Creek wetlands. Habitat for waterbirds and waders, including Rare and Migratory species. | Minor adverse |
| 9 | Small open seasonal wetland – part of Serpentine Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species. | Negligible |
| 10 | Shallow seasonal wetland and part of the Serpentine Creek wetland system – north of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Negligible |
| 11 | Shallow seasonal wetland and part of the Serpentine Creek wetland system – south of Georges Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Negligible |
| 12 | Seasonal wetland and part of the Serpentine Creek wetland system – south of Casuarina Road. Habitat for waterbirds and waders, including Rare and Migratory species. | Minor adverse |
| 13 | Dingo Creek riparian vegetation. Fauna movement; locally significant habitat corridor. | Minor adverse |

| Area # | Habitat and comments | Residual impacts following implementation of mitigation measures |
|--------|---|--|
| 14 | Station Creek riparian vegetation. Fauna movement; locally significant habitat corridor. | Minor adverse |
| 15 | Oakey Creek riparian vegetation. Fauna movement; locally significant habitat corridor. | Minor adverse |
| 16 | Seasonal wetland system comprising of natural form broad swales. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Negligible |

Table 7.15 Residual Impact Significance for Key Locations Within the Bajool to Gladstone Section of the Project Area

| Area # | Habitat and comments | Residual impacts following implementation of mitigation measures |
|--------|--|--|
| 17 | Seasonal wetland system comprising of natural form broad swales – south of Port Alma railway. Part of Inkerman Creek wetland system. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Negligible |
| 18 | Inkerman Creek and associated wetlands. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Minor adverse |
| 19 | Node of <i>Eucalyptus moluccana</i> and <i>Acacia harpophylla</i> woodland. Habitat node in largely cleared landscape. | Minor adverse |
| 20 | Southern extent of saline wetlands of Twelve Mile Creek Reserve. Adjacent to potential Yellow Chat habitat. | Negligible |
| 21 | Freshwater section of Twelve Mile Creek – adjacent and upstream of Twelve Mile Creek Reserve. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Minor adverse |
| 22 | Twelve Mile Creek tributary – riparian vegetation. Wildlife movement corridor. | Minor adverse |
| 23 | Broad seasonal wetland – part of Pelican Creek. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Negligible |
| 24 | Southern extent of the Hourigan Creek wetland complex. Habitat for waterbirds and waders, including Rare and Migratory species; potential Yellow Chat habitat. | Negligible |
| 25 | Hourigan Creek riparian vegetation. Wildlife movement corridor. | Minor adverse |
| 26 | Hourigan Creek riparian vegetation. Wildlife movement corridor. | Minor adverse |
| 27 | Raglan Creek riparian vegetation (western extent). Wildlife movement corridor. | Minor adverse |
| 28 | Raglan Creek riparian vegetation (eastern extent). Wildlife movement corridor. | Minor adverse |
| 29 | Remnant vegetation. Also large wetland approximately 100 m to south. Habitat node in largely cleared landscape. | Minor adverse |
| 30 | Darts Creek riparian vegetation – north of Darts Creek Road. Wildlife movement corridor. | Minor adverse |
| 31 | Darts Creek riparian vegetation – north of Popenia Road. | Minor adverse |
| 32 | Larcom Creek tributary riparian vegetation. | Minor adverse |
| 33 | Larcom Creek riparian vegetation. | Minor adverse |
| 34 | Boat Landing Creek riparian vegetation. | Minor adverse |
| 35 | Remnant vegetation to near north of railway line. | Minor adverse |

7.9 Cumulative and Interactive Impacts

The concept of cumulative impacts acknowledges that a development and associated activities can combine and interact with others to cause collective effects and that the resultant effect may be different in nature or extent from the effects of the individual activities alone. Cumulative impacts can result from a number of different elements within a project as well as from a number of different projects with interacting impacts in the same area. Cumulative impacts can be viewed in terms of the relationship between introducing a new development with existing land uses and the further interaction with other developments being planned.

As described previously, fauna habitat values within the project area have been strongly influenced by a history of cattle grazing and agriculture. This has resulted in extensive areas where native vegetation has been cleared. Those areas of native vegetation which remain, though often small and isolated or poorly connected, are of significance in maintaining local biodiversity values, and in some cases, supporting the only remaining habitat for species of conservation significance.

Although, the project has the potential to generate impacts to native fauna habitat, it is considered that the successful implementation of the recommended mitigation measures has the potential to reduce any cumulative and interactive effects to a level of relatively low significance. Whilst the cumulative and interactive effects of the addition of the project to the suite of existing land uses is considered to be of a relatively low significance, this result must be considered in the context of other potential projects which may be implemented within the Stanwell-Gladstone Infrastructure Corridor (SGIC). Other infrastructure projects include gas pipelines, water pipelines, and fibre optic cabling.

Further infrastructure within in the SGIC is likely to result in the following:

- Vegetation clearance, including removal of native and remnant vegetation which may lead to further reduction in habitat areas, habitat fragmentation, and the potential for introduction of feral animals and plants
- Widening of previous waterway crossings or establishment of new crossings with the potential to generate disruption to wildlife movement opportunities and alterations to surface hydrology
- Additional disturbance to seasonal wetlands with the potential to generate disruption to surface hydrology, disturbance to wildlife during key seasonal habitat usage, and the introduction of exotic flora and fauna.

Concomitant with the implementation and operation of each further project, there is the potential for cumulative and interactive impacts on local terrestrial fauna to reach a higher level of significance that that which can be attributed to the current project alone. These effects may result in diminishing the capacity of the local area to support current levels of native faunal diversity and the viability of local populations of some Threatened or otherwise significant taxa.

Many of habitat features within the SGIC (or transected by the SGIC), because of their size and/or context, may be approaching potential thresholds where repeated disturbances to them could result in significant deterioration of values. Any future proposed developments, will be required to address the cumulative impacts of their developments with the impacts of the other existing and the currently proposed developments in the area, and would be considered by the relevant approval authorities.

7.10 Summary and Conclusions

The terrestrial fauna and habitat values of the project area have been assessed through a comprehensive review of existing information and a field program, which has been implemented over a seven month period. The field study identified a diverse range of native fauna, including Rare, Endangered, Vulnerable and Migratory species, and the key areas which support higher fauna habitat values.

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. With the successful implementation of the recommended mitigation measures, it is considered that the impact of the project on terrestrial native fauna will be of relatively low significance.

Although, the project has the potential to generate impacts to native fauna habitat, it is considered that the successful implementation of the recommended mitigation measures has the potential to reduce any cumulative and interactive effects with existing land uses to a level of relatively low significance.

Many of habitat features within the SGIC (or transected by the SGIC), because of their size and/or context, may be approaching potential thresholds where repeated disturbances to them could result in significant deterioration of values. Any future proposed developments, will be required to address the cumulative impacts of their developments with the impacts of the other existing and the currently proposed developments in the area, and would be considered by the relevant approval authorities.

Table 7.16 Summary of Residual Impacts for the Project Area

| Feature Description | Current value (+ve/-ve) Substitution (yes/no) | Description of potential impacts | Mitigation measures | Residual impact |
|---|---|---|---|------------------------------|
| Geographic Features | | | | |
| Fitzroy River riparian habitats | +ve (though disturbed) Substitution: no | Removal of mature hollow-bearing trees; disruption to wildlife movement corridor. | Strict vegetation clearance protocols; protection protocols for hollow-bearing trees; reuse of trimmed limb hollows; post-construction area-specific restoration; minimal construction clearing path; trench fall management protocols. | Minor adverse |
| Seasonal wetlands between Fitzroy River and Bajool | +ve (though variable levels of disturbance) Substitution: no | Alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. | Minimal construction clearing path; sediment and pollutant controls; weed control protocols; post-construction area-specific restoration; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; ; trench fall management protocols. | Negligible/ minor adverse |
| Riparian vegetation habitats (e.g. Dingo Creek, Station Creek, Oakey Creek, Twelve Mile Creek, Pelican Creek, Hourigan Creek, Darts Creek, Larcom Creek, and Boat Landing Creek). | +ve (though variable levels of disturbance) Substitution: no | Removal of native vegetation; disruption to wildlife movement corridor; alteration to surface hydrology. | Strict vegetation clearance protocols; respreading of logs, fallen and cleared vegetation; post-construction area-specific restoration; minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns. | Negligible/ minor adverse |
| Inkerman Creek riparian habitat and associated wetlands (south of Bajool-Port Alma rail line) and Raglan Creek riparian habitat and associated tidal wetlands. | +ve Substitution: no | Removal of native vegetation; disruption to wildlife movement corridor; alteration to surface hydrology; disturbance to wildlife during key seasonal habitat usage; introduction of exotic flora. | Strict vegetation clearance protocols; post-construction area-specific restoration; trenchless construction and/or minimal construction clearing path; sediment and pollutant controls; rehabilitation of pre-construction drainage patterns; dry season construction scheduling; feral animal and weed control strategies; trench fall management protocols. | Minor adverse |
| Nodes and patches of native and remnant vegetation between Bajool and Gladstone | +ve Substitution: no | Native vegetation clearance; removal of mature hollow-bearing trees; habitat fragmentation; introduction of exotic flora and fauna. | Strict vegetation clearance protocols; minimal construction clearing path; protection protocols for hollow-bearing trees; respreading of logs, fallen and cleared vegetation; reuse of trimmed limb hollows; feral animal and weed control strategies; trench fall management protocols; post-construction area-specific restoration. | Minor adverse |

| Feature Description | Current value (+ve/-ve) Substitution (yes/no) | Description of potential impacts | Mitigation measures | Residual impact |
|---------------------------------------|--|--|--|-----------------|
| Biological features | | | | |
| Native Fauna Diversity | +ve Substitution: no | Loss of habitat; reduction of habitat patch size; habitat fragmentation; habitat alteration (edge effects); introduction of exotic flora and fauna. | Strict vegetation clearance protocols; minimal construction clearing path; protection protocols for hollow-bearing trees; respreading of logs, fallen and cleared vegetation; reuse of trimmed limb hollows; feral animal and weed control strategies; trench fall management protocols; post-construction area-specific restoration. | Minor adverse |
| Rare, Threatened or Migratory species | +ve Substitution: no | Loss of habitat; reduction of habitat patch size; habitat fragmentation; habitat alteration; disturbance during refuge or breeding stages; introduction of exotic flora and fauna. | Strict vegetation clearance protocols; minimal construction clearing path; microtunneling for some waterways; sediment and pollutant controls; weed control protocols; post-construction area-specific restoration; rehabilitation of pre-construction drainage patterns (wetlands and waterways); dry season construction scheduling (wetlands); protection protocols for hollow-bearing trees; respreading of logs, fallen and cleared vegetation; reuse of trimmed limb hollows; feral animal and weed control strategies; trench fall management protocols; post-construction area-specific restoration. | Minor adverse |

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