

# Appendix C

## Ecology Technical Report

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Ross River Dam to Douglas Water Treatment Plant Pipeline

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### Ross River Dam to Douglas Water Treatment Plant Pipeline Renewal

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## 1.0 Introduction

### 1.1 Project background

AECOM has been engaged by Townsville City Council (TCC) to undertake the Concept Design of the Ross River Dam (RRD) to Douglas Water Treatment Plant (DWTP) pipeline renewal (the Project).

The existing RRD to DWTP pipeline is approximately 9.5 km long. It is understood the existing DN1200 pipe, built in 1975, is a bespoke construction comprising an inner reinforced concrete pipe (RCP) that is wrapped in pre-stressed steel wire bands and encased in a grout shell.

The pipeline currently transfers bulk raw water from RRD to DWTP under both gravity and pumped operation, depending on demands at DWTP and levels in RRD. An assessment of the pipeline has indicated the pipe is in poor condition, particularly for the section from RRD to Allambie Lane. Many failures have been observed throughout the pipeline.

Given most of Townsville's raw water supply is via this pipeline, Council have recognised that the pipeline's deteriorated condition puts Townsville's water security at significant risk. It is critical that an alternative pipeline is designed and constructed to secure Townsville's water supply now and in the future.

To address this issue TCC is proposing to construct a new pipeline, with the old pipeline to remain in situ. To support project development, an ecological assessment has been undertaken to determine the ecological values and potential impacts associated with the construction and operation of the proposed new pipeline.

### 1.2 Project area and study area

The project area is approximately 12 km south west of the Townsville Central Business District (CBD), within Townsville City Council in North Queensland (Figure 1 in Appendix A). The project area is located along the eastern side of the Ross River predominantly within the Mount Stuart Training Area, managed by the Commonwealth Department of Defence (DoD). The project area is the construction corridor required for the proposed pipeline to be installed, which is generally 25 metres wide. The study area denotes the area assessed during field surveys to determine environmental values within and surrounding the project area.

Land uses within and surrounding the study area include military training, and a small disused quarry to the North of the Project. Lake Ross is upstream from the study area, which is utilised for recreation and town water supply. Upstream land uses also include agricultural development such as cropping and livestock, sand quarries, a solar farm, and community areas such as parks. Downstream is an urbanised environment, including a water treatment plant, Townsville city, with the mouth of Ross River leading into the Great Barrier Reef Marine Park.

### 1.3 Objectives and investigation scope

The objective of this ecological assessment was to identify the ecological values within the study area, assess the potential impact of the Project on these values and recommend mitigation measures to reduce the level of impact. This also includes an assessment of the significance of impacts on identified Matters of National Environmental Significance (MNES) protected under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Specifically, the scope of work for the ecological assessment includes the following:

- Flora
  - Identify and describe the floristic characteristics and vegetation communities
  - Verify the presence and extent of Regulated Vegetation and Regional Ecosystems (REs) as defined by the Queensland Herbarium
  - Determine the presence and extent of any Threatened Ecological Communities (TECs)

- Verify the presence of threatened flora species to confirm populations or suitable habitat
- Assess the likelihood of occurrence of conservation significant flora species, particularly MNES
- Identify introduced flora species presence, especially those declared under State legislation.
- Fauna
  - Identify and describe the fauna habitat, particularly values that can support conservation significant fauna species
  - Verify the presence of threatened or migratory fauna species to confirm populations or suitable habitat
  - Identify habitat resources that may provide breeding habitat for fauna species
  - Assess essential habitat factors for black-throated finch, coastal sheathtail bat, estuarine crocodile and squatter pigeon
  - Assess the likelihood of occurrence of conservation significant fauna species, particularly MNES
  - Identify pest fauna species presence, especially those declared under State legislation
  - Assess presence and values of riverine, wetland or any aquatic habitat, including its suitability for supporting threatened and migratory species.

## 2.0 Legislative and policy context

### 2.1 Commonwealth

#### 2.1.1 *Environmental Protection and Biodiversity Conservation Act 1999*

The EPBC Act is administered by the Department of Agriculture, Water and the Environment (DAWE) and establishes a process for environmental assessment and approval of proposed actions that have, will have or are likely to have a significant impact on MNES or on Commonwealth land.

MNES are outlined in the EPBC Act to include:

- World Heritage Properties
- National Heritage Places
- Wetlands of International Importance (listed under the Ramsar Convention)
- Great Barrier Reef Marine Park
- Commonwealth Marine Areas
- Listed Threatened Species
- Listed Threatened Ecological Communities (TECs)
- Migratory Species (listed under international agreements)
- Nuclear Actions (including uranium mines)
- A Water Resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act also covers actions on, or impacting on, Commonwealth land or actions by Commonwealth agencies.

Under the EPBC Act, conservation significant species are assigned a conservation status of:

- Extinct
- Extinct in the Wild
- Critically Endangered
- Endangered
- Vulnerable
- Migratory.

Threatened Ecological Communities (TECs) are assigned to one of three conservation categories:

- Critically Endangered
- Endangered
- Vulnerable.

Migratory species listed under the EPBC Act includes bird species, which are:

- Migratory species which are native to Australia and are included in the appendices to the Bonn Convention
- Migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA)
- Native, migratory species identified in a list established under an international agreement such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Under the EPBC Act, a referral to the DAWE is required if a project or action has the potential to cause a 'significant impact' on MNES. The determination is made with reference to the *Matters of National*

*Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013) and other EPBC Act policy statements including significant impact guidelines for individual threatened species, groups of species and threatened ecological communities.

A risk assessment and significant impact assessment has been completed for the Project to assess impacts to MNES relating to relevant threatened species, ecological communities, and migratory species (Section 3.4 and Appendix D).

### **2.1.2 Weeds of National Significance**

One of the primary objectives of the EPBC Act is to conserve Australian biodiversity which includes provisions for managing invasive species as threatening processes. The Australian Weeds Strategy was developed by the Commonwealth in conjunction with all state and territory governments to provide a national framework for the management of weed challenges and to reduce weed impacts on the environment. Under the strategy, 32 of Australia's most significant weed species are listed as Weeds of National Significance (WONS). WONS were declared based on an assessment process that prioritised weeds based on their invasiveness, potential for spread, and environmental, social and economic impacts. National management strategies and manuals have been published for all WONS. WONS identified within the study area are listed in Section 4.3.9.

## **2.2 Queensland**

### **2.2.1 Nature Conservation Act 1992**

The *Nature Conservation Act 1992* (NC Act) prohibits the taking or destruction, without authorisation, of protected flora and fauna species in the wild. All native plants and animals in Queensland are protected under Section 71 of the NC Act. This Act also provides for an integrated and comprehensive approach to conserve nature. The Act provides a legislative basis for research, community education, dedicating, declaring and managing protected areas, and protecting native wildlife and its habitat.

Threatened species are listed under the NC Act in the *Nature Conservation (Animals) Regulation 2020* and the *Nature Conservation (Plants) Regulation 2020* in the following categories:

- Near threatened
- Vulnerable
- Endangered
- Critically endangered
- Extinct in the wild.

Additionally, Special Least Concern species are protected under the NC Act for their cultural significance or their inclusion within international migratory bird agreements, and include:

- Echidna (*Tachyglossus aculeatus*)
- Platypus (*Ornithorhynchus anatinus*)
- Migratory bird species listed under the Bonn Convention, JAMBA, and CAMBA.

The Project is considered exempt from requiring authorisations or permits under the NC Act prior to clearing of listed conservation significant plant species, interfering with an animal breeding place, or removing protected animals. Regardless, Section 4.4.2 outlines the animal breeding places within the study area that may be impacted by clearing associated with the project area.

### 2.2.1.1 Protected plants framework

Within the NC Act, provisions exist for the regulation or restricted taking or using of protected plants. Section 89 of the Act states that 'a person, other than an authorised person, must not take a protected plant that is in the wild unless the plant is taken under:

- a conservation plan applicable to the plant; or
- a licence, permit or other authority issued or given under a regulation; or
- an exemption under a regulation'.

Activities that affect protected plants are regulated under the subordinate *Nature Conservation (Plants) Regulation 2020* which requires a flora survey be carried out where areas of clearing are to occur within 'High Risk Areas' shown on the 'Flora Survey Trigger Map'. High Risk Areas are known locations of critically endangered, endangered, vulnerable, or near threatened (EVNT) plants are buffered by 2 km. The Project is considered exempt from the NC Act protected plants framework, and no protected plants were found during extensive field surveys of the study area.

### 2.2.2 Environmental Protection Act 1994

The objective of the *Environmental Protection Act 1994* (EP Act) is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

The EP Act provides the key legislative framework for the protection of the environment in Queensland. Section 319 of the EP Act imposes a 'general environmental duty', which specifies that a person must not undertake any activity that may harm the environment without taking reasonable and practical measures to prevent or minimise the harm. Measures have been developed to reduce potential harm caused by the project, as outlined in Section 6.0.

### 2.2.3 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) regulates the clearing of native vegetation in Queensland and is administered by the Department of Natural Resources, Mines and Energy (DNRME). The purpose of the VM Act is to regulate the clearing of vegetation in a way that:

- a. conserves remnant vegetation
- b. conserves vegetation in declared areas
- c. ensures that clearing does not cause land degradation
- d. prevents the loss of biodiversity
- e. maintains ecological processes
- f. manages the environmental effects of the clearing to achieve the matters mentioned in paragraphs (a) to (e)
- g. reduces greenhouse gas emissions; and
- h. allows for sustainable land use (refer s3(1) of the VM Act).

The VM Act categorises and defines native vegetation as remnant (category B), high value regrowth (HVR) (category C), reef regrowth watercourse vegetation (category R) and non-remnant (category X). Remnant vegetation is further classified into a RE based on bioregion, landform and dominant canopy species.

Under the VM Act all REs are assigned a Vegetation Management Status (VM status). This is based on the current extent remaining compared to its pre-clearing extent, as gazetted under the VM Act and listed in the Regional Ecosystem Description Database (REDD) maintained by the Queensland Herbarium, Department of Environment and Science (DES). An RE considered to have "VM status" is described as an:

- **Endangered** regional ecosystem:
  - less than 10% of its pre-clearing extent remaining; or
  - 10% to 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha.
- **Of Concern** regional ecosystem:
  - 10% to 30% of its pre-clearing extent remaining; or
  - more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha.
- **Least Concern** regional ecosystem:
  - more than 30% of its pre-clearing extent remaining and the remnant vegetation remaining is more than 10,000 ha.

The clearing of regulated vegetation for this project is exempt. Regardless, Section 4.3.1 discusses REs within the area, and Sections 4.3.2 to 4.3.4 examines regulated vegetation.

#### **2.2.3.1 Essential Habitat**

Essential habitat is also regulated under the VM Act. Remnant (category B) and HVR (category C) vegetation in which 'Endangered' and 'Vulnerable' species listed under the NC Act have been known to occur are classified as essential habitat. Specifically, Section 20AC, Sub-Section 2 states 'Essential habitat, for protected wildlife, is a category A area, a category B area or category C area shown on the regulated vegetation management map -

- a. that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or
- b. in which the protected wildlife, at any stage of its life cycle, is located'.

The clearing of essential habitat for the project is exempt. Regardless, the role of essential habitat for flora species is examined in Section 4.3.8 with Section 4.4.5 discussing essential habitat for fauna.

#### **2.2.4 Biosecurity Act 2014**

The *Biosecurity Act 2014* is administered by the Department of Agriculture and Fisheries (DAF). The Act provides management measures to protect agricultural and tourism industries and the environment from pests, diseases and contaminants.

Under the Act, invasive plants and animals are categorised as either a 'Prohibited Matter' or a 'Restricted Matter' and replace the 'Declared' status under the superseded *Land Protection (Pest and Stock Route Management) Act 2002*. The *Biosecurity Act 2014* also requires every local government in Queensland to develop a biosecurity plan for their area. Restricted matter that is flora is discussed within Section 4.3.9 and restricted matter that is fauna is reviewed within Section 4.4.6.

## 3.0 Assessment methodology

### 3.1 Desktop assessment

A desktop assessment was undertaken to characterise and identify potential flora and fauna values that may be present in the study area. The desktop assessment included a review of literature, including the following previous studies:

- *Mount Stuart Training Area 2015 Weed Audit Report* (Natural Resource Assessments Pty Ltd, 2015)
- *Bushfire Management Plan for Mount Stuart Training Area* (Jacobs Group (Australia) Pty Ltd, 2015)
- *Mount Stuart Training Area Fauna update Project* (ENSR Australia Pty Ltd, 2008)
- *Dry Season Vertebrate Fauna Survey, Mount Stuart Training Area* (Australian Centre for Tropical Freshwater Research, 2000)
- *Powerlink Queensland Black-throated Finch Survey and Assessment: Proposed Ross – Townsville South (Stuart) Transmission Line* (Natural Resource Assessments Pty Ltd, 2005)
- *Mount Stuart Training Area Environmental Management Plan* (C&B Consultants Pty Ltd, 1997)

The desktop assessment also included a review of the following searches of publicly available datasets and online mapping:

- EPBC Act Online Protected Matters Search Tool (PMST) to identify MNES that may occur within the study area (Department of Agriculture Water and the Environment, [DAWE] 2020a)
- Wildlife Online database to identify flora and fauna species recorded within or surrounding the study area (Department of Environment and Science, [DES] 2020c)
- Atlas of Living Australia (ALA) database to identify locations of previously recorded flora and fauna species within or surrounding the study area (Atlas of Living Australia, 2021)
- eBird Australia database for bird records within and adjacent to the study area (eBird Australia, 2020)
- Regulated Vegetation Management Map to determine the extent of category A, category B, category C and category R vegetation within and surrounding the study area (Department of Natural Resources Mines and Energy [DNRME], 2020b)
- DNRME Vegetation Management REs map including essential habitat, watercourse and wetland mapping (DNRME, 2020a)
- The Queensland Herbarium REDD for current RE descriptions and geological and land zone descriptions (Queensland Herbarium, 2021)
- DES map of Queensland wetland environmental values to identify high ecological significance wetlands and general ecological significance wetlands (Department of Environment and Science [DES], 2020b)
- DES Protected Plants Flora Survey Trigger Map to identify the high-risk areas for protected plants (DES, 2020b)
- Species distribution maps from various current field guides.

Information collected as part of the desktop assessment was reviewed and used in the preparation of the field survey, to determine appropriate survey techniques to employ.

A 20 km search radius was applied for the PMST and Wildlife Online databases, using the central coordinates of the project area (-19.3678, 146.7344).

## 3.2 Field assessment

A field assessment across the study area was undertaken by AECOM ecologists over four days from the 1 to 4 February 2021 and consisted of a flora and fauna assessment as described below. Remote detection devices such as camera traps and anabats remained within the study area after the completion of the field work until 9th February. One additional field survey day was subsequently undertaken on 8<sup>th</sup> April 2021 by a single ecologist to survey small changes to the Project alignment.

### 3.2.1 Flora

#### 3.2.1.1 Vegetation community assessment

The extent, classification and condition of ground-truthed vegetation communities within the study area was validated in accordance with the *Methodology for surveying and mapping regional ecosystem and vegetation communities in Queensland* (Neldner et al., 2019). This involved traversing vegetation on foot throughout the study area, undertaking tertiary and quaternary level assessments. In addition, flora observations were utilised to assist in the classification, mapping and identification of flora species across the study area.

The following information was collected at each tertiary site:

- Site location (GPS co-ordinate), site photos, date and observer
- Vegetation structure which includes identifying the different strata (i.e. emergent, tree, shrub and ground layers) and the height and cover values of each strata
- Species composition (i.e. dominant species in each strata)
- RE and remnant status.

Quaternary-level sites were used to verify vegetation units and confirm dominant characteristic species. Structural analysis included recording the height class and life form of the dominant species within the mid and canopy strata as per Neldner *et al.* (2019). Evidence of previous disturbance, incidence of exotic species and general notes on soil type and ecological integrity were compiled for each quaternary survey site. Several time-encoded digital photographs were taken at each plot as a reference.

In total, six tertiary, 22 quaternary and 138 further observation sites were undertaken across the study area. The locations of the survey sites are shown in Figure 2.

#### 3.2.1.2 Specimen identification

Specimens of any plant taxa that could not be identified in the field were collected, pressed and dried in accordance with the requirements of the Queensland Herbarium (Bean, 2016). Dried specimens were then identified through reference books and keys and through comparison with named species. Nomenclature used in this report follows the Queensland Herbarium plant census (Brown & Bostock, 2020).

*Eucalyptus crebra* sensu lato was utilised in this report, which indicates the species may be *Eucalyptus crebra* or *Eucalyptus drepanophylla*. *E. drepanophylla* is considered a synonym of *E. crebra* by some authors (Euclid), therefore the regional ecosystem or habitat types are not impacted by this.

#### 3.2.1.3 Nomenclature

Taxonomic nomenclature used for the description of floral species is according to Census of the Queensland Flora 2018 (Bostock & Holland, 2018). Exotic flora species are signified in text by an asterisk (\*). Field references used for the identification and description of floral species include: Anderson (2016); Brooker & Kleinig (2004); Lester (2008); (Townsend, 2007).

### 3.2.2 Fauna

#### 3.2.2.1 Habitat assessments

Habitat assessments were undertaken to characterise the fauna habitat values within the study area. These assessments provide an indication of likely fauna utilisation, and suitability for fauna species, including conservation significant fauna. Habitat attributes recorded during the assessment include:

- Vegetation structure and dominant species, including a description of canopy, shrub and ground layer structure and composition
- Presence and abundance of tree hollows and stags
- Presence and abundance of woody debris such as habitat logs and ground timber
- Presence, abundance and depth of leaf litter
- Rocky habitat such as surface rocks, boulders, crevices, overhangs and caves
- Proximity to water (both permanent and ephemeral)
- Disturbance from invasive weeds/pests
- Other disturbances such as grazing pressure, clearing, thinning or fire
- Any other significant habitat features or values present.

Included in the habitat assessments were searches for signs of animal activity, including tracks, scats, scratches, bones, fur, feathers, nests, foraging holes and diggings.

At all fauna habitat assessment locations, active searches, incidental observations and visual and auditory survey of birds were conducted.

Targeted habitat assessments were undertaken for the black-throated finch, to determine the habitat features and quality available throughout the study area. This included assessing the availability and suitability of nesting tree species, grass species and abundance, permanent water, weeds and other threats.

A total of 33 general fauna habitat assessments, and 16 black-throated finch habitat assessments were undertaken across the study area. Survey sites are depicted in Figure 2.

#### **3.2.2.2 Bird census**

Diurnal birds were sampled using an area census method, supplemented by broad observational surveys. Birds were systematically sampled in each habitat type. Censuses were carried out in the early morning (in the first three to four hours after sunrise) and late afternoon (two hours prior to sunset), due to variation in avian activity during the day. Birds were counted in one hectare plots at each site over a period of twenty minutes. Incidental observations were also noted throughout the survey.

#### **3.2.2.3 Animal breeding place survey**

A non-invasive assessment of animal breeding places was conducted of animals listed as least concern; colonial breeders; special least concern and EVNT under the NC Act. This was completed by a suitably qualified ecologist and was conducted as per the guidelines (Department of Environment and Science, 2016), by identifying animal breeding places within the study area, with a focus on those belonging to birds and mammals. Primary targeted animal breeding places included bird nests and hollow-bearing trees. This survey was non-invasive and as such individual hollows or nests which were out of reach could not be checked to determine if they were being used by a protected animal to incubate or rear the animal's offspring.

#### **3.2.2.4 Active searches and incidental observations**

Active searches were undertaken for reptiles, amphibians, small mammals and cryptic or ground-dwelling bird species. This included scanning the trees and ground, searching beneath microhabitat such as rocks, fallen timber and peeling bark, digging through leaf litter and soil at tree bases and flushing birds from areas with a dense or grassy ground cover. Signs of fauna utilisation may include diggings, scats, tracks, bird feathers, and latrine sites, which were attributed to the appropriate species where possible.

The searches were focused on locating signs of conservation significant species such as latrine sites or pellet searches; inspection of hollow logs and surrounding subterranean cavities; turning logs and rocks; and searches for dens or burrows. Any logs or rocks moved during searches were carefully replaced where possible.

Active searches were undertaken within suitable microhabitat at each habitat assessment site. All fauna observed incidentally within or in close proximity to the study area were also recorded.

#### **3.2.2.5 Spotlighting and call playback**

Spotlighting and call playback was undertaken for threatened species including the koala, greater glider, spectacled flying-fox, masked owl and ghost bat. Spotlighting was conducted with two ecologists over four consecutive nights (1 to 4 February 2021), for 3 to 4 hours per night. Calls were played for 10-20 minutes and included the koala, masked owl (northern), barking owl, southern boobook, barn owl and rufous owl.

#### **3.2.2.6 Anabat**

Remote ultrasonic acoustic devices (anabats) were utilised to determine the presence of bat and microbat species. Three anabats were deployed across the study area, left to record ultrasonic sounds for seven consecutive nights from 1 to 9 February 2021. The recorded call data was analysed by Balance! Environmental and processed using Anabat Insight Version 1.9.7 (Titley Scientific, Brisbane), with the resulting report provided in Appendix E.

#### **3.2.2.7 Remote camera**

Remote cameras (Reconyx brand) were deployed to determine the presence of northern quoll and other species in the study area. A total of 11 cameras were set and baited with universal bait and sardines, for a total of seven consecutive nights from 1 to 9 February 2021. The photographs from the remote cameras were analysed by an ecologist to determine the identity of species captured.

### **3.2.3 Target species survey effort**

A summary of the survey effort utilising the abovementioned survey techniques for each of the targeted species identified in the desktop assessment is outlined in Table 1 below. Detailed targeted surveys were not included in the scope, and therefore some species do not meet the survey requirements; however this was supplemented with habitat assessments as a proxy for determining potential presence.

Table 1 Survey guideline requirements and survey effort

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
<b>Birds</b>				
Black-throated finch (southern) ( <i>Poephila cincta cincta</i> )	<p>Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010b). Background paper to the Significant impact guidelines for the endangered black-throated finch (southern) (Department of the Environment Water Heritage and the Arts, 2009).</p> <p>The study area falls within the modelled distribution of the species as well as mapped 'important areas' as identified in the Significant Impact Guidelines for the black-throated finch (southern) (Department of the Environment Water Heritage and the Arts, 2009).</p>	<p><b>Survey techniques</b> For study areas that fall within the mapped 'important areas', only habitat assessments are required under the referral guideline. Where suitable habitat is identified, presence is assumed.</p> <p><b>Seasonal considerations</b> As a rough guide surveys are recommended between November and February in areas south of latitude 23° and March to May north of 23°.</p>	<ul style="list-style-type: none"> <li>Wet season survey (February 2021).</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> <li>Methods involved waterhole watching at suitable waterholes, nest searches and targeted searches.</li> <li>A total of 84 person hours over five days of land-based area searches including walking/flushing/driving transects.</li> <li>A total of seven person hours over four days of targeted searches including waterhole and habitat watching.</li> </ul>	<p><b>Requirements met</b> The survey guidelines for this species with sites that fall within mapped important areas were met.</p> <p>This species was not detected, though presence is assumed.</p>

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
Squatter pigeon (southern) ( <i>Geophaps scripta scripta</i> )	Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010b)	<p><b>Survey techniques</b> The survey guidelines for Australia's threatened birds recommends the following survey methods and effort for the squatter pigeon (southern):</p> <ul style="list-style-type: none"> <li>Road driving during day (driving transects).</li> <li>Active searches: 15 hours over 3 days in areas &lt;50 ha.</li> <li>Flushing surveys: 10 hours over 3 days in areas &lt;50 ha.</li> <li>Waterhole searches: Survey effort not specified.</li> </ul> <p><b>Seasonal considerations</b> No evidence of long-distance seasonal movements or seasonal considerations required.</p>	<ul style="list-style-type: none"> <li>Wet season survey (February 2021).</li> <li>A total of 84 person hours over five days of area searches including active and flushing methods</li> <li>Waterholes and dams were visually surveyed throughout the surveys.</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements met</b> Survey effort undertaken exceeds the minimum survey requirements for the species, given the size of the project area.</p> <p>The survey consisted of all recommended survey techniques (active searches, flushing surveys, road driving and waterhole searches).</p> <p>This species was not detected, though presence is assumed.</p>
Red goshawk ( <i>Erythrotriorchis radiatus</i> )	Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010b)	<p><b>Survey techniques</b> The survey guidelines for Australia's threatened birds recommends the following survey method and effort for the red goshawk:</p> <ul style="list-style-type: none"> <li>Area searches: 80 hours over 10 days.</li> <li>Search in groups of tall trees and in trees along riverbanks for nests.</li> </ul> <p>Red goshawks are very secretive, so scanning for nests is the most effective way to detect the species presence.</p>	<ul style="list-style-type: none"> <li>Wet season survey (February 2021).</li> <li>A total of 84 person hours over five days of area searches</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements partially met</b> The required survey effort is ten days of area searches, which was not met.</p> <p>Searches for tall trees and potential nests were conducted for the species along Ross River throughout the study area</p> <p>Audio and visual surveys for birds were conducted, including whilst travelling along roads and tracks. This species was not detected, though presence is assumed.</p>

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
		<p><b>Seasonal considerations</b> No evidence of long-distance seasonal movements or seasonal considerations required.</p>		
White-throated needletail ( <i>Hirundapus caudacutus</i> )	No specific guideline, information sourced from literature - Species Profile and Threats Database (Department of Agriculture Water and the Environment, 2021b)	<p><b>Survey techniques</b> Area survey and timed area counts (survey effort not specified).</p> <p><b>Seasonal considerations</b> Surveys must be conducted between October and April in northern and eastern Australia.</p>	<ul style="list-style-type: none"> <li>Wet season survey (February 2021).</li> <li>A total of 84 person hours over five days of area searches</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements met</b> Survey techniques and seasonal requirements have been met. This species was not detected, though presence is assumed.</p>
<b>Migratory species</b>				
Oriental cuckoo and migrant flycatchers during breeding season and migration (fork-tailed swift, satin flycatcher, rufous fantail, black-faced monarch)	Referral guideline for 14 birds listed as migratory species under the EPBC Act (Department of the Environment, 2015b)	<p><b>Survey techniques</b> The EPBC Act referral guideline for 14 birds listed as migratory under the EPBC Act prescribes the following survey methods and effort for migratory species:</p> <ul style="list-style-type: none"> <li>Area survey and timed area counts (survey effort not specified).</li> </ul> <p><b>Seasonal considerations</b> Surveys should be conducted during the appropriate survey period:</p> <ul style="list-style-type: none"> <li>Oriental cuckoo: September to May.</li> <li>Fork-tailed swift: October to April.</li> <li>Satin flycatcher: spring or autumn.</li> <li>Rufous fantail: spring or autumn.</li> <li>Black-faced monarch: spring, summer or autumn.</li> </ul>	<ul style="list-style-type: none"> <li>Wet season survey (February 2021).</li> <li>A total of 84 person hours over five days of land based area searches including</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements met</b> Survey techniques and seasonal requirements have been met These species were not detected, though presence is assumed.</p>

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
Little curlew ( <i>Numenius minutus</i> )	EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment and Energy, 2017)	<p><b>Survey techniques</b> The EPBC Act Policy Statement 3.21 – Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species, recommends the following survey methods and effort:</p> <ul style="list-style-type: none"> <li>Four surveys during the months when the majority of migratory shorebirds are present in the area, as replicate surveys over this period are important to measure population variability. For example, one survey in December, two surveys in January, one survey in February</li> <li>Surveys should be conducted during the day and consist of area searches or line transects in suitable habitat (i.e. wetland or other waterbodies and their surrounding vegetation)</li> </ul> <p><b>Seasonal considerations</b> Surveys should be conducted during the months when the majority of migratory shorebirds are present in the area. The little curlew is present in Australia from September to April. Conduct surveys as close to high tide as practicable and at a maximum of no more than two hours either side of high tide</p>	<ul style="list-style-type: none"> <li>7 hours of active bird surveys over four days during February, however not all survey time was conducted at habitat suitable for the species</li> <li>140 hours of incidental bird surveys over five days during February</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements not met</b> Targeted surveys were not undertaken across the months when the majority of migratory shorebirds are present in the area. Targeted surveys did not occur in habitat suitable for the species. However, the survey area does not contain core habitat for this species and therefore full survey effort was not considered to be required.</p>
Estuarine crocodile ( <i>Crocodylus porosus</i> )	No specific guideline, information sourced from literature - Species Profile and	<p><b>Survey techniques</b> Area survey and timed area counts (survey effort not specified).</p>	<ul style="list-style-type: none"> <li>Active searches during daytime for opportunistic observations, as well as signs such as tracks and bank slides</li> </ul>	<p><b>Requirements met</b> Survey techniques and seasonal requirements have been met This</p>

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
	Threats Database (Department of Agriculture Water and the Environment, 2021b)	<b>Seasonal considerations</b> None	<ul style="list-style-type: none"> <li>Spotlighting was undertaken for four consecutive nights for 3 -4 hours per night, which included spending some time at the Ross River in potential crocodile habitat</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	species was not detected, though presence is assumed.
<b>Mammals</b>				
Bare-rumped sheath-tailed bat ( <i>Saccolaimus saccolaimus nudicluniatus</i> )	Survey guidelines for Australia's threatened bats (Department of the Environment Water Heritage and the Arts, 2010a)	<b>Survey techniques</b> The survey guidelines for Australia's threatened bats recommends the following survey method and effort for the bare-rumped sheath-tailed bat: <ul style="list-style-type: none"> <li>Unattended bat recorders: 16 detector nights over 4 nights.</li> <li>Mistnets: 16 trap nights over 4 nights. It should be noted that this species has never been caught in harp traps, mistnets or by using triplines.</li> <li>Roost searches: 1-2 hours per survey day.</li> </ul> <b>Seasonal considerations</b> Although virtually nothing is known about seasonal movements of this species, it is recommended that surveys be conducted between August and April.	<ul style="list-style-type: none"> <li>Unattended bat recorders: 21 detector nights over six nights in February 2021</li> <li>Counts of hollow-bearing trees were also undertaken.</li> <li>General habitat assessments were conducted throughout the study area</li> </ul>	<b>Requirements met</b> This species was confirmed within the study area by acoustic detection. As this species is rarely captured in mist or harp traps, this method was not undertaken. The survey was within the preferred seasonal timing.

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
Ghost bat ( <i>Macroderma gigas</i> )	Targeted species survey guidelines – ghost bat (Hourigan, 2011).	<p><b>Survey techniques</b></p> <p>The survey guidelines for the ghost bat recommend:</p> <ul style="list-style-type: none"> <li>• Attended bat recorders: <ul style="list-style-type: none"> <li>- Walking transects with a hand-held bat detector and spotlight</li> <li>- 8 detector hours over 4 nights.</li> </ul> </li> <li>• Harp traps and mist nets (optional): <ul style="list-style-type: none"> <li>- A minimum of 8 trap nights over 4 nights, plus 8 mist net hours over 4 nights (optional)</li> </ul> </li> <li>• Roost searches: <ul style="list-style-type: none"> <li>- 2 hours per survey day</li> </ul> </li> </ul> <p><b>Seasonal considerations</b></p> <p>Ghost bats vary seasonally in the use of roosts, with individuals congregating in maternity roosts from September to April and dispersing in small groups over winter. Surveys targeting this species should be carried out between September and April, as the species may be easier to detect when individuals are more aggregated.</p> <p>However, as ghost bats have the potential to be present in a wider range of areas during the winter months, surveys may need to be repeated between June and August, particularly if maternity roosts are not present within the Project Area.</p>	<ul style="list-style-type: none"> <li>• Unattended bat recorders: 21 detector nights over six nights in February 2021</li> <li>• 28 person hours of spotlighting over 4 nights</li> <li>• Roost searches: undertaken whilst conducting habitat assessments over five days in the field. No roosts or caves were identified in the study area</li> <li>• General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements partially met</b></p> <p>Survey effort undertaken meets the minimum survey requirements for the species, except for attended acoustic bat recorders. The survey was within the preferred seasonal timing.</p>

Species	Survey guideline documents	Survey guideline requirement	Effort undertaken	Assessment of survey effort achieved
Northern quoll ( <i>Dasyurus hallucatus</i> )	<p>Survey guidelines for Australia's threatened mammals (Department of Sustainability, Environment, Water, Population and Communities, 2011).</p> <p>EPBC Act referral guideline for the endangered northern quoll <i>Dasyurus hallucatus</i> (Department of the Environment, 2016).</p>	<p><b>Survey techniques</b></p> <p>The survey guidelines for Australia's threatened mammals recommends a range of survey methods to detect the northern quoll. The EPBC Act referral guidelines for the endangered northern quoll do not prescribe specific survey effort requirements due to the variation of this species' ecology and population sizes across its distribution. However, this guideline does make survey recommendations for Queensland which include:</p> <ul style="list-style-type: none"> <li>• Camera trapping (as opposed to cage trapping) targeted to habitat critical to the survival of the species. Transects of 10 camera traps spaced at least 100 m intervals for four nights is recommended</li> <li>• Supplementary techniques including: <ul style="list-style-type: none"> <li>- Latrine searches</li> <li>- Detection dogs</li> <li>- Hair tubes in conjunction with camera traps</li> </ul> </li> </ul> <p><b>Seasonal considerations</b></p> <p>Camera traps can be used at any time of the year, however preferably when individuals are likely to be active and more detectable.</p>	<ul style="list-style-type: none"> <li>• Camera traps were deployed at spaced intervals throughout the study area during February 2021 (11 cameras over six trap nights, with a total effort of 66 camera trap nights)</li> <li>• Latrine searches were also conducted in potentially suitable habitat</li> <li>• General habitat assessments were conducted throughout the study area</li> </ul>	<p><b>Requirements met for reconnaissance survey only</b></p> <p>A combination of survey techniques including the key technique for Queensland, as recommended by the survey guidelines, were utilised to determine utilisation in areas of potential 'habitat critical to the survival of the species'. Targeted surveying was conducted in February, which should coincide with good activity levels due to warm temperatures and an abundance of prey during wet season.</p>

### 3.2.4 Limitations

All field assessments are subject to inherent limitations in the detection success of targeted species. These limitations often result in a degree of false-absence records (i.e. a species is present, but not detected). It is important, therefore, that the limitations to surveys are identified and the survey results are viewed with these constraints in mind.

A flora field survey has inherent limitations associated with the variability of vegetation communities across a survey location, and changes to the detectability and presence of species over time. The seasonal conditions during which the survey was undertaken was conducive to a relatively high degree of detectable floral diversity. However, it is recognised that a single field study cannot always account for 100% of potential floral diversity present across a survey location.

For those species not detected and with records nearby, habitat assessments were undertaken to determine the value of the study area to support such species. The absence of a species was not assumed because it was not detected. However, the detection of fauna species during habitat assessments is limited, given the cryptic and nocturnal nature of many fauna. Further, seasonality and weather conditions influence the detectability of some taxa.

The species directly observed during this survey are opportunistic sightings only and not considered exhaustive. Detailed targeted surveys were not within scope for this assessment, due to the time sensitive nature of the project providing water to Townsville. General and targeted habitat assessments were undertaken to identify habitat features available for conservation significant species within the study area, active searches targeted signs of utilisation, and remote devices such as cameras and anabats provided additional survey effort.

Field survey data collection to inform mapping was conducted using a hand-held iPad unit with aerial imagery. The accuracy of the iPad is generally <5 metres and is not intended to be relied upon for design purposes.

### 3.3 Likelihood of Occurrence Assessment

A likelihood of occurrence assessment for conservation significant species and communities identified during the desktop review was undertaken. The assessment considered known habitat and ecological requirements of the species against the vegetation and habitat types and resources identified in the field survey. The full likelihood of occurrence assessment is presented in Appendix C.

Each species was assessed against the categories defined below.

- **Known:** Species was recorded in the study area during the field assessment, and/or there are species records within the study area
- **Likely:** There are species records within the study area, and suitable habitat is present
- **Potential:** There are species records within the broader area and/or habitat may be suitable or marginal in the study area
- **Unlikely:** Habitat may be suitable or marginal in the study area, however no species records exist within the broader area, and the species distribution is not close to the study area
- **No:** Suitable habitat does not exist in the study area, there are no records of the species in the surrounding area, species distribution is not close to the study area.

This process is to be used as a guide and is not to be used as indicating species presence or absence other than where observed presence is indicated.

### 3.4 Impact Assessment

MNES known, likely or having potential to occur within the project area were subjected to a two-step process to assess the potential for significant impacts, as outlined in Figure 1. The purpose of the two-step approach was to focus in on the key MNES values relevant to potential project impacts and determine significant impacts.

The first step was a risk assessment, which involved reviewing the nature and magnitude, as well as likely consequences of potential Project impacts. The findings of the risk assessment indicated the MNES' vulnerability to potential impacts, and whether further assessment via the significant impact assessment process was necessary to determine potential significant impacts.

For the purpose of the impact assessments, total clearing of the project area has been conservatively assumed. The full significant impact assessment is presented in Appendix D.

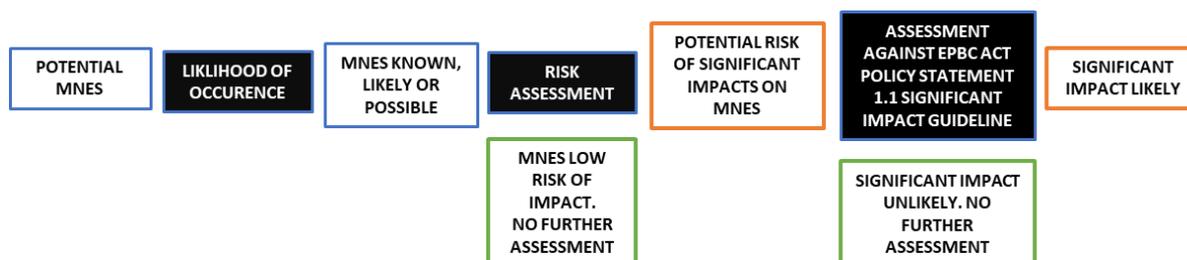


Figure 1 Impact assessment process for potential, likely or known MNES within the study area

### 3.4.1 Risk assessment

Potential direct and indirect Project impacts on MNES within the Project Area were assessed by determining the worst-case scenario consequences and the likelihood of such anticipated consequences hypothetically occurring. The results of this were evaluated via a risk matrix to identify the associated level of Project risk to all relevant MNES.

To determine the anticipated consequence, the nature and magnitude of potential Project impacts were assessed against three consequence levels which contained multiple criteria. The context of the specific MNES' ecology such as community or species' distribution, habitat preferences including breeding habitat and movement patterns was considered. For MNES with referral guidance documents, any terminology, area thresholds and recommendations detailed within were considered foremost. Knowledge gaps and known threats were also reviewed. To assign a consequence level of one or two, all criteria associated with that level must be met, otherwise a level three is automatically assigned. Only one of the criteria in consequence level three needs to be met in order for that level to be assigned.

MNES triggered further assessment if the risk matrix resulted in a 'potential' risk rating, whilst MNES with a 'low' risk rating required no further assessment. The risk assessment framework, including likelihood and consequence criteria for specific MNES is detailed in Appendix D.

### 3.4.2 Significant impact assessment

The *EPBC Act Policy Statement 1.1* (DotE, 2013) provides the framework for the assessment of potential impacts upon MNES as well as a process for determining the level of significance of impacts. In accordance with the guideline, impacts on MNES are to be assessed utilising the broadest scope of proposed action, with consideration to both direct and indirect impacts and proposed measures that may avoid and reduce impacts. Significance is tested through a set criterion stipulated in the guideline, which is tailored to each MNES, and for most values, their conservation status.

For all MNES evaluated with a 'potential' risk rating as a result of the assessment process described in Section 3.4.1, significant impact assessments were undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (Department of the Environment, 2013). The approach and specific significant impact criteria utilised is outlined in Appendix D.

## 4.0 Results

### 4.1 Regional context

#### 4.1.1 Bioregion and subregion

The study area occurs within the Brigalow Belt Bioregion, which covers the 500-759 mm rainfall area between the Queensland – New South Wales border in the south, to Townsville in the north. The Bioregion is characterised by the tree species *Acacia harpophylla* (brigalow) that forms forest and woodland on clay soils. Brigalow does not predominate across the entire region, with the bioregion including a range of ecosystems including eucalypt forest and woodland, grassland, dry rainforest, cypress pine woodland and riparian communities (Sattler & Williams, 1999).

Within the Brigalow Belt Bioregion, the study area occurs within the Townsville Plains subregion (11.1). This includes the coastal flats of the Ross, Black and Bohle rivers, which flow from the eastern slopes of Hervey range.

#### 4.1.2 Surface geology and land zones

The Queensland Department of Resources Townsville Hinterland regional surface geological mapping identified the study area to contain three different geology units (Queensland Department of Resources, 2000). Geology units are described in Table 2.

**Table 2 Major surface geology units**

Unit Name	Age	Lithology Summary	Dominant rock	General location within study area	Area within study area (ha)
Qa-QLD	Quaternary	Clay, silt, sand and gravel; flood-plain alluvium	Alluvium	Majority	174.0
Julago Volcanics	Early permian	Rhyolitic to andesitic lava, tuff, volcanic breccia, agglomerate, some conglomerate, sandstone, siltstone, shale, coal seams	Mixed mafites and felsites (mainly volcanics)	South	11.1
Agate Creek Volcanic Group	Early permian	Rhyodacitic welded tuff, agglomerate, andesite, basalt, mudstone, quartzose sandstone	Mixed mafites and felsites (mainly volcanics)	Far south	0.04

Land zones are categories that describe the major geologies, the associated landforms and geomorphic processes in Queensland, and are a critical component of the RE classification scheme. Two land zones have been identified within the project area, based on the available surface geology mapping. Two land zones (Table 3) have been identified and are broadly consistent with the surface geology mapping.

**Table 3 Land zones present within the project area**

Land Zone	Definition (Wilson and Taylor 2012)
3	<b>Recent Quaternary alluvial systems</b> , including closed depressions, paleo-estuarine deposits currently under freshwater influence, inland lakes and associated wave built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.

Land Zone	Definition (Wilson and Taylor 2012)
12	<b>Mesozoic to Proterozoic igneous rocks</b> , forming ranges, hills and lowlands. Acid, intermediate and basic intrusive and volcanic rocks such as granites, granodiorites, gabbros, dolerites, andesites and rhyolites, as well as minor areas of associated interbedded sediments. Excludes serpentinites (Land Zone 11) and younger igneous rocks (Land Zone 8). Soils are mainly Tenosols on steeper slopes with Chromosols and Sodosols on lower slopes and gently undulating areas. Soils are typically of low to moderate fertility.

### 4.1.3 Climate

The climate of the Townsville region is tropical, with lower rainfall than other tropical areas due to the geographic location of the region. The average annual rainfall is 1136 mm per year, however there is considerable variation from year to year, primarily caused by the inconsistent nature of tropical lows and thunderstorms, including cyclone activity (Bureau of Meteorology, 2021).

The summer is characterised by hot and humid thunderstorms from October, with monsoon rain events from December to April delivering the highest rainfall period of the year. Monsoon winds collect heat and moisture to deliver into the monsoon trough, often producing widespread flooding rains over the region, and occasionally leading to cyclone activity. The winter is characterised by south-east trade winds producing mostly fine weather, warm days and cool nights with low rainfall (BoM 2021).

## 4.2 Survey timing and climatic conditions

The field survey was conducted between 1 and 4 February 2021. Rainfall received in the Townsville Aero (Station 32040) prior to the field survey over the summer season was typical of the historical average. Weather conditions during the field survey were favourable, with only 0.6 mm rainfall on the 5 February. Temperatures were consistent across the survey period, with an average minimum temperature of 25.5 °C and average maximum temperature of 32.9 °C. This temperature is above average for February (average minimum 24.3 °C and maximum 31.4 °C), with the last four days of the field survey recorded as the hottest days for the month of February 2021 (Bureau of Meteorology, 2021).

## 4.3 Flora

### 4.3.1 Vegetation communities

The Department of Environment and Science (DES) Queensland Herbarium regional ecosystem (RE) mapping (Version 11) was reviewed as part of the initial desktop assessment to determine the classification and status of State mapped REs across the study area. The State RE mapping for the study area identified four REs with least concern status under the VM Act, displayed in Figure 3 (Appendix A).

All four State mapped REs were ground-truthed as occurring within the study area during field surveys, however boundaries for each RE were refined. An additional RE 11.12.9 was found to occur in the southern portion of the study area. Powerline easements, access tracks and roads that occur within the study area that have been cleared of vegetation were ground-truthed as non-remnant.

Ground-truthed REs are mapped in Figure 4 (Appendix A) and summarised in Table 4, in accordance with the Regional Ecosystem Description Database (REDD) Version 12 (Queensland Herbarium, 2021). A detailed description based on field validated data is provided below.

**Table 4 Ground-truthed REs**

RE	Description	VM Act Status <sup>1</sup>	Biodiversity Status <sup>2</sup>	Project area (ha)	Study area (ha)
11.3.12	<i>Melaleuca viridiflora</i> woodland to open woodland to 10 m on alluvial plains.	Least concern	No concern at present	0.47	5.88
11.3.25b	<i>Melaleuca leucadendra</i> , <i>Melaleuca fluviatilis</i> and <i>Casuarina cunninghamiana</i> open forest to woodland to 22 m on alluvial drainage lines and banks of major rivers.	Least concern	Of concern	2.53	52.51
11.3.30	<i>Eucalyptus crebra</i> sensu lato woodland to 14 m on older alluvial floodplains.	Least concern	No concern at present	7.38	52.46
11.3.35	<i>Eucalyptus platyphylla</i> and <i>Corymbia clarksoniana</i> woodland to 18 m on older alluvial floodplains.	Least concern	No concern at present	3.02	28.87
11.12.9	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> , <i>Corymbia tessellaris</i> and <i>Eucalyptus drepanophylla</i> woodland to 14 m on lower slopes of igneous rocks.	Least concern	No concern at present	2.06	9.17
-	Non-remnant	-	-	7.81	36.09

<sup>1</sup> Conservation status of REs under the VM Act.<sup>2</sup> Biodiversity (BD) status of the RE, under the EP Act, based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem.

#### 4.3.1.1 *Melaleuca viridiflora* woodland to open woodland (RE 11.3.12)

This woodland community occurs in small pockets within the northern section of the study area. The canopy is dominated by red flowering paperbark (*Melaleuca viridiflora*) to 12 m and varies in cover from 14.5% to 20%. Emergent Poplar gum (*Eucalyptus platyphylla*) are present throughout some areas of this RE. A low tree layer of very sparse red paperbark to 4 m exists. This species also comprises the very sparse shrub layer to 2 m.

Ground forb species include shrubby stylo (*Stylosanthes scabra*), sicklepod (*Senna artemisioides*), slender violet-bush (*Hybanthus monopetalus*), common fringe-sedge (*Fimbristylis dichotoma*), hairy joyweed (*Alternanthera nana*), desert spurge (*Euphorbia tannensis*) and yellow buttons (*Chrysocephalum apiculatum*).

Grass species include black speargrass (*Heteropogon contortus*), Golden beardgrass (*Chrysopogon fallax*), woodland lovegrass (*Eragrostis sororia*), purple lovegrass (*Eragrostis lacunaria*), kangaroo grass (*Themeda triandra*), cockatoo grass (*Alloteropsis semialata*), scented-top grass (*Capillipedium parviflorum*) and native millet (*Panicum decompositum*).

Introduced species include urena burr (*Urena lobata*\*).



Plate 1 Regional Ecosystem 11.3.12 – *Melaleuca viridiflora* woodland

#### 4.3.1.2 Melaleuca fringing riparian open forest to woodland (RE 11.3.25b)

This fringing riparian open forest to woodland community occurs along creek lines, drainage lines and along the banks of the Ross River. The canopy is dominated by long-leaved paperbark (*Melaleuca leucadendra*) and weeping paperbark (*Melaleuca fluviatilis*), with combinations of sub-dominant trees including Moreton Bay ash (*Corymbia tessellaris*), forest red gum (*Eucalyptus tereticornis*) and river she-oak (*Casuarina cunninghamiana*). The canopy is up to 24 m tall and varies in cover from 10% to 75%. The sparse lower tree layer includes the species Pandanus (*Pandanus cookii*), Leichhardt tree (*Nauclea orientalis*), swamp mahogany (*Lophostemon suaveolens*), blush macaranga (*Macaranga tanarius*) and basswood (*Polyscias australiana*). In some areas, the understorey within this RE is dominated by rainforest species.

The shrub layer is generally absent throughout the study area. However, the ground layer is typically very sparse and includes forbs such as spiky mat-rush (*Lomandra longifolia*), gambia pea (*Crotalaria goreensis*), sticky sedge (*Cyperus fulvus*), and bush basil (*Plectranthus graveolens*). Grasses are uncommon but may occur in in deposition areas of stream bed where there is an open canopy and include giant speargrass (*Heteropogon triticeus*).

Introduced species found in locations of this RE include the following restricted matter; Chinee apple (*Ziziphus mauritiana*\*), rubber vine (*Cryptostegia grandiflora*\*), lantana (*Lantana camara*\*) and Singapore daisy (*Sphagneticola trilobata*\*). Other introduced species include blue billygoat weed (*Ageratum houstonianum*\*).



Plate 2 Regional Ecosystem 11.3.25b – Melaleuca fringing riparian open forest

#### 4.3.1.3 *Eucalyptus crebra* woodland (RE 11.3.30)

This woodland community is dominant throughout the [RE]. The canopy is dominated by narrow-leaved ironbark (*Eucalyptus crebra* sensu lato) woodland with scattered Dallachy's ghost gum (*Corymbia dallachiana*) also occurring. The canopy is up to 18 m tall and averages 15% cover. A very sparse second tree layer is present and comprises red flowering paperbark (*Melaleuca viridiflora*) and occasional *Persoonia falcata* to 6 m. The second tree layer and shrub layer (to 1.8m) were variable in density within the RE, from very sparse to absent in some locations. Other tree and shrub species occurring in varying abundance include smooth-leaved quinine (*Petalostigma banksii*), silver grevillea (*Grevillea parallela*), beefwood (*Grevillea striata*), dysentery bush (*Grewia latifolia*), dogwood (*Vachellia bidwillii*) and lemonwood (*Dolichandrone heterophylla*).

Ground cover was generally sparse and averaged 24.5% cover, dominated by a diversity of native forbs and grasses due to the recent rainfall experienced in the region over the wet season. Forb species include shrubby stylo (*Stylosanthes scabra*), blue trumpet (*Brunoniella acaulis*) and *Sida rhombifolia*\*. Grass species include golden beard grass (*Chrysopogon fallax*), mountain wanderrie grass (*Eriachne mucronata*), cockatoo grass (*Alloteroopsis semialata*), kangaroo grass (*Themeda triandra*), native millet (*Panicum decompositum*) and digit grass (*Digitaria* sp.).



Plate 3 Regional Ecosystem 11.3.30 – *Eucalyptus crebra* woodland

#### 4.3.1.4 *Eucalyptus platyphylla* woodland (RE 11.3.35)

This woodland community occurs throughout the study area and is most dominant in the centre of the study area. The canopy occurs to a height of 24 m and is dominated by poplar gum (*Eucalyptus platyphylla*) with Moreton Bay ash (*Corymbia tessellaris*) and grey bloodwood (*Corymbia clarksoniana*) present and locally abundant in some areas. The very sparse second tree layer to 4 m consists of cocky apple (*Planchonia careya*), with a tall shrub layer of juvenile tree species, and the occasional silver grevillea (*Grevillea parallela*) and acacia species. Red flowering paperbark (*Melaleuca viridiflora*) was sometimes present within this RE as a tall shrub layer to 2 m.

Ground cover was generally sparse and averaged 21% cover, dominated by native species. Overall, a greater cover of introduced ground cover species than other eucalypt woodland communities in the study area. Ground cover species include forbs such as *Glycine tomentella*, pink tongue (*Rostellularia adscendens*), smooth darling-pea (*Swainsona galegifolia*) and sicklepod (*Senna obtusifolia*). Grass species include black speargrass (*Heteropogon contortus*), kangaroo grass (*Themeda triandra*), Golden beardgrass (*Chrysopogon fallax*), woodland lovegrass (*Eragrostis sororia*), poverty grass (*Eremochloa bimaculata*) and cockatoo grass (*Alloteropsis semialata*).

Introduced species found within this RE include urena burr (*Urena lobata*\*) , blue billygoat weed (*Ageratum houstonianum*\*) and blue snakeweed (*Stachytarpheta jamaicensis*\*).



Plate 4 Regional Ecosystem 11.3.35 – *Eucalyptus platyphylla* woodland

#### 4.3.1.5 Mixed eucalypt woodland (RE 11.12.9)

Woodland mixed eucalypt community on igneous rock 14 m was dominated by narrow-leaved ironbark (*Eucalyptus crebra* sensu lato), with red bloodwood (*Corymbia erythrophloia*) in the tree and shrub layers. This community is confined to the southern study area where the igneous geology of Mount Stuart extended down to the high bank of the Ross River. The sparse to very sparse second tree layer is up to 6 m tall with the very sparse shrub layer up to 1.8 m tall. Other shrubs include white currant (*Flueggea virosa*) and native gardenia (*Larsenaikia ochreatea*). This RE has a grassy ground cover with a diversity of herbaceous species. Forb species included flemingia (*Flemingia parviflora*), slender flat-sedge (*Cyperus gracilis*), native pea (*Rhynchosia minina*), flannel weed (*Sida cordifolia*\*), Brown's sedge (*Scleria brownii*), Birdsville indigo (*Indigofera linnaei*), hairy commelina (*Commelina diffusa*) and dwarf morning-glory (*Evolvulus alsinoides*). Grasses are less diverse in this community and include black speargrass (*Heteropogon contortus*), and kangaroo grass (*Themeda triandra*).

Weed species present within this RE include the restricted matter Chinese apple (*Ziziphus mauritiana*\*), and other introduced species such as urena burr (*Urena lobata*\*).



Plate 5 Regional Ecosystem 11.12.9 – Mixed Eucalypt woodland

#### 4.3.2 Regulated vegetation

The DNRME Vegetation Management Report identified three vegetation management categories occurring within the study area (Figure 3):

- Category B (remnant vegetation), mapped north and south of the powerline easement. In Queensland, remnant vegetation is described and mapped by the Queensland Herbarium as REs (refer to Section 4.3.1)
- Category R (reef-regrowth watercourse vegetation), mapped at the southern extent of the study area, adjacent to the Ross River Dam
- Category X (non-remnant vegetation) mapped along the powerline easement.

The field survey found that the desktop mapping of regulated vegetation within the study area is generally represented by the conditions on the ground. Category X vegetation was mapped along the cleared access tracks, roads, powerline easements and fence lines, with Category B vegetation ground-truthed within the remainder of the study area (Figure 4 in Appendix A).

#### 4.3.3 Regulated vegetation within a defined distance to a watercourse

Within the study area, Ross River and its tributaries are mapped and were confirmed during the field surveys, as containing regulated vegetation (Category B) within a defined distance to a watercourse.

#### 4.3.4 Regulated vegetation within 100 m of a wetland

There is no regulated vegetation within 100 m of a wetland mapped within the study area. Field surveys confirmed Queensland government mapping.

#### 4.3.5 Threatened ecological communities

The desktop assessment identified *semi-evergreen vine thickets of the Brigalow Belt (North and South)* and *Nandewar bioregions* as potentially occurring within the study area. However, no TECs were recorded during field surveys within the study area.

#### 4.3.6 Flora species diversity

The field surveys identified the presence of 99 taxa representing 37 families, with the full species list provided in Appendix B. The dominant families were Fabaceae (15 taxa), followed by Poaceae (13 taxa) and Myrtaceae (11 taxa).

#### 4.3.7 Conservation significant flora species

The desktop assessment identified 15 conservation significant flora species as having the potential to occur within 20 km of the study area, including eight EPBC Act listed species. No conservation significant species were identified in the study area during the field survey. All conservation significant flora species were also confirmed as unlikely to occur within the study area. There was a lack of suitable habitat for several species, with marginal habitat present for conservation significant rainforest species, in the form of Eucalypt-dominated open forest with a rainforest understorey in the tributaries of Ross River. All species were confirmed as unlikely to occur in the project area due to the comprehensive survey effort which did not locate any conservation significant flora species. A complete likelihood of occurrence assessment is provided in Appendix C. The study area is not mapped as a 'high risk area' on the Protected Plants Flora Survey Trigger Map (Appendix F).

#### 4.3.8 Essential habitat

No essential habitat for conservation significant flora species is mapped within the study area.

#### 4.3.9 Introduced flora species

A total of four introduced species were identified within the study area that are listed under the *Biosecurity Act 2014*, and two of these species are also listed as a Weed of National Significance (WONS) (Table 5).

**Table 5 Introduced weed species listed as WONS and under the *Biosecurity Act 2014***

Common Name	Scientific Name	WONS	<i>Biosecurity Act 2014</i> Status*
Rubber vine	<i>Cryptostegia grandiflora</i> *	Yes	Restricted, Category 3
Lantana	<i>Lantana camara</i> *	Yes	Restricted, Category 3
Singapore daisy	<i>Sphagneticola trilobata</i> *	No	Restricted, Category 3
Chinee apple	<i>Ziziphus mauritiana</i> *	No	Restricted, Category 3

## 4.4 Fauna

### 4.4.1 Fauna habitat

The study area is primarily alluvial open woodland and riparian eucalypt woodland, with cleared areas associated with the powerline easement and access tracks. Nonetheless, various fauna habitat types were confirmed within the study area, and mapped in Figure 5 (Appendix A).

Fauna habitat within the study area has been subject to disturbance from weeds, pests, erosion and other edge effects. However, microhabitat features are present within each of the habitat types, which provides habitat opportunities for several species. Table 6 outlines the habitat types recorded within the study area, with a description of each provided below.

**Table 6 Fauna habitat types**

Habitat type	Analogous REs	Project area (ha)	Study area (ha)
1. Melaleuca woodland on alluvial plains	11.3.12	0.47	5.88
2. Melaleuca riparian woodland to open forest	11.3.25b	2.53	52.51
3. Eucalyptus woodland on alluvial plains	11.3.30, 11.3.35	10.40	81.33
4. Eucalyptus woodland on igneous rocks	11.12.9	2.06	9.17
5. Non-remnant alluvial plains	NA	7.81	36.09

#### 1. Melaleuca woodland on alluvial plains

This habitat occurs in the northern portion of the study area on the alluvial plains, with only small sections intersecting the project area. This habitat is in very good condition, with minor disturbance by weed incursion. The soil is sandy loam, dominated by native grasses.

This habitat contains scattered small hollows (approximately 1-5 per ha) generally within stags of emergent poplar gums. These hollows offer opportunities for arboreal species such as possums, as well as hollow-dependent species such as bats, owls and parrots.

Flowering melaleuca and acacia species offer foraging opportunities for foliage-gleaning and nectar-feeding birds and bats. Mistletoe was also observed within the habitat type. This area is primary breeding, foraging and dispersal habitat for the conservation significant species black-throated finch, due to the availability of nesting trees such as red flowering paperbark (*Melaleuca viridiflora*), the abundance of preferred native grass species, low weed incursion, and short distance and accessibility to permanent water. The vulnerable squatter pigeon (southern subspecies) would also utilise this habitat for breeding, foraging and dispersal due to the sandy substrate and sparse ground cover.

Microhabitat features included occasional small rocks, small woody debris, termite mounds and decorticating bark. This may be utilised by reptile and amphibian species for shelter and foraging opportunities.

#### 2. Melaleuca riparian open forest to woodland

This habitat occurs banks adjacent to the Ross River and on drainage lines intersecting the project area. This habitat is generally in good condition, with disturbance from weeds and erosion minor. Two

restricted weed species were recorded at locations within this habitat type; rubber vine (*Cryptostegia grandiflora*\*) in low to moderate densities, and lantana (*Lantana camara*\*) in low densities.

Many species will utilise riparian habitat due to the opportunity for shelter, water and movement throughout the landscape. It is likely to be suitable habitat for conservation significant species such as the rufous fantail, due to the dense rainforest type understorey available in sections of this habitat type. It may also be utilised by the northern quoll to move between foraging areas.

This habitat contains few to no hollows (<5 per ha), as the dominant mature melaleuca species do not typically form hollows. Some emergent eucalypts provide suitable potential nesting habitat for corvid and raptor bird species. The flowering melaleuca species offer foraging opportunities for foliage-gleaning and nectar-feeding birds and bats, and the melaleucas offer nesting opportunities for the black-throated finch.

Microhabitat features included occasional small logs, common large logs, common decortivating bark, and dense shrub cover. Water is readily available in this habitat type in a variety of forms from slow flowing or ponding creek lines, to permanent water in the Ross River. Sections along Ross River consist of a rocky creek bank with visible exposure of bedrock in the form of boulder piles and tors, deeply fissured rock and subterranean cavities surrounded by *Eucalyptus* woodland with a dense to mid-dense understorey. and may provide denning habitat for northern quoll. The remainder and majority of riparian sections along the Ross River of a sandy substrate. These conditions create suitable habitat for a range of common amphibian species. Microhabitat features included occasional small logs, common large logs, common decortivating bark, and dense shrub cover.

The black-throated finch and squatter pigeon would find suitable access to permanent water, however areas where the creek banks are steep may impede the movement of the squatter pigeon for water access. Some creek lines within this habitat type may be unsuitable for black-throated finch due to the dense riparian vegetation restricting access to water. Sections along Ross River consist of a rocky creek bank with exposed granite boulders and bedrock, however majority of the habitat consists of a sandy substrate. Sandy banks may provide suitable nesting habitat for pardalotes and rainbow bee-eaters. Bat and bird species may utilise the flyway created by the Ross River and roost in the tree hollows. The lower banks of the Ross River are likely to provide suitable breeding habitat for the estuarine crocodile. Waders may utilise some areas of the Ross River and the associated tributaries where shallow water and suitable fringing vegetation is present. However, some areas contain vegetation which is too dense is unlikely to be utilised.

There is a low density of grasses in this habitat type, except on some locations along Ross River which have a sparser shrub cover. However, leaf litter is common, and in some areas deep, which offers shelter and foraging opportunities for reptiles and amphibians.

### **3. Eucalyptus woodland on alluvial plains**

This habitat occurs on the alluvial plains throughout the study area and is in good condition apart from some areas of canopy dieback, potentially due to flood disturbance from 2019. Other disturbance includes erosion and minor weed species.

Common small (1-10 per ha) and occasional large hollows were recorded within this habitat type, offering breeding places for many species. In some areas larger hollows were rare, primarily due to the poor hollow formation in the narrow-leaved ironbark (*Eucalyptus crebra* sensu lato). The flowering melaleuca species offer foraging opportunities for foliage-gleaning and nectar-feeding birds and bats, and the melaleucas offer nesting opportunities for the black-throated finch.

Microhabitat features include a common presence of small rocks and termite mounds, occasional to common small and large sized logs, and scattered decortivating bark.

The ground cover is dominated by native grasses, with suitable sandy bare ground to allow for foraging on fallen seed on the ground by species such as the squatter pigeon and black-throated finch. Two black-throated finch nesting colonies were identified in 2008 (ENSR Australia Pty Ltd, 2008) in this habitat type 100 m east of the study area. The colonies comprised of six adults and juveniles with no nests located during that survey effort and an adult pair near at least three nests which appeared active or recently active.

Many woodland birds, frogs, reptiles and macropods would utilise this habitat type, and it is likely to be suitable habitat for conservation significant species such as the black-throated finch, bare-rumped sheath-tail bat and squatter pigeon.

#### 4. Eucalyptus woodland on igneous rocks

This habitat type occurs in the south eastern corner of the study area and is in good condition with minor disturbance from weeds and tracks. The restricted weed species Chinese apple (*Ziziphus mauritiana*\*) was recorded at locations in this habitat type. There is a gentle incline with an igneous exposed rocky surface, and several drainage lines along the slopes.

Small to medium hollows were occasional to common (1-10 per ha) throughout this habitat type, particularly found in *Eucalyptus platyphylla*, *Corymbia clarksoniana* and *C. dallachiana*, as well as stags. These hollows may provide suitable roosting habitat for the conservation significant species the bare-rumped sheath-tail bat, as well as arboreal mammals such as possums. However, no large hollows were recorded.

Microhabitat features include scattered small and large logs, abundant rocks and boulders of different sizes, as well as common decorticating bark and ground termite mounds. The rocky surface offers habitat opportunities for reptile species.

Native grasses dominate the ground layer in most locations, with some places dominated by forbs rather than grasses.

This area contains sections of suitable denning habitat for northern quoll due to the visible exposure of bedrock in the form of boulder piles and tors, deeply fissured rock and subterranean cavities surrounded by *Eucalyptus* woodland with a dense to mid-dense understory.

#### 5. Non-remnant alluvial plains

This habitat type primarily consists of tracks and a powerline easement intersecting the study area. Whilst this is non-remnant and not vegetated, it is likely to still be utilised for conservation significant fauna such as squatter pigeon and black-throated finch for foraging. However, it does not contain the requirements for breeding habitat for these species. There are grasses, grass seeds, shade and sandy soils available within this habitat type. Bat and bird species may utilise the flyway created by the openness of this non-remnant habitat, and roost in tree hollows from neighbouring habitat types. It is also likely that introduced fauna such as feral dogs would be advantaged by this habitat type as a vector for movement through the landscape.

##### 4.4.2 Animal breeding places

Animal breeding places were recorded throughout the study area and are displayed on Figure 2. Small, medium and large hollows were observed within the study area, recorded in a diversity of tree species including *Eucalyptus tereticornis*, *E. platyphylla*, *Corymbia clarksoniana* and stags.

Small, medium and large bird nests were observed. Notably, a large raptor nest was observed just outside the project area but within the study area. The nest appeared in good condition, approximately a metre wide, in a very tall *Eucalyptus tereticornis* amongst a stand of trees.

##### 4.4.3 Fauna species diversity

A total of 116 native fauna species were recorded during the field survey, comprising 72 bird species, 27 mammal species and eight reptile species and nine amphibian species. All observed fauna were typical for the region and analogous to the habitat types recorded on site. The full list of species is provided in Appendix B.

###### 4.4.3.1 Birds

Birds were the primary fauna group observed throughout the survey. A total of 72 native bird species were recorded.

A variety of nectar-feeding birds (honeyeaters and parrots) were recorded in the Eucalypt woodland and riparian habitat, including the white-throated honeyeater (*Meliphreptus albogularis*), green rosella (*Platycercus caledonicus*), and rainbow lorikeet (*Trichoglossus haematodus*).

Passerines were less common, including the mistletoebird (*Dicaeum hirundinaceum*) and striated pardalote (*Pardalotus striatus*). Larger woodland birds included the Australasian Figbird (*Sphecothebes vieillotii*), the noisy and little friarbirds (*Philemon corniculatus*; *Philemon citreogularis*), dollarbird (*Eurystomus orientalis*), pheasant coucal (*Centropus phasianinus*) and channel-billed cuckoo (*Scythrops novaehollandiae*).

Birds of prey such as owls and raptors were also common within the study area, with eight species recorded including the white-bellied sea-eagle (*Haliaeetus leucogaster*) listed as a marine species under the EPBC Act. Other raptors included the wedge-tailed eagle (*Aquila audax*), nankeen kestrel (*Falco cenchroides*), brahminy kite (*Haliastur indus*) and black kite (*Milvus migrans*). Owls and relatives included the barking owl (*Ninox connivens*), southern boobook (*Ninox novaeseelandiae*) and the tawny frogmouth (*Podargus strigoides*).

A range of waterbird species were recorded including the pacific black duck (*Anas superciliosa*), plumed whistling-duck (*Dendrocygna eytoni*), Australian pelican (*Pelecanus conspicillatus*), Australasian grebe (*Tachybaptus novaehollandiae*), little black cormorant (*Phalacrocorax sulcirostris*), and comb-crested jacana (*Irediparra gallinacea*). These species were primarily observed in the lagoon to the south of the project area, near Ross Park.

Other more disturbance tolerant bird species were recorded across the study area, including the torresian crow (*Corvus orru*), pied butcherbird (*Cracticus nigrogularis*), Australian magpie (*Cracticus tibicen*), and Australian white ibis (*Threskiornis molucca*).

#### 4.4.3.2 Mammals

Excluding introduced species, a total of 27 mammal species and one additional mammal genus were recorded during the field survey, either through direct observation, tracks, scats, remote camera or anabat recording. Macropods were the most commonly encountered mammal during the field survey, with the agile wallaby (*Macropus agilis*) observed foraging and on remote cameras, and the eastern grey kangaroo (*Macropus giganteus*) also observed foraging. A dingo (*Canis lupus dingo*) was confirmed on a remote camera, indicating the dog tracks observed may be from the native dingo rather than feral dog. Dog was also confirmed through scat analysis, with the dog scat containing agile wallaby. A rufous bettong (*Aepyprymnus rufescens*) and brushtail possum (*Trichosurus vulpecula*) were also observed during the field survey.

A total of 23 flying-foxes, bats, and microbat species were recorded within the study area, either through direct observation or recorded on the anabat devices. Two flying-foxes were observed; the black flying-fox (*Pteropus alecto*) and the little red flying-fox (*Pteropus scapulatus*). Melaleucas were in flower during a day trip in April, which is a food source for the flying-foxes. A total of 17 bat species and one bat genus were confidently identified on anabat recordings, with an additional two possible species that were not positively identified (Appendix E). Bats found to be utilising the study area were primarily forest dwellers that prefer to roost in tree hollows, with a few cave dwellers. The threatened bare-rumped sheath-tail bat (*Saccolaimus saccolaimus*) was recorded most nights within habitat types 2, 3 and 4. No other threatened species were detected through anabat recording analysis.

#### 4.4.3.3 Reptiles and amphibians

Eight reptile species and nine amphibian species were recorded during the field survey, not including the introduced cane toad (*Rhinella marina*\*). The reptiles included a brown tree snake (*Boiga irregularis*), four skinks, three geckoes and a yellow-spotted monitor (*Varanus panoptes*). The amphibians included six tree or rocket frogs in the genus *Litoria*, two *Cyclorana* genus, and the ornate burrowing frog (*Platyplectrum ornatum*).

#### 4.4.4 Conservation significant fauna

The desktop assessment identified seven threatened fauna species (EPBC Act and/or NC Act) with the potential to occur within the study area, including four bird and three mammal species (Appendix C). A further ten listed migratory species (EPBC Act) were also identified with potential to occur. Out of these, one species, bare-rumped sheath tail bat, which is listed vulnerable under the EPBC Act and endangered under the NC Act, was identified as occurring with the study area during the field survey. The species was recorded most survey nights within habitat types 2, 3 and 4; which are the treed habitat types on alluvial floodplain, alluvial riparian, and igneous rock substrates.

The remainder of the species returned in the desktop assessment were subject to the likelihood of occurrence assessment which considered the known habitat and ecological requirements of the species against the vegetation and habitat types identified in the field survey, cross checked with available species records in the area.

Results from the likelihood of occurrence assessment found four threatened or migratory species are likely to occur within the project area, and nine threatened or migratory species have the potential to occur within the study area (Table 7). Of these species, the white-throated needletail and fork-tailed swift were considered to be potential flyovers only, therefore they would only sporadically utilise the airspace above the study area and would be highly unlikely to utilise the available vegetation to roost, forage or breed.

Of particular note is the likely presence of black-throated finch within the study area. Whilst the black-throated finch was not seen during the field survey, there are records for the black-throated finch located within the Mount Stuart area approximately 8 km to the east, and on Bohle River 3 km to the west of the project area (Atlas of Living Australia, 2021). A previous study undertaken in 2008 (ENSR Australia Pty Ltd, 2008) identified black-throated finch nests within and adjacent to the study area. The study area also sits within the Greater Townsville Important Areas for the black-throated finch. The study area contains the preferred habitat of this species, such as palatable foraging grass species, suitable nesting trees and access to a permanent source of fresh water.

The NC Act listed species coastal sheath-tail bat (*Taphozous australis*) was found close to the study area in 2000 and 2008 (ENSR AECOM 2008), however this species is state listed and was not assessed further.

Conservation significant species identified as known, likely or potentially to occur and associated habitat types within the study area are listed in Table 7, depicting the breeding, foraging and dispersal habitat utilisation. The complete likelihood of occurrence assessment is detailed in Appendix C.

**Table 7 Potential occurrence of conservation significant fauna species within the project area**

Species	Status		Utilisation of habitat types			Comments
	EPBC Act <sup>1</sup>	NC Act <sup>2</sup>	Breeding	Foraging	Dispersal	
<b>Known</b>						
Bare-rumped sheathtail bat ( <i>Saccolaimus saccolaimus nudidcluniatius</i> )	V	E	1, 2, 3, 4	1, 2, 3, 4, 5	1, 2, 3, 4, 5	
<b>Likely</b>						
Black-throated finch ( <i>Poephila cincta cincta</i> )	E	E	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	
Fork-tailed swift ( <i>Apus pacificus</i> )	M, Ma	SLC	-	1, 2, 3, 4, 5	1, 2, 3, 4, 5	Flyover habitat
White-throated needletail ( <i>Hirundapus caudacutus</i> )	V, M, Ma	V	-	1, 2, 3, 4, 5	1, 2, 3, 4, 5	Flyover habitat
Estuarine crocodile ( <i>Crocodylus porosus</i> )	M, Ma	V	2	2	2	No nesting habitat
Coastal sheathtail bat ( <i>Taphozous australis</i> )	-	NT	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	
<b>Potential</b>						
Red goshawk ( <i>Erythrotriorchis radiatus</i> )	V	E	1, 2, 3, 4	1, 2, 3, 4, 5	1, 2, 3, 4, 5	
Squatter pigeon (southern subspecies) ( <i>Geophaps scripta scripta</i> )	V	V	-	1, 2, 3, 4, 5	1, 2, 3, 4, 5	
Oriental cuckoo ( <i>Cuculus optatus</i> )	M	SLC	-	1, 2, 3, 4	1, 2, 3, 4	
Black-faced monarch ( <i>Monarcha melanopsis</i> )	M, Ma	SLC	-	1, 2	1, 2	Where it crosses the river and drainage lines
Satin flycatcher ( <i>Myiagra cyanoleuca</i> )	M, Ma	SLC	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	
Little curlew ( <i>Numenius minutus</i> )	MW, Ma	SLC	-	1, 2, 3, 4	1, 2, 3, 4	Foraging and roosting habitat
Rufous fantail ( <i>Rhipidura rufifrons</i> )	M, Ma	SLC	-	2	2	Where it crosses the river and drainage lines
Osprey ( <i>Pandion haliaetus</i> )	MW, Ma	SLC	-	2	2	Where it crosses the river, flyover for remaining habitat type
Northern quoll ( <i>Dasyurus hallucatus</i> )	E	LC	2	1, 2, 3, 4	1, 2, 3, 4	Breeding and denning habitat in rocky outcrops associated with habitat type 2
Ghost bat ( <i>Macroderma gigas</i> )	E	E	-	1, 2, 3, 4, 5	1, 2, 3, 4, 5	

<sup>1</sup> V=Vulnerable; E=Endangered; M = Migratory; MW=Migratory wetland; Ma=Marine<sup>2</sup> V=Vulnerable; E=Endangered; SLC=Special Least Concern

#### 4.4.5 Essential habitat

Essential habitat is compiled from a combination of species habitat models and buffered species records. Essential habitat, for protected wildlife, means an area of vegetation shown on the Regulated Vegetation Management Map as assessable vegetation:

1. That has at least three essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database. Essential habitat factors are comprised of – regional ecosystem (mandatory for most species), vegetation community, altitude, soils, position in landscape; **or**
2. In which the protected wildlife, at any stage of its life cycle, is located.

Essential habitat is mapped in the study area for the black-throated finch (*Poephila cincta cincta*), coastal sheath-tail bat (*Taphozous australis*), estuarine crocodile (*Crocodylus porosus*) and squatter pigeon (southern subspecies) (*Geophaps scripta scripta*). Essential habitat is also mapped on Figure 3 (Appendix A).

##### 4.4.5.1 Black-throated finch

The essential habitat for black-throated finch and their occurrence within the project area is presented in Table 8. The assessment concludes that the habitat is likely to meet the definition of essential habitat for the black-throated finch within the study area.

**Table 8 Essential habitat factors for black-throated finch**

Habitat factors	Occurrence within the project area
<p><b>REs (mandatory for the species)</b>            11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.35, 11.3.36, 11.3.37, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.15, 11.11.16, 11.11.17, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20</p>	<p><b>Present.</b>            The project area contains REs 11.3.12, 11.3.25, 11.3.30, 11.3.35, 11.12.9.</p>
<p><b>Vegetation community</b>            Grassy open woodland dominated by Eucalyptus, Acacia and Melaleuca spp. (e.g. <i>E. platyphylla</i>, <i>E. erythrophloia</i>, <i>E. melanophloia</i>, <i>E. brownii</i>, <i>E. whitei</i>, <i>E. similis</i>, <i>E. camaldulensis</i>, <i>Corymbia plena</i>, <i>C. dallachiana</i>, <i>C. setosa</i>, <i>M. viridiflora</i>, <i>M. leucodendra</i>) with high diversity ground cover of perennial grasses (e.g. <i>Heteropogon</i>, <i>Themeda</i>, <i>Bothriochloa</i>, <i>Eulalia</i>, <i>Enneapogon</i>, <i>Triodia</i>, <i>Triopogon</i>, <i>Chrysopogon</i>, <i>Aristida</i>) and shrub layer usually sparse or absent. Nest in topmost twiggy branches of eucalypt, occasionally in tree hollow or termite mound, up to 12 m above ground.</p>	<p><b>Present.</b></p>
<p><b>Altitude</b>            50-350 m</p>	<p><b>Present.</b></p>

#### 4.4.5.2 Coastal sheathtail bat

The essential habitat for coastal sheathtail bat and their occurrence within the project area is presented in **Table 9**. The assessment concludes that the habitat meets the definition of essential habitat for the coastal sheathtail bat within the study area.

**Table 9 Essential habitat factors for coastal sheathtail bat**

Habitat factors	Occurrence within the study area
<p><b>REs (mandatory for the species)</b>            11.1.4, 11.2.1, 11.2.2, 11.2.3, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.11, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.20, 11.3.23, 11.3.25, 11.3.26, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.32, 11.3.33, 11.3.34, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.1, 11.4.2, 11.4.3, 11.4.5, 11.4.6, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.7, 11.5.8, 11.5.9, 11.5.11, 11.5.12, 11.5.13, 11.5.14, 11.5.15, 11.5.16, 11.5.17, 11.5.18, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.3, 11.7.4, 11.7.5, 11.7.6, 11.7.7, 11.8.1, 11.8.2, 11.8.3, 11.8.4, 11.8.5, 11.8.6, 11.8.7, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.13, 11.8.14, 11.8.15, 11.9.1, 11.9.2, 11.9.3, 11.9.4, 11.9.5, 11.9.6, 11.9.7, 11.9.8, 11.9.9, 11.9.10, 11.9.11, 11.9.13, 11.9.14, 11.10.1, 11.10.2, 11.10.3, 11.10.4, 11.10.5, 11.10.6, 11.10.7, 11.10.8, 11.10.9, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.2, 11.11.3, 11.11.4, 11.11.5, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.12, 11.11.13, 11.11.14, 11.11.15, 11.11.16, 11.11.17, 11.11.18, 11.11.19, 11.11.20, 11.11.21, 11.12.1, 11.12.2, 11.12.3, 11.12.4, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.15, 11.12.16, 11.12.17, 11.12.18, 11.12.19, 11.12.20, 11.12.21</p>	<p><b>Present.</b>            The project area contains REs 11.3.12, 11.3.25, 11.3.30, 11.3.35, 11.12.9.</p>
<p><b>Vegetation community</b>            All habitats within a few kilometres of coast, e.g. dune mesophyll/sclerophyll scrub, mangroves (Rhizophora, Bruguiera), heath, open forest/woodland, rainforest/monsoon forest and Melaleuca/sedge swamp, rocky escarpments ± low shrubfield.</p>	<p><b>Present.</b>            The study area contains melaleucas and eucalyptus woodland.</p>
<p><b>Altitude</b>            Sea level to 150 m</p>	<p><b>Present.</b></p>

#### 4.4.5.3 Estuarine crocodile

The essential habitat for estuarine crocodile and their occurrence within the project area is presented in Table 10. The assessment concludes that the habitat meets the definition of essential habitat for the estuarine crocodile within the study area.

**Table 10 Essential habitat factors for estuarine crocodile**

Habitat factors	Occurrence within the project area
<p><b>REs (mandatory for the species)</b> All regional ecosystems within the stream / wetland buffer as determined by VMA code.</p>	<p><b>Present.</b> Regional ecosystems within the project area are intersected by the applicable stream buffer, which equates to 50 m from the defining bank of Ross River, and 10 m from the defining bank of drainage lines within the study area.</p>
<p><b>Vegetation community</b> Estuaries and major rivers, billabongs and swamps in dry season; freshwater swamps in wet season, occasionally found in open sea; also in dune swale swamps and dams; mostly within 40-50km of coastline (some breeding populations up to 100km from sea). Nest sites vegetated areas (preference for Melaleuca swamp forest with Thoracostachyum or Scleria sedgeswamp &amp;/or Stenoclaena fern) near permanent freshwater (&lt;100-200m), often on north-west banks, prime areas associated with productive deepwater estuaries; will also use marginal sites, e.g. grassy areas (Imperata, Ischaemum, Themeda, Sorghum) near forest edge or with sparse eucalypt, riverbank/fringe forest (Melaleuca, Corypha, Acacia), mangrove fringe, salt meadow behind mangrove, and sparse short (&lt;40cm) sedgeland/swamp.</p>	<p><b>Present.</b> The project area contains melaleuca riverbank habitat, and grassy areas near forest edges</p>
<p><b>Altitude</b> Sea level to 100 m</p>	<p><b>Present.</b></p>
<p><b>Position in landscape</b> Near and in waterbodies</p>	<p><b>Present.</b> The Ross River is adjacent to the study area.</p>

#### 4.4.5.4 Squatter pigeon (southern subspecies)

The essential habitat for squatter pigeon (southern subspecies) and their occurrence within the project area is presented in Table 11. The assessment concludes that the habitat meets the definition of essential habitat for the squatter pigeon (southern subspecies) within the study area.

**Table 11 Essential habitat factors for squatter pigeon (southern subspecies)**

Habitat factors	Occurrence within the project area
<p><b>REs (mandatory for the species)</b> 11.2.1, 11.2.5, 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.6, 11.3.7, 11.3.8, 11.3.9, 11.3.10, 11.3.12, 11.3.13, 11.3.14, 11.3.15, 11.3.16, 11.3.17, 11.3.18, 11.3.19, 11.3.23, 11.3.25, 11.3.27, 11.3.28, 11.3.29, 11.3.30, 11.3.35, 11.3.36, 11.3.37, 11.3.38, 11.3.39, 11.4.2, 11.4.3, 11.4.5, 11.4.8, 11.4.10, 11.4.12, 11.4.13, 11.5.1, 11.5.2, 11.5.3, 11.5.4, 11.5.5, 11.5.8, 11.5.9, 11.5.12, 11.5.13, 11.5.14, 11.5.17, 11.5.20, 11.5.21, 11.7.1, 11.7.2, 11.7.4, 11.7.6, 11.8.2, 11.8.4, 11.8.5, 11.8.8, 11.8.9, 11.8.11, 11.8.12, 11.8.14, 11.8.15, 11.9.2, 11.9.3, 11.9.7, 11.9.9, 11.9.14, 11.10.1, 11.10.4, 11.10.6, 11.10.7, 11.10.11, 11.10.12, 11.10.13, 11.11.1, 11.11.3, 11.11.4, 11.11.6, 11.11.7, 11.11.8, 11.11.9, 11.11.10, 11.11.11, 11.11.15, 11.11.16, 11.11.19, 11.11.20, 11.12.1, 11.12.2, 11.12.3, 11.12.5, 11.12.6, 11.12.7, 11.12.8, 11.12.9, 11.12.10, 11.12.11, 11.12.12, 11.12.13, 11.12.14, 11.12.17, 11.12.20</p>	<p><b>Present.</b> The project area contains REs 11.3.12, 11.3.25, 11.3.30, 11.3.35, 11.12.9.</p>
<p><b>Vegetation community</b> Dry eucalypt woodland (including poplar box, spotted gum, yellow box, acacia and callitris), with sparse short grass, often on sandy areas near to permanent water; grassy eucalypt woodlands. Nest on ground near or under grass tussock, log or low bush.</p>	<p><b>Present.</b> The project area contains habitat that consists of dry eucalypt woodland, including appropriate native grasses, and sandy areas located near permanent water.</p>
<p><b>Position in landscape</b> Gravelly ridges, traprock and river flats.</p>	<p><b>Present.</b> The project area contains river flats.</p>

#### 4.4.6 Introduced fauna species

A total of three introduced species listed under the *Biosecurity Act 2014* were identified within the study area (Table 12).

**Table 12 Introduced pest species listed under the *Biosecurity Act 2014***

Common Name	Scientific Name	<i>Biosecurity Act 2014</i> Status
Feral dog	<i>Canis lupus</i> *	Category 3, 4, 6
Feral pig	<i>Sus scrofa</i> *	Category 3, 4, 6
Cane toad	<i>Rhinella marina</i> *	Prohibited matter under Schedule 1

Introduced fauna recorded during field surveys that are not listed under the *Biosecurity Act 2014* included the Indian myna (*Sturnus tristis*\*).

Other introduced fauna species likely to occur within the study area may include the feral cat (*Felis catus*\*), European fox (*Vulpes vulpes*\*), house mouse (*Mus musculus*\*), black rat (*Rattus rattus*\*), or European rabbit (*Oryctolagus cuniculus*\*).

#### 4.4.7 Wetlands and watercourses

The study area exists parallel to the lower section of the Ross River, which is the main watercourse (stream order 6) in the Townsville region. The mouth of the Ross River exits approximately 13 km in a straight line to the north-east of the study area. Upstream to the south, the Ross River opens into Lake Ross, a lacustrine wetland and dam. Lake Ross stores over 200,000 million litres of water and supplies around 80% of Townsville's potable water (Townsville North Queensland, n.d.). The Ross River Reservoir is listed as a Wetland of National Significance under the Directory of Important Wetlands (Environment Australia, 2001), providing habitat to a diversity of fauna and bird life.

A number of stream order 1 and 2 watercourses are mapped in the study area, as gullies flowing from the Mt Stuart ridges into the Ross River, which are not permanent waterbodies. No other wetlands occur within the study area.

#### 4.4.8 Landscape connectivity

The study area is located south of the urbanised city of Townsville. The Mount Stuart Training Area surrounding the study area consists of a mosaic of remnant and non-remnant vegetation, with remnant vegetation around Mount Stuart itself. The Ross River, Lake Ross and associated tributaries facilitate connectivity for species dispersal throughout the region, with large areas of remnant vegetation located at Hervey Range to the west, Mingela State Forest to the south and Mount Elliott to the east. The mouth of the Ross River flows into the Great Barrier Reef Marine Park to the north east of the study area. Therefore, the study area is generally well-connected and acts as an important vector for species dispersal and movement throughout the Townsville region. Some long-term factors limiting connectivity in this area include encroaching urbanisation, land use modification upstream, and altered hydrology and river morphology throughout the Ross catchment.

A review of DES BPA corridor mapping identified State level biodiversity areas occur within the study area, with a very small section of Regional level biodiversity area in the far south of the study area near Ross Park (Queensland Department of Environment and Science, 2018). Fauna have ample opportunity for movement throughout the study area, with shelter opportunities such as logs, rocks and vegetation cover across the landscape. The watercourse riparian and drainage line areas contribute a high level of connectivity, with the dense vegetation offering protection for smaller birds to move through the study area. There are few disturbed areas in the study area that would hinder movement of most common species.

### 4.5 Matters of National Environmental Significance

A summary of MNES values identified within the study area are presented in Table 13.

**Table 13 MNES within the study area**

MNES Value	Presence Value Present?	Comments
World heritage properties	X	There are no world heritage properties within proximity to the project area.
National heritage places	X	There are no national heritage places within proximity to the project area.
Wetlands of international importance (listed under the Ramsar convention)	X	There are no Wetlands of International Importance within proximity to the project area.
Listed threatened species and ecological communities	✓	<p>One listed threatened fauna species was confirmed as known within the project area:</p> <ul style="list-style-type: none"> <li>Bare-rumped sheath-tail bat</li> </ul> <p>Five listed threatened fauna species are likely to occur within the project area. These are:</p> <ul style="list-style-type: none"> <li>Black-throated finch</li> <li>Northern quoll</li> <li>Squatter pigeon (southern subspecies)</li> </ul>

MNES Value	Presence Value Present?	Comments
		<ul style="list-style-type: none"> <li>Red goshawk</li> <li>Ghost bat</li> </ul> <p>No threatened flora were considered potential to occur within the project area. No Threatened Ecological Communities were confirmed present within the project area.</p>
Migratory species	✓	<p>Eight listed migratory species potentially occur within the project area. These are:</p> <ul style="list-style-type: none"> <li>Estuarine crocodile</li> <li>Satin flycatcher</li> <li>Rufous fantail</li> <li>Oriental cuckoo</li> <li>Black-faced monarch</li> <li>Little curlew</li> <li>Osprey</li> </ul> <p>Two other species are likely to flyover the project area. These are:</p> <ul style="list-style-type: none"> <li>White-throated needletail</li> <li>Fork-tailed swift</li> </ul>
Commonwealth marine areas	X	The project area is sufficiently distant from any Commonwealth Marine Area that no impacts are anticipated.
Great Barrier Reef Marine Park	X	The Great Barrier Reef Marine Park is not located within proximity to the project area.
Nuclear actions (including uranium mines)	X	The Project is not and does not involve a nuclear action.
A water resource, in relation to coal seam gas development and large coal mining development	X	The Project is not a coal seam gas development or a large coal mining development.
Commonwealth land	✓	Mount Stuart Training Area (this is not assessed as part of this Ecology Technical Report).

## 5.0 Potential impacts

The most significant potential impacts on ecological values are likely to occur as a result of disturbance of vegetation and microhabitat features during the construction of the Project. This disturbance corridor (the Project Area) has been limited to a maximum width of 25m. This corridor width minimises the direct impact area of the Project whilst allowing for the required installation of the pipeline and ancillary works.

Only the minimum area required to maintain the pipeline easement and fire break will remain cleared during operation, with approximately 30% of the disturbance corridor to be rehabilitated with native species representative of the original vegetation community. However, this rehabilitation will be limited to the understorey with the restoration of native grass species rather than overstorey shrub and tree species. Nonetheless, this rehabilitation will reduce the long-term width of clearing impact to approximately 18m. The ground and stream profiles will be returned to preconstruction levels for the operational phase.

Based on these disturbance assumptions, potential impacts on ecological values has been assessed with the results outlined below. The impacts discussed below consider three scenarios:

- Permanent partial impact: clearing that will be temporary as the area will be rehabilitated. However, rehabilitation will be limited to the understorey and therefore a permanent partial impact will remain due to the lack of overstorey vegetation and associated habitat resources
- Permanent complete impact: clearing the will be permanent as no rehabilitation will be undertaken
- Total impact: area of permanent partial impact and permanent complete impact within the study area.

The assessment below also includes the consideration of further potential direct and indirect impacts associated with Project construction and operational activities. Mitigation and management measures to minimise the potential impacts on flora and fauna values are discussed in Section 6.0.

### 5.1 Direct impacts

#### 5.1.1 Vegetation clearing and habitat loss

The Project design has been developed to avoid and minimise vegetation clearing wherever feasible by co-locating the new pipeline with the existing cleared track and fence line which runs above the high bank of the Ross River. However, removal of native vegetation cannot be completely avoided. The areas of potential impact (i.e. vegetation removal and associated habitat loss) are discussed below and quantified in Table 14.

**Table 14 Potential impacts to vegetation communities and habitat types**

Habitat type	Vegetation community	VM Act status	Biodiversity status	Permanent partial impact (ha)	Permanent complete impact (ha)	Total area within project area (ha)
<i>Melaleuca</i> woodland on alluvial plains	<i>Melaleuca viridiflora</i> woodland (RE 11.3.12)	Least concern	No concern at present	0.141	0.329	0.47
<i>Melaleuca</i> riparian woodland	Melaleuca fringing riparian open forest (RE 11.3.25b)	Least concern	Of concern	0.759	1.771	2.53
	<i>Eucalyptus crebra</i> woodland (RE 11.3.30)	Least concern	No concern at present	2.214	5.166	7.38

Habitat type	Vegetation community	VM Act status	Biodiversity status	Permanent partial impact (ha)	Permanent complete impact (ha)	Total area within project area (ha)
<i>Eucalyptus</i> woodland on alluvial plains	<i>Eucalyptus platyphylla</i> woodland (RE 11.3.35)	Least concern	No concern at present	0.906	2.114	3.02
<i>Eucalyptus</i> woodland on igneous rocks.	Mixed Eucalypt woodland (RE 11.12.9)	Least concern	No concern at present	0.618	1.442	2.06
<b>TOTAL</b>				4.638	10.822	<b>15.46</b>

### 5.1.1 Loss or alteration of conservation significant fauna habitat

The maximum required clearing will impact on approximately 12.4 ha of habitat for conservation significant species; however with the anticipated rehabilitation of the pipeline this total impact will likely comprise of approximately 3.726 ha of permanent partial impact (only overstorey vegetation will be permanently lost) and approximately 8.694 ha of permanent complete impact (area will remain completely cleared). How this loss of habitat impacts each individual species through the direct loss of foraging and breeding resources varies depending on the current utilisation of the study area by the species and the species-specific habitat requirements. This is quantified for each known, likely or potentially occurring conservation significant species in Table 15.

**Table 15 Potential impacts to conservation significant fauna habitat**

Species	EPBC Act status <sup>1</sup>	NC Act status <sup>2</sup>	Habitat utilisation	Permanent partial impact (ha)	Permanent complete impact (ha)	Total impact within study area (ha)
Bare-rumped sheath-tail bat	V	E	Breeding, roosting, foraging and dispersal	-	15.46	15.46
			Foraging and dispersal	-	7.81	7.81
Black-throated finch	E	E	Nesting	-	15.46	15.46
			Foraging and dispersal only	4.638	10.82	15.46
Red goshawk	V	E	Nesting	-	15.46	15.46
			Foraging and dispersal only	4.638	10.82	15.46
Squatter Pigeon	V	V	Foraging and dispersal	4.638	10.82	15.46
Northern quoll	E	LC	Breeding / denning	0	0.16	0.16
			Foraging and dispersal only	4.59	10.71	15.30

Species	EPBC Act status <sup>1</sup>	NC Act status <sup>2</sup>	Habitat utilisation	Permanent partial impact (ha)	Permanent complete impact (ha)	Total impact within study area (ha)
Ghost bat	E	E	Foraging and dispersal only	-	15.46	15.46
Black-faced monarch	M	SLC	Foraging and dispersal only	-	2.46	2.46
Satin flycatcher	M	SLC	Breeding	-	15.46	15.46
			Foraging and dispersal only	4.638	10.82	15.46
Rufous fantail	M	SLC	Breeding, foraging, dispersal	-	2.46	2.46
Oriental cuckoo	M	SLC	Foraging and dispersal only	4.638	10.82	15.46
Little curlew	M	SLC	Roosting, foraging and dispersal	-	15.46	15.46
Estuarine crocodile	M	V	Breeding, foraging and dispersal	0	0.27	0.27
Osprey	M	SLC	Foraging and dispersal only	0.13	0.29	0.42
			Flyover habitat	0.633	1.48	2.11
Fork-tailed swift (flyover only)	M	SLC	Foraging and dispersal only	4.638	10.82	15.46
White-throated needletail (flyover only)	V, M	V	Foraging and dispersal only	4.638	10.82	15.46

<sup>1</sup> V=Vulnerable; E=Endangered; M = Migratory; MW=Migratory wetland; Ma=Marine

<sup>2</sup> V=Vulnerable; E=Endangered; SLC=Special Least Concern

### 5.1.2 Fragmentation

Fragmentation of habitat can impact on species populations through a number of mechanisms including increasing edge effects, reducing gene flow between small, isolated populations, reducing the potential for species to adapt to environmental change and loss or severe modification of the interactions between species.

The removal of vegetation for the Project largely occurs adjacent to the existing cleared track and fence line which runs above the high bank along the Ross River. The track is not currently considered a barrier to fauna movement due to its' narrow width (5-10 m) and presence of adjacent vegetation. During construction the disturbance corridor will be up to 25m wide, through terrestrial habitat and will require deep trenching throughout. During this period, some severance of fauna dispersal pathways is likely for some small bodied species (i.e. frogs, skinks, geckoes). Heightened activity during construction may also create a temporary barrier or deter some species from dispersing through the area. However, movements of birds, bats and larger bodied terrestrial species are unlikely to be significantly impacted. Furthermore, the long-term width of clearing impact will be reduced to

approximately 18m and the ground and stream profiles will be returned to preconstruction levels for the operational phase.

Installation of the pipe will also require open trenching in creek channels and temporary waterway barrier works in the form of bunding will be installed in creeks holding water. This will result in temporary disconnection of fish habitat. However, the stream profile will be returned post construction and fish passage is expected to be successfully restored.

The final cleared corridor will present minimal fauna dispersal concerns and is unlikely to functionally disconnect populations of species east and west of the pipeline.

### **5.1.3 Disturbance, injury and mortality of fauna**

Clearing of vegetation can result in injury or mortality of fauna, particularly ground dwelling fauna, including squatter pigeon, that may be crushed by machinery or struck by vehicles. Arboreal mammals may be trapped in trees as they are felled. Additionally, nesting birds for which breeding places were observed, may be disturbed and displaced. Whilst a localised impact on fauna may occur, the impact on fauna populations within the broader landscape is considered minimal. Further, impacts will be predominantly restricted to the construction phase, with limited human visitation and vehicular movements during operation.

## **5.2 Indirect impacts**

### **5.2.1 Altered hydrology**

Potential indirect impacts to the Ross River and its tributaries during construction may occur during trenching and bunding for pipeline installation and the cut and fill works for the construction of laydown pads and tracks. These activities may lead to increased degradation of habitat values through sedimentation and decreased soil stability. Other construction impacts to Ross River and its tributaries include:

- Temporary alteration of natural flow regimes
- Erosion and sedimentation
- Reduced water quality from point and non-point sources
- Stockpiles of soil during construction may cause a direct influx of sediment in the surface water runoff from the work sites, particularly from areas of cleared vegetation
- Increased nutrient input which may have flow on effects to vegetation and algal growth
- Contamination of hydrocarbons and other chemicals due to spills
- Sediment and suspended solids as a run-off from the road
- Changes to soil chemistry due to:
  - Importation of foreign soils
  - Exposure of subsoils
- Facilitation of the establishment of terrestrial and aquatic weed species, which may further degrade habitat value in fringing vegetation
- Changes to air quality due to machinery use
- Increased dust levels reducing the quality of habitat and plant health by reducing light for photosynthesis.

### **5.2.2 Weed species**

Activities that may increase the risk of establishment of new weed infestations and proliferation of existing weeds include the following:

- Soil disturbance through vegetation clearance and construction activities

- Areas of ground remaining bare for extended periods will establish weed species where there is little competition from other species
- Increased vehicular traffic through the area during construction
- Importation of construction materials to the site which may harbour introduced species.

Weed proliferation can degrade vegetation communities by increasing fuel loads (with the potential to alter fire regimes), reducing floristic diversity, altering the vegetation structure, causing vegetation dieback and altering habitat for native fauna species.

### 5.2.3 Pests and feral fauna

Three pest fauna species were identified during ecological surveys (feral dog, feral pig, cane toad) and the study area may support populations of a range of other species including: feral cat, black rat, European fox, house mouse and European rabbit.

Some potential impacts of these pest fauna to native species include that they may:

- Prey on native species and compete for food
- Carry diseases that may affect native animals
- Act as the primary prey for other exotic predators such as feral cats or foxes which then threaten native species
- Be predated on by native predators (i.e. northern quoll) leading to lethal ingestion of toxic species (i.e. cane toad).

Given the limited extent of clearing and the ability of most of the potentially present feral species to persist in highly diverse habitats, it is unlikely that Project activities will result in the further proliferation of these species.

Trenching in the construction phase of the Project may enhance conditions which are favourable for the establishment and or proliferation of cane toad. Where trenches are inundated by rainfalls, this may increase artificial aquatic habitat, producing favourable conditions for cane toad breeding and proliferation. Lethal toxic poisoning through ingestion of the cane toad has been identified as the cause of local extinctions of northern quoll.

### 5.2.4 Noise and vibration

During the construction phase, there will be an increase in noise and vibration in the project area as machinery undertakes clearing, earthworks and other activities. When activity and noise are occurring in areas adjoining retained habitat, temporary potential impacts may include:

- Reduced foraging ability by auditory predators due to increased background noise
- Increased risk of predation by visual predators due to increased background noise
- Increased potential for collisions with vehicles
- Human visitation causing disturbance to foraging or breeding behaviours.

Current research indicates that there are no government policies or other widely-accepted guidelines in respect to the noise levels which may be acceptable to wildlife. The levels or character of noise that may “startle” or otherwise affect the feeding or breeding pattern of birds or other wild animals are also not firmly established in the technical literature.

Sudden loud, impulsive or impact noises may cause birds and other fauna to become startled, which if occurring over the longer term, may affect feeding and breeding behaviour in some species. These impacts are expected to occur to the fauna using the habitats both within and immediately adjacent to the project area.

It is expected that excavation, construction and earthmoving associated with the Project will potentially cause disturbance to all groups of fauna, especially birds and hollow-dwelling fauna. This may result in the temporary avoidance of the area for the duration of these activities.

### 5.2.5 Dust

Deposition of dust, sand and soil resulting from construction may have potential impacts on vegetation if excessive levels are sustained over extended periods. When dust settles on plant foliage it can reduce the amount of light penetration on the leaf surface, block and damage stomata, and slow rates of gas exchange and water loss (Farmer, 1993). Reduction in the ability to photosynthesise due to physical effects may result in reduced growth rates of vegetation and decreases in floral vigour and overall community health.

## 6.0 Avoidance, Minimisation, Mitigation and Management

### 6.1 Avoidance and minimisation

The Project has been designed to avoid, to the greatest extent possible, areas of ecological value. This was achieved by prioritising the co-location of the new pipeline with the existing cleared track running north-south above the high bank of the Ross River. The width of the construction corridor has been reduced to the minimum practical width of 25m. Direct impacts will be limited to within this corridor during construction. During operation, this corridor will be reduced to the minimum required width to support the pipeline easement and a firebreak (approximately 18m). The remaining area will be rehabilitated and reinstated with native vegetation consistent with the surrounding remnant communities. Only approximately 50 % of the construction corridor contains remnant vegetation the remainder is along non-remnant vegetation e.g. tracks, pipeline.

### 6.2 Mitigation and management

#### 6.2.1 Vegetation clearing

Where removal of remnant vegetation cannot be avoided, a range of measures should be implemented to mitigate and manage the extent of impact to native vegetation communities. These include:

- Project planning should seek to avoid or minimise vegetation clearing in sensitive environments, specifically riparian areas and areas ground-truthed as remnant
- The Environmental Management Plan (EMP) should include a section on vegetation management that is to provide clear guidance on areas to be cleared and retained, methods for clearing and other relevant environmental protection measures
- Workers should be made aware of vegetation management requirements in induction training and through work instructions
- Topsoil should be removed, stockpiled and reapplied in the same land zone from where it was removed for any rehabilitation/revegetation works.

#### 6.2.2 Loss or alteration of fauna habitat and habitat fragmentation

While the extent of vegetation clearing for the proposed works will mean that impacts to fauna and their habitat is likely unavoidable, there are a range of measures that should be considered by the Project team to minimise the level of impact. These include:

- Suitably qualified fauna spotter-catchers must be engaged to undertake pre-clearance habitat searches and be present during vegetation clearing activities to minimise fauna harm
- The Environmental Management Plan (EMP) should provide clear guidance on areas to be cleared and retained, methods for clearing, role of the spotter-catcher and other relevant environmental protection matters
- The Project team should identify and map clear no-go zones to avoid unauthorised disturbance of areas of sensitive vegetation and habitat; such as identified nests, potential breeding places, trees that are to be retained and important microhabitat for MNES species. Important microhabitat that should be avoided wherever possible includes:
  - Hollow bearing trees
  - Large hollow logs
  - Boulders.
- If habitat trees can be retained without compromising safety, these will be identified and clearly marked
- Habitat features such as felled trees and logs should be considered for relocation to other areas where practical to provide microhabitat for fauna

- Consideration of connectivity and fauna passage should be undertaken at each design stage going forward. This should include consideration of staging works such that temporary barriers to fauna movement during construction (i.e. trenches) are restricted to smaller portions of the alignment at any one time
- Clearing vegetation should be planned in a sequential manner which directs any escaping fauna to adjacent native vegetation
- Rehabilitation works should be undertaken to minimise longer term clearing impacts within the disturbance corridor and include a revegetation strategy focused on restoring ecological values in key areas i.e. ensure appropriate grass species utilised by black-throated finch for foraging are included in suitable habitat
- Design and construction of the instream works should seek to minimise impacts to fish passage, migration and movement barriers where possible
- All work should be completed, and bunds removed during low flows when the flow will be contained wholly within the low flow channel
- Instream microhabitat such as log tangles and boulders should be retained in-situ or relocated to adjacent areas where practical
- Design should consider minimising instream impacts and inclusion of suitable design measures for mitigating and/or treating pollutants such as swales, vegetated buffer strips, bioretention systems, gross pollutant traps and spill capture treatments where feasible
- A Weed and Pest Management Plan should be implemented for the Project (this should include the control of aquatic weeds and pests).

### **6.2.3 Disturbance, injury, and mortality of fauna**

Proposed mitigation measures to reduce the likelihood of injury or mortality to fauna include the following:

- Pre-clearance surveys to identify shelters / nests potentially utilised by conservation significant fauna should be undertaken
- Fauna spotter-catchers must be used to capture and relocate fauna prior to clearing
- A clear escape path should be kept available for ground fauna during construction works
- Any injured, sick and dead vertebrate fauna must be recorded before (by fauna spotter-catchers), during and after construction and operation. Any fauna injured by Project activities should be transported to a vet or recognised wildlife carer
- Vegetation clearing will be limited to daytime hours to reduce impacts from construction light and noise on nocturnal species
- Tall equipment such as cranes should be lowered from dusk to dawn to minimise potential for flying species to be injured or killed through machinery strike
- Monitoring of trenches during construction is to be conducted regularly to ensure no fauna entrapment.

### **6.2.4 Altered hydrology**

Indirect impacts to waterways can generally be managed through the implementation of construction environmental management measures. Mitigation measures that should be considered by the Project team include:

- Development of an appropriate spill prevention and response plan to cover Project activities and the types and quantities of fuel, oil and chemicals held.
- Stockpiling/laydown areas, plant and equipment storage areas should be located away from Ross River and its tributaries and within already cleared or disturbed areas, where possible.

- Construction to be completed outside of the wet season when creeks are not inundated or flowing, where possible.
- Development of an Erosion and Sediment Control Plan for the Project in accordance with *Best Practice Erosion and Sediment Control Guidelines* (International Erosion Control Association, 2019).
- Rehabilitation works should be undertaken to minimise longer term clearing impacts within the disturbance corridor and include a revegetation strategy focused on restoring ecological values in key areas.

#### **6.2.5 Introduction or exacerbation of weeds and feral animals**

The risk of the potential impacts related to the establishment and proliferation of weeds and feral animals should be mitigated and managed, through measures including the adoption of a Weed and Pest Management Plan (WMP). The Plan should include:

- The management of weeds and pests during construction will be included in the WMP, to be developed prior to any works commencing. Consideration should be given to measures to mitigate the establishment and or proliferation of cane toad, feral cats, feral dogs and weed grass species
- Known WONS and category 3 restricted invasive weeds will be identified in or adjacent to the project area
- Appropriate wash down protocols should be developed and implemented for any vehicles or machinery entering the project construction site
- Monitoring of trenches during construction should be conducted regularly to determine the occurrence of ponding and potential breeding of cane toad. If evidence of cane toad breeding is found, an eradication strategy will be developed to mitigate the proliferation of this species
- The origin of high-risk construction materials, machinery and equipment should be identified to mitigate introduction of weed species
- Management methods to control spread of weeds considered to be Restricted Matters must be in keeping with regional management practice or Queensland DAF pest control prescriptions
- Promotion of awareness of weed management should be undertaken by inclusion of weed issues, pictures and procedures into the project's site induction program
- Weed monitoring should be undertaken to identify and appropriately manage weeds.

#### **6.2.6 Noise and vibration**

The construction works should be conducted during daylight hours and no temporary or permanent lighting is proposed to be instated as part of the Project. Impacts from noise will therefore be limited to temporary construction noise. The operation phase of the Project is not expected to result in increased noise or light, therefore the impacts during the operational phases of the Project will reflect current levels.

#### **6.2.7 Dust**

Dust generation during the construction phase should be minimised, particularly around sensitive environments (i.e. habitat for black-throated finch (southern) and squatter pigeon (southern)). This can be achieved by dust suppression measures, such as water trucks and sprinklers, where required.

## 6.3 Species-specific measures for avoidance, minimisation, mitigation and management

### 6.3.1 Black-throated finch

Direct impact to black-throated finch habitat has been minimised by co-locating infrastructure with existing tracks and non-remnant areas. Potential impacts are likely to be further reduced for the black-throated finch by implementing the following measures:

- Approximately 30% of the project area will be rehabilitated with a diversity of native grasses that are known as foraging grasses for the black-throated finch in the ground layer. At a minimum, rehabilitation efforts will aim to restore the area to be suitable for foraging purposes
- Pre-clearance surveys by a spotter-catcher will be undertaken in mapped habitat areas and near water sources to ensure any nests have been vacated prior to vegetation clearance
- Any identified active nesting colonies within or adjacent to the Project alignment will be avoided during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until the nests have been vacated
- Weed wash down requirements for vehicles entering and exiting the Project construction site will be strictly implemented to avoid the introduction or spread of weed species into and around the construction site
- The Weed and Pest Management Plan will detail provisions to monitor and control the spread or establishment of exotic grass species which may degrade the habitat and reduce resource availability
- Sediment and erosion control plans will be required by the construction tender and prepared by the contractor for the various construction activities on site. These will be required for the entire project area and will have a strong focus on minimising impacts of works near waterways.

### 6.3.2 Northern quoll

The following mitigation measures will help to further reduce potential impacts to northern quoll habitat:

- It is noted that boulder piles which provide suitable denning habitat have been avoided in design
- Hollow logs and felled hollow bearing trees should be relocated to other areas of mapped northern quoll habitat to provide denning resources
- Fuel loads of weeds should be managed to minimise the risk of high fire intensity. Inappropriate fire regimes can result in significant impact to northern quoll
- Water retaining voids or pits in the design should be avoided where these are not otherwise required for the control of stormwater run-off and erosion and sediment control measures. Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads

### 6.3.3 Bare-rumped sheathtail bat

Potential impacts are likely to be further reduced for the bare-rumped sheathtail bat by implementing the following mitigation measures:

- A spotter-catcher must be on-site during clearing activities to identify any potential roost trees (i.e. hollow bearing trees). Any bats found to be potentially affected by the Project construction will be relocated to an alternative nearby empty hollow
- Any identified active roosting maternity colonies within or adjacent to the Project alignment will be considered during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until these roosting maternity colonies have moved on
- Clearing works should be staged to allow bats to leave roosting sites
- No vegetation clearing should occur at night (bright lights can interfere with bat behaviour)

- Clearing of hollow-bearing trees will only occur where necessary and cleared logs/stags will be relocated to adjoining habitat that is to be retained.

#### **6.3.4 Squatter pigeon**

Potential impacts are likely to be further reduced for the squatter pigeon by implementing the following mitigation measures:

- As squatter pigeon nests on the ground and is at high risk of direct mortality. These should be identified and clearly demarcated by a spotter catcher during pre-clearance surveys
- To reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks wherever practicable
- Suitable speed limits to be implemented during construction to reduce risk of vehicle collision for this species.

#### **6.3.5 Red goshawk**

Potential impacts are likely to be further reduced for the red goshawk by implementing the following mitigation measures:

- Tall trees that contain large raptor nests (even if abandoned) should be retained if possible, especially where located along watercourses. These should be identified and clearly demarcated by a spotter catcher during pre-clearance surveys.

## 7.0 Impacts to MNES

A total of fifteen species listed under the EPBC Act are known, likely or have the potential to occur within the study area. The overall risk to MNES values associated with the potential Project impacts differ, based on a combination of factors including the community or species' ecological characteristics and the likely consequence of such impacts. As such, an initial risk assessment was undertaken in accordance with the developed risk framework (Appendix D) and the approach detailed in Section 3.4.

Of the fifteen identified MNES species, the risk assessment determined that thirteen species were at low risk of being significantly impacted by the Project. This included four threatened species and all potentially present migratory species. The primary reasons for this determination were as follows:

- Bare-rumped sheath-tail bat: any individuals that may utilise the project area were not considered to constitute an important population as the study area it is not near the limit of the species range, it was not known to be important for maintaining genetic diversity and it was not known to be a key source population as defined under *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013).
- Red goshawk: although suitable habitat was found within the survey area including nesting as well as foraging and dispersal, habitat was not considered 'habitat critical to the survival of the species' as it does not meet the definition as per *The National recovery plan for the red goshawk* (Department of Environment and Resource Management, 2012)
- White-throated needletail, squatter pigeon (southern) & ghost bat: any individuals that may utilise the survey area were not considered to constitute an important population, nor was there potential habitat within the survey area considered 'habitat critical to the survival of the species'
- Migratory species: available habitat within the survey area was unlikely to support an ecologically significant proportion of the population
- Overall for most species, the area of clearing impact in the context of available habitat that will remain in the surrounding area is low, and unlikely to effect the persistence of the population in the area.

Two MNES were determined to require detailed assessment against the significant impact assessment criteria specified in the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DotE, 2013). These MNES were:

- Black-throated finch
- Northern quoll.

Both the black-throated finch and the northern quoll are listed endangered under the EPBC Act and have referral guidance documents. Based on the recommendations of these referral guidance documents and the quality of habitat provided by the study area, both species were considered to be at potential risk of significant impacts.

The full significant impact assessments are detailed in Appendix D. The results of the assessments concluded that significant impacts to the northern quoll as a result of the Project are unlikely; however potential impacts to the black-throated finch *may* be significant.

The survey area occurs within an 'important area' as defined in *Significant impact guidelines for the endangered black-throated finch (southern)* (DEWHA, 2009). As per these guidelines, where suitable habitat is validated to exist within mapped important areas, the species should be presumed to be present. Whilst the field assessment did not confirm the presence of black-throated finch, potential habitat was recorded. Potential habitat within the survey area is considered habitat critical to the survival of the species due to an abundance of suitable grass species and nesting trees, with the Ross River providing a permanent water source.

Impacts to black-throated finch habitat will be low; and direct impacts (clearing of vegetation) have been minimised as much as possible through design and commitments to rehabilitate the maximum amount of cleared areas during operation are in place. Large adjacent areas of suitable habitat will remain for the affected species that will allow for populations to persist, and the shape and scale of clearing not resulting in a barrier to movement for these species. However, it is anticipated that a net

loss of nesting trees within 1km of a permanent water source (the Ross River) will occur as a result of the Project, which is an adverse impact to habitat critical to the survival of the species. As per the *Significant impact guidelines for the endangered black-throated finch (southern)* (Department of the Environment Water Heritage and the Arts, 2009), this form of disturbance can significantly impact the species.

Potential habitat for northern quoll within the study area is considered habitat critical to the survival of the species as it comprises suitable foraging and dispersal habitat in close proximity to denning habitat associated with Mount Stuart. Given the extent of potential denning habitat at Mount Stuart, potential exists for the adjacent area to support a population of northern quoll that is considered important. As specified by the EPBC Act Referral guideline for the northern quoll, actions which are likely to impact on habitat critical to the species *may* have a significant impact. Whilst some direct impacts to habitat critical to the survival of the species will occur as a result of the Project, this habitat is associated with foraging and dispersal habitat rather than denning habitat, which is highly abundant in the surrounding landscape. Therefore, in the context of the wider area, impacts on northern quoll, including habitat critical to the survival of the species are low and not considered significant.

A summary of the impact assessment process and overall direct impacts on MNES is provided in Table 16 below.

**Table 16 Outcome of Risk Assessment/Significant Impact Assessments and area of potential habitat for MNES species and communities**

MNES		Outcome of Risk Assessment	Significant Impact Expected (Yes/No)	Impacts within study area (ha)
<b>Conservation significant fauna</b>				
Black-throated finch (southern)	Breeding / Foraging / dispersal	Potential risk	No	15.46
Northern quoll	Breeding / denning / foraging / dispersal	Potential risk	No	0.16
	Foraging and dispersal only			15.30
Bare-rumped sheathtail bat	Breeding / roosting / foraging / dispersal	Low risk	No	15.46
	Foraging / Dispersal only			0
Red goshawk	Breeding / nesting / foraging / dispersal	Low risk	No	15.46
	Foraging / dispersal only			0
White-throated needletail	Foraging / dispersal	Low risk	No	15.46
Ghost bat	Foraging / dispersal	Low risk	No	15.46
Squatter pigeon	Foraging / dispersal	Low risk	No	15.46
<b>Migratory fauna</b>				
Fork-tailed swift	Foraging / dispersal	Low risk	No	15.46
Oriental cuckoo	Foraging / dispersal	Low risk	No	15.46
Satin flycatcher	Breeding / foraging / dispersal	Low risk	No	15.46
Rufous fantail	Breeding / foraging / dispersal	Low risk	No	2.46
Black-faced monarch	Foraging / dispersal	Low risk	No	2.46
Little curlew	Foraging / roosting	Low risk	No	15.46
Eastern osprey	Foraging / dispersal	Low risk	No	0.42
	Flyover habitat			2.11
Estuarine crocodile	Breeding / foraging / dispersal	Low risk	No	0.27

## 8.0 Conclusion and recommendations

AECOM was engaged by Townsville City Council to deliver the detailed design for the RRD to DWTP pipeline (the Project). The package of work included an ecological assessment to identify ecological values and potential project related impacts. The results of this assessment will inform and support the planning and approvals for the Project.

Ecological values validated within the study area include remnant and intact vegetation communities that support a range of habitat values and resources for a diversity of flora and fauna species, including conservation significant species. Cleared areas associated with existing access tracks, powerline easements and fence lines also occur throughout the study area.

A targeted field survey confirmed presence of the bare-rumped sheathtail bat, listed as vulnerable under the EPBC Act and endangered under the NC Act. Five conservation significant species are also considered likely to occur; the black-throated finch, coastal sheathtail bat, fork-tailed swift, white-throated needletail and estuarine crocodile. A further ten conservation significant species are considered to potentially occur within the study area, including; red goshawk, squatter pigeon (southern), oriental cuckoo, black-faced monarch, satin flycatcher, little curlew, rufous fantail, osprey, northern quoll and ghost bat.

Of note is the likely presence of black-throated finch within the study area. Whilst the black-throated finch was not seen during the field survey, there are records for the black-throated finch located within the Mount Stuart area approximately 8 km to the east, and on Bohle River 3 km to the west of the project area. A previous study undertaken in 2008 identified black-throated finch nests within and adjacent to the study area. The study area also sits within the Greater Townsville Important Areas for the black-throated finch. The study area contains the preferred habitat of this species, such as palatable foraging grass species, suitable nesting trees and access to a permanent source of fresh water.

Potential direct and indirect impacts to ecological values may occur as a result of the Project. However, with the sensitive siting and design of the Project, including the prioritisation of co-locating the new pipeline with existing cleared areas and the reduced corridor width of 25 m, impacts have been substantially reduced. Total maximum clearing of vegetation communities and habitats has been calculated at 15.46 ha. Furthermore, approximately 30% of the pipeline easement will be rehabilitated, returning some ecological values to the area such as foraging resources. Suitable mitigation and management techniques have also been developed to remove or further reduce impacts, particularly indirect impacts to ecological values.

MNES identified within the study area are restricted to threatened and migratory species and associated potential habitat. An impact assessment for known, likely and potentially occurring MNES within the study area was completed via a two-step process. The initial risk assessment identified that the majority of potentially occurring threatened and migratory species are at a low risk of significant impact as defined under the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (Department of the Environment, 2013), due to the combination of the following factors:

- study area lacking habitat critical for the survival or important habitat for the particular species
- inability of the study area to support an important population or ecologically significant proportion of a population.

the area of clearing impact in the context of available similar habitat that will remain in the surrounding area is low and unlikely to affect the persistence of the population in the area. However, black-throated finch and northern quoll were identified as a potential risk of significant impact and were further assessed under the detailed significant impact criteria outlined in the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (Department of the Environment, 2013).

The finding of this assessment determined a potential significant impact on habitat critical to the survival for the black-throated finch. This is due to the anticipated net loss of nesting trees within close proximity to a permanent water source. Significant impacts on northern quoll are not anticipated as a result of the Project as whilst habitat critical to the survival of the species will be removed, this habitat

is associated with foraging and dispersal habitat which is highly abundant in the surrounding landscape. Therefore, in the broader context, impacts are low.

Based on the outcome of the significant impact assessment, it is recommended that the Project is referred to DAWE for potential impacts to black-throated finch. Whilst impacts to northern quoll are unlikely to be significant, the Project is likely to be considered high risk as per the species-specific referral guidelines and therefore should also be considered in the Project referral to DAWE.

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# Appendix A

Report figures

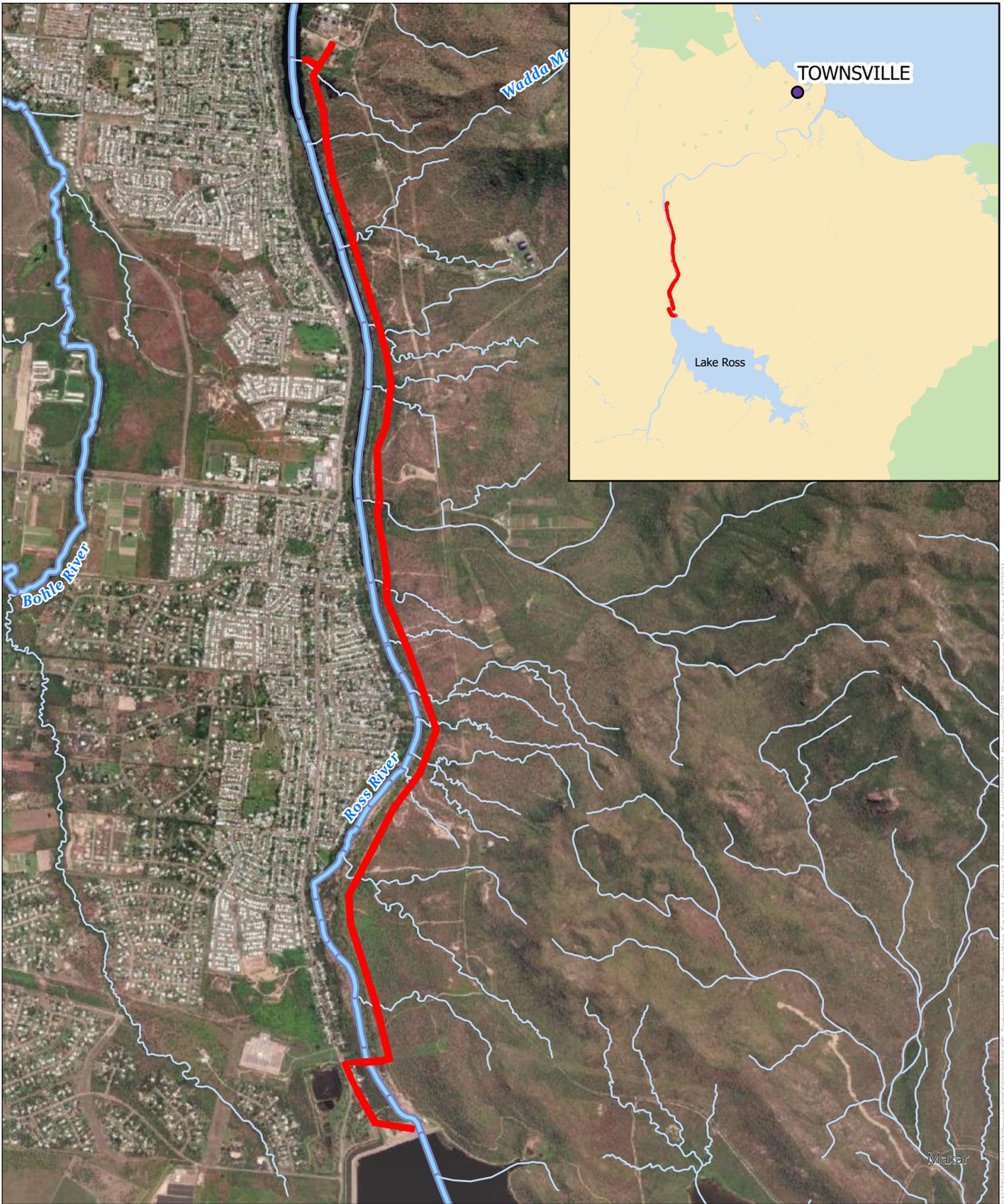


Figure 1: Project area

Legend

- Project area
- Watercourses
- Major
- Minor
- Townships

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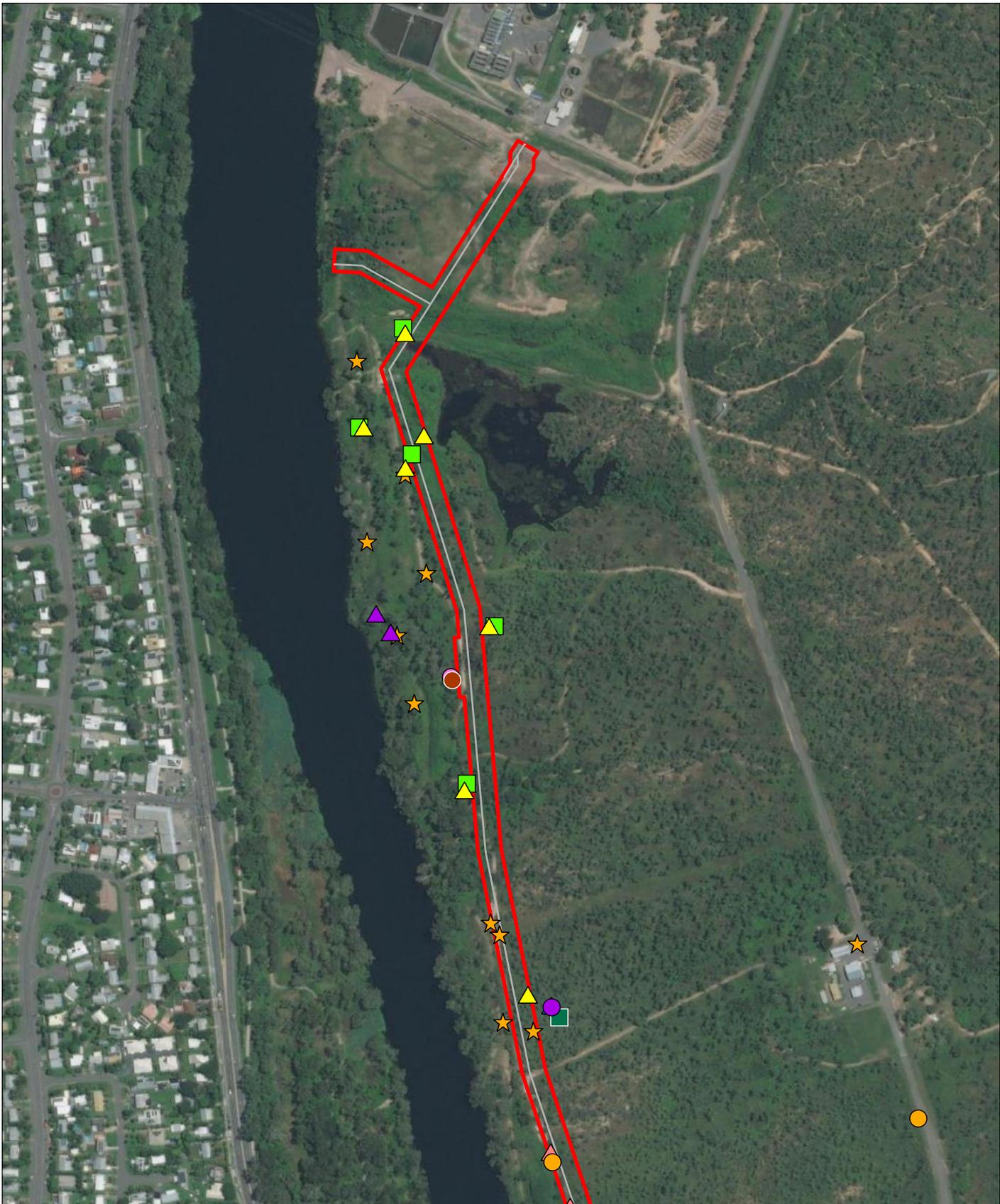
N

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**Figure 2: Survey locations Map 1 of 8**

- Legend**
- Project area
  - Pipeline
- Survey types**
- ★ General observation
  - ▲ Fauna observation
  - Quaternary assessment
  - ▲ Black-throated finch habitat assessment
  - Tertiary assessment
  - Active search
  - Bird census
  - Anabat
  - Spotlighting

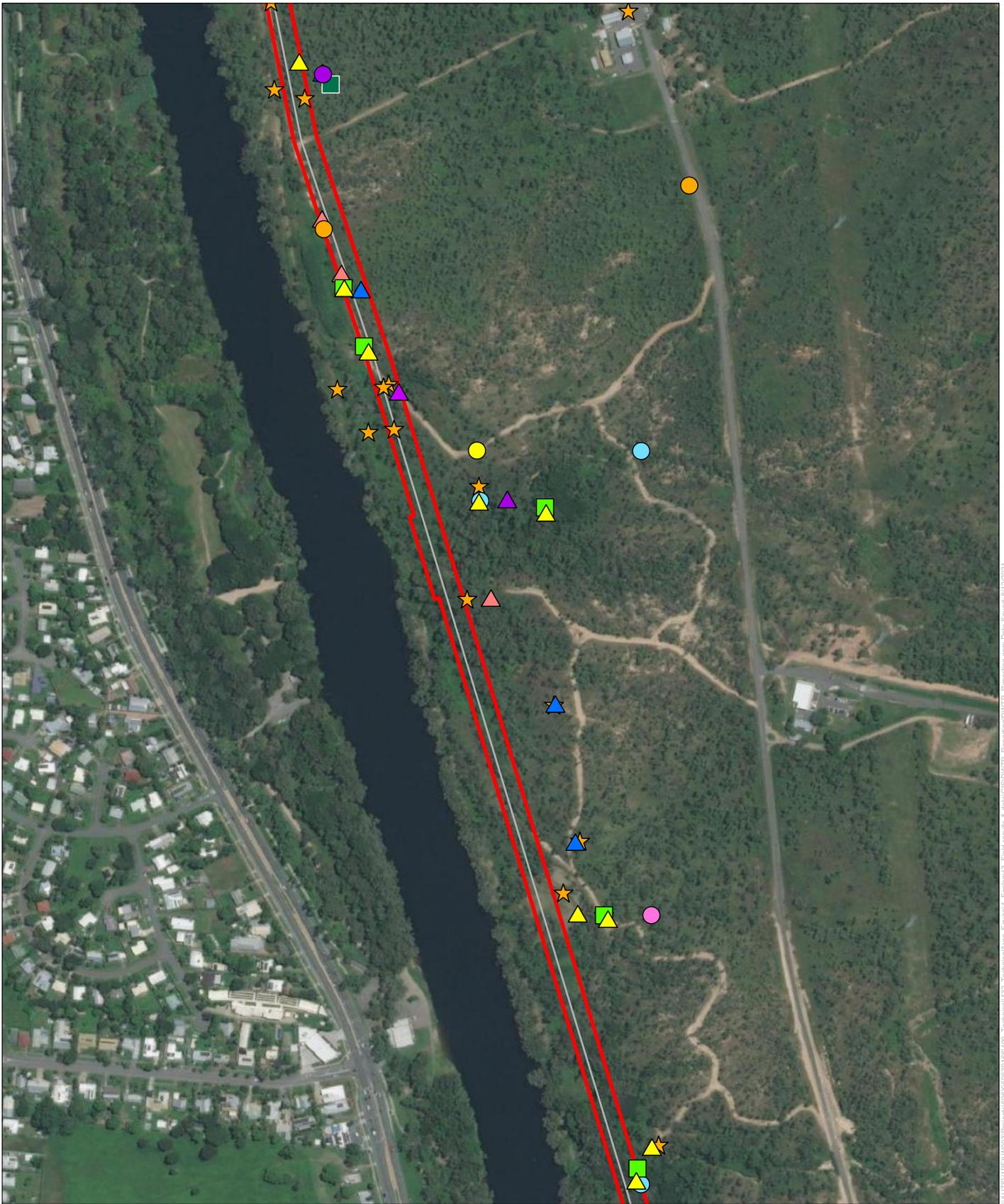
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N

0      100      200  
 Meters

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**Figure 2: Survey locations Map 2 of 8**

**Legend**

- |   |   |   |
|---|---|---|
|  Project area         |  Flora observation                       |  Active search |
|  Pipeline             |  Tertiary assessment                     |  Anabat        |
| <b>Survey types</b>   |  General habitat assessment              |  Remote camera |
|  General observation |  Black-throated finch habitat assessment |  Spotlighting  |
|  Fauna observation   |   |  Call playback |



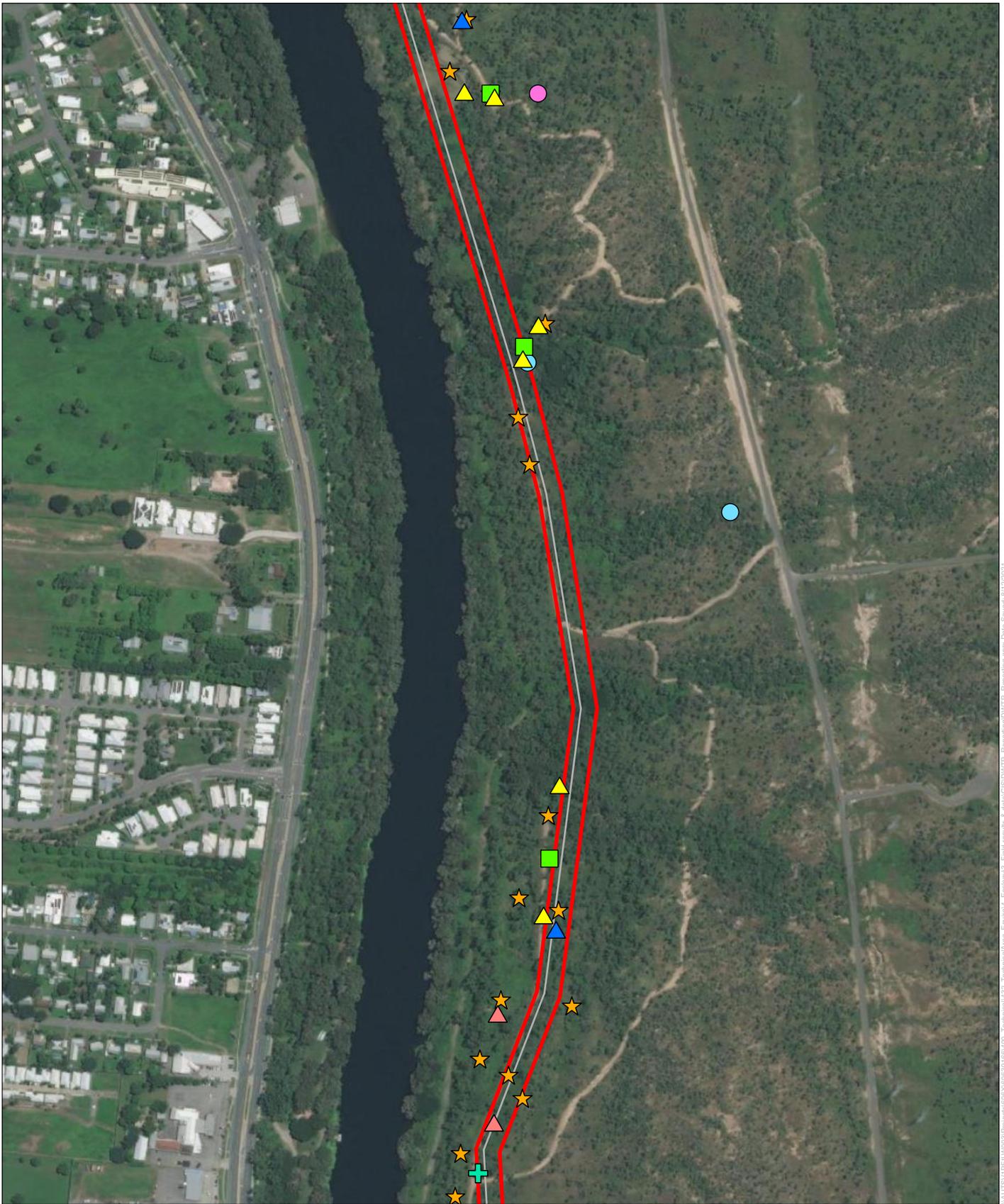
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**Figure 2: Survey locations Map 3 of 8**

 Project area

 Pipeline

**Survey types**

 General observation

 General habitat assessment

 Black-throated finch habitat assessment

 Anabat

 Remote camera

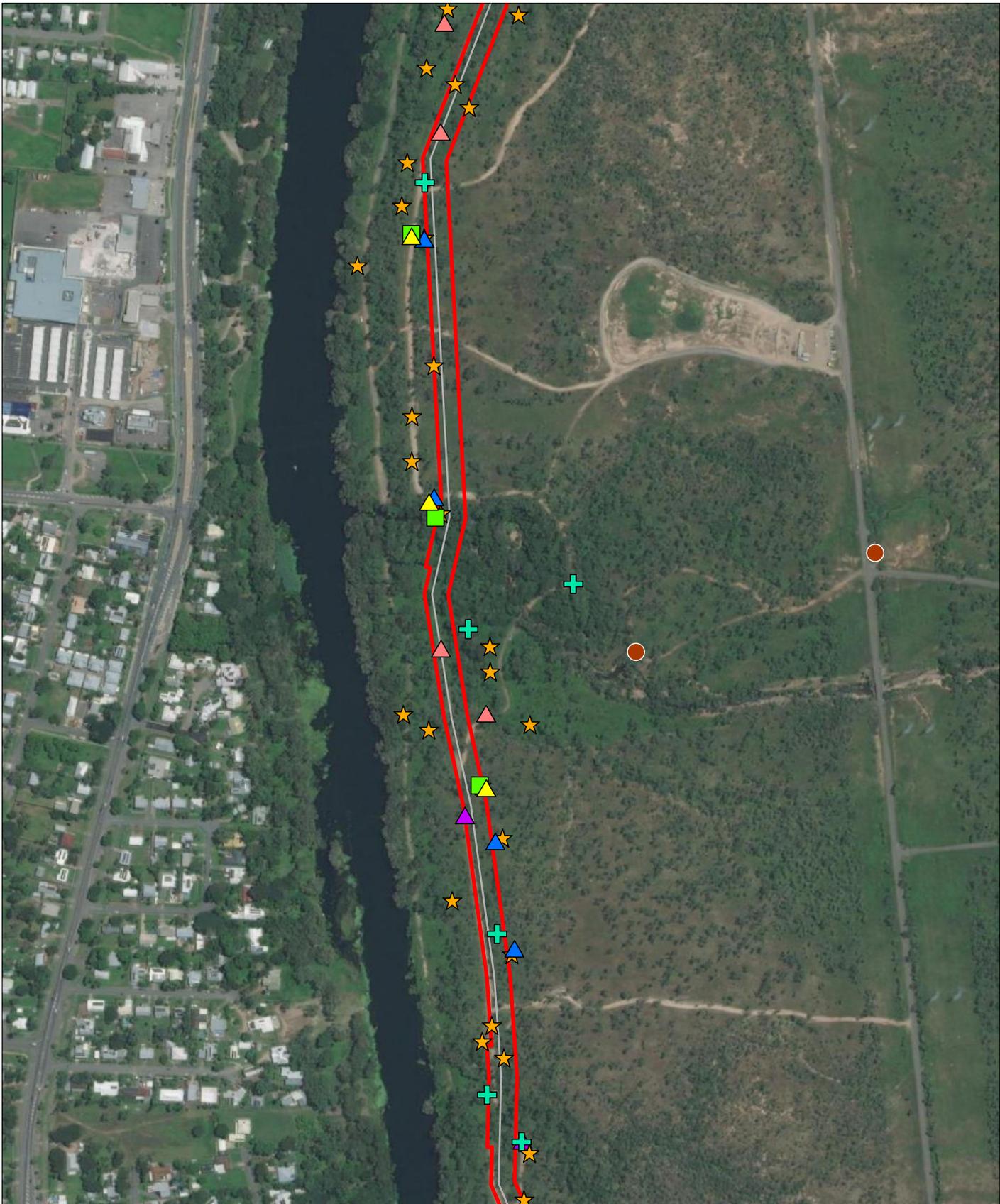


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**Figure 2: Survey locations Map 4 of 8**

- Legend**
- Project area
  - Pipeline
- Survey types**
- ★ General observation
  - + Animal breeding place

- ▲ Fauna observation
- ▲ General habitat assessment
- ▲ Black-throated finch habitat assessment
- Bird census



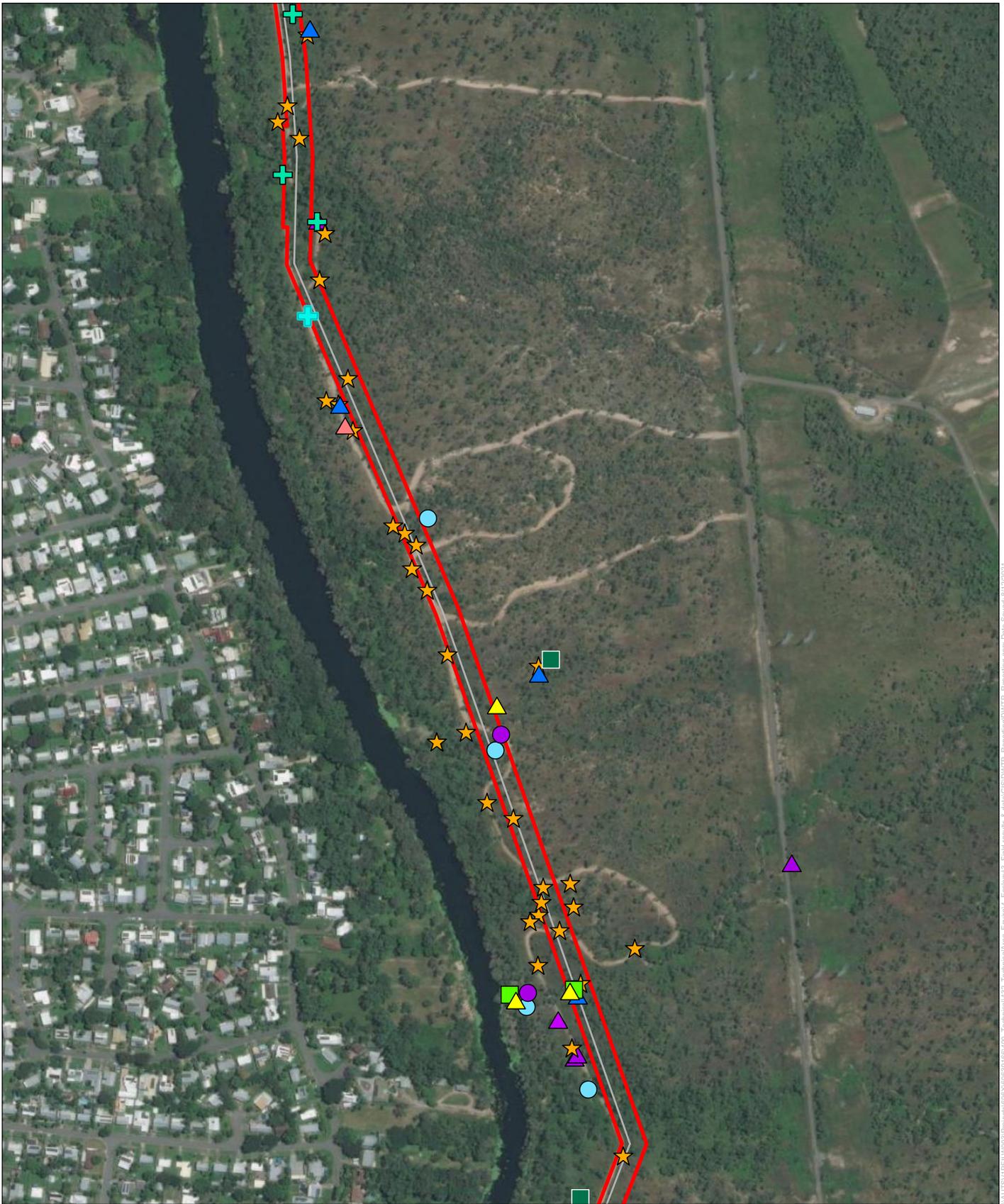
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**Figure 2: Survey locations Map 5 of 8**

- Legend**
- Project area
  - Pipeline
  - Survey types**
  - ★ General observation
  - + Animal breeding place
  - ▲ Fauna observation
  - ▲ Flora observation
  - Tertiary assessment
  - ▲ General habitat assessment
  - ▲ Black-throated finch habitat assessment
  - Active search
  - Remote camera



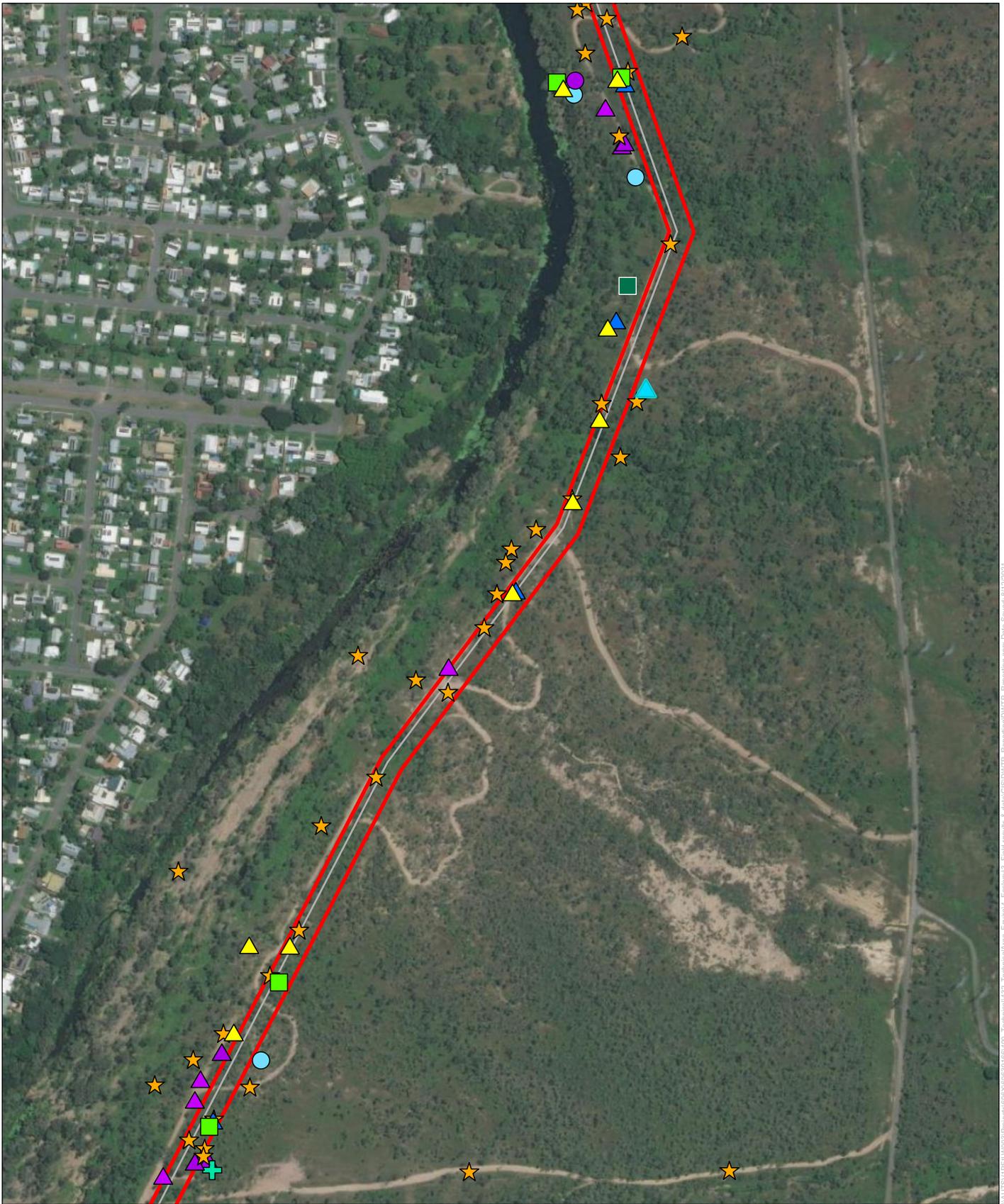
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**Figure 2: Survey locations Map 6 of 8**

- Legend**
- Project area
  - Pipeline
  - Tertiary assessment
  - General habitat assessment
  - Black-throated finch habitat assessment
  - Fauna observation
  - Animal breeding place
  - Active search
  - Remote camera
  - General observation
- Survey types**
- General observation
  - Animal breeding place
  - Fauna observation
  - Active search
  - Remote camera

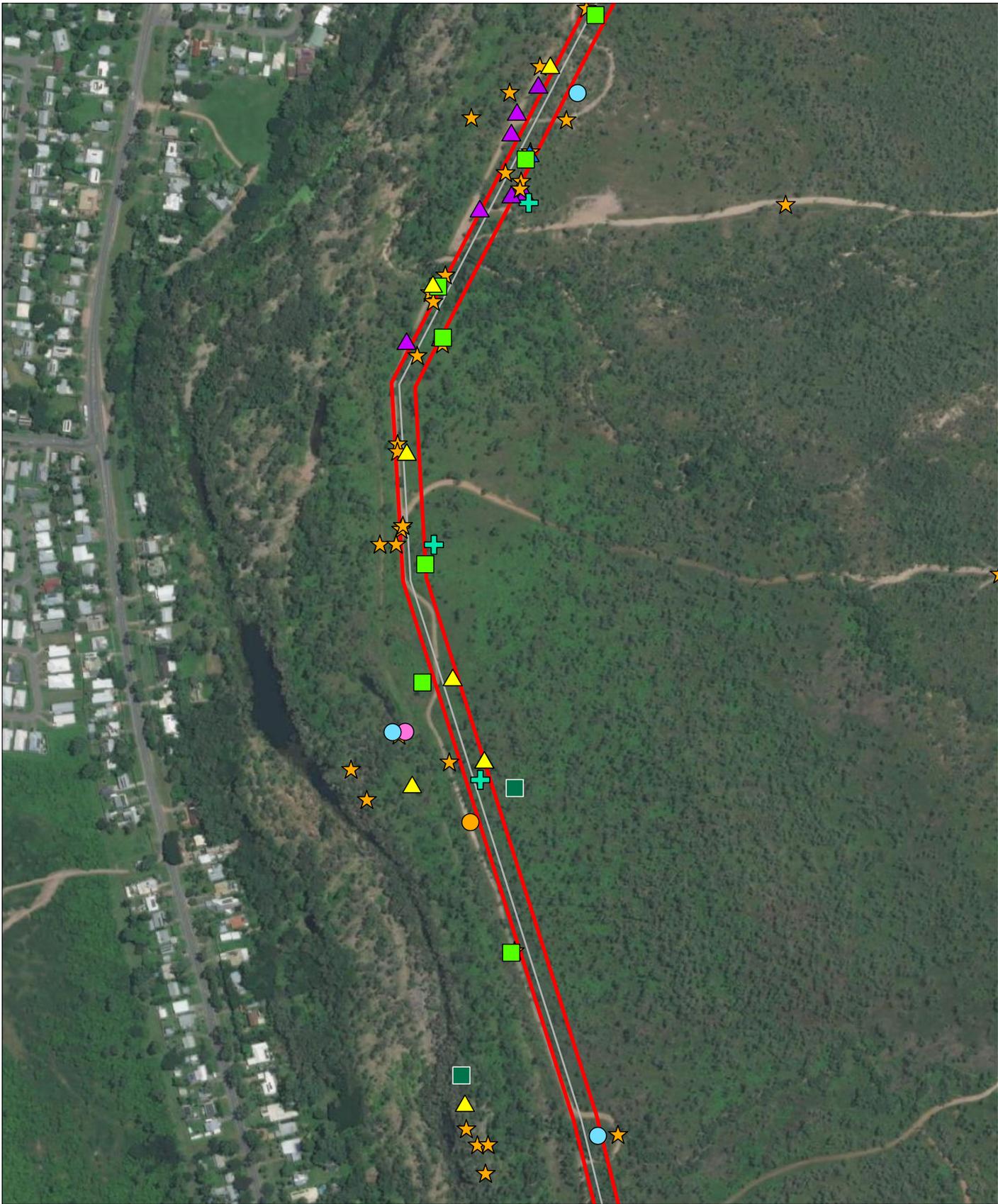


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**Figure 2: Survey locations Map 7 of 8**

**Legend**

- |   |   |
|---|---|
|  Project area           |  General habitat assessment              |
|  Pipeline               |  Black-throated finch habitat assessment |
| <b>Survey types</b>   |  Anabat                                  |
|  General observation   |  Remote camera                           |
|  Animal breeding place |  Spotlighting                            |
|  Fauna observation     |   |
|  Tertiary assessment   |   |



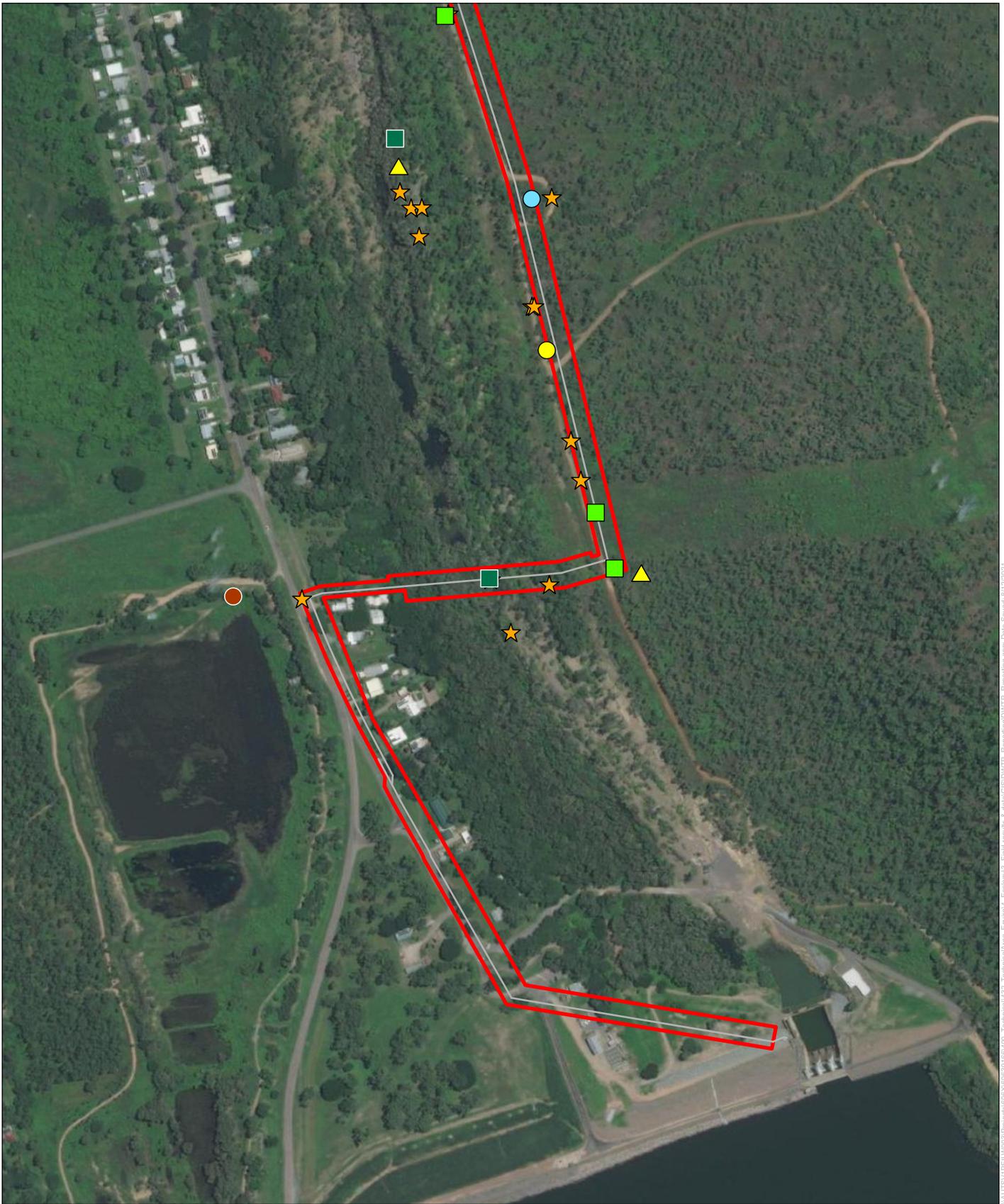
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**Figure 2: Survey locations Map 8 of 8**

Project area

— Pipeline

Survey types

★ General observation

■ Quaternary assessment

■ Tertiary assessment

▲ General habitat assessment

● Bird census

● Remote camera

● Call playback



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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 1 of 8**

**Legend**

— Pipeline

▭ Project area

**Vegetation management category**

▭ Category A or B area that is least concern

▭ Category C or R area that is of least concern

Non-remnant



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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 2 of 8**

**Legend**

- Pipeline
- Project area
- Vegetation management category**
- Category A or B area that is least concern
- Non-remnant



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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 4 of 8**

**Legend**

- |  |   |
|--|---|
|  Pipeline          | <b>Vegetation management category</b>   |
|  Project area      |  Category A or B area that is least concern    |
|  Essential Habitat |  Category C or R area that is of least concern |
|  | <b>Non-remnant</b>  |

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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 5 of 8**

**Legend**

- |  |   |
|--|---|
|  Pipeline          | <b>Vegetation management category</b>   |
|  Project area      |  Category A or B area that is least concern    |
|  Essential Habitat |  Category C or R area that is of least concern |
|  |  Non-remnant                                   |



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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 6 of 8**

**Legend**

- |  |   |
|--|---|
|  Pipeline          | <b>Vegetation management category</b>   |
|  Project area      |  Category A or B area that is least concern    |
|  Essential Habitat |  Category C or R area that is of least concern |
|  | Non-remnant   |

**AECOM**

0 100 200  
Meters

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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 7 of 8**

**Legend**

- |  |   |
|--|---|
|  Pipeline          | <b>Vegetation management category</b>   |
|  Project area      |  Category A or B area that is least concern    |
|  Essential Habitat |  Category C or R area that is of least concern |
|  | <b>Non-remnant</b>  |



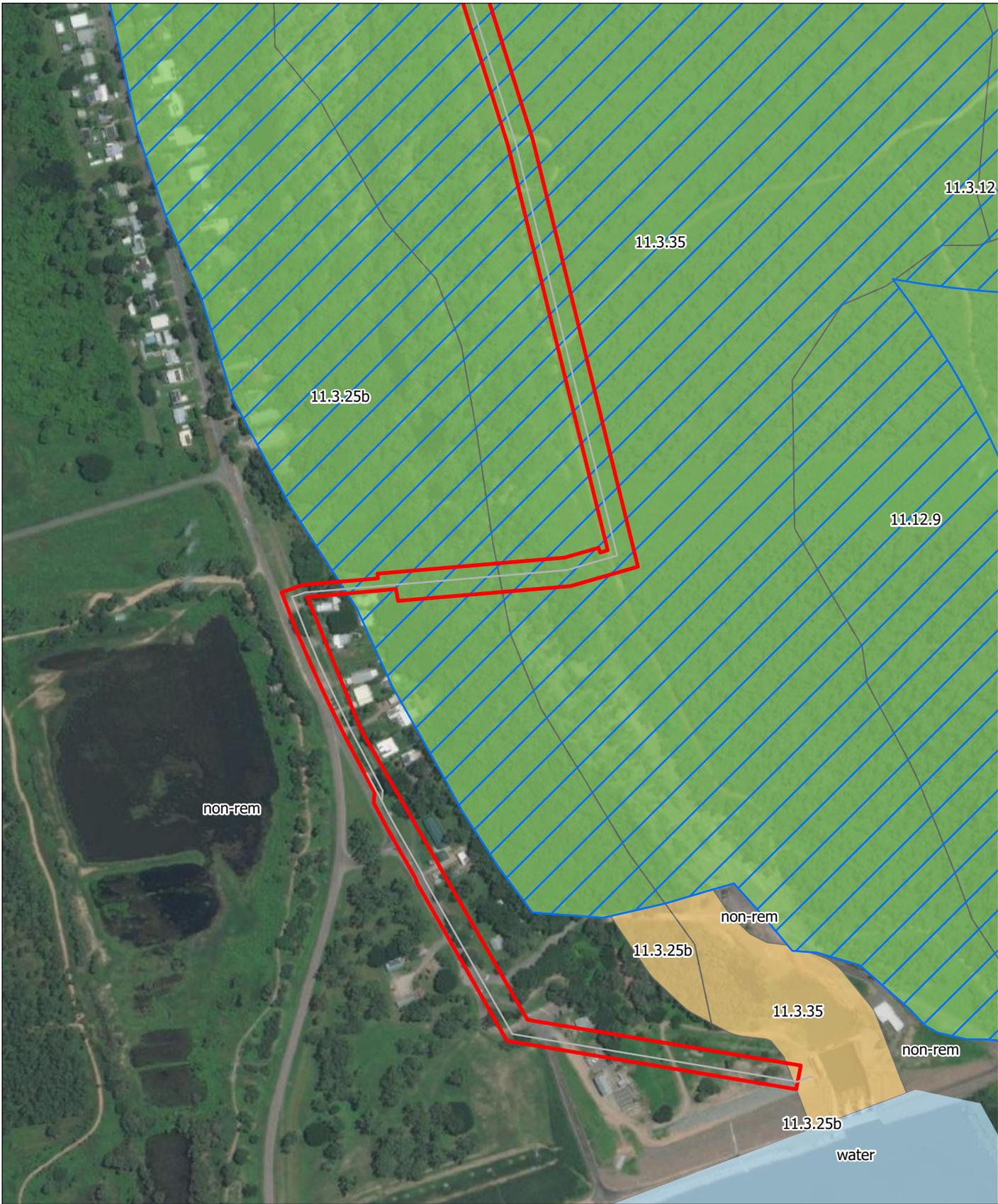
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**Figure 3: State mapped regional ecosystems and Essential Habitat**  
**Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Essential Habitat
-  Category A or B area that is least concern
-  Category C or R area that is of least concern
-  Water
-  Non-remnant



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**Figure 4: Ground-truthed regional ecosystems Map 1 of 8**

**Legend**

- Pipeline
- Project area
- Ground-truthed regional ecosystems
- 11.3.25b
- 11.3.30
- 11.3.35
- 11.3.12
- Non-remnant



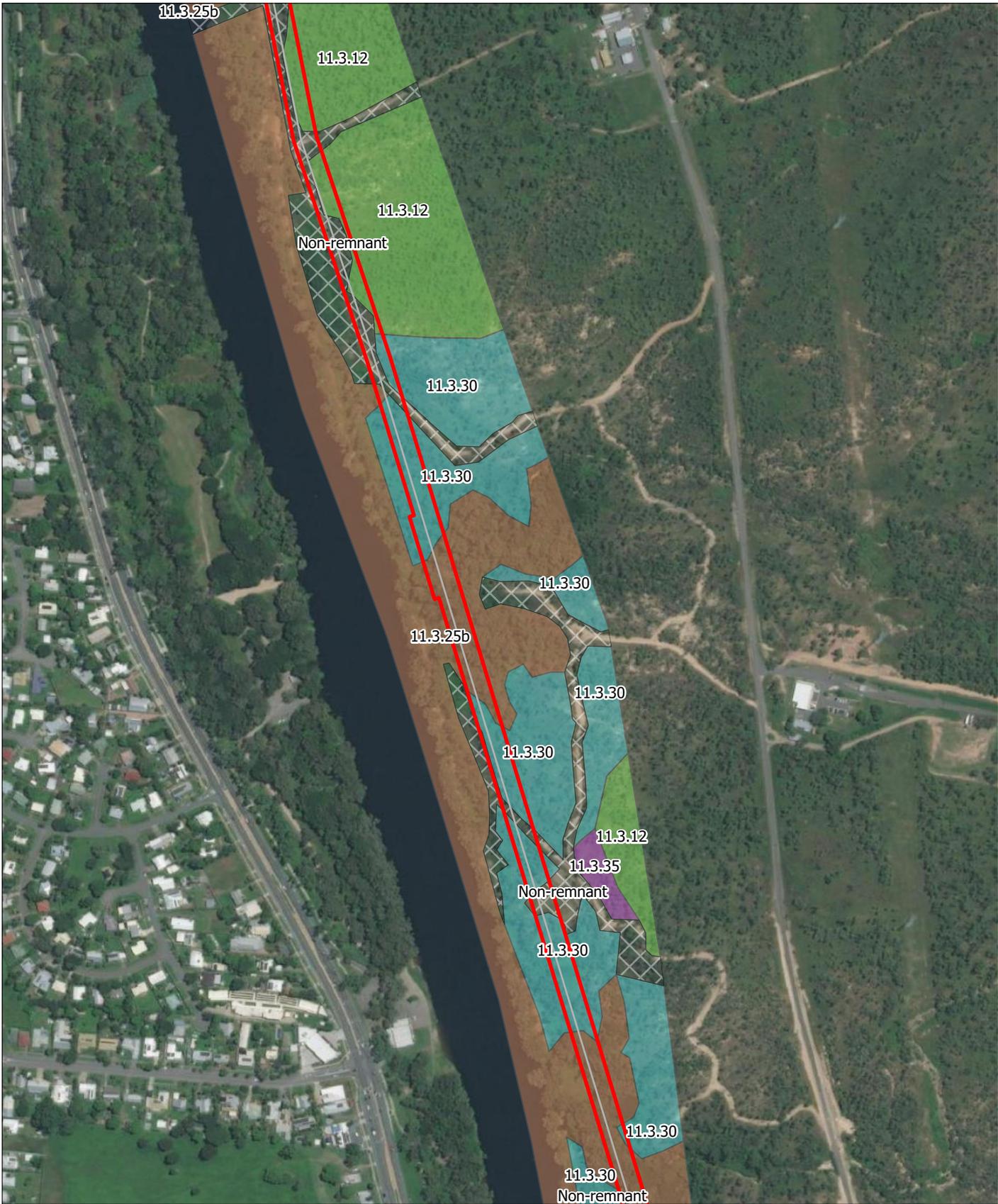
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**Figure 4: Ground-truthed regional ecosystems Map 2 of 8**

**Legend**

- Pipeline
- Project area
- Ground-truthed regional ecosystems
- 11.3.12
- 11.3.25b
- 11.3.30
- 11.3.35
- Non-remnant



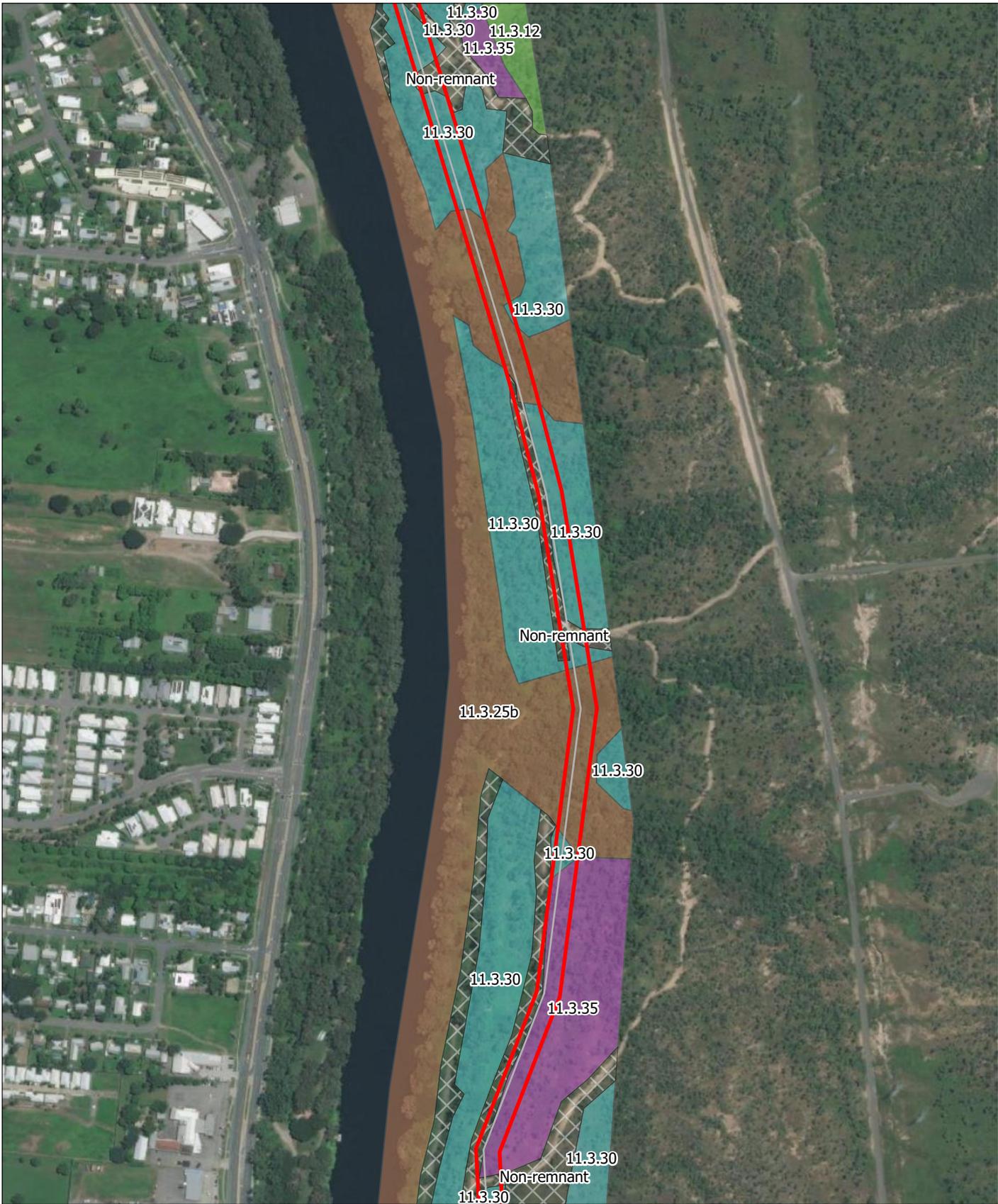
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**Figure 4: Ground-truthed regional ecosystems Map 3 of 8**

**Legend**

- Pipeline
- Project area
- Ground-truthed regional ecosystems
- 11.3.12
- 11.3.25b
- 11.3.30
- 11.3.35
- Non-remnant



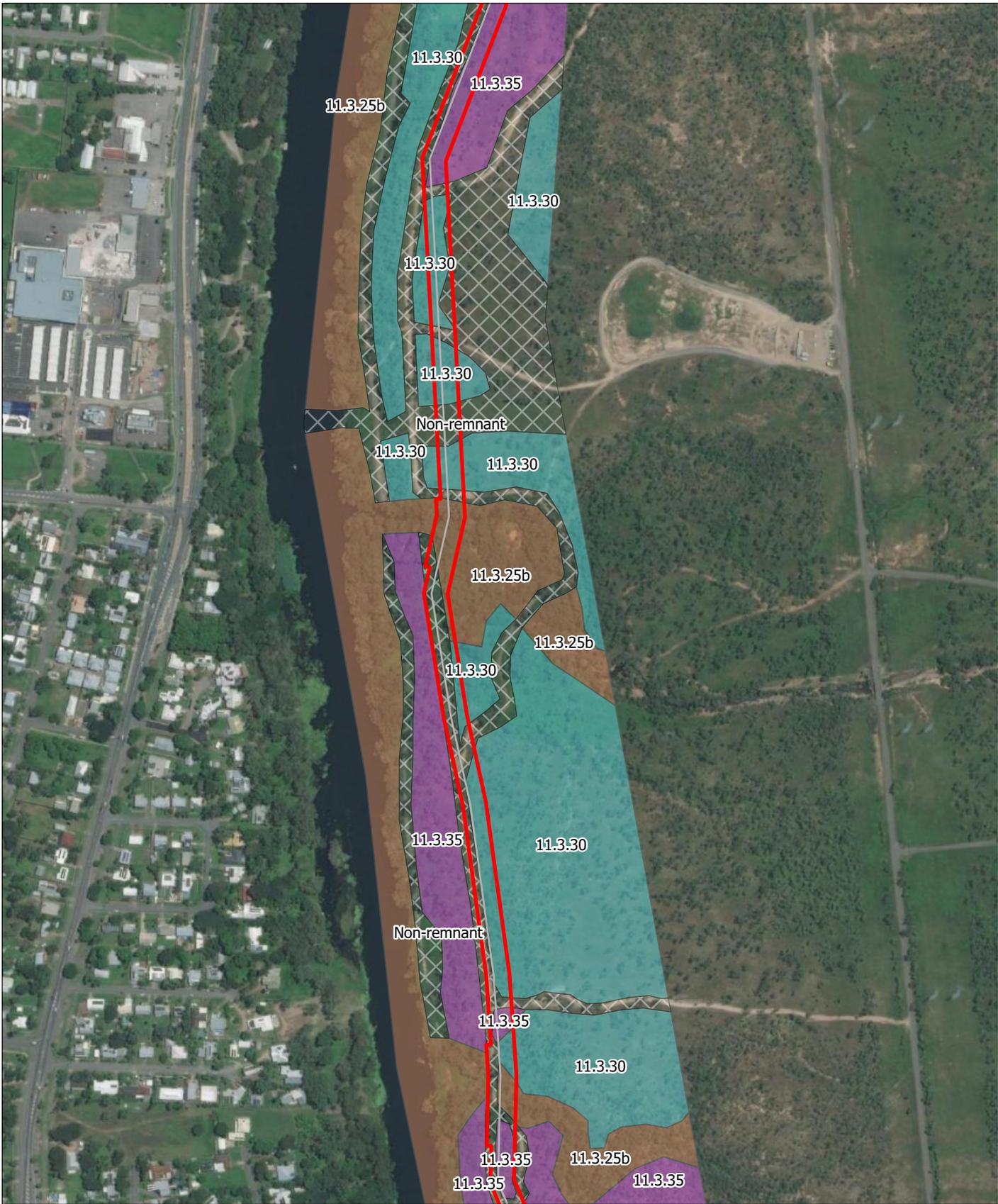
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**Figure 4: Ground-truthed regional ecosystems Map 4 of 8**

**Legend**

- Pipeline
- Project area
- Ground-truthed regional ecosystems
- 11.3.30
- 11.3.35
- Non-remnant
- 11.3.25b



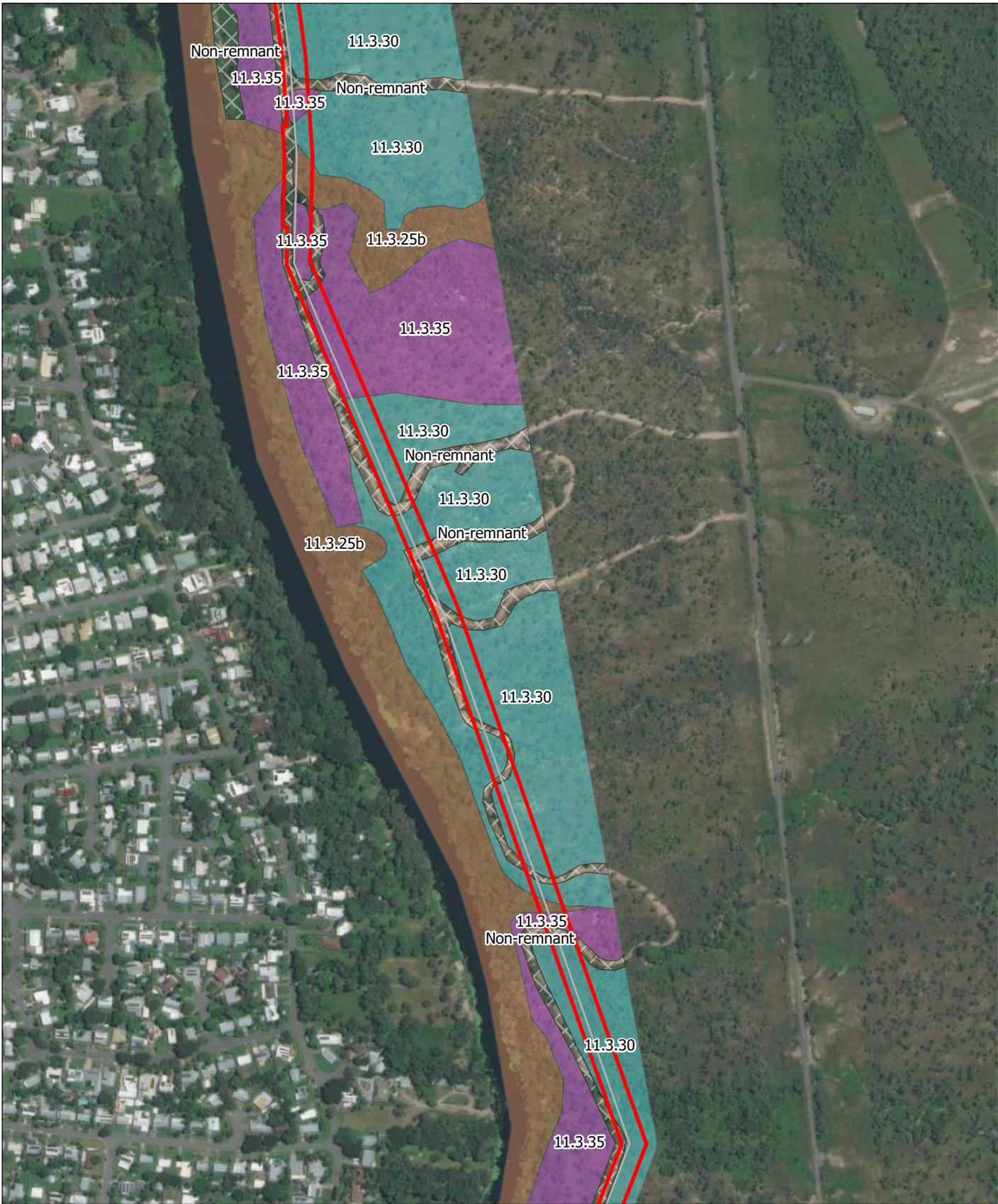
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**Figure 4: Ground-truthed regional ecosystems Map 5 of 8**

**Legend**

- Pipeline
- Project area
- Ground-truthed regional ecosystems
  - 11.3.30
  - 11.3.35
  - Non-remnant
  - 11.3.25b



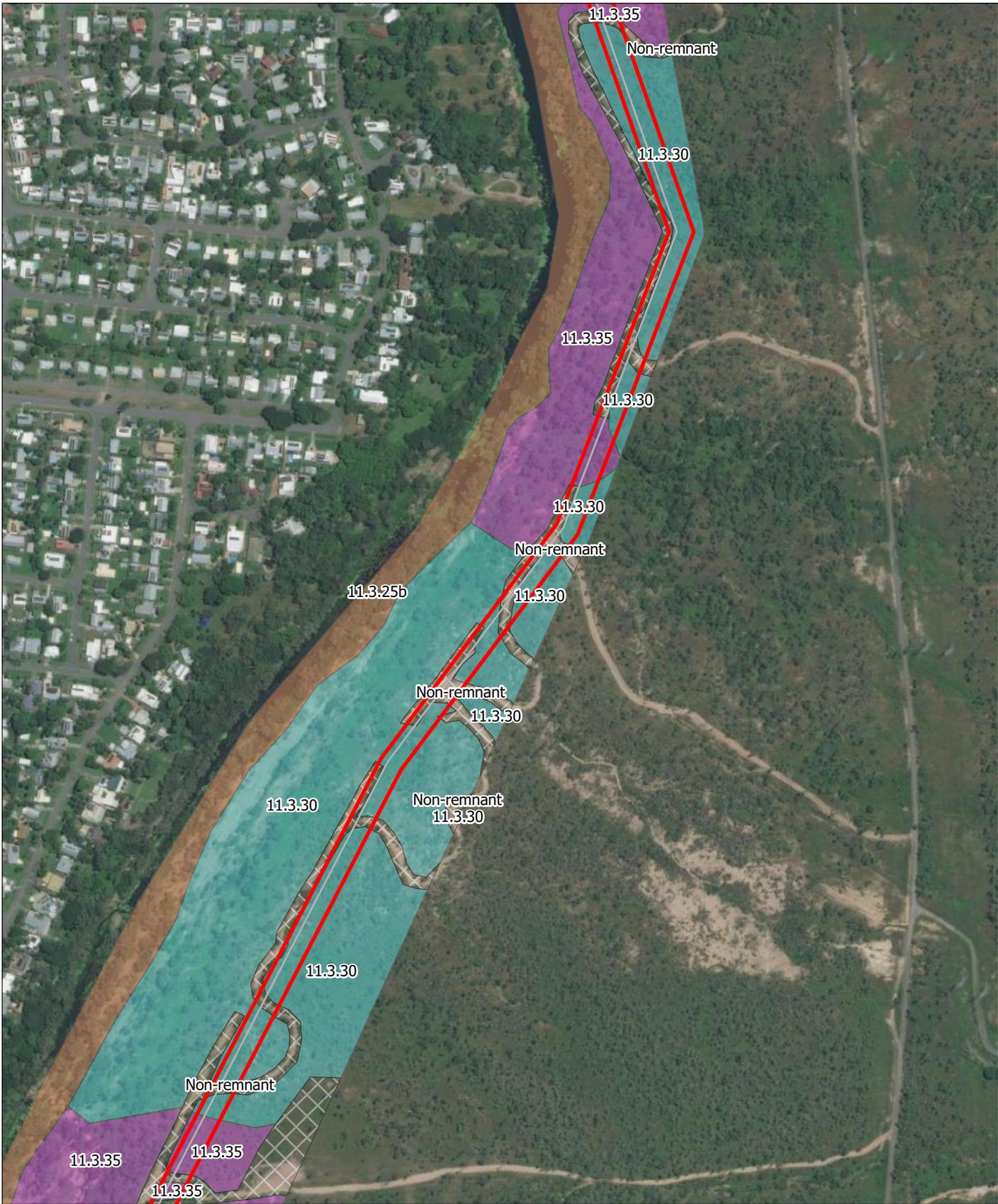
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**Figure 4: Ground-truthed regional ecosystems Map 6 of 8**

**Legend**

- Pipeline
- Project area
- Ground-truthed regional ecosystems
- 11.3.30
- 11.3.35
- 11.3.25b
- Non-remnant



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**Figure 4: Ground-truthed regional ecosystems Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
- Ground-truthed regional ecosystems**
-  11.3.25b
-  11.3.30
-  11.3.35
-  11.12.9
-  Non-remnant



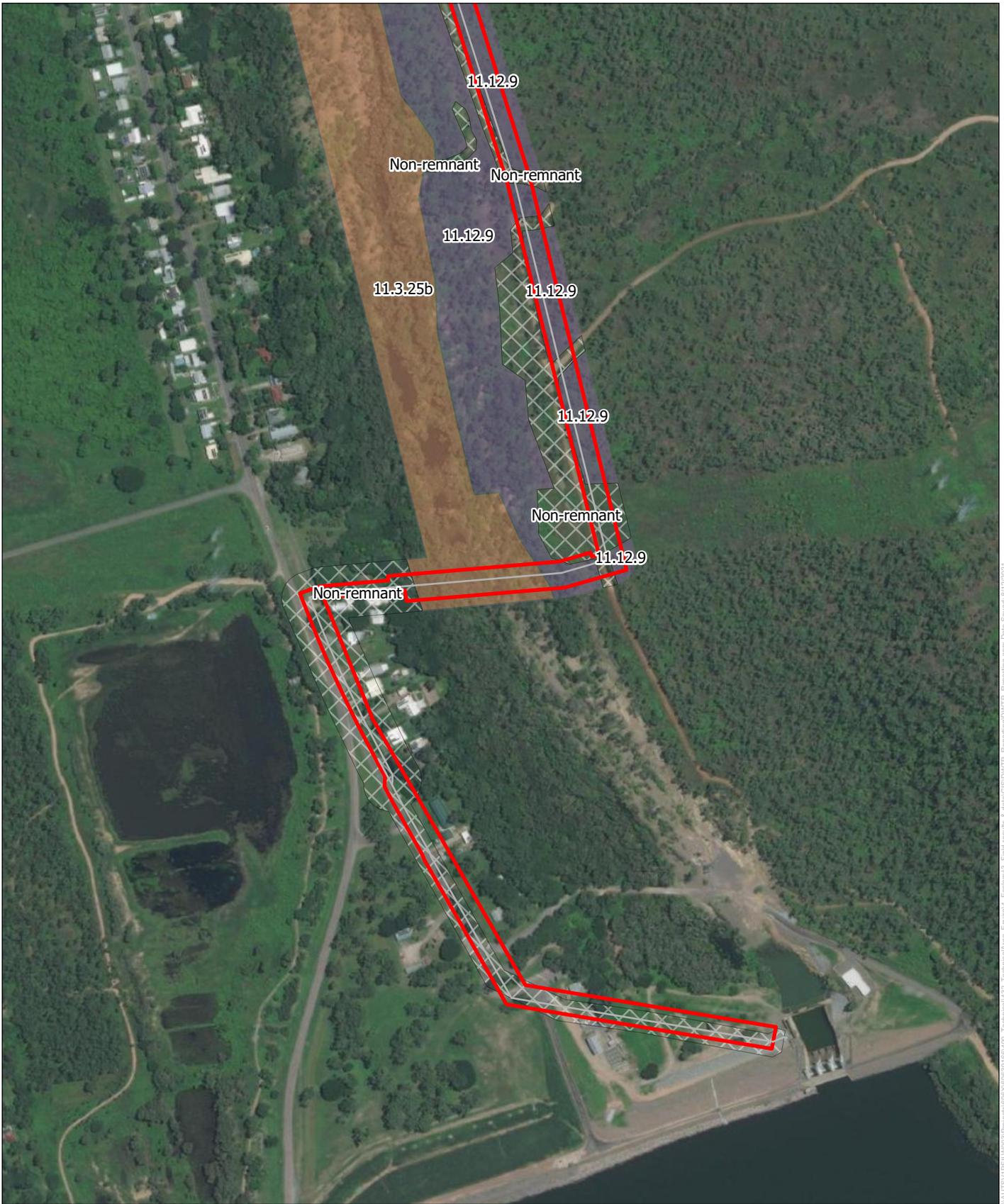
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**Figure 4: Ground-truthed regional ecosystems Map 8 of 8**

**Legend**

- Pipeline
- Project area
- 11.3.25b
- 11.12.9
- Non-remnant



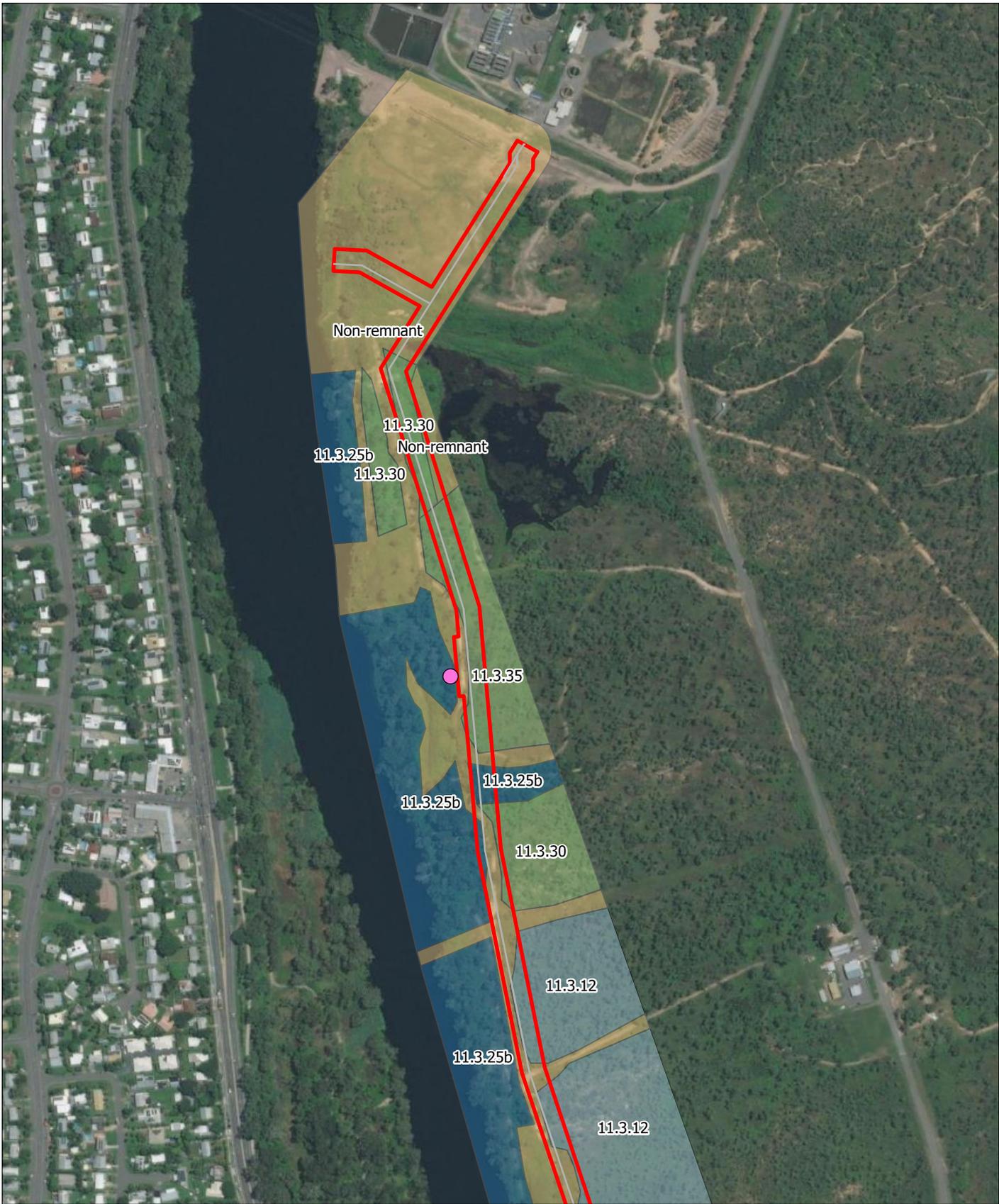
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**Figure 5: Fauna habitat Map 1 of 8**

**Legend**

- Pipeline
- Project area
- Bare-rumped sheattail bat record (anabat)
- 1. Melaleuca woodland on alluvial plains
- 2. Melaleuca riparian woodland
- 3. Eucalyptus woodland on alluvial plains
- 5. Non-remnant alluvial plains



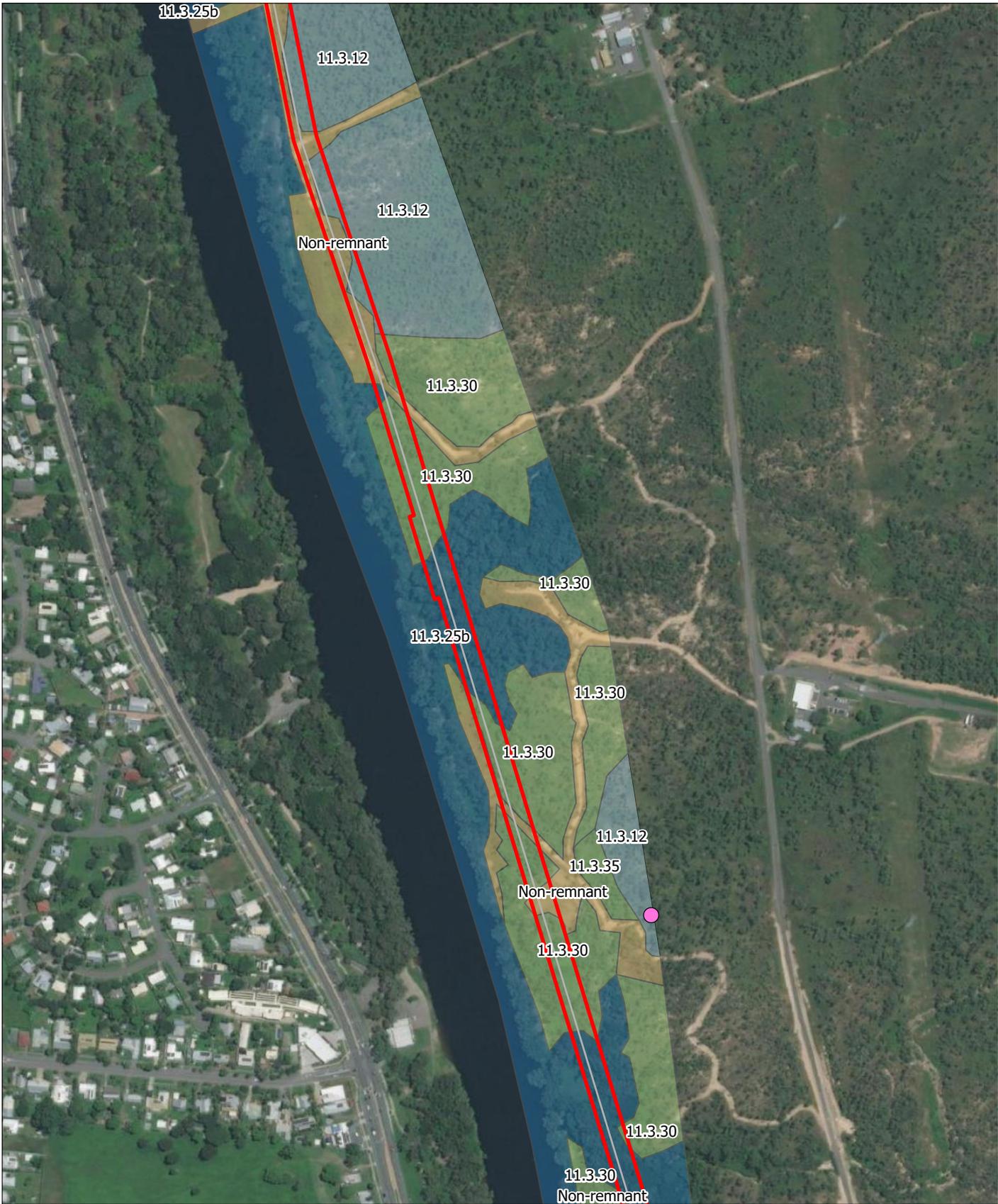
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**Figure 5: Fauna habitat Map 2 of 8**

**Legend**

- Pipeline
- Project area
- Bare-rumped sheathtail bat record (anabat)
- 2. Melaleuca riparian woodland
- 3. Eucalyptus woodland on alluvial plains
- 5. Non-remnant alluvial plains

**Fauna habitat types**

- 1. Melaleuca woodland on alluvial plains



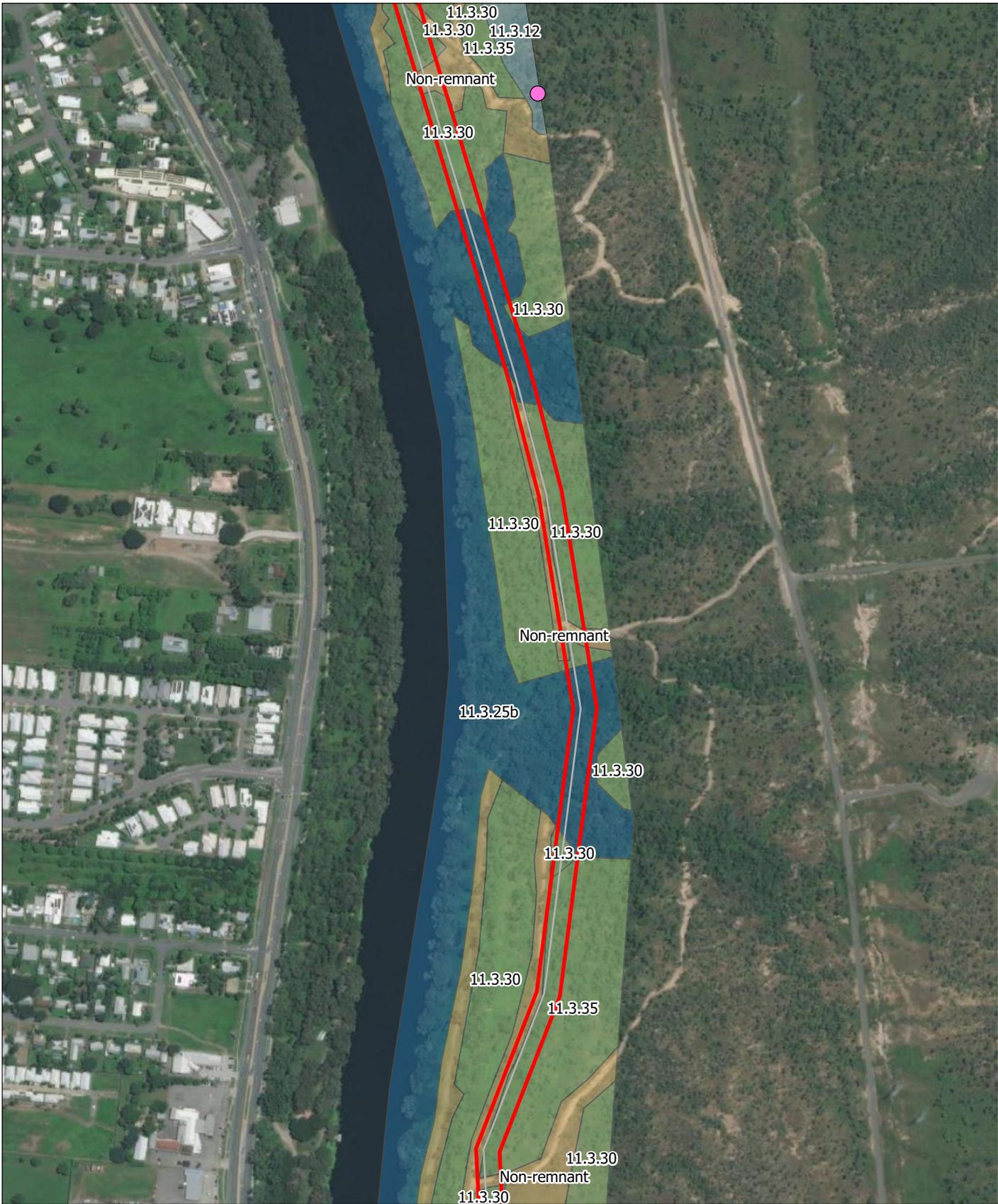
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**Figure 5: Fauna habitat Map 3 of 8**

**Legend**

- Pipeline
- Project area
- Bare-rumped sheattail bat record (anabat)
- 2. Melaleuca riparian woodland
- 3. Eucalyptus woodland on alluvial plains
- 5. Non-remnant alluvial plains

**Fauna habitat types**

- 1. Melaleuca woodland on alluvial plains



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Figure 5: Fauna habitat Map 4 of 8

Legend

- Pipeline
  - Project area
  - Bare-rumped sheattail bat record (anabat)
- Fauna habitat types
- 2. Melaleuca riparian woodland
  - 3. Eucalyptus woodland on alluvial plains
  - 5. Non-remnant alluvial plains



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**Figure 5: Fauna habitat Map 5 of 8**

**Legend**

- Pipeline
  - Project area
  - Bare-rumped sheathtail bat record (anabat)
- Fauna habitat types**
- 2. Melaleuca riparian woodland
  - 3. Eucalyptus woodland on alluvial plains
  - 5. Non-remnant alluvial plains



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**Figure 5: Fauna habitat Map 6 of 8**

**Legend**

- Pipeline
  - Project area
  - Bare-rumped sheattail bat record (anabat)
- Fauna habitat types**
- 2. Melaleuca riparian woodland
  - 3. Eucalyptus woodland on alluvial plains
  - 5. Non-remnant alluvial plains



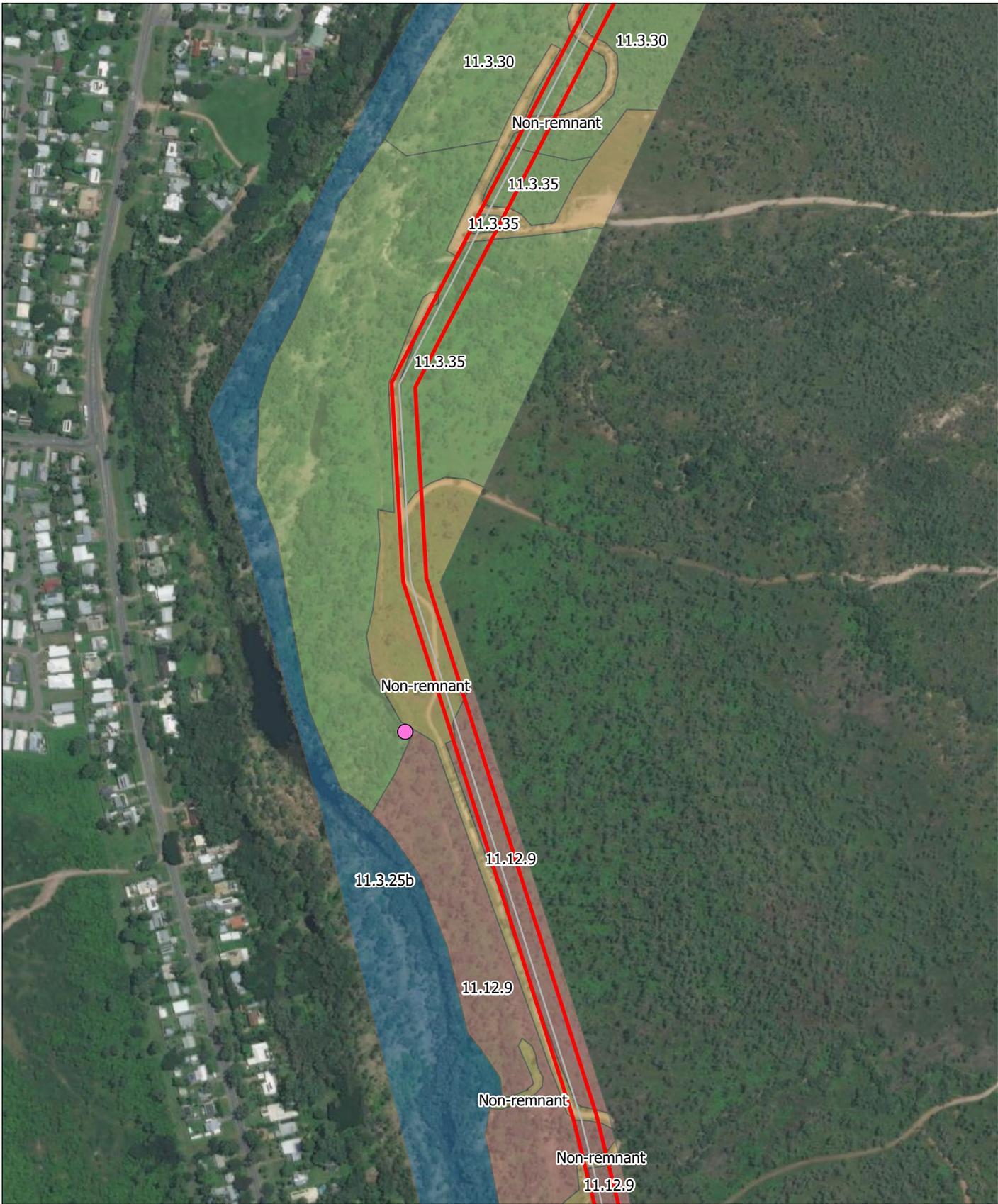
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**Figure 5: Fauna habitat Map 7 of 8**

**Legend**

- Pipeline
- Project area
- Bare-rumped sheathtail bat record (anabat)
- 2. Melaleuca riparian woodland
- 3. Eucalyptus woodland on alluvial plains
- 4. Eucalyptus woodland on igneous rocks
- 5. Non-remnant alluvial plains

**Fauna habitat types**



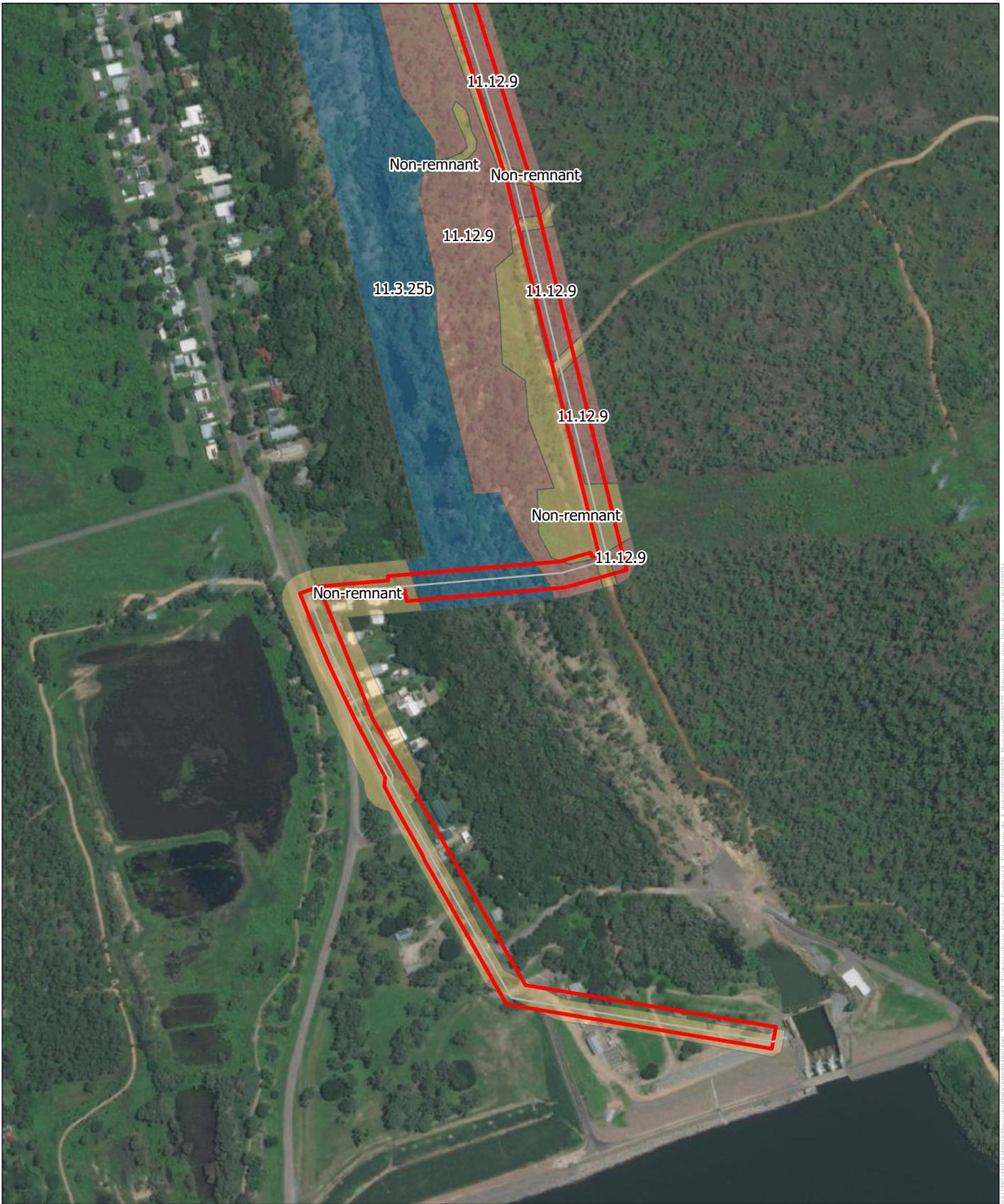
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**Figure 5: Fauna habitat Map 8 of 8**

**Legend**

- Pipeline
  - Project area
  - Bare-rumped sheathtail bat record (anabat)
- Fauna habitat types**
- 2. Melaleuca riparian woodland
  - 4. Eucalyptus woodland on igneous rocks
  - 5. Non-remnant alluvial plains



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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 1 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 3 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 5 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo

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0 100 200  
Meters

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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 6 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



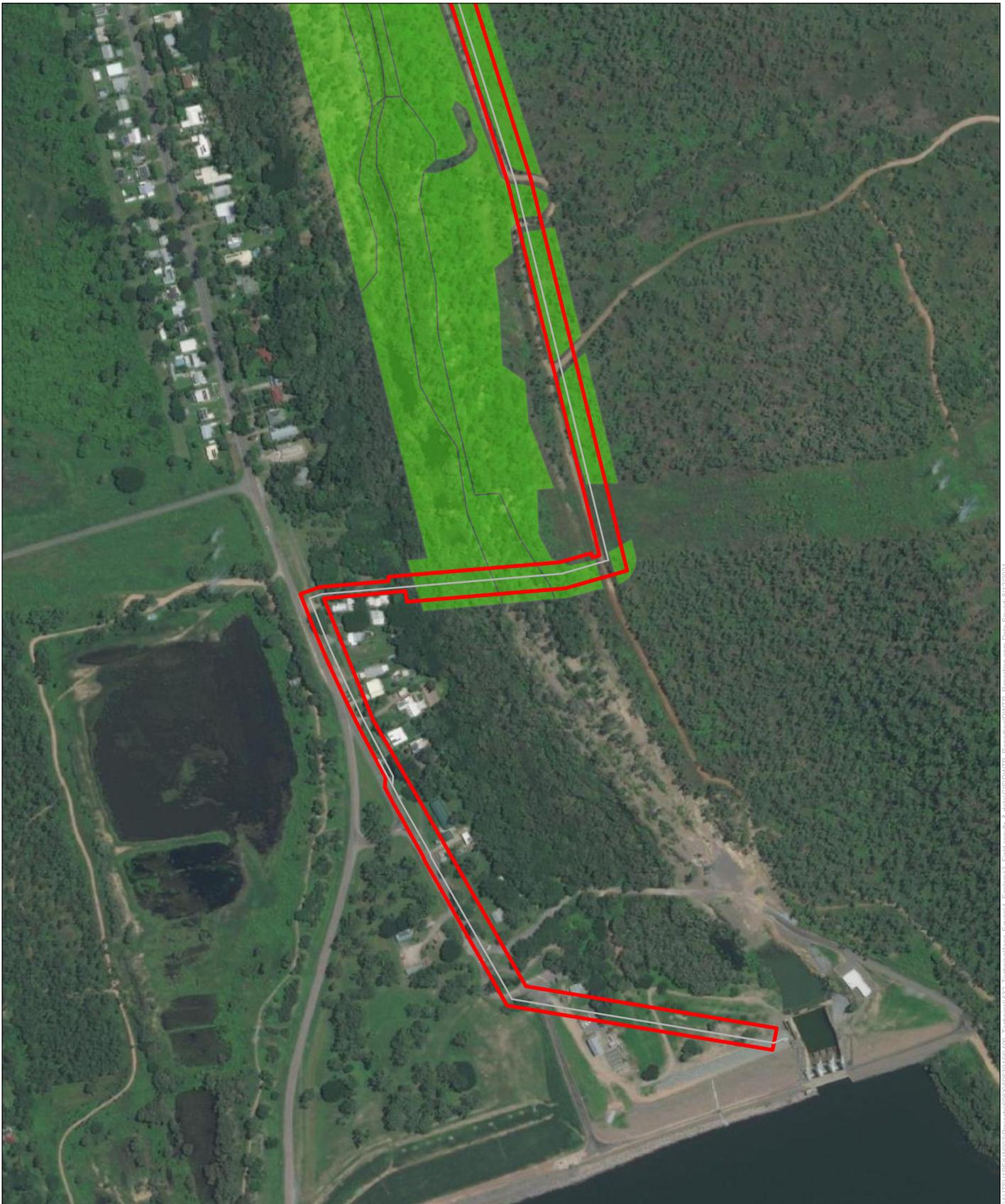
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**Figure 6: Habitat for black-throated finch, satin flycatcher, little curlew and oriental cuckoo Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for black-throated finch and satin flycatcher; roosting, foraging and dispersal for little curlew; foraging and dispersal for oriental cuckoo



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**Figure 7: Habitat for northern quoll Map 1 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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**Figure 7: Habitat for northern quoll Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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**Figure 7: Habitat for northern quoll Map 3 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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**Figure 7: Habitat for northern quoll Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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**Figure 7: Habitat for northern quoll Map 5 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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**Figure 7: Habitat for northern quoll Map 6 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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**Figure 7: Habitat for northern quoll Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



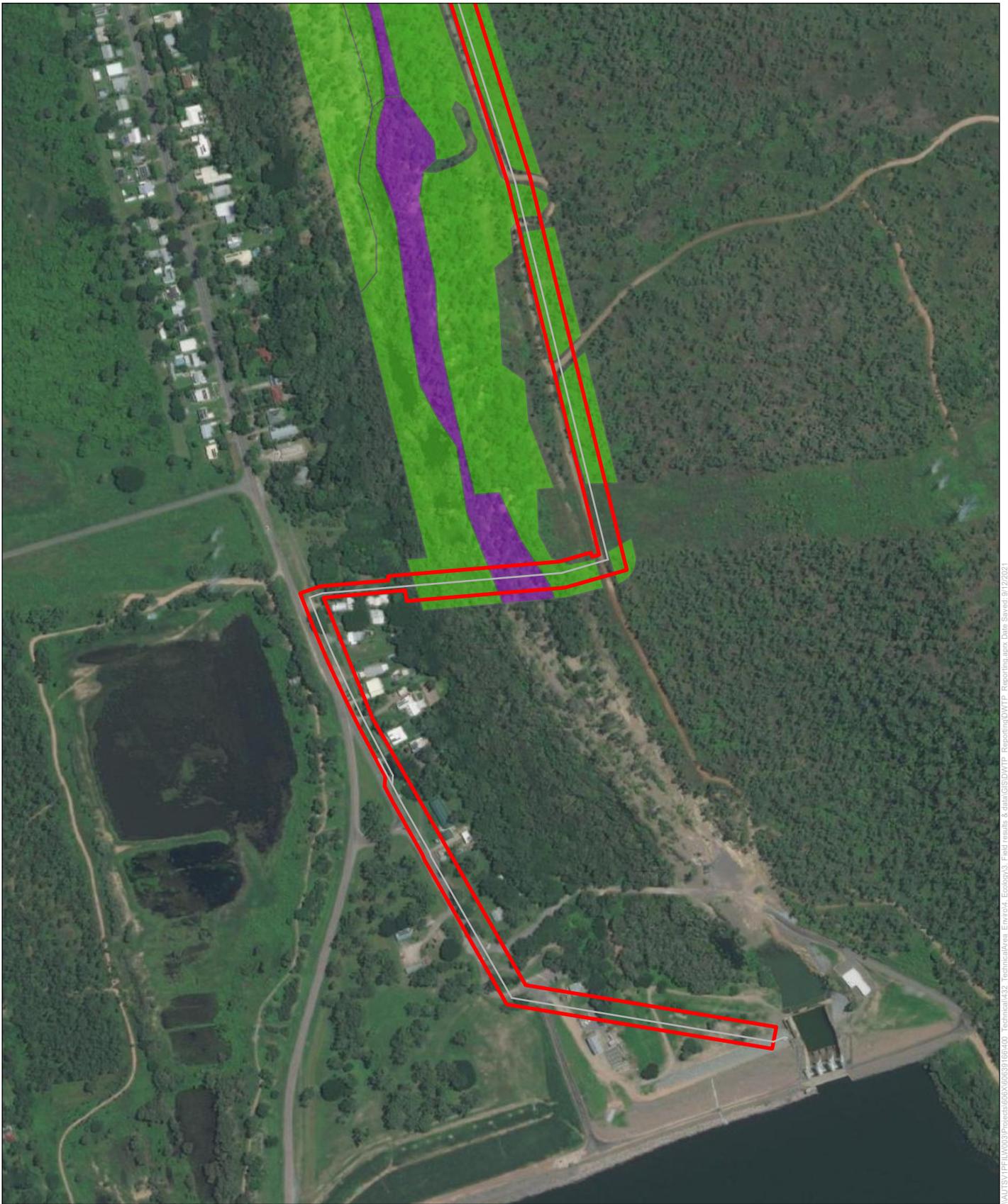
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**Figure 7: Habitat for northern quoll Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for the northern quoll
-  Denning, breeding, foraging and dispersal habitat for the northern quoll



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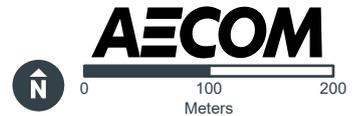
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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 1 of 8**

**Legend**

- Pipeline
- Project area
- Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
- Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk  
Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
-  Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 3 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
-  Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
-  Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 5 of 8**

**Legend**

- Pipeline
- Project area
- Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
- Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 6 of 8**

**Legend**

- Pipeline
- Project area
- Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
- Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
-  Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 8: Habitat for bare-rumped sheathtail bat and red goshawk**  
**Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk
-  Foraging and dispersal habitat for bare-rumped sheathtail bat (known) and red goshawk



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 1 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 3 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 5 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 6 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 9: Habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for squatter pigeon, ghost bat, white-throated needletail and fork-tailed swift



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**Figure 10: Habitat for estuarine crocodile Map 1 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 10: Habitat for estuarine crocodile Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 10: Habitat for estuarine crocodile Map 3 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 10: Habitat for estuarine crocodile Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 10: Habitat for estuarine crocodile Map 5 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 10: Habitat for estuarine crocodile Map 6 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



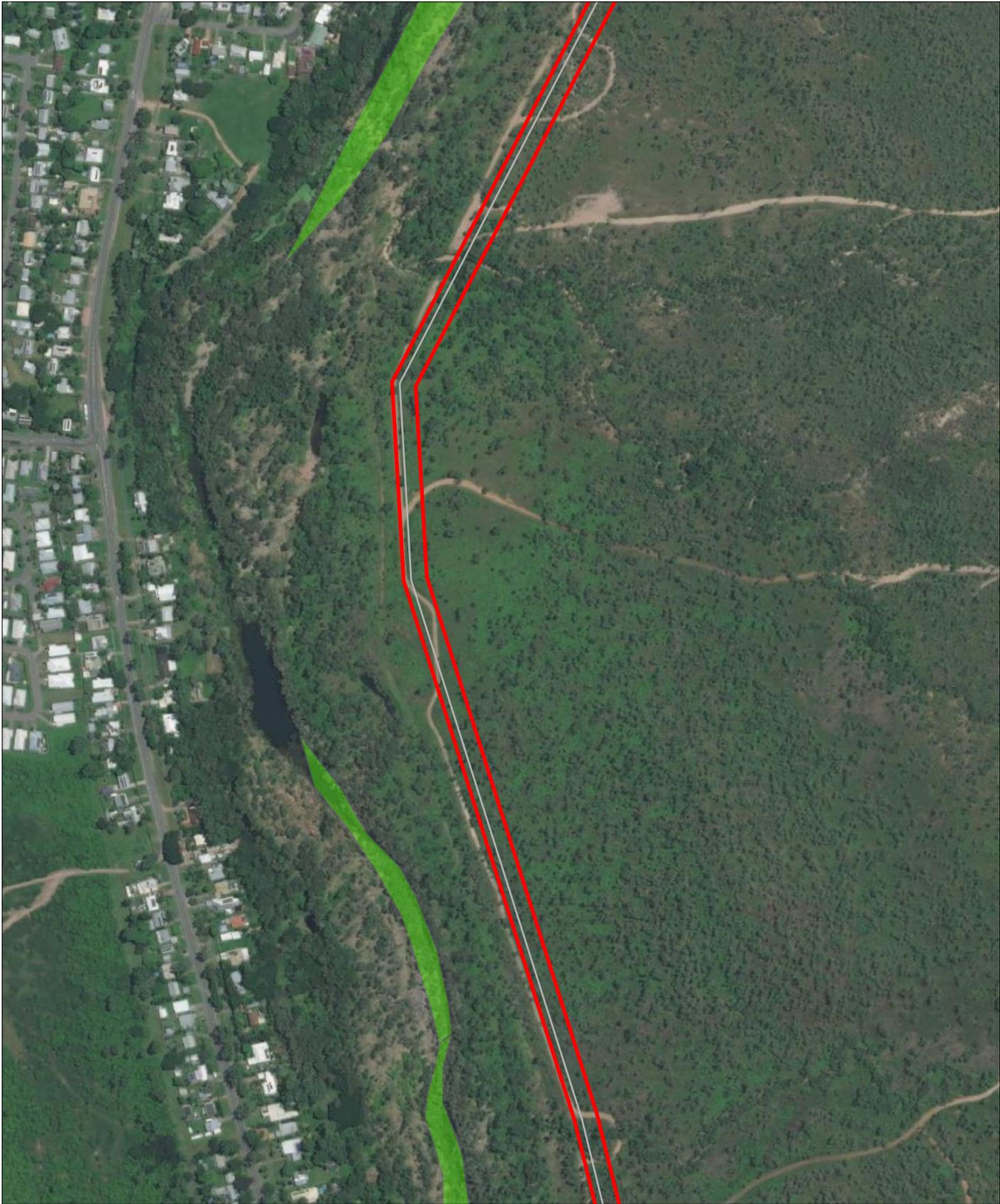
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**Figure 10: Habitat for estuarine crocodile Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 10: Habitat for estuarine crocodile Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Breeding, foraging and dispersal habitat for estuarine crocodile



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**Figure 11: Habitat for osprey Map 1 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey



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**Figure 11: Habitat for osprey Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey

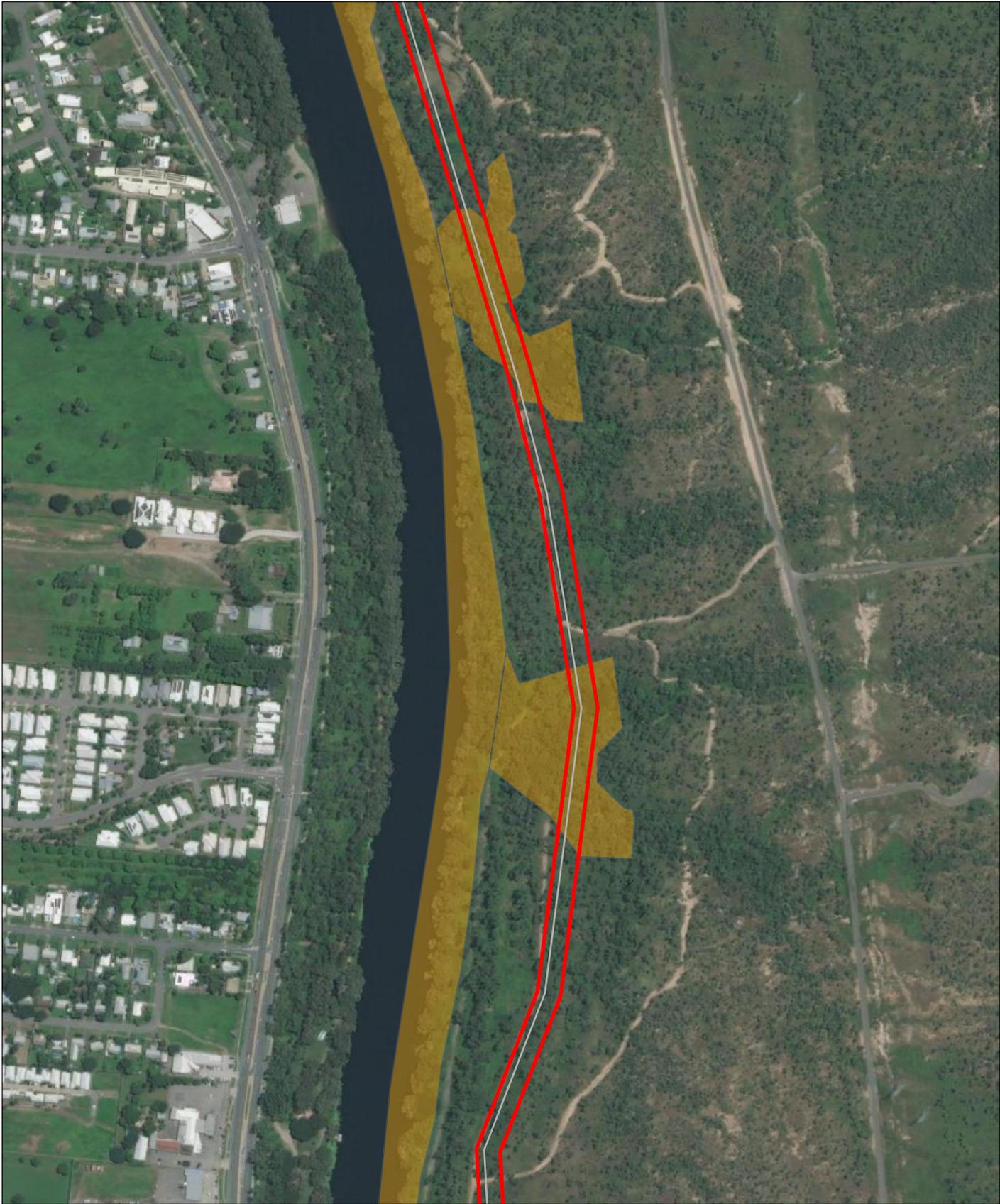


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**Figure 11: Habitat for osprey Map 3 of 8**

**Legend**

- Pipeline
- Project area
- Foraging and dispersal habitat for osprey
- Flyover habitat for osprey



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**Figure 11: Habitat for osprey Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey



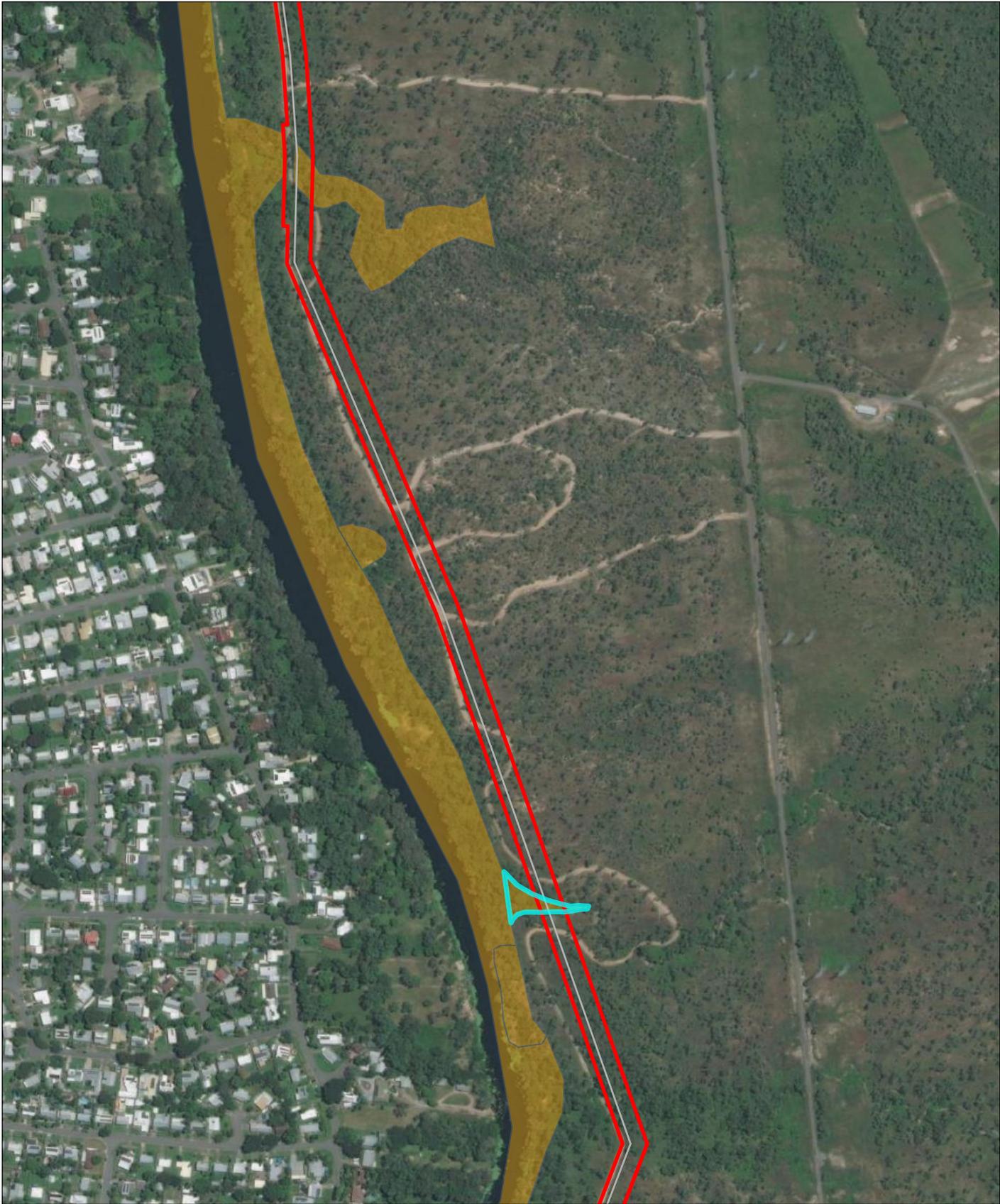
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**Figure 11: Habitat for osprey Map 5 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey



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**Figure 11: Habitat for osprey Map 6 of 8**  
**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey



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**Figure 11: Habitat for osprey Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey



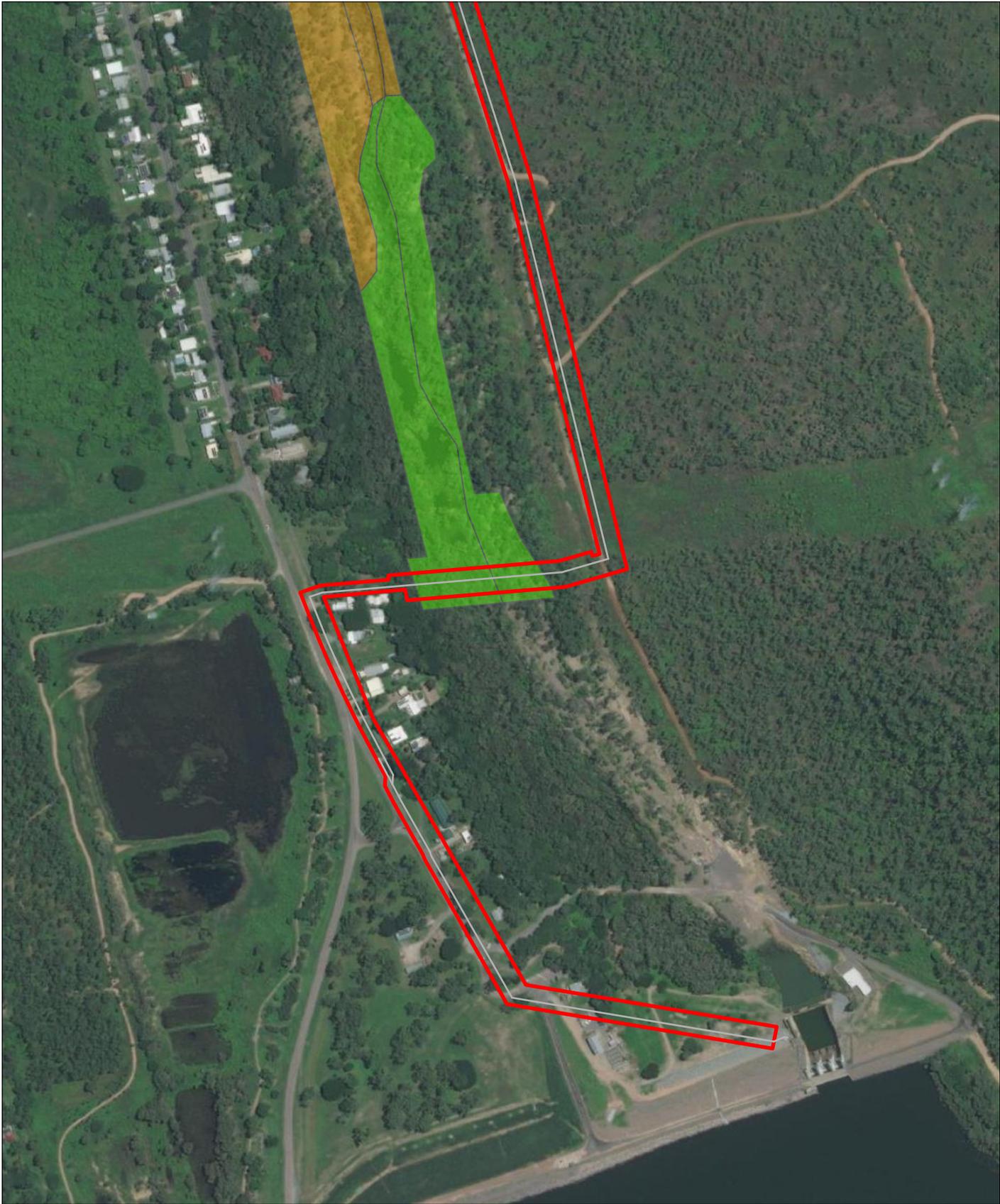
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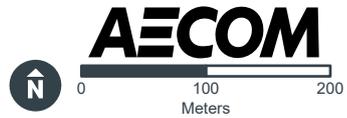
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**Figure 11: Habitat for osprey Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for osprey
-  Flyover habitat for osprey



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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 1 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 2 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 3 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 4 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



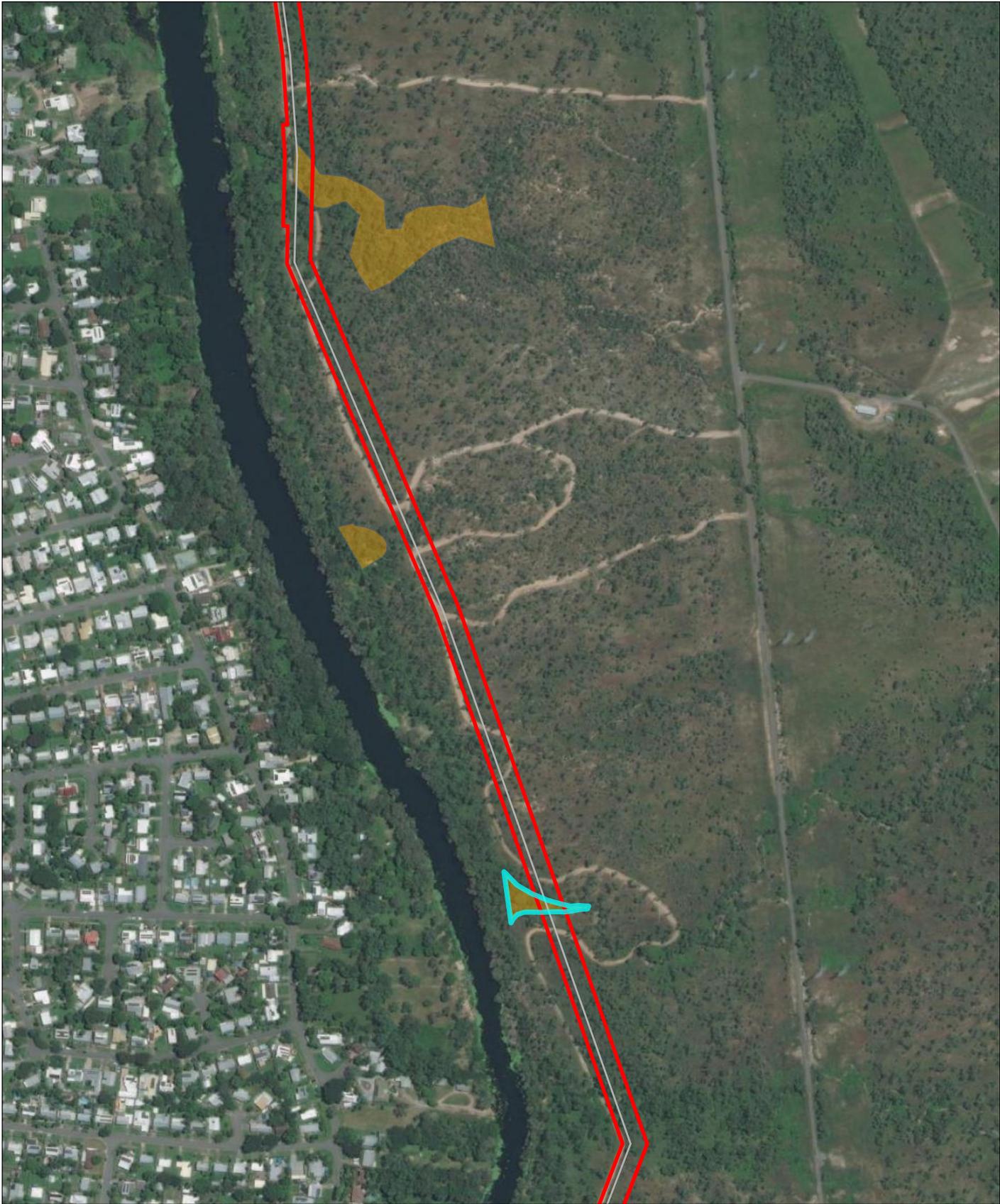
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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 5 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



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**Figure 12: Habitat for rufous fantail and black-faced monarch**

**Map 6 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 7 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



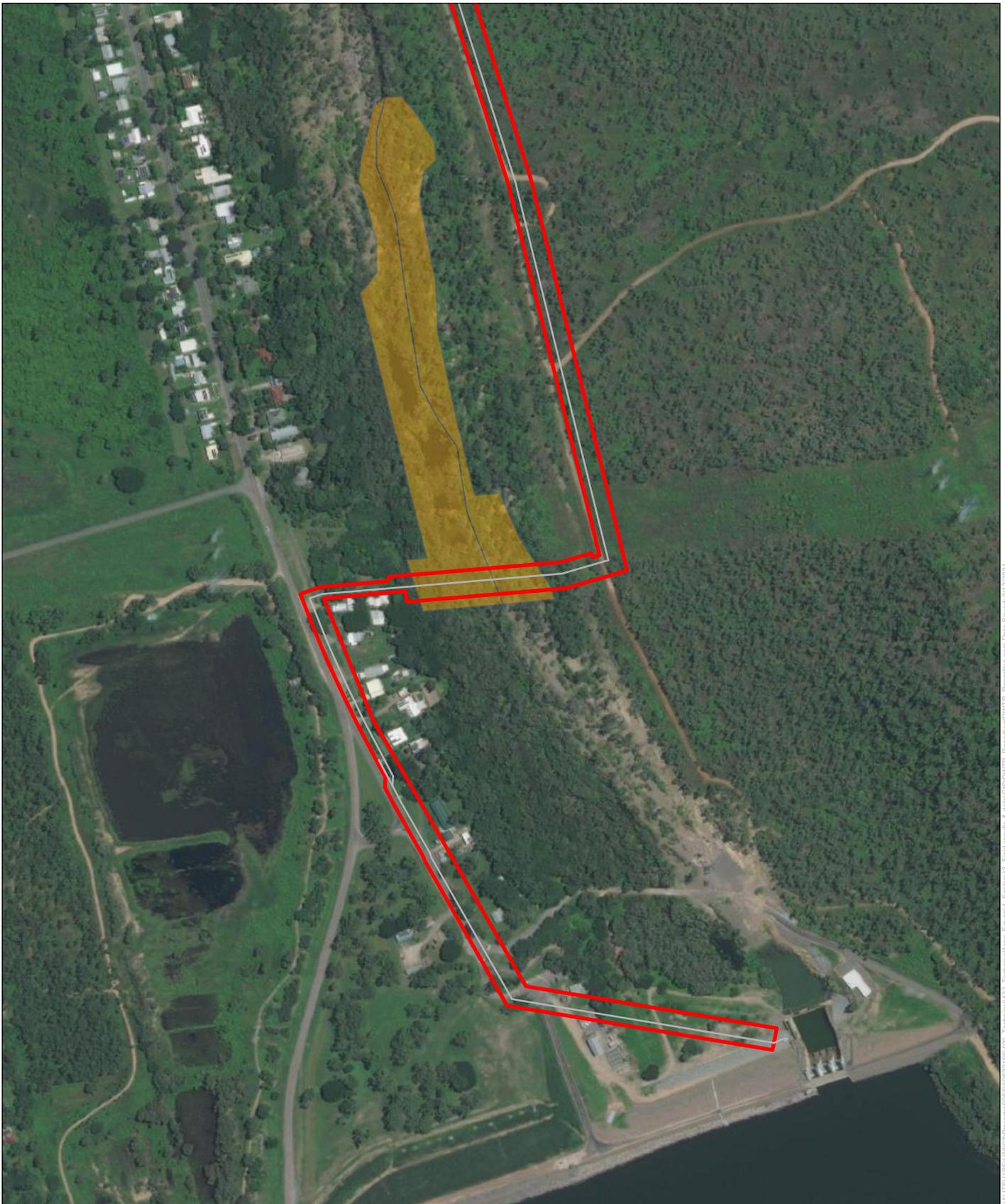
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**Figure 12: Habitat for rufous fantail and black-faced monarch**  
**Map 8 of 8**

**Legend**

-  Pipeline
-  Project area
-  Foraging and dispersal habitat for rufous fantail and black-faced monarch



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# Appendix B

Flora and fauna species  
lists

## Appendix B Flora and fauna species lists

Table 17 Flora species list

Family	Scientific name	Common name	NC Act status	EPBC Act status
Acanthaceae	<i>Brunoniella acaulis</i>	Blue trumpet	Least concern	-
Acanthaceae	<i>Rostellularia adscendens</i>	Pink tongues	Least concern	-
Amaranthaceae	<i>Alternanthera nana</i>	Hairy joyweed	Least concern	-
Amaryllidaceae	<i>Crinum flaccidum</i>	Murray lily	Least concern	-
Annonaceae	<i>Melodorum leichhardtii</i>	Zig zag vine	Least concern	-
Apocynaceae	<i>Cryptostegia grandiflora</i> *	Rubber vine	-	-
Araliaceae	<i>Polyscias australiana</i>	Basswood	Least concern	-
Asparagaceae	<i>Lomandra longifolia</i>	Spiky-head mat-rush	Least concern	-
Asparagaceae	<i>Thysanotus tuberosus</i>	Common fringe lily	Least concern	-
Asteraceae	<i>Ageratum houstonianum</i>	Blue billygoat weed	Least concern	-
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow buttons	Least concern	-
Asteraceae	<i>Cyanthillium cinereum</i>	Purple fleabane	Least concern	-
Asteraceae	<i>Sphagneticola trilobata</i> *	Singapore daisy	-	-
Asteraceae	<i>Tridax procumbens</i>	Coatbuttons	Least concern	-
Bignoniaceae	<i>Dolichandrone heterophylla</i>	Lemonwood	Least concern	-
Cannabaceae	<i>Trema tomentosa</i>	Poison peach	Least concern	-
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River she-oak	Least concern	-
Commelinaceae	<i>Commelina diffusa</i>	Hairy commelina	Least concern	-
Convolvulaceae	<i>Evolvulus alsinoides</i>	Dwarf morning-glory	Least concern	-
Cyperaceae	<i>Cyperus fulvus</i>	Sticky sedge	Least concern	-
Cyperaceae	<i>Cyperus gracilis</i>	Slender flat-sedge	Least concern	-
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common fringe-sedge	Least concern	-
Cyperaceae	<i>Fimbristylis vaginata</i>	-	Least concern	-
Cyperaceae	<i>Scleria brownii</i>	Brown's sedge	Least concern	-
Euphorbiaceae	<i>Euphorbia hirta</i>	Asthma plant	Least concern	-
Euphorbiaceae	<i>Euphorbia tannensis</i>	Desert spurge	Least concern	-
Euphorbiaceae	<i>Macaranga tanarius</i>	Blush macaranga	Least concern	-
Euphorbiaceae	<i>Ricinus communis</i> *	Castor oil plant	-	-
Fabaceae	<i>Abrus precatorius</i>	Crab's eye creeper	Least concern	-
Fabaceae	<i>Aeschynomene indica</i>	Budda pea	Least concern	-
Fabaceae	<i>Crotalaria goreensis</i>	Gambia pea	Least concern	-
Fabaceae	<i>Crotalaria pallida</i>	Smooth crotalaria	Least concern	-
Fabaceae	<i>Flemingia parviflora</i>	Flemingia	Least concern	-
Fabaceae	<i>Glycine tabacina</i>	Variable glycine	Least concern	-
Fabaceae	<i>Glycine tomentella</i>	Woolly glycine	Least concern	-
Fabaceae	<i>Indigofera hirsuta</i>	Hairy indigo	Least concern	-
Fabaceae	<i>Indigofera linifolia</i>	Narrow-leaved indigo	Least concern	-
Fabaceae	<i>Indigofera linnaei</i>	Birdsville indigo	Least concern	-
Fabaceae	<i>Rhynchosia minima</i>	Rhynchosia	Least concern	-
Fabaceae	<i>Senna artemisioides</i>	Silver cassia	Least concern	-

Family	Scientific name	Common name	NC Act status	EPBC Act status
Fabaceae	<i>Senna obtusifolia</i>	Sicklepod	Least concern	-
Fabaceae	<i>Stylosanthes scabra</i>	Shrubby stylo	Least concern	-
Fabaceae	<i>Swainsona galegifolia</i>	Smooth darling-pea	Least concern	-
Iridaceae	<i>Patersonia sericea</i>	Silky purple-flag	Least concern	-
Lamiaceae	<i>Ocimum americanum</i>	Hairy basil	Least concern	-
Lamiaceae	<i>Plectranthus graveolens</i>	Bush basil	Least concern	-
Lauraceae	<i>Cassytha pubescens</i>	Downy dodder-laurel	Least concern	-
Lecythidaceae	<i>Planchonia careya</i>	Cocky apple	Least concern	-
Malvaceae	<i>Sida acuta</i>	Spiny-head sida	Least concern	-
Malvaceae	<i>Sida cordifolia</i>	Flannel weed	Least concern	-
Malvaceae	<i>Sida rhombifolia</i>	Paddy's lucerne	Least concern	-
Malvaceae	<i>Urena lobata</i>	Urena burr	Least concern	-
Malvaceae	<i>Waltheria indica</i>	Waltheria	Least concern	-
Meliaceae	<i>Azadirachta indica</i> *	Neem tree	-	-
Mimosaceae	<i>Albizia procera</i>	White siris	Least concern	-
Mimosaceae	<i>Vachellia bidwillii</i>	Dogwood	Least concern	-
Moraceae	<i>Ficus racemosa</i>	Cluster fig	Least concern	-
Myrtaceae	<i>Corymbia clarksoniana</i>	Grey bloodwood	Least concern	-
Myrtaceae	<i>Corymbia dallachiana</i>	Dallachy's ghost gum	Least concern	-
Myrtaceae	<i>Corymbia erythrophloia</i>	Red bloodwood	Least concern	-
Myrtaceae	<i>Corymbia tessellaris</i>	Moreton Bay ash	Least concern	-
Myrtaceae	<i>Eucalyptus crebra sensu lato</i>	Narrow-leaved ironbark	Least concern	-
Myrtaceae	<i>Eucalyptus platyphylla</i>	Poplar gum	Least concern	-
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest red gum	Least concern	-
Myrtaceae	<i>Lophostemon suaveolens</i>	Swamp mahogany	Least concern	-
Myrtaceae	<i>Melaleuca fluviatilis</i>	Weeping paperbark	Least concern	-
Myrtaceae	<i>Melaleuca leucadendra</i>	Long-leaved paperbark	Least concern	-
Myrtaceae	<i>Melaleuca viridiflora</i>	Red flowering paperbark	Least concern	-
Passifloraceae	<i>Passiflora foetida</i>	Stinking passion vine	Least concern	-
Phyllanthaceae	<i>Flueggea virosa</i>	White currant	Least concern	-
Phyllanthaceae	<i>Phyllanthus gunnii</i>	Scrubby spurge	Least concern	-
Phyllanthaceae	<i>Phyllanthus virgatus</i>	Creeping phyllanthus	Least concern	-
Picrodendraceae	<i>Petalostigma banksii</i>	Smooth-leaved quinine	Least concern	-
Poaceae	<i>Alloteropsis semialata</i>	Cockatoo grass	Least concern	-
Poaceae	<i>Capillipedium parviflorum</i>	Scented-top grass	Least concern	-
Poaceae	<i>Chrysopogon fallax</i>	Golden beard grass	Least concern	-
Poaceae	<i>Digitaria sp.</i>	Digit grass	Least concern	-
Poaceae	<i>Eragrostis lacunaria</i>	Purple lovegrass	Least concern	-
Poaceae	<i>Eragrostis sororia</i>	Woodland lovegrass	Least concern	-
Poaceae	<i>Eremochloa bimaculata</i>	Poverty grass	Least concern	-
Poaceae	<i>Eriachne mucronata</i>	Mountain wanderrie grass	Least concern	-
Poaceae	<i>Heteropogon contortus</i>	Black speargrass	Least concern	-
Poaceae	<i>Heteropogon triticeus</i>	Giant speargrass	Least concern	-

Family	Scientific name	Common name	NC Act status	EPBC Act status
Poaceae	<i>Melinis repens</i> *	Red Natal	-	-
Poaceae	<i>Panicum decompositum</i>	Native millet	Least concern	-
Poaceae	<i>Themeda triandra</i>	Kangaroo grass	Least concern	-
Portulacaceae	<i>Portulaca pilosa</i>	Pink purslane	Least concern	-
Proteaceae	<i>Grevillea parallela</i>	Silver grevillea	Least concern	-
Proteaceae	<i>Grevillea striata</i>	Beefwood	Least concern	-
Proteaceae	<i>Persoonia falcata</i>	Wild pear	Least concern	-
Rhamnaceae	<i>Ziziphus mauritiana</i> *	Chinee apple	-	-
Rubiaceae	<i>Coelospermum reticulatum</i>	Medicine bush	Least concern	-
Rubiaceae	<i>Larsenaikia ochreatea</i>	Native gardenia	Least concern	-
Rubiaceae	<i>Nauclea orientalis</i>	Leichhardt tree	Least concern	-
Solanaceae	<i>Solanum torvum</i> *	Devil's fig	-	-
Sparrmanniaceae	<i>Grewia latifolia</i>	Dysentry bush	Least concern	-
Verbenaceae	<i>Stachytarpheta jamaicensis</i>	Blue snakeweed	Least concern	-
Violaceae	<i>Hybanthus enneaspermus</i>	Blue spade flower	Least concern	-
Violaceae	<i>Hybanthus monopetalus</i>	Slender violet-bush	Least concern	-

Table 18 Fauna species list

Group	Scientific name	Common name	NC Act status	EPBC Act status
Amphibia	<i>Cyclorana alboguttata</i>	Green-striped Burrowing Frog	Least concern	-
Amphibia	<i>Cyclorana novaehollandiae</i>	Eastern Snapping Frog	Least concern	-
Amphibia	<i>Litoria caerulea</i>	Green Tree Frog	Least concern	-
Amphibia	<i>Litoria fallax</i>	Eastern Sedge Frog	Least concern	-
Amphibia	<i>Litoria inermis</i>	Bumpy Rocket Frog	Least concern	-
Amphibia	<i>Litoria nasuta</i>	Striped Rocket Frog	Least concern	-
Amphibia	<i>Litoria rothii</i>	Roth's Tree Frog	Least concern	-
Amphibia	<i>Litoria rubella</i>	Desert Tree Frog	Least concern	-
Amphibia	<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog	Least concern	-
Amphibia	<i>Rhinella marina</i> *	Cane Toad	-	-
Aves	<i>Anas superciliosa</i>	Pacific Black Duck	Least concern	-
Aves	<i>Aprosmictus erythropterus</i>	Red-winged Parrot	Least concern	-
Aves	<i>Aquila audax</i>	Wedge-tailed Eagle	Least concern	-
Aves	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	Least concern	-
Aves	<i>Burhinus grallarius</i>	Bush Stone-curlew	Least concern	-
Aves	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	Least concern	-
Aves	<i>Calyptorhynchus banksii</i>	Red-tailed black cockatoo	Least concern	-
Aves	<i>Centropus phasianinus</i>	Pheasant coucal	Least concern	-
Aves	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Least concern	-
Aves	<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike	Least concern	-
Aves	<i>Corvus orru</i>	Torresian Crow	Least concern	-
Aves	<i>Cracticus nigrogularis</i>	Pied Butcherbird	Least concern	-
Aves	<i>Cracticus tibicen</i>	Australian Magpie	Least concern	-
Aves	<i>Dacelo leachii</i>	Blue-winged Kookaburra	Least concern	-
Aves	<i>Dacelo novaeguineae</i>	Laughing kookaburra	Least concern	-
Aves	<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck	Least concern	-
Aves	<i>Dicaeum hirundinaceum</i>	Mistletoebird	Least concern	-
Aves	<i>Dicrurus bracteatus</i>	Spangled Drongo	Least concern	-
Aves	<i>Eurystomus orientalis</i>	Dollarbird	Least concern	-
Aves	<i>Falco cenchroides</i>	Nankeen Kestrel	Least concern	-
Aves	<i>Geopelia humeralis</i>	Bar-shouldered Dove	Least concern	-
Aves	<i>Geopelia striata</i>	Peaceful Dove	Least concern	-
Aves	<i>Grallina cyanoleuca</i>	Magpie-lark	Least concern	-
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Least concern	Marine
Aves	<i>Haliastur indus</i>	Brahminy Kite	Least concern	-
Aves	<i>Haliastur sphenurus</i>	Whistling kite	Least concern	-
Aves	<i>Irediparra gallinacea</i>	Comb-crested Jacana	Least concern	-
Aves	<i>Lichmera indistincta</i>	Brown honeyeater	Least concern	-
Aves	<i>Melithreptus albogularis</i>	White-throated Honeyeater	Least concern	-

Group	Scientific name	Common name	NC Act status	EPBC Act status
Aves	<i>Merops ornatus</i>	Rainbow Bee-eater	Least concern	Marine
Aves	<i>Milvus migrans</i>	Black Kite	Least concern	-
Aves	<i>Ninox connivens</i>	Barking Owl	Least concern	-
Aves	<i>Ninox novaeseelandiae</i>	Southern Boobook	Least concern	-
Aves	<i>Pardalotus striatus</i>	Striated Pardalote	Least concern	-
Aves	<i>Pelecanus conspicillatus</i>	Australian Pelican	Least concern	-
Aves	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	Least concern	-
Aves	<i>Philemon citreogularis</i>	Little Friarbird	Least concern	-
Aves	<i>Philemon corniculatus</i>	Noisy Friarbird	Least concern	-
Aves	<i>Platycercus adscitus</i>	Pale-headed rosella	Least concern	-
Aves	<i>Platycercus caledonicus</i>	Green Rosella	Least concern	-
Aves	<i>Podargus strigoides</i>	Tawny Frogmouth	Least concern	-
Aves	<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird	Least concern	-
Aves	<i>Ptilotula penicillata</i>	White-plumed honeyeater	Least concern	-
Aves	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	Least concern	-
Aves	<i>Sphecotheres vieilloti</i>	Australasian Figbird	Least concern	-
Aves	<i>Stomiopera flava</i>	Yellow honeyeater	Least concern	-
Aves	<i>Sturnus tristis</i>	Common Myna	Least concern	-
Aves	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	Least concern	-
Aves	<i>Threskiornis molucca</i>	Australian White Ibis	Least concern	-
Aves	<i>Todiramphus macleayii</i>	Forest Kingfisher	Least concern	-
Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Least concern	-
Aves	<i>Vanellus miles</i>	Masked Lapwing	Least concern	-
Fish	<i>Toxotes sp.</i>	Archerfish	Least concern	-
Mammalia	<i>Aepyprymnus rufescens</i>	Rufous Bettong	Least concern	-
Mammalia	<i>Austronomus australis</i>	White-striped Free-tailed Bat	Least concern	-
Mammalia	<i>Canis lupus dingo</i>	Dingo	Least concern	-
Mammalia	<i>Canis lupus*</i>	Dog	-	-
Mammalia	<i>Chaerephon jobensis</i>	Greater northern freetail-bat	Least concern	-
Mammalia	<i>Chalinolobus gouldii</i>	Gould's wattled bat	Least concern	-
Mammalia	<i>Chalinolobus morio</i>	Chocolate wattled bat	Least concern	-
Mammalia	<i>Chalinolobus nigrogriseus</i>	Hoey wattled bat	Least concern	-
Mammalia	<i>Isoodon macrourus</i>	Northern brown bandicoot	Least concern	-
Mammalia	<i>Macropus agilis</i>	Agile Wallaby	Least concern	-
Mammalia	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	Least concern	-
Mammalia	<i>Miniopterus australis</i>	Little bent-winged bat	Least concern	-
Mammalia	<i>Miniopterus orianae</i>	Large bent-winged bat	Least concern	-
Mammalia	<i>Myotis macropus</i>	Southern myotis	Least concern	-
Mammalia	<i>Nyctophilus sp.</i>	Long-eared bat	Least concern	-
Mammalia	<i>Ozimops lumsdenae</i>	Northern free-tailed bat	Least concern	-

Group	Scientific name	Common name	NC Act status	EPBC Act status
Mammalia	<i>Ozimops ridei</i>	Eastern freetail bat	Least concern	-
Mammalia	<i>Pteropus alecto</i>	Black Flying-fox	Least concern	-
Mammalia	<i>Pteropus scapulatus</i>	Little Red Flying-fox	Least concern	-
Mammalia	<i>Rhinolophus megaphyllus</i>	Eastern horseshoe bat	Least concern	-
Mammalia	<i>Saccolaimus saccolaimus</i>	Bare-rumped sheath-tail bat	Endangered	Vulnerable
Mammalia	<i>Scoteanax rueppellii</i>	Greater broad-nosed bat	Least concern	-
Mammalia	<i>Scotorepens balstoni</i>	Inland broad-nosed bat	Least concern	-
Mammalia	<i>Scotorepens greyii</i>	Little broad-nosed bat	Least concern	-
Mammalia	<i>Scotorepens orion</i>	Eastern broad-nosed bat	Least concern	-
Mammalia	<i>Scotorepens sanborni</i>	Northern broad-nosed bat	Least concern	-
Mammalia	<i>Sus scrofa</i> *	Pig	-	-
Mammalia	<i>Taphozous troughtoni (possible)</i>	Troughton's sheath-tailed bat	Least concern	-
Mammalia	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	Least concern	-
Mammalia	<i>Vespadelus pumilus</i>	Eastern forest bat	Least concern	-
Mammalia	<i>Vespadelus troughtoni</i>	Eastern cave bat	Least concern	-
Reptilia	<i>Boiga irregularis</i>	Brown Tree Snake	Least concern	-
Reptilia	<i>Carlia jarnoldae</i>	Lined Rainbow-skink	Least concern	-
Reptilia	<i>Carlia pectoralis</i>	Open-litter Rainbow-skink	Least concern	-
Reptilia	<i>Cryptoblepharus megastictus</i>	Blotched Snake-eyed Skink	Least concern	-
Reptilia	<i>Cryptoblepharus virgatus</i>	Wall Skink	Least concern	-
Reptilia	<i>Gehyra dubia</i>	Dubious Dtella	Least concern	-
Reptilia	<i>Lepidodactylus lugubris</i>	Mourning Gecko	Least concern	-
Reptilia	<i>Oedura castelnaui</i>	Northern Velvet Gecko	Least concern	-
Reptilia	<i>Varanus sp.</i>	Monitor species	Least concern	-
Reptilia	<i>Varanus panoptes</i>	Yellow-spotted Monitor	Least concern	-

# Appendix C

## Likelihood of occurrence assessment

## Appendix C Likelihood of occurrence assessment

A likelihood of occurrence assessment was undertaken for threatened flora and fauna species and communities identified during the desktop review. The assessment considered known habitat and ecological requirements of the species against the vegetation communities and habitat values identified in the field survey. Each species was assessed against the categories defined in Section 3.3.

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
<b>Birds</b>					
Wedge-tailed Shearwater	<i>Ardenna pacifica</i>	V	M, Ma	<p>The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters (Department of Agriculture Water and the Environment, 2021b). The species tolerates a range of surface-temperatures and salinities but is most abundant where temperatures are greater than 21 °C and salinity is greater than 34.6 %. In tropical zones the species may feed over cool nutrient-rich waters.</p> <p>The species breeds throughout its known range, mainly on vegetated islands, atolls and cays, but one colony is also known on the Australian mainland (Department of Agriculture Water and the Environment, 2021b). The largest breeding colony is known from the Capricorn-Bunker group of islands. =</p>	<p><b>Unlikely</b> A previous record exists across the Ross River from the project area from 1995, and some records from the 1980s occur near Townsville city (ALA). However, this is a pelagic species that would be an uncommon occurrence along the coast of Townsville.</p>
Australasian Bittern	<i>Botaurus poiciloptilus</i>	E	E	<p>The Australasian bittern occurs mainly in freshwater wetlands and, rarely, in estuaries or tidal wetlands. It favours wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds.</p> <p>In Australia, the Australasian bittern occurs from south-east Queensland to south-east South Australia as far as the Adelaide Region, southern Eyre Peninsula, Tasmania and in the southwest of Western Australia. Vagrants have also been recorded from northern Australia, including one record from Argyle Downs in the extreme north-east of Western Australia (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. All records are along the Australian coastline, and no records are within 20 km of the project area. This species is a vagrant in northern Australia.</p>
Red knot	<i>Calidris canutus</i>	E	E, Ma, M, MW	<p>The Red knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours, sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs (Department of Agriculture Water and the Environment, 2021b) . They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. This species does not breed in Australia.</p> <p>The red knot is common in all the main suitable habitats around the coast of Australia and is occasionally recorded inland. In Queensland, they migrate along the coast north of 19 °S, sometimes in large numbers. It is widespread along the coast south of Townsville.</p>	<p><b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. All records are along the Australian coastline only a few kilometres inland (ALA).</p>
Curlew sandpiper	<i>Calidris ferruginea</i>	E	CE, M, MW, Ma	<p>In Australia, curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers (Department of Agriculture Water and the Environment, 2021b).Inhabits intertidal mudflats of estuaries, lagoons, mangrove channels in sheltered coastal areas. Recorded inland around ephemeral and permanent lakes, dams, waterholes. This species does not breed in Australia.</p>	<p><b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. All records in northern Queensland are along the coastline only a few kilometres inland, with one undated record at the south eastern edge of Lake Ross (ALA).</p>
Great knot	<i>Calidris tenuirostris</i>	E	CE, Ma, M, MW	<p>The great knot is a non-breeding migrant to Australia. It has been recorded around the entirety of the Australian coast, with a few scattered records inland. Sheltered coastal habitats, with large intertidal mudflats or sandflats are preferred. However, they have also been found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, salt lakes and non-tidal lagoons (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> Suitable habitat is marginal within the project area, and records are found along the coastline &gt; 10 km from the project area.</p>
Greater sand plover, Large sand plover	<i>Charadrius leschenaultii</i>	V	V, Ma, MW	<p>The greater sand plover is a non-breeding migrant to Australia. It is almost entirely coastal, inhabiting littoral and estuarine habitats. They are reported to mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons, inshore reefs, small rocky islands or coral reefs (Department of Agriculture Water and the Environment, 2021b).</p> <p>It has been recorded in the coastal areas of all states in Australia, however the greatest numbers occur in northern Australia. Internationally important sites in Australia include Eighty Mile Beach (Western Australia), Roebuck Bay (Western Australia), south-eastern corner of Gulf of Carpentaria (Queensland), Ashmore Reef (Western Australia) and the Darwin area (Northern Territory).</p>	<p><b>Unlikely</b> Suitable habitat is marginal within the project area, and records are found along the coastline &gt; 10 km from the project area.</p>

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
Lesser sand plover, Mongolian plover	<i>Charadrius mongolus</i>	E	E, Ma, MW	<p>The lesser sand plover is a non-breeding migrant to Australia. Within Australia, this species is widespread in coastal regions and has been recorded in all states. It mainly occurs in northern and eastern Australia, in south-eastern parts of the Gulf of Carpentaria, western Cape York Peninsula and islands in Torres Strait, and along the entire east coast, though it occasionally also occurs inland. There are nine internationally important sites for this species in Queensland including Townsville and the Ross River mouth (Department of Agriculture Water and the Environment, 2021b).</p> <p>It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves.</p>	<b>Unlikely</b> Suitable habitat is marginal within the project area, and records are found along the coastline > 10 km from the project area.
Macleay's fig-parrot	<i>Cyclopsitta diophthalma macleayana</i>	V	-	<p>The subspecies inhabits coastal and contiguous mountain rainforests of north-eastern Queensland, from Mount Amos, near Cooktown, south to Cardwell, and possibly the Seaview Ranges. This subspecies is particularly common in the Atherton Tableland region and near Cairns where it visits fig trees to feed during the breeding season (Forshaw, 1992). They frequent rainforest, gallery forest and adjacent open forest up to about 750 m above sea level.</p>	<b>Unlikely</b> Suitable habitat (rainforest and figs) is limited within the project area, only one record within 20 km, occurring on the coastline near Townsville Town Common (ALA).
Red goshawk	<i>Erythrotriorchis radiatus</i>	E	V	<p>In northern Queensland, red goshawks are mainly associated with extensive, uncleared, mosaics of native vegetation, especially riparian vegetation, open forest and woodland that contain a mix of eucalypt, ironbark and bloodwood species. Permanent water (watercourses and wetlands) is usually present in close proximity, with tall emergent trees used for nesting. The red goshawk is thought to have a very large home range covering between 50 and 220 square kilometres.</p> <p>This species is sparsely distributed across coastal and sub-coastal Australia, from the western Kimberly to northern New South Wales. There appears to have been a contraction in range in recent years. Occasionally recorded from gorge country in central Australia and western Queensland (Department of Agriculture Water and the Environment, 2021b).</p>	<b>Potential</b> The project area has marginal preferred habitat for this species. One large raptor nest was found in the project area, with anecdotal evidence of two other nests nearby and a wedge-tailed eagle utilising it. Habitat is limited to RE 11.3.25 and emergent eucalypts. Species recorded within 3 km to the west of the project area on Bohle River in 1998, with another record > 10 km to the west in 2000 (ALA).
Gouldian finch	<i>Erythrura gouldiae</i>	E	E	<p>Gouldian finches feed almost exclusively on grass seed and depend on a relatively small number of grass species which seed at different times throughout the year. When breeding they utilise small patches of open woodland, usually on ridges dominated by cavity bearing trees such as white northern gum (<i>Eucalyptus brevifolia</i>) in the west and Territory salmon gum (<i>E. tintinnans</i>) in the east, with an understorey of grasses such as sorghum (<i>Sarga spp.</i>), <i>Schizachyrium spp.</i> and spinifex (<i>Triodia spp.</i>), preferably within 2-4 km of perennial waterholes or springs. After breeding they will flock and move across the broader landscape following grass seed resources (Threatened Species Scientific Committee, 2016b). Grass species include cockatoo grass (<i>Alloteropsis semialata</i>), golden beard grass (<i>Chrysopogon fallax</i>), spinifex (<i>Triodia spp.</i>), giant speargrass (<i>Heteropogon triticeus</i>), white grass (<i>Sehima nervosum</i>), ricegrass (<i>Xerochloa laniflora</i>) and kangaroo grass (<i>Themeda triandra</i>) (O'Malley, 2006).</p> <p>The species has undergone significant population decline and a contraction of their known range, and is now recorded reliably only at a small number of sites in NT and WA, however it is rarely seen in the wild in Queensland (O'Malley, 2006).</p>	<b>Unlikely</b> The project area contains suitable foraging grasses for the species outside of their breeding season. However, only one record occurs within 20km of the project area from 1948, located to the north on Bowen Road near the Townsville Golf Club and Ross River. The species is unlikely to be persisting in the region.
Beach stone-curlew	<i>Esacus magnirostris</i>	V	Ma	<p>The Beach stone-curlew occurs on open, undisturbed beaches, islands, reefs, and estuarine intertidal sand and mudflats, preferring beaches with estuaries or mangroves nearby. However, this species also frequents river mouths, offshore sandbars associated with coral atolls, reefs and rock platforms and coastal lagoons (Birdlife Australia, 2019).</p> <p>This species is restricted to the littoral zone, where it nests on the ground just above the tideline. It is distributed around the tropical Australian coasts and extends to Asia (New South Wales Office of Environment and Heritage, 2019).</p>	<b>Unlikely</b> No suitable habitat is present within the project area, and records are generally found along the coastline > 10 km from the project area. One record is found approximately 3 km to the west of the project area, however it has very poor spatial accuracy (ALA).
Grey falcon	<i>Falco hypoleucos</i>	V	V	<p>The grey falcon occurs at low densities across inland Australia, though the ecology of the grey falcon is known almost entirely from anecdotal and opportunistic observations. This species inhabits lightly timbered interior plains, especially stony plains and lightly timbered <i>Acacia</i> scrub. Interior plains. It has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter.</p> <p>The grey falcon occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia. This species is mainly found where annual rainfall is less than 500 mm, except when wet years are followed by drought, when the species becomes more widespread (Threatened Species Scientific Committee, 2020).</p>	<b>Unlikely</b> Habitat within the project area is generally unsuitable for this species. The project area is coastal with >500mm rainfall and is east of the great dividing range, therefore it is unlikely the species would persist in the area. One record is located in the ocean, which is considered spatially and temporally inaccurate.

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
White-bellied storm-petrel (Tasman sea; Australasia)	<i>Fregetta grallaria grallaria</i>	LC	V	It occurs across sub-tropical and tropical waters in the Tasman Sea, Coral Sea and, possibly the central Pacific Ocean (Department of Agriculture Water and the Environment, 2021b). In the non-breeding season, it reaches and forages over near-shore waters along the continental shelf of mainland Australia. It breeds, in Australian territory, on offshore islets and rocks in the Lord Howe Island group.	<b>Unlikely</b> The White-bellied storm-petrel is a pelagic species with very a limited terrestrial extent of occurrence. It is considered unlikely to occur within the project area, and no records of the species occur within 20 km (ALA).
Squatter pigeon (southern subspecies)	<i>Geophaps scripta scripta</i>	V	V	The squatter pigeon occurs in dry grassy woodland and open forest, mostly in sandy areas close to water. Breeding and foraging habitat is centralised around water resources such as dams and creeks. This sub-species is ground-dwelling that inhabits the grassy understorey of open eucalypt woodland, as well as sown grasslands with scattered remnant trees, disturbed areas (such as roads, railways, settlements and stockyards), scrubland, and <i>Acacia</i> regrowth.  In Queensland, foraging and breeding habitat is known to be associated with the soil landscapes of Land Zone 5 (well drained sandy or loamy soils on undulating plains and foothills) and Land Zone 7 (lateritic soils on low jump-ups and escarpments) (Department of Agriculture Water and the Environment, 2021b). Breeding habitat is within 1 km of suitable waterbodies, whereas foraging can occur up to 3 km from such waterbodies.  Waterbodies that are suitable for the species occur on the lower, gentle slopes and plateaus of sandstone ranges (equivalent to Land Zone 10), alluvial clay soils on river or creek flats (represented by Land Zone 3) or non-alluvial clay soils on flats or plains which are not associated with current alluvial deposits (represented by Land Zone 4). This sub-species is now largely (if not wholly) restricted to Queensland, from the New South Wales border, north to the Burdekin River, west to Charleville and Longreach, and east to the coast to Townsville and Proserpine (Department of Agriculture Water and the Environment, 2021b).	<b>Potential</b> The subspecies is known to breed and forage on land zones 3, 5 and 7, where suitable waterbodies are present (easily accessible with gently sloping banks) within 1-3km. Suitable breeding and foraging habitat is widely available within the project area. The subspecies has been previously recorded approximately 4 km to the west in 1998, 5 km to the east in 2008 (ENSR AECOM 2008) and 4 km to the south in 2020 (ALA).
Bar-tailed godwit (Baueri), Western Alaskan bar-tailed godwit	<i>Limosa lapponica, Limosa lapponica baueri</i>	V	V, Ma, M	The Bar-tailed godwit (western Alaskan) occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (Threatened Species Scientific Committee, 2016a). It has also been recorded in coastal sewage farms and saltworks, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Preferred habitat is not present within the project area, and records are generally found along the coastline > 10 km from the project area, with a few records on the south eastern edge of Lake Ross (ALA).
Major Mitchell's Cockatoo	<i>Lophochroa leadbeateri</i>	V	-	The pink cockatoo inhabits a wide range of treed and treeless inland habitats within easy reach of water, favouring dry woodlands. The species feeds on seeds from the ground, including from species of <i>Acacia spp.</i> And <i>Callitris spp.</i> , and nests in tree hollows such as in eucalypt trees.  The species' distribution incorporates arid to semi-arid inland from south-western Queensland to north-west Victoria, through most of South Australia, and north into the south-west Northern Territory. However, sporadic records exist across Australia including Townsville and Normanton.	<b>Unlikely</b> Suitable habitat may occur within the project area, however there are minimal large hollows available for breeding habitat and the species is typically known from arid to semi-arid inland areas. A few species records are located > 10 km to the north of the project area in Townsville city and near Townsville Town Common (ALA).
Southern giant-petrel	<i>Macronectes giganteus</i>	E	E, Ma, M	The species is widespread throughout the Southern Ocean. It breeds on six subantarctic and Antarctic islands in Australian territory; Macquarie Island, Heard Island and McDonald Island in the Southern Ocean, and Giganteus Island, Hawker Island, and Frazier Island in the Australian Antarctic Territories (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> The southern giant-petrel is a coastal to pelagic species with very a limited terrestrial extent of occurrence. It is considered unlikely to occur within the project area, and one record exists on the coast near Townsville Town Common with no date (ALA)
Star finch (eastern, southern)	<i>Neochmia ruficauda ruficauda</i>	E	E	The Star Finch occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water (Garnett 1993). It also occurs in cleared or suburban areas such as along roadsides and in towns (Department of Agriculture Water and the Environment, 2021b) . Studies at nine former sites of the star finch (eastern) found that the habitat consisted mainly of woodland. These habitats are dominated by trees that are typically associated with permanent water or areas that are regularly inundated; the most common species are <i>E. coolabah</i> , <i>E. tereticornis</i> , <i>E. tessellaris</i> , <i>M. leucadendra</i> , <i>E. camaldulensis</i> and <i>Casuarina cunninghamii</i> .  Its distribution is believed to extend north to Bowen, west to beyond Winton and south to near Wowan (Department of Agriculture Water and the Environment, 2021b). Recent records have been obtained only from scattered sites in central Queensland (i.e. between 21°S and 25°S, and 141°E and 150°E) and, consequently, the star finch (eastern) now appears to be extinct in both south-eastern Queensland and northern New South Wales.	<b>Unlikely</b> Preferred habitat of this finch species is present within the project area. However, the current known distribution does not extend as far north as the Townsville region, and no recent records exist in the region (ALA).

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
Eastern curlew	<i>Numenius madagascariensis</i>	E	CE, Ma, MW, M	During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets (Department of Agriculture Water and the Environment, 2021b). Within Australia, the eastern curlew has a primarily coastal distribution, they are rarely recorded inland (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. However, scattered records occur surrounding the project area including directly to the south at Ross Park, and to the north east along Ross River (ALA).
Black-throated finch (southern)	<i>Poephila cincta cincta</i>	E	E	The Black-throated finch (southern) primary stronghold is the region surrounding Townsville (Black-throated Finch Recovery Team, 2007a). However, it is also known to occur in scattered locations across central-eastern Queensland. Its preferred habitat is grassy open woodland/forest dominated by <i>Eucalyptus</i> , <i>Melaleuca</i> or <i>Acacia</i> , but the species is also known from pandanus flats and scrubby plains. The black-throated finch (southern) feeds on the seed of native grasses from the ground. Three resources are required for the species to persist: water, palatable grass seeds and trees providing suitable habitat. If any of these three resources are not available, Black-throated finch (southern) is unlikely to be present. Further, if connectivity disturbances between these resources are larger than 1km, the disconnected area is unlikely to sustain Black-throated finch (southern) populations.	<b>Likely</b> The study area contains the preferred habitat of this species, such as palatable foraging grass species, suitable nesting trees and access to a permanent source of fresh water. Particularly, RE 11.3.30 and RE 11.3.12 contain high value breeding habitat, and RE 11.3.35 has moderate to marginally suitable habitat due to the density of ground cover. However, the entire project area is considered dispersal habitat, including gently sloping banks for access to ephemeral pools of water. Records for the species exist within the Mount Stuart area including two nesting colonies identified in 2008 100m east of the study area (ENSR AECOM 2008), a record approximately 8 km to the east, and a record on Bohle River 3 km to the west of the project area (ALA).
Australian Painted Snipe	<i>Rostratula australis</i> ; <i>Rostratula benghalensis</i> (sensu lato)	V	E, Ma	The Australian painted snipe inhabits shallow inland wetlands, brackish or freshwater, that are permanently or temporarily inundated. Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Suitable wetlands usually support a mosaic of low, patchy vegetation, as well as lignum and canegrass. Habitat often includes rank emergent vegetation and they are also known to use tree lined areas.  The species has been recorded from wetlands in all Australian states, however is most common in eastern Australia, especially the Murray-Darling Basin. Individuals are nomadic, and there is some evidence of partial migration from south-eastern wetlands to coastal central and northern Queensland in autumn and winter (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Preferred habitat is limited to some exposed muddy banks along the Ross River for potential foraging and breeding, and a wetland to the south west of the project area outside the construction footprint, with dispersal habitat marginal. There are scattered records nearby including two located to the south of the project area near Ross Park from 1994, and a record 2 km to the north west in Carlyle Gardens from 2011 (ALA).
Buff-breasted Button-quail	<i>Turnix olivii</i>	E	E	The buff-breasted button-quail prefers patches of short, sparse grassland, on a terrain of small stones, often on the lower slopes of hills and ridges, and sometimes in open glades amongst <i>Melaleuca</i> , <i>Acacia</i> , <i>Alphitonia</i> or <i>Tristania</i> , in rainforest or open Eucalyptus woodland (Department of Agriculture Water and the Environment, 2021b). The species has been recorded on burnt patches of habitat.  The species is one of the least known birds in Australia, with extent of occurrence estimated at 2000 km <sup>2</sup> in north-eastern Queensland. This may include the Iron Range and near Coen, Cooktown, Musgrave, Mount Molloy, Mareeba, Chillagoe and Ingham. However, records in some locations are not recent, and the species' range is expected to be decreasing, with little known about population fragmentation within the range (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Whilst suitable habitat may exist for foraging within the project area, the species distribution is poorly known, and no records exist within 20 km of the project area (ALA).
Masked Owl (northern)	<i>Tyto novaehollandiae kimberli</i>	V	V	The masked owl (northern) is known to use a range of habitat types in Queensland including riparian forest, rainforest, open forests, <i>Melaleuca</i> swamps, and mangrove edges and along sugar cane field margins. This species usually nests in tree hollows, within patches of closed forest.  In Queensland, there are historical records of the masked owl (northern) from the Normanton region, and from Pascoe, Archer, Chester and Watson Rivers on Cape York Peninsula. It occurs along the southern rim of the Gulf of Carpentaria, Cape York Peninsula and south to Atherton Tablelands and the Einasleigh-Burdekin divide (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Some suitable habitat may exist for foraging within the project area, however the species distribution is poorly known, and public databases indicate that the closest known records are from Tumoulin, Queensland and further north towards Atherton approximately 340km to the north. The project area lacks large hollows for roosting and breeding, therefore the species is considered unlikely to utilise the project area for foraging activities.

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
<b>Migratory Birds</b>					
Common Sandpiper	<i>Actitis hypoleucos</i>	SLC	MW, Ma	<p>The common sandpiper is known to occur in a range of wetland environments, both coastal and inland, with varying levels of salinity. Their primary habitat is rocky shorelines and narrow muddy margins of billabongs, lakes, estuaries and mangroves. The species has also been recorded on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties (Department of Agriculture Water and the Environment, 2021b).</p> <p>Found along all coastlines of Australia and in many areas inland, the common sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> A wetland adjacent to the north of the project area may provide habitat when suitable environmental conditions prevail, however the project will not directly impact this area. The majority of records are along the coastline, however some records exist to the south of the project area around Lake Ross, and to the north east further along the Ross River (ALA).</p>
Fork-tailed Swift	<i>Apus pacificus</i>	SLC	M, Ma	<p>The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.</p> <p>This species mostly occurs over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. They often occur over cliffs and beaches and over islands and sometimes well out to sea.</p> <p>This species is generally recorded east of the Great Dividing Range from Cooktown to the New South Wales border, but extends further west in southern Queensland (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Likely (flyover only)</b> The fork-tailed swift is an aerial species known to fly over broad habitat types. Records occur surrounding the project area throughout Townsville, including recent records nearby from 2014-2018 (ALA). This species is likely to occur in the airspace above the project area.</p>
Ruddy Turnstone	<i>Arenaria interpres</i>	SLC	MW	<p>This species is a non-breeding migrant to Australia. In Australasia, the Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs, with occasional records of inland populations. It is reported to strongly prefer rocky shores or beaches where there are large deposits of rotting seaweed. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches. It can, however, be found on sand, coral or shell beaches, shoals, cays and dry ridges of sand or coral.</p> <p>There are 15 recognised sites of international importance in Australia, however none occur in Queensland (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> This species is primarily coastal and wetlands suitable for this species to persist are not present within the project area. In Townsville, all records are within a few kilometres of the coastline, &gt; 10 km from the project area (ALA).</p>
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	SLC	MW, Ma	<p>In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms.</p> <p>In Queensland, the sharp-tailed sandpiper is recorded in most regions, being widespread along much of the coast and are very sparsely scattered inland, particularly in central and south-western regions. Many inland records are of birds on passage (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. The species records are primarily within a few kilometres of the coastline, with scattered inland occurrences including a few records at Lake Ross to the south of the project area, and one record along the Ross River to the north of the project area, noting that these inland records are &gt; 15 years old (ALA).</p>
Sanderling	<i>Calidris alba</i>	SLC	MW, Ma	<p>In Australia, the species is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed. Sanderlings also occur on beaches that may contain wave-washed rocky outcrops. Less often the species occurs on more sheltered sandy shorelines of estuaries, inlets and harbours. Rarely, they are recorded in near-coastal wetlands, such as lagoons, hypersaline lakes, salt ponds and samphire flats. There are rare inland records from sandy shores of ephemeral brackish lakes and brackish river-pools (Department of Agriculture Water and the Environment, 2021b).</p> <p>The sanderling is a non-breeding migrant in Australia, almost always occurring in coastal areas. Inland records have occurred in most states of singles or small groups, birds probably on migration. In Queensland, this species is occasionally recorded in the Gulf of Carpentaria and Torres Strait. Scattered records also occur in mid-east and south-east Queensland from Townsville and Alva Beach, south to Fraser Island, and around Moreton Bay and Point Danger, including on offshore islands (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. In Queensland, all records occur along the coastline, &gt; 10 km from the project area (ALA).</p>

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
Pectoral Sandpiper	<i>Calidris melanotos</i>	SLC	MW, Ma	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. This species is usually found in coastal or near coastal habitat but very occasionally found further inland.  In Queensland, most records for the pectoral sandpiper occur around Cairns. There are scattered records elsewhere, mainly from east of the Great Divide between Townsville and Yeppoon. Records also exist in the south-east of the state as well as a few inland records at Mount Isa, Longreach and Oakley (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. In Queensland, all records occur along the coastline, > 10 km from the project area (ALA).
Red-necked Stint	<i>Calidris ruficollis</i>	SLC	MW, Ma	In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They sometimes use flooded paddocks or damp grasslands. They have occasionally been recorded on dry gibber plains, with little or no perennial vegetation (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Marginal habitat is present in wetlands adjacent to the north east of the project area, however this will not be directly impacted by the project. Records are primarily located along the coastline, with a nearby record on Ross River to the north of the project area from 2006, and at Lake Ross to the south of the project area from 2013 (ALA).
Double-banded plover	<i>Charadrius bicinctus</i>	SLC	M, Ma	The double-banded plover prefers littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks. It is also found on seagrass beds, especially <i>Zostera</i> , which, when exposed at low tide, remain heavily saturated or have numerous water-filled depression (Department of Agriculture Water and the Environment, 2021b). The species can be found in both coastal and inland areas, and during non-breeding season is common in eastern and southern Australia, mainly between the Tropic of Capricorn and western Eyre Peninsula, with occasional records in northern Queensland and Western Australia.	<b>Unlikely</b> Marginal habitat is present in wetlands adjacent to the north east of the project area, however this will not be directly impacted by the project. Records are primarily located along the coastline, > 10 km from the project area (ALA).
Little ringed plover	<i>Charadrius dubius</i>	SLC	M	This species is a non-breeding migrant to Australia. It has an extremely large range across the northern hemisphere, but in Australia records are rare. In Queensland it has been recorded in Cairns and south of Ayr.	<b>Unlikely</b> This species is rare in Australia and not known from the Townsville area (eBird, 2021). A few old species records exist > 10 km to the north of the project area from 1984-1985, near Mount St John (ALA).
Oriental Plover, Oriental Dotterel	<i>Charadrius veredus</i>	SLC	MW, Ma	Immediately after arriving in non-breeding grounds in northern Australia, Oriental Plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland (Department of Agriculture Water and the Environment, 2021b). Thereafter they usually inhabit flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps, or open areas that have been recently burnt (Department of Agriculture Water and the Environment, 2021b).  The species occurs in both coastal and inland areas, mostly in northern Australia, with records commonly along the north-western coast, and few scattered records elsewhere along the northern coast.	<b>Unlikely</b> This species is primarily coastal and wetlands suitable for this species to persist are not present within the project area. In Queensland, all records are along the coastline, and one record at Lake Ross, all > 10 km from the project area (ALA).
Oriental Cuckoo	<i>Cuculus optatus</i>	SLC	M	This species uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types. It mainly inhabits coniferous, deciduous and mixed forests. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.  The oriental cuckoo is a regular migrant to Australia, where it spends the non-breeding season (Sept- May) in coastal regions across northern and eastern Australia as well as offshore islands (Department of the Environment, 2015b).	<b>Potential</b> Suitable riparian habitat exists within the project area to support the species. Recent records are scattered around the project area, including Ross River, Lake Ross and Bohle River (ALA).
Lesser Frigatebird	<i>Fregata ariel</i>	SLC	M, Ma	This species is found in tropical and subtropical seas, coasts and islands, nesting in low trees, shrubs and grasses (Department of Agriculture Water and the Environment, 2021b). It is common in tropical seas, breeding on remote islands, including Christmas Island in the Indian Ocean in recent years.	<b>Unlikely</b> Whilst suitable habitat may be present within the project area, the species is primarily coastal, with recent records > 10 km from the project area along the coast (ALA).

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
Great Frigatebird, Greater Frigatebird	<i>Fregata minor</i>	-	M, Ma	The great frigatebird inhabits small, remote islands in tropical and sub-tropical waters, where it breeds in small bushes, low trees, mangroves and even on the ground (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Whilst suitable habitat may be present within the project area, the species is primarily coastal, with records > 10 km from the project area along the coast (ALA).
Latham's Snipe	<i>Gallinago hardwickii</i>	SLC	MW, Ma	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level (Department of Agriculture Water and the Environment, 2021b). They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.  Latham's snipe is a non-breeding visitor to south-eastern Australia, and is a passage migrant through northern Australia. This species has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. In Queensland, the range extends inland over the eastern tablelands in south-eastern Queensland (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> A wetland adjacent to the north of the project area may provide habitat when suitable environmental conditions prevail, however the project will not directly impact this area. Scattered nearby records occur along Ross River, including an old record from 1965 directly adjacent to the project area (ALA).
Swinhoe's Snipe	<i>Gallinago megala</i>	SLC	MW, Ma	During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. The species is also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens (Department of Agriculture Water and the Environment, 2021b).  The species has few definite records in Australia, however it has been recorded in the north between the Kimberley Divide and Cape York Peninsula, commonly in the Top End of the Northern Territory, and in Western Australia. In Queensland, specimens have been taken at Normanton and the species has also been sighted at Mount Isa (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. No species records occur in the Townsville area (ALA).
Pin-tailed Snipe	<i>Gallinago stenura</i>	-	MW, Ma	During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. No species records occur in the Townsville area (ALA).
White-throated Needletail	<i>Hirundapus caudacutus</i>	V	V, M, Ma	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (Department of Agriculture Water and the Environment, 2021b). Due to their aerial nature, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Department of Agriculture Water and the Environment, 2021b).  This species is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and New South Wales, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (Department of the Environment, 2015b).	<b>Likely (flyover only)</b> Aerial species known to fly over broad habitat types. Records occur surrounding the project from 2015-2018 (ALA). This species is likely to occur in the airspace above the project, occasionally roosting in the tree hollows.
Caspian tern	<i>Hydroprogne caspia</i>	SLC	MW	The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks (Department of Agriculture Water and the Environment, 2021b). They also use artificial wetlands, including reservoirs, sewage ponds and saltworks. In offshore areas the species prefers sheltered situations, particularly near islands, and is rarely seen beyond reefs.  The Caspian Tern usually forages in open wetlands, including lakes and rivers. They often prefer sheltered shallow water near the margins, but can also be found in open coastal waters. In coastal inlets they may prefer to forage in tidal channels, or over submerged mudbanks (Department of Agriculture Water and the Environment, 2021b). The Caspian Tern breeds on variable types of sites including low islands, cays, spits, banks, ridges, beaches of sand or shell, terrestrial wetlands and stony or rocky islets or banks. Nests may be in the open, or among low or sparse vegetation, including herbfield, tussocks, samphire or other prostrate sand-binding plants. They sometimes nest near bushes or other shelter such as large sticks, driftwood, piles of beachcast seagrass. Nests usually consist of a slight hollow scraped in the ground, and is left bare or is lined with grass, a few twigs, seaweed, feathers, small stones and shells. Generally roosting occurs on bare exposed sand or shell spits, banks or shores of coasts, lakes, estuaries, coastal	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. A wetland adjacent to the north of the project area may provide habitat when suitable environmental conditions prevail, however the project will not directly impact this area. Scattered nearby records occur along Ross River, including an old record from 1997 directly adjacent to the project area (ENSR AECOM 2008).

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				lagoons and inlets. Occasionally they nest among beachcast debris above the high-water mark or at artificial sites, including islands in reservoirs, or on dredge-spoil (Department of Agriculture Water and the Environment, 2021b).	
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	SLC	MW, Ma	The Broad-billed Sandpiper occurs in sheltered parts of the coast, favouring estuarine mudflats but also occasionally occur on saltmarshes, shallow freshwater lagoons, saltworks and sewage farms, and in areas with large soft intertidal mudflats, which may have shell or sandbanks nearby. Occasionally they occur on reefs or rocky platforms. They have also been recorded in creeks, swamps and lakes near the coast, particularly those with bare mudflats or sand exposed by receding water. They often favour mud among, or fringed by, mangroves, particularly on the seaward side and sometimes occur in estuaries edged by saltmarsh (Department of Agriculture Water and the Environment, 2021b).  In Australia, the species is most common on the north and north-west coasts. In Queensland, they have been seen at Coen River, Eagle Island, Cairns, Innisfail, Townsville and Jerona.	<b>Unlikely</b> Mudflats and lagoons suitable for this species to persist are not present within the project area. In the Townsville area, reliable ALA records are restricted to the coast.
Bar-tailed Godwit; Western Alaskan bar-tailed godwit	<i>Limosa lapponica</i> ; <i>Limosa lapponica baueri</i>	SLC	MW	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (Department of Agriculture Water and the Environment, 2021b). It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> The species is primarily coastal and suitable roosting habitat is not present within the project area. In the Townsville area, reliable ALA records are restricted to the coast and the far south east of Lake Ross.
Black-tailed Godwit	<i>Limosa limosa</i>	SLC	MW, Ma	In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets (Department of Agriculture Water and the Environment, 2021b). The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, salt flats, river pools, swamps, lagoons and floodplains. There are a few inland records, around shallow, freshwater and saline lakes, swamps, dams and bore-overflows. They also use lagoons in sewage farms and saltworks (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> The species is primarily coastal and the project area does not provide suitable roosting habitat or wetland habitat. In the Townsville area, reliable species records are restricted to the coast, and some undated records to the south east of Lake Ross (ALA).
Black-faced Monarch	<i>Monarcha melanopsis</i>	SLC	M, Ma	The black-faced monarch is a wet forest specialist, occurring mainly in rainforests and riparian vegetation. This species mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrub land, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. The species is occasionally found in eucalypt forest (mainly wet sclerophyll forest) nearby preferred rainforest habitat, particularly in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands often with a patchy understorey. The species is more likely to be found in these marginal habitats when on passage (Australian winter).  In Queensland, the black-faced monarch is widespread from the islands of the Torres Strait and on Cape York Peninsula, south along the coasts (occasionally including offshore islands) and the eastern slopes of the Great Divide, to the New South Wales border (Department of the Environment, 2015b).	<b>Potential</b> Vegetation on much of the Project area consists of eucalypt open woodland which may be dispersed through when on passage, however given the availability of more suitable habitat in the area, is unlikely to be used by the species. One small patch of riparian forest with higher cover and dense understorey does exist in the south of the Project area where the disturbance corridor crosses the Ross River and connects to Riverway Drive. Several records exist around this area (ALA), and the species may use this habitat when on migration.
Spectacled Monarch	<i>Monarcha trivirgatus</i>	SLC	M, Ma	This species occupies dense vegetation, mainly in rainforest but also in moist or wet sclerophyll forest and occasionally in other densely vegetated habitats such as mangroves, drier forest, woodlands, parks and gardens.  The spectacled monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales (Department of the Environment, 2015b).	<b>Unlikely</b> Suitable wet forest and rainforest habitat does not occur within the project area. Occasional records exist around Townsville and along the Ross River (ALA); however the species is unlikely to utilise the project area.
Yellow Wagtail	<i>Motacilla flava</i>	SLC	M, Ma	The yellow wagtail is considered one of five 'extremely uncommon migrants' to Australia. When in Australia it is a regular wet season visitor to northern Australia. In Queensland this species has been recorded from Mossman south to Townsville Habitat requirements for the yellow wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Preferred habitat is not present within the Study Area or project area. Records occur near the Townsville Town Common, > 10 km to the north of the project area (ALA). The yellow wagtail is also considered an extremely uncommon migrant (Department of the Environment, 2015b).

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
				The yellow wagtail is a regular wet season visitor to northern Australia. In Queensland this species is a regular visitor from Mossman south to Townsville. The species is a vagrant further south and on Heron Island (Department of the Environment, 2015b).	
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	SLC	M, Ma	Satin flycatchers are eucalypt forest and woodland inhabitants. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland. The diversity of occupied habitats expands during migration, with the species recorded in most wooded habitats. Wintering birds in northern Queensland will use rainforest – gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.  In Queensland, this species is widespread but scattered in the east, being recorded on passage on a few islands in the western Torres Strait. Satin flycatchers are also found extensively along the Great Dividing Range (Department of the Environment, 2015b).	<b>Potential</b> Suitable marginal habitat exists in the project area within the riparian areas for foraging and breeding. Records occur near the Townsville Town Common and scattered throughout broader Townsville, with a 2017 record approximately 4 km east of the project area at the James Cook University, and a 2012 record 4km to the west at Bohle River (ALA).
Little Curlew	<i>Numenius minutus</i>	SLC	MW, Ma	The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used (Department of Agriculture Water and the Environment, 2021b).  The species generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland Coast. In Queensland, the little curlew is generally widespread in coastal regions with some inland records (Department of Agriculture Water and the Environment, 2021b).	<b>Potential</b> Suitable habitat exists in the project area as the species utilises many broad habitat types. Records occur primarily along the coastline > 10 km from the project area, with one record approximately 6 km to the north along Ross River from 2019, and one record with no date on the east of Lake Ross (ALA).
Whimbrel	<i>Numenius phaeopus</i>	SLC	MW, Ma	The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas. It also used salt flats with saltmarsh, or saline grasslands with standing water left after high spring-tides, and in similar habitats in sewage farms and salt fields (Department of Agriculture Water and the Environment, 2021b). There are a small number of inland records from saline lakes and cane grass swamps. It has also been recorded in coastal dunes and on a football field (Department of Agriculture Water and the Environment, 2021b). The species is a regular migrant to Australia with a primarily coastal distribution. In Queensland it is found along almost the entire coast, with scattered records elsewhere (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Suitable habitat is limited in the project area, with records occurring > 10 km from the project area along the coast (ALA).
Osprey	<i>Pandion haliaetus</i>	SLC	MW, Ma	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia (Department of Agriculture Water and the Environment, 2021b). They require extensive areas of open fresh, brackish or saline water for foraging.  The breeding range of the osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in New South Wales; with a second isolated breeding population on the coast of South Australia, extending from Head of Bight east to Cape Spencer and Kangaroo Island (Department of Agriculture Water and the Environment, 2021b).	<b>Potential</b> The species is likely to occasionally use the Ross River adjacent to the site to forage or may occur over the project area when travelling to and from foraging sites. A recent record from 2018 occurs along the Townsville coastline (ALA).
Ruff (Reeve)	<i>Philomachus pugnax</i>	SLC	MW, Ma	In Australia the Ruff is found on generally fresh, brackish or saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. They are occasionally seen on sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. They are sometimes found on wetlands surrounded by dense vegetation including grass, sedges, saltmarsh and reeds. They have been observed on sand spits and other sandy habitats including shingles. The Ruff forages on exposed mudflats, in shallow water and occasionally on dry mud (Department of Agriculture Water and the Environment, 2021b).  In Queensland, the ruff is widely scattered at several localities including Edward River, Hasties Swamp, Atherton Tableland, Townsville, Alva, and in the south-east at Lytton, Myrtle town, Luggage Point, Nudgee and Dyer's Lagoon (DoE 2021).	<b>Unlikely</b> Suitable foraging habitat may occur within the project area, however it is unlikely to be considered the species' primary habitat. Records are > 15 km from the project area at the mouth of Ross River, however these are from 1985 (ALA).
Pacific Golden Plover	<i>Pluvialis fulva</i>	SLC	MW, Ma	Within Australia, this species is widespread in coastal regions, though there are also a number of inland records (in all states), sometimes far inland and usually along major river systems, especially the Murray and Darling Rivers and their tributaries (Department of Agriculture Water and the Environment, 2021b). Most Pacific Golden Plovers occur along the	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. Species records are

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
				east coast, and are especially widespread along the Queensland and NSW coastlines. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. The species is also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks.	> 10 km from the project area close to the coastline, with one stray record at Lake Ross with no date (ALA).
Grey Plover	<i>Pluvialis squatarola</i>	SLC	MW, Ma	The grey plover is a non-breeding migrant to Australia, where it is found along the coasts of all states and is especially abundant on the western and southern coastlines. Internationally important sites in Queensland include south-eastern Gulf of Carpentaria and the Great Sandy Strait. This species usually inhabits sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. Species records are > 10 km from the project area close to the coastline (ALA).
Rufous Fantail	<i>Rhipidura rufifrons</i>	SLC	M, Ma	In east and south-east Australia, the rufous fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts, usually with a dense shrubby understorey often including ferns.  The rufous fantail is found in northern and eastern coastal Australia, being more common in the north. This species migrates to south-east Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Department of the Environment, 2015b).	<b>Potential</b> Suitable habitat is present within the project area, including riparian areas for foraging and breeding. Numerous records occur in the region, with the most recent records from 2015 and 2016 along Ross River and a record from 2013 on the Bohle River (ALA).
Little Tern	<i>Sternula albifrons</i> ; <i>Sterna albifrons</i> ;	SLC	M, Ma	In Australia, little terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (Department of Agriculture Water and the Environment, 2021b).  The Australian breeding population can be divided into two major subpopulations: (1) a northern subpopulation that breeds across northern Australia, from about Broome in north-western Western Australia, through coastal Northern Territory to the Gulf of Carpentaria and eastern Cape York Peninsula; and (2) an eastern subpopulation that breeds on the eastern and south-eastern coast of the mainland and northern and eastern Tasmania.	<b>Unlikely</b> This species is primarily coastal and wetlands suitable for this species to persist are not present within the project area. There is a record from 2019 approximately 5 km to the west of the project area near the Bohle River, however all other records occur along the coast > 10 km north (ALA).
Grey-tailed Tattler	<i>Tringa brevipes</i> ; <i>Heteroscelus brevipes</i>	SLC	MW, Ma	The grey-tailed tattler is found along the entire coast, with small numbers located in the Gulf of Carpentaria. It is widespread along the east coast and the Torres Strait. There is a continuous population along the entire east coast of Cape York Peninsula with rare inland occurrences.  The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> No suitable habitat occurs within the project area. Reliable species records occur only along the coastline, > 10 km from the project area (ALA).
Wood Sandpiper	<i>Tringa glareola</i>	SLC	MW, Ma	In Queensland, there are sparsely scattered records, generally south of 17° S, but also around Cairns.  The wood sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation and often with fallen timber. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. This species uses artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. Numerous species records occur only along the coastline, > 10 km from the project area (ALA).
Wandering Tattler	<i>Tringa incana</i> ; <i>Heteroscelus incanus</i>	SLC	MW, Ma	The Wandering Tattler is a non-breeding vagrant in the East Asian-Australasian Flyway and is uncommon in Australia. It is generally found on rocky coasts with reefs and platforms, points, spits, piers, offshore islands and shingle beaches or beds. It is occasionally seen on coral reefs or beaches, and tends to avoid mudflats (Department of Agriculture Water and the Environment, 2021b). Foraging habitat is among rocks or shingle, or in shallow pools at edges of reefs or beaches, mainly along the tideline. Wandering Tattlers have been recorded roosting or perching on top of boulders surrounded by or close to water (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> No suitable habitat occurs within the project area. Species records are sparsely located along the coastline (ALA).
Common Greenshank	<i>Tringa nebularia</i>	SLC	MW, Ma	The common greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms.	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. Numerous records occur around Townsville, primarily close to the coastline, with records at Ross Park directly to the

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
				In Queensland, this species is widespread in the Gulf country and eastern Gulf of Carpentaria. It has been recorded in most coastal regions, possibly with a gap between north Cape York Peninsula and Cooktown. Inland, there have been a few records south of a line from near Dalby to Mount Guide, and sparsely scattered records elsewhere (Department of Agriculture Water and the Environment, 2021b).	south of the project area from 2014, records along Ross River to the north, and in Lake Ross (ALA).
Marsh Sandpiper	<i>Tringa stagnatilis</i>	SLC	MW, Ma	The marsh sandpiper is found on coastal and inland wetlands throughout Australia. The species is widespread in coastal Queensland, but few records exist north of Cooktown.  This species lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Wetlands suitable for this species to persist are not present within the project area. Numerous species records occur around Townsville, close to the coastline and at Lake Ross (ALA).
Terek Sandpiper	<i>Xenus cinereus</i>	SLC	MW, Ma	The terek sandpiper is a non-breeding migrant to Australia. In Australia, this species has a primarily coastal distribution and is more widespread and common in northern and eastern Australia than southern Australia. There are twelve sites of international significance in Australia, four of which are in Queensland including south-east Gulf of Carpentaria, Shoalwater Bay and Broad Sound, the Great Sandy Strait and Moreton Bay.  It mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. The species has also been recorded on islets, mudbanks, sandbanks and spits, and near mangroves and occasionally in samphire ( <i>Halosarcia</i> spp.). Mangroves are preferred for roosting (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> This species is primarily coastal and wetlands within the project area are not tidal. In the Townsville area, reliable species records are restricted to the coast (ALA).
<b>Mammals</b>					
Northern Quoll	<i>Dasyurus hallucatus</i>	LC	E	The northern quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern quolls are also known to occupy non rocky lowland habitats such as beach scrub communities in central Queensland. Northern quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes.  In Queensland, the northern quoll is known to occur as far south as Gracemere and Mount Morgan, south of Rockhampton, as far north as Weipa in Queensland and extends as far west into central Queensland to the vicinity of Carnarvon Range National Park (Department of Agriculture Water and the Environment, 2021b).	<b>Potential</b> Although the species has not been confirmed at Mt Stuart, high value potential habitat for this species does exist in the interior rugged hilly landforms, with rocky areas suitable for denning and a diversity of adjacent habitats which can be utilised for foraging and dispersal. If the species is present, it may utilise the habitat within the project area for these purposes or to access water. A few species records occur in Townsville city, however these are spatially and temporally inaccurate from 1991 or with no date (ALA). This is an elusive species and therefore has the potential to occur in the project area.
Semon's leaf-nosed bat, Greater wart-nosed Horseshoe bat	<i>Hipposideros semoni</i>	E	V	Semon's leaf-nosed bat occurs mainly in north-eastern Australia (along eastern Cape York Peninsula to Townsville), with the majority of records around Iron Range, Kulla, Oyala Thumotang and Cape Melville National Parks, and near Cooktown (Threatened Species Scientific Committee, 2016c). It is found in tropical rainforest, monsoon forest, wet sclerophyll forest and open savannah woodland (Department of Agriculture Water and the Environment, 2021b). It is known to roost in houses, abandoned buildings, caves and trees (Threatened Species Scientific Committee, 2016c).	<b>Unlikely</b> Limited roosting is available in the study area, with the species considered unlikely to be found within Townsville. The bat call analysis did not detect the species.
Ghost bat	<i>Macroderma gigas</i>	E	E	The species current range is discontinuous, with geographically disjunct colonies occurring in the Pilbara, Kimberley, Northern Territory (particularly the coastline, including Groote Eylandt), the Gulf of Carpentaria, coastal and near coastal eastern Queensland from Cape York to near Rockhampton, and western Queensland (including Riversleigh and Cammoweal districts). They occupy habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests. During the daytime they roost in caves, rock crevices and old mines. Permanent roost sites include deep natural caves or disused mines with a relatively stable temperature of 23°–28°C and a moderate to high relative humidity of 50–100 percent (Department of Agriculture Water and the Environment, 2021b). From September to April, ghost bats aggregate in maternity roost sites to breed. Most of the colony disperses (up to 150km) from maternity roosts during the non-breeding season in the cooler months. During this time, ghost bats use large numbers of caves, rock shelters, overhangs, vertical cracks, and mines as day roosts. Ghost bats forage an average of 1.9km from day roosts.	<b>Potential</b> No suitable roosting habitat is present within the project area and no previous records exist in the area. The closest known Ghost bat colony is located at Hervey's Range > 25 km to the west of the project area, which has similar geology and is connected to the project area. The species may use the area for foraging and dispersal.

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Black-footed tree-rat (North Queensland)	<i>Mesembriomys gouldii rattooides</i>	LC	V	The black-footed tree-rat (north Queensland) is a nocturnal medium-sized native mammal and one of the largest rodents in Australia. Its distribution and ecology are poorly known. In north Queensland, this species mostly occurs in eucalypt forests and woodlands, especially where hollows are relatively plentiful. Denning mostly occurs in tree hollows, but occasionally in dense foliage (notably of Pandanus) and in buildings (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> The project area contains eucalypt woodland and scattered pandanus trees which are important to this species. However, no species records occur in the wider Townsville area within 20 km of the project area.
Greater glider	<i>Petauroides volans</i>	V	V	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. An isolated inland subpopulation occurs in the Gregory Range west of Townsville, and another in the Einasleigh Uplands. The species is largely restricted to eucalypt forests. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant large hollows (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> The project area does not contain many of the habitat values required to support this species. There are minimal large hollows to support breeding habitat, and the mature trees are generally shorter than the preferred habitat type for the greater glider. There may be foraging or breeding habitat in the adjacent ranges for the species. However, no species records occur in the wider Townsville area within 20 km of the project area.
Sharman's rock wallaby	<i>Petrogale sharmani</i>	V	V	The species occurs in a variety of rocky habitats (including rocky outcrops, boulder piles, gorges, cliff lines and rocky slopes) within open forests or grassy woodlands. It shelters during the day in rocky refuges or dense vegetation, emerging at dusk to feed.  The range of Sharman's rock-wallaby is limited. It is known from only about 20 colonies scattered within a 2,000 km <sup>2</sup> area of the Seaview and Coane Ranges, west of Ingham in north-eastern Queensland (Department of Agriculture Water and the Environment, 2021b).	<b>No</b> Suitable habitat for this species is not found within the project area such as rocky outcrops. The project area also occurs outside the known distribution for the species, with no records in 20 km of the project area (ALA).
Koala	<i>Phascolarctos cinereus</i>	V	V	Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities. Koalas eat a variety of eucalypt leaves and a few other related tree species, including <i>Lophostemon</i> , <i>Melaleuca</i> and <i>Corymbia</i> species. Koalas are found in higher densities where food trees are growing on more fertile soils and along watercourses.  In north Queensland, the koala's distribution extends inland from the east coast: from the Wet Tropics bioregion, into the Einasleigh Uplands bioregion in the north of the state (Department of Agriculture Water and the Environment, 2021b). The northern limit of the distribution of the koala in Queensland has contracted to the south, from approximately Cooktown to inland of Cairns, since the late 1960s.  All observations of koala in the Townsville area, both anecdotal and confirmed, have been of koalas in <i>Eucalyptus crebra</i> -dominated woodland habitat, where the woodlands are contiguous with large areas of similar floristic composition, or in riparian areas with <i>Eucalyptus tereticornis</i> as the characteristic species.	<b>Unlikely</b> <i>Eucalyptus</i> and <i>Corymbia</i> species are common within the project area; however koalas are extremely rare in the Townsville area and the only locally confirmed records for the koala occur on Magnetic Island (Dr. C. Hoskin, James Cook University Townsville, pers. Comm, 2018). Records on ALA include one from 1960 at Hervey Range, two at Townsville city with unknown coordinate precisions, and one at Bluewater. Numerous records occur on Magnetic Island.
Spectacled flying-fox	<i>Pteropus conspicillatus</i>	V	E	This species was long assumed to feed primarily on rainforest species but individuals regularly feed on a wide variety of non-rainforest species, including eucalypts ( <i>Eucalyptus</i> spp., <i>Corymbia</i> spp.) in tall open forests adjoining rainforest communities and in tropical woodland and savanna ecosystems.  The spectacled flying-fox occurs in north-eastern Queensland, north of Cardwell with past records from Brisbane and Chillagoe. It is restricted to tropical rainforest areas, most specifically, the species occurs between Ingham and Cooktown, and between the McIlwraith and Iron Ranges of Cape York (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> No suitable rainforest habitat is found within or adjacent the project area and there are no nearby camps identified on the National Flying-fox Register. No species records occur within 20 km of the project area (ALA).
Greater large-eared horseshoe bat	<i>Rhinolophus robertsi</i>	E	V	The greater large-eared horseshoe bat prefers lowland rainforest, along gallery forest-lines creeks within open eucalypt forest, <i>Melaleuca</i> forest with rainforest understorey, open savannah woodland and tall riparian woodland of <i>Melaleuca</i> , forest red gum ( <i>Eucalyptus tereticornis</i> ) and Moreton Bay ash ( <i>E. tessellaris</i> ) (Department of Agriculture Water and the Environment, 2021b). The species roosts in caves and underground mines located in rainforest, open eucalypt forest and woodland, and may utilise road culverts, basal hollows of large trees, dense vegetation, rockpiles and areas beneath creekbanks (Department of Agriculture Water and the Environment, 2021b).  The species is found only in northern Queensland, from the Iron Range southwards to Townsville and west to the karst regions of Chillagoe and Mitchell-Palmer. The southern limit of its range has not been clarified, and it may be present south of Townsville at Mt Elliott and Cape Cleveland (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> The species was not detected at anabat sites from 2-8 February 2021. However, suitable foraging habitat may be present and insects are also present for feeding. Minimal roosting or breeding habitat due to lack of hollows. No species records occur within 20 km of the project area (ALA).

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
Bare-rumped Sheathtail Bat	<i>Saccolaimus saccolaimus nudicluniatus</i>	E	V	<p>The bare-rumped sheath-tailed bat occurs mostly in lowland areas, typically in a range of woodland, forest and open environments, and possibly rainforest (Department of Agriculture Water and the Environment, 2021b). . In Queensland, it is known to be associated with coastal lowland rainforests, and more open forests dominated by Eucalyptus or Corymbia species interspersed with coastal lowland rainforest. Overseas, it has been observed roosting in various hollow-bearing tree species and geological formations, such as caves. However, surveys of caves in Queensland and the Northern Territory have failed to locate this subspecies (Threatened Species Scientific Committee, 2016d). The small number of roosts recorded in Australia have all been found in deep tree hollows of poplar gum (<i>Eucalyptus platyphylla</i>), Darwin woollybutt (<i>E. miniata</i>), Darwin stringybark (<i>E. tetradonta</i>) and weeping paperbark (<i>Melaleuca leucadendra syn. Leucodendron</i>) (Threatened Species Scientific Committee, 2016d).</p> <p>The habitat adjacent to the roost in the Jerona Fauna Sanctuary at Ayr in north Queensland was in <i>Eucalyptus platyphylla</i> woodland, typical of the alluvial plains adjacent to the lower Burdekin and Houghton Rivers, near Townsville. Adjacent to this habitat were woodlands dominated by <i>Eucalyptus tessellaris</i> and <i>Eucalyptus papuana</i>. At Iron Range, roosts were located in <i>Eucalyptus tetradonta</i> with <i>Corymbia clarksoniana</i>.</p> <p>The type locality for the bare-rumped sheath-tailed bat is Babinda Creek near Cardwell, North Queensland. Occasional individuals have been collected from a narrow coastal region between Ayr and Cooktown, with one isolated specimen from north of Coen on Cape York Peninsula. Other observations include a road-killed individual on Magnetic Island off Townsville; a sighting of up to 15 individuals flushed from a roost tree in the Iron Range area; and likely acoustic detection in an area to the west of Townsville (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Known</b></p> <p>The species was positively recorded at all three anabat survey sites from 2-8 February 2021. The species is likely to utilise the project area for foraging and dispersal. Suitable roosting habitat is marginal and the species may not permanently occupy the project area.</p>
Coastal sheathtail bat	<i>Taphozous australis</i>	NT	-	<p>The coastal sheathtail bat forages within about one kilometre of the ocean, in habitat including sand dune scrub, mangroves, melaleuca swamps, coastal heathlands, open eucalypt forest, and grasslands. The species is distributed in a thin band along the north-east coast of Queensland from Shoalwater Bay to Cape York.</p>	<p><b>Likely</b></p> <p>The species was not detected at anabat sites from 2-8 February 2021. Records of roosting in the shallow caves of the southern Mount Stuart Training Area dated 2000 and 2008 occur as close as 300 m east of the southern study area (ENSR AECOM 2008) and about 15 km to the north east of the project area near Townsville city on Ross Creek from 2000 (ALA). The species prefers to be within a few kilometres of the coast, however with recent records close to the project area it is considered likely to occur.</p>
Water mouse	<i>Xeromys myoides</i>	V	V	<p>The water mouse has been recorded in coastal saltmarsh, mangrove and adjacent freshwater wetland habitats in the Northern Territory, Queensland and New Guinea (Department of the Environment and Resource Management, 2010). Until recently In Queensland, the species was known from the Proserpine area south to near the Queensland/ New South Wales border. However, in 2017, a population was identified in Cairns. Habitat for this species includes mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands, and in central Queensland, they have only been captured in the high inter-tidal zone in tall, closed fringing mangrove forest containing only <i>Ceriops tagal</i> and/or <i>Bruguiera</i> species (Ball, 2004) and in saline grassland adjacent to closed forest of <i>Ceriops tagal</i> and/or <i>Bruguiera</i> species and <i>Avicennia marina</i> (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b></p> <p>Previous surveys conducted at the mouth of the Ross River and involving a total survey effort of 290 trap nights and active searches, failed to detect the water mouse (BAAM 2004). The 2004 study concluded that water mouse would be an unlikely occurrence in the area due to the extent of anthropogenic disturbance and based on the known extent of distribution at the time. Additionally, the project area does not contain estuarine wetlands, grasslands and forblands (land zone 1), which are recognised as core habitat for this species.</p>
<b>Frogs</b>					
Lace-eyed Tree Frog	<i>Litoria dayi</i>	V	V	<p>The lace-eyed tree frog is a rainforest species endemic to the Wet Tropics Bioregion, associated with rainforests and rainforest margins preferring fast-flowing rocky streams, but also utilising slower watercourses where ample vegetation exists along the margins (Department of Agriculture Water and the Environment, 2021b). It may be found on rocks, boulders and vegetation in or adjacent to streams.</p> <p>The species is considered to occur throughout the Wet Tropics Bioregion from Paluma to Cooktown, northern Queensland, at altitude between 0 and 1200m (Threatened Species Scientific Committee, 2019). It was last recorded from Mt Spec State Forest in 1990 and the Kirrama Range in 1989.</p>	<p><b>Unlikely</b></p> <p>The species prefers rainforest habitat and flowing shallow mountain streams. Therefore, limited suitable habitat exists within the project area, and the species is unlikely to occur. A record occurs near the mouth of Ross River on Boundary Street, however this has no date or spatial accuracy information and is considered unreliable (ALA).</p>

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
<b>Reptiles</b>					
Common Death Adder	<i>Acanthopis antarcticus</i>	V	-	The common death adder occurs from central Queensland through New South Wales to the southern parts of South Australia and Western Australia (Queensland Department of Environment and Science, 2019e). The species inhabits a variety of well-drained habitats including rainforests and wet sclerophyll forests, woodland, shrublands, grasslands and coastal heathlands, preferring sites with deep fixed leaf litter.	<b>Unlikely</b> The project area lacks the microhabitat features required by the species such as deep leaf litter, or shrub cover and woody debris in absence of leaf litter. Therefore it is unlikely the species would persist in the area, particularly as no records are found within 20 km of the project area (ALA).
Yakka Skink	<i>Egernia rugosa</i>	V	V	Common woodland and open forest vegetation types this species has been recorded in include <i>Acacia harpophylla</i> ; <i>Acacia aneura</i> ; <i>Acacia catenulata</i> ; <i>Acacia shirleyi</i> ; <i>Casuarina cristata</i> ; <i>Eucalyptus populnea</i> ; Ironbark ( <i>Eucalyptus</i> spp.); and <i>Callitris glaucophylla</i> . The yakka skink is commonly found in cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. The species often takes refuge in large hollow logs and has been known to excavate deep burrow systems, sometimes under dense ground vegetation (Department of the Environment, 2014).  The Yakka Skink is endemic to Queensland where its distribution is patchy. Isolated populations occur from the coast to the hinterland of sub-humid to semi-arid eastern Queensland. This vast area covers portions of the Brigalow Belt (North and South), Mulga Lands, South-east Queensland, Einasleigh Uplands, Wet Tropics and Cape York Peninsula Biogeographical Regions (Department of Agriculture Water and the Environment, 2021b). Its core habitat is within the Mulga Lands and Brigalow Belt South Bioregions, where it is found in open dry sclerophyll forest or woodland (Department of the Environment, 2014).	<b>Unlikely</b> No suitable habitat is present within the project area, with a lack of coarse woody debris and large logs required by the species. No previous records exist in the region (ALA). Therefore, it is considered unlikely to occur.
Saxicoline Sunskink	<i>Lampropholis mirabilis</i>	NT	-	The Saxicoline sunskink is restricted to Magnetic Island, Queensland, and adjacent parts of the mainland in the Townsville district (Cogger, 2014; Wilson & Swan, 2013). It is found among granitic rocks at the edges of, or in clearings in rain- and monsoon forest, vine thickets and denser woodland habitats (Cogger, 2014).	<b>Unlikely</b> Marginal habitat occurs within the study area in the form of rocky outcrops occur within southern sections of RE 11.3.25 and RE 11.12.9 and consist of visible exposure of bedrock in the form of piles and tors, deeply fissured rock and subterranean cavities. The species has been most recently recorded near Mount Stuart in 2017 approximately 3 km to the east of the project area (ALA), with another two sightings in the same area in 1999 (ENSR Australia Pty Ltd, 2008).
Gulbaru gecko	<i>Phyllurus gulbaru</i>	CE	CE	The Gulbaru gecko has only been found in a specific rocky rainforest habitat type, in two isolated sub-populations located in Patterson's Gorge, at the southern end of the Paluma Range. This habitat is generally dominated by Hoop Pines ( <i>Araucaria cunninghamii</i> ).	<b>Unlikely</b> No suitable habitat is present to support this species within the project area. Records for the species are > 15 km to the west in Rangewood near the Alice River (ALA).
<b>Marine Reptiles</b>					
Loggerhead Turtle	<i>Caretta caretta</i>	E	E, M, Ma	In Australia, Loggerhead turtles' nest on open, sandy beaches (Department of Agriculture Water and the Environment, 2021b). Small Loggerhead turtles live at or near the surface of the ocean and move with the ocean currents. Loggerhead turtles choose a wide variety of tidal and sub-tidal habitat as feeding areas and show fidelity to both their foraging and breeding areas (Limpus, 2008). When ready for breeding, mature turtles migrate to their chosen breeding area. Feeding areas include waters with both hard and soft substrates including rocky and coral reefs, muddy bays, sandflats, estuaries and seagrass meadows (Department of Agriculture Water and the Environment, 2021b)	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. No records for the species are found within 20 km of the project area (ALA).
Green Turtle	<i>Chelonia mydas</i>	V	V, M, Ma	Green Turtles nest, forage and migrate across tropical northern Australia (Department of Agriculture Water and the Environment, 2021b). Green Turtles spend their first five to ten years drifting on ocean currents. During this pelagic phase, they are often found in association with drift lines and rafts of Sargassum (a floating marine plant that is also carried by currents). Once they reach 30 to 40cm curved carapace length, they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Spatially accurate records for the species are restricted to the coastline > 15 km from the project area (ALA).
Estuarine Crocodile, Saltwater crocodile	<i>Crocodylus porosus</i>	V	M, Ma	Estuarine crocodiles mostly occur in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast (Department of Agriculture Water and the Environment, 2021b). Preferred nesting habitat includes	<b>Potential</b> Whilst no evidence of species presence was recorded, the species is known to occur in the Ross

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
				elevated, isolated freshwater swamps that do not experience the influence of tidal movements. Floating rafts of vegetation also provide important nesting habitat.  In Queensland the saltwater crocodile inhabits reef, coastal and inland waterways from Gladstone on the east coast, throughout the Cape York Peninsula and west to the Queensland - Northern Territory border (Department of Agriculture Water and the Environment, 2021b).	River and records occur to the north in Ross Creek from 2019 (ALA). Suitable habitat is present in the south of the Project area where the disturbance corridor crosses the Ross River and connects to Riverway Drive as well as in drainage lines throughout the project area.
Leatherback Turtle, Leathery turtle	<i>Dermochelys coriacea</i>	E	E, M, Ma	This species has the widest distribution of any marine turtle. It is found in tropical to sub-polar oceans, from the North Sea and the Gulf of Alaska, to the southern Pacific and Atlantic Oceans. In Australia, the Leatherback Turtle has been recorded feeding in coastal waters offshore of all Australian States. There is no historical evidence of a large nesting population of Leatherback Turtles in Australia (Department of the Environment Water Heritage and the Arts, 2008a). Leatherback Turtles in Australian waters are likely to be foraging migrants, from breeding populations in neighbouring countries.	<b>Unlikely</b> The habitat of the Leatherback Turtle comprises pelagic marine foraging areas (Department of the Environment Water Heritage and the Arts, 2008a) which are absent from the project area. No records for the species are found within 20 km of the project area (ALA).
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	E	V, M, Ma	Hawksbill Turtles are found in tropical, subtropical and temperate waters in all the oceans of the world (Department of Agriculture Water and the Environment, 2021b). They spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with rafts of Sargassum (a floating marine plant that is also carried by currents). Once Hawksbill turtles reach 30 to 40cm curved carapace length, they settle and forage in tropical tidal and sub-tidal coral and rocky reef habitat. They primarily feed on sponges and algae. They have also been found, though less frequently, within seagrass habitats of coastal waters, as well as the deeper habitats of trawl fisheries.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species are confined to the coast > 15 km from the project area (ALA).
Olive Ridley Turtle, Pacific Ridley turtle	<i>Lepidochelys olivacea</i>	E	E, M, Ma	Olive Ridley Turtles have a pelagic phase of unknown length. Small juveniles through to adults reside in coastal zones along the northern coast of Australia and historical bycatch data indicates that large immature and adult-sized Olive Ridelys are present all year round over soft bottomed habits of the northern Australian continental shelf waters (Department of Agriculture Water and the Environment, 2021b).  Foraging habitat can range from depths of several metres to over 100m. Apart from one exception, Olive Ridley Turtles have not been recorded in coral reef habitat or shallow inshore seagrass flats (Limpus, 2008).	<b>Unlikely</b> The Olive Ridley Turtle is a pelagic species, and therefore suitable habitat is not present for the species to persist in the project area. Records for the species are confined to the coast > 15 km from the project area (ALA).
Flatback Turtle	<i>Natator depressus</i>	V	V, M, Ma	Post-hatchling and juvenile Flatback turtles do not have the wide dispersal phase in the oceanic environment like other sea turtles (Department of Agriculture Water and the Environment, 2021b). Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya although the extent of their range is not fully known. Nesting habitat includes sandy beaches in the tropics and subtropics with sand temperatures between 25 °C and 33 °C, at nest depth (Limpus 1995a), and the main nesting areas along the Queensland east coast are Peak Island, Wild Duck Island and Avoid Island, with minor rookeries in Mon Repos and Curtis Island. No significant nesting beaches are recognised in the Townsville region, although this species has been recorded nesting in low densities on a number of sandy beaches close to the project area, including Magnetic, Herald and Rattlesnake Islands, the Strand and AIMS beach.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species are confined to the coast > 15 km from the project area (ALA). Whilst one record occurs at the mouth of Ross River from 1970, and the species is known to occur in the shallow waters of Cleveland Bay, it is unlikely that individuals would utilise the river further inland.
<b>Sharks and Rays</b>					
Narrow Sawfish	<i>Anoxypristis cuspidata</i>	-	M, Ma	Primarily a benthic species, preferring sand, mud, and seagrass. <i>A. cuspidata</i> is found in estuaries, bays, and river mouths.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species are confined to the ocean and coastline > 15 km from the project area (ALA).
White Shark, Great White Shark	<i>Carcharodon carcharias</i>	-	V, M, Ma	Can be found in the coastal surface waters of all the major oceans. Within Australian waters, the majority of recorded White Shark movements occur between the coast and the 100 metre depth contour; however both adults and juveniles have been recorded diving to depths of over 1,200 m.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA).
Oceanic whitetip shark	<i>Carcharhinus longimanus</i>	-	M, Ma	The species occurs in tropical and warm temperate waters, usually well offshore beyond the continental shelf or around oceanic islands. Mostly occurs in oceanic areas off northern Australia, recorded off South Australia, but usually rare off the southern coast.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA).

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Porbeagle, Mackerel Shark	<i>Lamna nasus</i>	-	M, Ma	Porbeagles inhabit waters both over continental shelves as well as ocean basins. They prefer cold water between 1-18°C, however sightings have been reported in waters up to 23°C. The depth range for the porbeagle shark appears to be between 0-715 m.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA).
Reef Manta Ray	<i>Manta alfredi</i>	-	M, Ma	Manta rays are open ocean creatures and not considered river or reef inhabitants.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA).
Giant Manta Ray	<i>Manta birostris</i>	-	M, Ma	Manta rays are open ocean creatures and not considered river or reef inhabitants.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA).
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	<i>Pristis pristis</i>	-	V, M, Ma	The species is found in marine and freshwater habitats. ranging from coastal, shallow waters in tropical regions, which include estuaries, rivers and lagoons, to deep open-water and coral reefs.	<b>Unlikely</b> Suitable habitat may be present alongside the project area due to the generalist habitat requirements for the species. However, species records do not occur within 20 km of the project area (ALA).
Green Sawfish, Dindagubba, Narrowsnout Sawfish	<i>Pristis zijsron</i>	-	V, M, Ma	This species inhabits muddy or sandy bottom habitats in inshore marine areas, intertidal areas and the lower parts of rivers. It can be found in lagoons, estuaries and shallow bays.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA). Additionally, the species has not been recorded in Townsville netting programs since the early 1990s following a notable decline in the previous two decades (BTM, 2012).
Whale Shark	<i>Rhincodon typus</i>	-	V, M, Ma	In Australia, the whale shark is known primarily from northern Western Australia, the Northern Territory and Queensland.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA).
<b>TECs</b>					
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions		-	E	Characterised by tree species with microphyll sized leaves (2.5 to 7 cm long), in high to medium fertility soils. Frequent presence of swollen-stemmed bottle trees ( <i>Brachychiton australis</i> , <i>B. rupestris</i> ) as emergents from the vegetation are characteristic of the TEC (Department of the Environment, 2001). Thickets typically have an uneven canopy 4–9m high with mixed evergreen, semi-evergreen and deciduous emergent tree species 9–18m high with prominent vines or scrambling plants found in the canopy (McDonald, 2010). Typically, occurs in areas with climatic conditions containing a distinct 'dry' season. A large variation in canopy density and height attributed to rainfall as well as presence of rock (McDonald, 2010).  REs in the Brigalow Belt Bioregion that correspond to this TEC include: 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, and 11.11.18.	<b>Not Present</b> Suitable conditions absent from the site. The field survey did not find any REs analogous with the description of this TEC within the project area.
<b>Plants</b>					
Mt Stuart Mystery Tree	<i>Backhousia tetraptera</i>	CR	-	The species typically grows in deciduous vine thickets in gullies and creeks protected from fire. The species is known only from an isolated population near the summit of Mt. Stuart, Townsville. About 120 mature individuals grow on the creek, in the base of a deep gully directly below the peak of Mt Stuart (NPQ Townsville, 2010).	<b>Unlikely</b> Marginal habitat for the species may occur in the study area in the form of RE 11.3.25 containing a rainforest understorey. However, it is not expected that the structure of canopy and subcanopy would provide conditions for the species to persist. The species is known only from an isolated area at Mt Stuart, with records 5 km to the east of the project

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
					area (ALA). A thorough survey of the study area did not identify the species.
Hoop pine orchid, miniature moss-orchid	<i>Bulbophyllum globuliforme</i>	NT	V	This small orchid occurs in notophyll vine forest and some microphyll vine forest with <i>Araucaria cunninghamii</i> (hoop pine emergent). It is thought the hoop pine needs to be at least 100 years old before it is suitable as habitat for the hoop pine orchid.	<b>Unlikely</b> Suitable habitat consisting of hoop pines is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA). However, many orchid locations are kept hidden due to illegal activity threatening the species. A thorough survey of the study area did not identify the species.
-	<i>Commersonia reticulata</i>	V	-	Little is known about this species, however the <i>Commersonia</i> genus is in the Malvaceae family and is a flowering forb to shrub. The species is considered to prefer hills and ranges with igneous rock substrate in Eucalyptus low open woodland, but may also be found on red or white sand substrates.	<b>Unlikely</b> Suitable habitat is poorly known for the species, however suitable habitat may occur within RE 11.12.9 in the study area. Records for the species occur nearly 20 km from the project area, located to the south of Pinnacles National Park from 1997 and 2018 (ALA). A thorough survey of the study area did not identify the species.
-	<i>Croton magneticus</i>	V	-	This small tree or shrub grows in deciduous vine thickets (dry rainforest) on soils derived from sandstone, granite or acid agglomerate substrates, often in association with <i>Croton amhemicus</i> and <i>C. pheballoides</i> . The species distribution is restricted to an area between Greenvale to near Collinsville in north eastern Queensland (Queensland Department of Environment and Science, 2019f).	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Although granite-derived soils exist in the southern sections of the study area, no vine thicket communities were identified. The species is considered rare to occasional on Mt Stuart, with one record from 1997 to the south of Mt Stuart Road approximately 5 km to the east of the project area (ALA). A thorough survey of the study area did not identify the species.
Bluegrass	<i>Dichanthium setosum</i>	LC	V	<i>Dichanthium setosum</i> is associated with heavy basaltic black soils and redbrown loams with clay subsoil (often in gilgai). Associated species include <i>Eucalyptus albens</i> , <i>Eucalyptus melanophloia</i> , <i>Eucalyptus melliodora</i> , <i>Eucalyptus viminalis</i> , <i>Myoporum debile</i> , <i>Aristida ramosa</i> , <i>Themeda triandra</i> , <i>Poa sieberiana</i> , <i>Bothriochloa ambigua</i> , <i>Bothriochloa decipiens</i> , <i>Macrozamia stenomera</i> , <i>Medicago minima</i> , <i>Leptorhynchus squamatus</i> , <i>Lomandra aff. longifolia</i> , <i>Ajuga australis</i> , <i>Calotis hispidula</i> and <i>Austrodanthonia spp.</i> , <i>Dichopogon spp.</i> , <i>Brachyscome spp.</i> , <i>Vittadinia spp.</i> , <i>Wahlenbergia spp.</i> and <i>Psoralea spp.</i> In Queensland this species has been reported from the Leichhardt, Morton, North Kennedy and Port Curtis regions (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area, in particular the heavy basaltic black soils. Records for the species do not occur within 20 km of the project area (ALA). A thorough survey of the study area did not identify the species.
Cliff Quandong	<i>Dubouzetia saxatilis</i>	V	-	The species is a small woody shrub found only on ranges south-west of Townsville, on steep rhyolitic cliff faces.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area, in particular the geology type. Records for the species are > 10 km to the west of the project area, near Frederick Peak and South Pinnacle, with the latest record from 2004 (ALA). A thorough survey of the study area did not identify the species.
Mt Stuart Ironbark	<i>Eucalyptus paedoglauca</i>	V	V	<i>Eucalyptus paedoglauca</i> occurs only in the Townsville area of north-east Queensland. The extent of occurrence is about 400 km <sup>2</sup> (Department of the Environment Water Heritage and the Arts, 2008b). The area of occupancy and total population size are unknown, but there are estimated to be thousands of trees. This species occurs within the Burdekin (Queensland) Natural Resource Management Region. It occurs on ridges or hill slopes on shallow sandy-loam soil. All known populations occur in areas of remnant vegetation.	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area, in particular the geology type, as the project area is primarily alluvial. Areas in the southern project area may provide marginal habitat for the species. Records for the species are > 3 km to the east of the project area surrounding Mount Stuart (ALA). A thorough survey of the study area did not identify the species.

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
Scarlet fuchsia	<i>Graptophyllum excelsum</i>	NT	-	The species is a dense shrub to 3 metres tall, preferring semi-evergreen vine thickets, and occasionally grassy woodland in association with <i>Eucalyptus cullenii</i> and <i>Corymbia erythrophloia</i> .  The species occurs along the coastal regions from northern to southern Queensland. Populations are recorded at Dimbulah, Chillagoe, Townsville, Charters Towers, Kelsey Creek west of Proserpine, and most commonly at Mount Etna and Chillagoe-Mount Mungana areas (Queensland Department of Environment and Science, 2019a).	<b>Unlikely</b> Marginal habitat is limited for the species to persist in the project area, in the rainforest understorey of RE 11.3.25. Records exist for the species approximately 10 km to the north and south of the project area from 2009 and 2015 (ALA). A thorough survey of the study area did not identify the species.
Shrubby bush pear	<i>Marsdenia brevifolia</i>	V	V	North of Rockhampton, this species grows on serpentine rock outcrops or crumbly black soils derived from serpentine in eucalypt woodland, often with <i>Eucalyptus fibrosa</i> and <i>Corymbia xanthope</i> . At Hidden Valley near Paluma, plants grow in woodland on granite soils and on Magnetic Island the species occurs in open forest on dark acid agglomerate soils. <i>Marsdenia brevifolia</i> occurs in north and central Queensland where it is known from near Townsville, Springsure and north of Rockhampton (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area, in particular the soil type. Records for the species do not occur within 20 km of the project area (ALA). A thorough survey of the study area did not identify the species.
Ant Plant	<i>Myrmecodia beccarii</i>	V	V	This species occurs in open woodland dominated by <i>Melaleuca viridiflora</i> or mangroves. <i>Myrmecodia beccarii</i> occurs in coastal woodland and mangrove between Cooktown and Ingham in Queensland (Department of Agriculture Water and the Environment, 2021b).	<b>Unlikely</b> Suitable habitat is marginally present in the project area, such as melaleuca species. Records for the species do not occur within 20 km of the project area (ALA), and the species has not been recorded south of Toomulla. A thorough survey of the study area did not identify the species.
-	<i>Omphalea celata</i>	V	V	<i>Omphalea celata</i> occurs in fragmented semi evergreen vine thicket or araucarian microphyll vine forest. Recorded along watercourses in steep sided gorges and gullies on weathered metamorphic or granitic soils (Queensland Department of Environment and Science, 2019b). Associated species include <i>Eucalyptus raveretiana</i> , <i>E. tereticornis</i> , <i>Lysiphyllum hookeri</i> and <i>Ficus opposita</i> .	<b>Unlikely</b> Marginal habitat for the species occurs in the project area, such as <i>Eucalyptus tereticornis</i> woodland and RE 11.3.25 with a rainforest understorey. However, records for the species do not occur within 20 km of the project area (ALA). A thorough survey of the study area did not identify the species.
-	<i>Paspalidium udum</i>	V	-	A grass species that becomes dominant in water-filled sink-holes in rugged basalt, sometimes co-dominant with Phragmites and associated with <i>Cyperus alopecuroides</i> and <i>Diplachne parviflora</i> , found in shallow water. In the Townsville Town Common, the species is described as occurring in seasonal wetland with <i>Urochloa mutica</i> and <i>Eleocharis dulcis</i> . The species is restricted to two populations near Townsville (Queensland Department of Environment and Science, 2019c).	<b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area, in particular the soil type. Nearby records for the species occur to the east approximately 2 km into the Mount Stuart area from 2005, and at James Cook University from 2006 (ALA). A thorough survey of the study area did not identify the species.
Lesser swamp-orchid	<i>Phaius australis</i>	E	E	A large ground orchid growing in areas where soils are almost always damp, but not flooded for lengthy periods. Sands are generally the underlying soil type, found in coastal habitats between swamps and forests or in suitable areas inland. Habitat includes swampy sclerophyll forest dominated by melaleucas, swampy forest that often have sclerophyll emergent, or fringing open forest and melaleuca swamp forest associated with rainforest species. May also occur in wallum, sedgeland, rainforest and closed forest. They grow in deep shade but can also occur in full sun, preferring higher altitudes in northern Queensland (Queensland Department of Environment and Science, 2019d).	<b>Unlikely</b> Suitable habitat is marginally present in the project area, in particular the soil type, however the project area is considered too dry for the species. Records for the species do not occur within 20 km of the project area (ALA). A thorough survey of the study area did not identify the species.
-	<i>Sannantha papillosa</i>	E	-	A shrub to 1.5 metres preferring shrubland on outcrops of granite-like rocks, on skeletal soils, and associated with shrubs such as <i>Leptospermum brachyandrum</i> , <i>Leptospermum petersonii</i> subsp. <i>Lanceolatum</i> , <i>Corymbia trachyphloia</i> and <i>Melaleuca pearsonii</i> . The species occurs in three locations; on Frederick Peak and in Bowling Green Bay National Park south of Townsville, and from Sydney Heads, Homevale National Park, west of Mackay (Queensland Department of Environment and Science, 2019g).	<b>Unlikely</b> Marginal habitat may occur in the project area, due to the presence of granite-derived soils, however the vegetation assemblage does not reflect the species' known suitable habitat. Species records occur to the east about 2 km from the project area, with poor spatial and temporal accuracy from 1990, and to the west near Frederick Peak from 1998 (ALA). A thorough survey of the study area did not identify the species.

Common Name	Scientific Name	Status NC Act	Status EPBC Act	Preferred Habitat	Likelihood of Occurrence in the study area
-	<i>Tephrosia levillei</i>	V	V	<p>Has been recorded growing on alluvial plains in <i>Eucalyptus cullenii</i> woodland with <i>C. erythrophloia</i>, <i>Erythrophleum chlorostachys</i> and <i>Grevillea glauca</i>, and in tall open forest of Eucalyptus and Corymbia species over dense <i>Heteropogon contortus</i> on red sand.</p> <p><i>Tephrosia levillei</i> is currently known from the area between Chillagoe and Forty Mile Scrub (five collections) with one collection further south, near Ravenswood (Department of Agriculture Water and the Environment, 2021b).</p>	<p><b>Unlikely</b> Suitable habitat is not present for the species to persist in the project area. Records for the species do not occur within 20 km of the project area (ALA). A thorough survey of the study area did not identify the species.</p>

# Appendix D

## Significant Impact Assessment

## Appendix D Significant Impact Assessment

### 1. Initial risk assessment

As detailed in Section 7.0, MNES values within the Project Area may be directly or indirectly impacted by the development of the Project. However, the overall risk to MNES values associated with these potential Project impacts will differ, based on a combination of factors including the community or species' ecological characteristics and the likely consequence of such impacts. As such, an initial risk assessment was undertaken in accordance with the developed risk framework (Table 19) and the approach detailed in Section 3.4, to identify MNES that are at low risk to potential Project impacts and MNES that are at potential risk and require further assessment.

Findings of the risk assessment determined that two MNES require further assessment against the significant impact assessment criteria:

- Black-throated finch (*Poephila cincta cincta*); and
- Northern quoll (*Dasyurus hallucatus*)

Significant impact assessments are discussed in Section 2.

Table 19 Risk assessment for potential impacts to MNES

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
<b>Endangered Species</b>					
Black-throated finch (southern)	<p>The black-throated finch (southern) historically occurred from far south-eastern Queensland (QLD), near the Queensland-New South Wales border, through eastern QLD north to the divide between the Burdekin and Lynd Rivers. The subspecies is now extinct at most sites south of Burdekin River, and is confined to a very few remaining 'pockets' of suitable habitat. This species occurs mainly in grassy, open woodlands and forests, typically dominated by <i>Eucalyptus</i>, <i>Corymbia</i> and <i>Melaleuca</i>, and occasionally in tussock grasslands or other habitats (i.e. freshwater wetlands), often along or near watercourses, or in the vicinity of water. Habitat critical to the survival of the species has been identified as water sources, grass seeds, and trees providing suitable nesting habitat; all of which does occur within the study area.</p> <p>As per the <i>Significant impact guidelines for the endangered black-throated finch (southern)</i> (Department of the Environment Water Heritage and the Arts, 2009), 'important areas' have been mapped for this species using confirmed recent records. Much of the Townsville area including the study area is an 'important area' for the species. Potential impacts to an important area that are likely to result in a significant impact include (but are not limited to) clearing of grassland and/or grassy woodland, earthworks or excavation and the introduction of exotic plants, particularly exotic grasses.</p>	<p>This species is considered a potential occurrence within the study area due to the presence of suitable habitat and the location being within an 'important area' as defined in <i>Significant impact guidelines for the endangered black-throated finch (southern)</i> (Department of the Environment Water Heritage and the Arts, 2009). Habitat is mapped on Figure 6.</p> <p>A total of 148.89 ha of potentially suitable habitat occurs, which is considered breeding, foraging and dispersal habitat. All potential habitat is considered habitat critical to the survival of the species. Vegetation clearing required for the construction of the project will result in direct impacts to 15.46 ha of potential habitat. The referral guideline for this species states that the loss of habitat critical to the survival of the species is likely to result in a significant impact. Given it does not nominate impact area thresholds that may result in a significant impact, further investigation is required.</p>	3	Possible	<b>Potential risk – further investigation needed via significant impact assessment</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
Northern quoll	<p>This species has a discontinuous distribution across northern Australia. In Queensland, populations have persisted despite the presence of cane toads in upland rocky areas and several coastal sites. Although northern quolls can be found in a variety of habitat across their range, habitat critical to the survival of the species is considered offshore islands, rocky habitats and structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs. Populations important for the long-term survival of the species (important populations) include high density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present.</p> <p>This species is thought to occur within the Mount Stuart area which is within 1 km of the Project area. Habitat present at Mount Stuart is therefore habitat critical to the survival of the species. Foraging habitat within the study area is also critical habitat given its proximity to Mount Stuart. As specified by the EPBC Act Referral guideline for the northern quoll, actions which are likely to have a significant impact on the northern quoll are those that: result in the loss of critical habitat, decrease the size of an important population and therefore interfere with the recovery of the species, introduce inappropriate fire regimes or grazing activities, fragment an important population or result in invasive species or increases of them that are harmful to the northern quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk (Department of Sustainability, Environment, Water, 2011).</p>	<p>This species is considered potentially occurring within the study area due to the presence of suitable habitat (Figure 7). The study area also occurs within the 'known/likely to occur' area of the species' distribution as identified in the referral guideline document. Any individuals within the Project area are considered an important population.</p> <p>A total of 148.9 ha of potentially suitable habitat occurs within the study area, including 2.73 ha of denning and foraging habitat and 146.17 ha of foraging and dispersal habitat. All potential habitat is considered habitat critical to the survival of the species. Direct impacts will occur to a small 0.16 ha of denning habitat, and 15.30 ha of foraging and dispersal habitat, resulting in a total of 15.46 ha that may be directly impacted via vegetation clearing.</p> <p>The referral guideline for this species states that the loss of habitat critical to the survival of a northern quoll population is likely to result in a significant impact. Given it does not nominate impact area thresholds that may result in a significant impact, further investigation is required.</p>	2	Unlikely to highly unlikely	<b>Potential risk – further investigation required via significant impact assessment</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
<b>Vulnerable Species</b>					
Bare-rumped sheath-tail bat	<p>The bare-rumped sheath-tail bat occurs in two distinct populations, one in coastal Queensland (QLD) from around Townsville to near Coen, and another in the top end of the Northern Territory. This species is thought to occur in naturally low densities across the landscape (Murphy, 2002), however, the area occupied by a colony for foraging purposes has never been documented. Their ‘highly probable’ presence at multiple locations across the landscape indicates that a high proportion of the area is being utilised for foraging purposes (Department of Agriculture Water and the Environment, 2021b). The SPRAT does not identify important populations of the bare-rumped sheath-tail bat. Using the generic definition in the Significant Impact Guideline 1.1, the study area does not contain an important population as it is not near the limit of the species range, it is not known to be important for maintaining genetic diversity and it is not known to be a key source population.</p> <p>The bare-rumped sheath-tail bat occurs mostly in lowland areas, typically in a range of woodland, forest and open environments. In Australia, all confirmed roosting records are from deep tree hollows in <i>Eucalyptus platyphylla</i>, <i>Eucalyptus miniata</i>, <i>Eucalyptus tetradonta</i> and <i>Melaleuca leucadendra</i> (Churchill, 2008). Hollows in these tree species have also been used as maternity roosts. The conservation advice for this species states that no roosts are currently protected from known threatening processes and habitat critical to the survival of the species has not been identified</p>	<p>This species was confirmed to occur within the study area following positive identification from bat call data collected during the field survey, and presence suitable habitat (Figure 8). However, no populations are currently known to be under threat and any individuals within the study area are not considered to comprise an important population due to the species’ reported low densities across the landscape. A total of 184.98 ha of potentially suitable habitat occurs within the study area, including 148.89 ha of breeding and roosting habitat and 36.09 ha of foraging and dispersal habitat. All potential habitat is considered habitat critical to the survival of the species.</p> <p>Vegetation clearing required for the Project will result in direct impacts to breeding and roosting habitat (15.46 ha). Most hollow-bearing trees that occur within the project area will be cleared for construction; however hollow-bearing trees were recorded across the study area indicating that resources required for breeding will be retained. Furthermore, given the likely low density of individuals, only a small percentage of available hollows in the suitable habitat within the study area are likely utilised at one time. Based on the species’ broad habitat requirements, a large amount of suitable habitat is likely to occur within the wider area, including along the Ross River. Therefore, the reduction in available habitat and hollow-bearing trees as a result of the Project is not considered to affect</p>	2	Unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	<p>(Threatened Species Scientific Committee, 2016d) and as such the generic definition has been used. Based on this definition, REs 11.3.12, 11.3.25b, 11.3.30, 11.3.35 and 11.12.9 within the study area may be considered critical to the survival of the species given the suitability for foraging, breeding, roosting and dispersal. The main threats to the species that have been identified are loss of habitat (primarily tropical eucalypt woodland) and reduction in tree hollow availability.</p>	<p>the species' persistence in the area. This species is highly mobile, nocturnal and not considered sensitive to potential indirect impacts as a result of the Project. Nonetheless, species-specific mitigation measures listed in Section 6.3.3 will be implemented to ensure the impacts are managed.</p>			
Red goshawk	<p>The red goshawk is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia, from western Kimberley Division to north-eastern New South Wales. It inhabits coastal and sub-coastal tall open forests and woodlands, tropical savannas traversed by wooded or forested rivers, and the edges of rainforests. In northern Queensland, red goshawks are mainly associated with extensive, uncleared, mosaics of native vegetation, especially riparian vegetation, open forest and woodland that contain a mix of eucalypt, ironbark and bloodwood species. Nesting habitat usually comprises a tall stand of trees (average 31 m) within 1 km of permanent water, often adjacent to rivers or clearings. <i>The National recovery plan for the red goshawk</i> states habitat critical for red goshawk survival needs to contain all known sites for nesting, food resources, water, shelter, essential travel routes, dispersal, buffer areas, and sites needed for the future recovery (Department of Environment and Resource Management, 2012). Important populations are not defined; there is limited population information and available data is considered unreliable. The main</p>	<p>This species is considered a potential occurrence within the study area due to the presence of suitable habitat (Figure 8). Two ALA records are noted; one within 3 km to the west of the project area on Bohle River (1998) and another greater than 10 km to the west from 2000. Any individuals within the study area are considered an important population. Within the study area a total of 184.98 ha of suitable habitat occurs including 148.89 ha foraging and dispersal habitat and 36.09 ha nesting habitat. Potential nesting habitat is considered to occur due to the presence of raptor nests, however habitat is marginal as the tallest trees were approximately 25 m, which is well below the average of 31 m. No breeding pairs have been identified within the study area, and none are known from the Townsville region. Potential habitat within the study area is not considered habitat critical to the species as it does not contain all necessary features (such as travel routes and known nesting sites) and is unlikely to be unique in the landscape. A total of 15.46 ha of potential nesting habitat and no</p>	2	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	identified threats to the species include habitat loss, fragmentation, disturbance of nest sites, threats to prey and information/education gaps (Threatened Species Scientific Committee, 2015).	foraging and dispersal will be directly impacted via vegetation clearing. However, given the likely large areas of suitable habitat within the wider region, these impacts are expected to be low and inconsequential to the success of the species. As this species is highly mobile and construction works will be completed in phases, areas of disturbance can be temporarily avoided. Any trees containing raptor nests will be retained. Habitat fragmentation and threats to prey (birds) are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 6.0.			
Squatter pigeon (southern)	<p>The squatter pigeon (southern) is a ground-dwelling bird that inhabits the grassy understorey of open woodland, as well as sown grasslands with scattered remnant trees, disturbed areas, scrubland, and <i>Acacia</i> regrowth. Its current distribution extends from the Burdekin-Lynd Divide in central Queensland, south to West Wyalong in northern NSW. Important populations of squatter pigeon (southern) have been defined as per those listed in the SPRAT (Department of Agriculture Water and the Environment, 2021b):</p> <ul style="list-style-type: none"> <li>• Populations occurring in the Condamine River catchment and Darling Downs of southern Queensland</li> <li>• The populations known to occur in the Warwick-Inglewood-Texas region of southern Queensland, and</li> <li>• Any populations potentially occurring in northern New South Wales.</li> </ul> <p>As such, any individuals within the Survey Area are not considered an important population. This</p>	This species is considered a potential occurrence within the study area due to the presence of suitable habitat (Figure 9) and ALA records within 5 km. Any individuals that occur within the study area (and project area) are not considered to constitute an important population. A total of 15.46 ha of suitable habitat will be directly impacted via vegetation clearing. However, as habitat does not occur on Land Zone 5 or 7 it is suitable for foraging and dispersal only and is not considered habitat critical for the survival of the species. Given the vast areas of suitable habitat within the study area (184.99 ha) and wider local area, this reduction in habitat is minor and unlikely to affect the persistence of the species. Any increased pest presence, increased weeds in the ground layer and temporarily increased noise and activity during construction may also indirectly affect this species. Increased traffic within the Project area will be temporary	2	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	<p>species is also widely distributed, with the extent of occurrence estimated to be 440,000 km<sup>2</sup> and the area of occupancy to be 10,000 km<sup>2</sup>.</p> <p>In Queensland, foraging and breeding habitat is known to be associated with the soil landscapes of Land Zone 5 and 7 (Department of Agriculture Water and the Environment, 2021b). Breeding habitat is within 1 km of suitable waterbodies, whereas foraging can occur up to 3 km from such waterbodies. There are no species-specific guidelines for determining habitat critical to the survival of the squatter pigeon (southern); however based on the generic definition habitat within the Survey Area is not considered critical.</p> <p>The main identified threats to the species include ongoing clearance of habitat for farming or development purposes; grazing of habitat by livestock and feral herbivores; and predation, especially by feral cats (<i>Felis catus</i>) and foxes (<i>Vulpes vulpes</i>).</p>	<p>(primarily during construction), pest levels are unlikely to be exacerbated beyond current levels and approximately 30% of the project area will be rehabilitated with native grass species, with weed controls also in place. Potential indirect impacts will be low and managed via the mitigation measures detailed in Section 6.0.</p>			
White-throated needletail	<p>The white-throated needletail breeds in the northern hemisphere and migrates in the austral summer months to Australia. While in Australia, this species is widespread and predominately aerial. There is no current accurate population estimate, however the global population is estimated at greater than 10,000 birds (Higgins, 1999). Important populations are not defined, however important habitat includes large tracts of native vegetation, particularly forest. The species usually roosts in tall trees on cliffs or steep slopes that have vantage points, amongst dense foliage in the canopy or in hollows. Identified threats to this species whilst in Australia include habitat loss and fragmentation, mortality due</p>	<p>This species may potentially occur in the airspace above the study area, however is unlikely to depend on the vegetation to forage or roost (Figure 9). A number of recent ALA records also occur surrounding the study area (2015-2018). A total of 184.99 ha of potential suitable habitat occurs within the study area, however this is not considered to be important habitat as it is not suitable for roosting. As no important habitat occurs, any individuals within the study area are not considered an important population. Direct impacts will be limited to 15.46 ha of foraging only habitat via vegetation clearing. Given this species is predominately</p>	2	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	to collision with wind turbines and overhead wires, poisoning and pesticides.	aerial, is widespread within Australia and has broad habitat requirements, impacts are unlikely to affect the persistence of the species. Further the linear nature of the disturbance will not result in habitat fragmentation in the context of this species. All other key threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 6.0.			
Ghost bat	The ghost bat occurs across northern Australia where they occupy habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests. From September to April, ghost bats aggregate in maternity roost sites to breed. Maternity roost sites used permanently are generally deep natural caves or disused mines. Most of the colony disperses (up to 150 km) from maternity roosts during the non-breeding season in the cooler months. During this time, they use large numbers of caves, rock shelters, overhangs, vertical cracks, and mines as day roosts. Radio tracking by Tidemann <i>et al.</i> , (1985) revealed ghost bats forage an average of 1.9 km from day roosts, over an area of 61 ha, generally returning to the same areas each night. Habitat critical to the survival of the species is not defined for ghost bat but based on the generic definition is considered to include breeding habitat. Key threats to the species include habitat loss (destruction of, or disturbance to, roost sites and nearby areas) due to mining and poisoning by cane toads.	This species is considered a potential occurrence within the study area, as 184.99 ha of suitable foraging habitat is available and a known colony is present in the region (>25km away at Hervey's Range) which is functionally connected with the study area (Figure 9). Roosting habitat may be available in the rugged areas of Mount Stuart, however no suitable roosting habitat is present within the project area. A total of 15.46 ha of potential foraging habitat will be disturbed as a result of vegetation clearing. As no roosting or breeding habitat is present, it is not considered to be habitat critical to the survival of the species. The SPRAT does not identify 'important populations' of the ghost bat (Department of Agriculture Water and the Environment, 2021b). However, using the generic definition, any population that may be present in the study area does not meet the criteria to be considered important due to the position within the species range, the lack of breeding habitat and functional connectivity with known populations. Although 15.46 ha of potential foraging habitat will be impacted, the shape and scale of this	2	Unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
		impact is inconsequential in the context of habitat availability in the area and it will not result in a barrier to movement for this mobile species. Cane toads are already present and the works are not expected to result in the proliferation of this species. Pest management measures will be implemented to ensure this impact is managed.			
<b>Migratory Species</b>					
Fork-tailed swift	<p>The fork-tailed swift is almost exclusively aerial, recorded generally east of the Great Dividing Range from Cooktown to the New South Wales border, but extends further west in southern Queensland (Department of Agriculture Water and the Environment, 2021b). This species mostly occurs over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. The fork-tailed swift does not breed in Australia.</p> <p>The upper (1%) and lower (0.1%) thresholds for ecologically significant proportions of the population of this species are estimated at 1,000 and 100 respectively.</p> <p>As per the species SPRAT profile, there are no significant threats to the species in Australia, however they are known to collide with wind turbines.</p>	<p>This species may potentially occur in the airspace above the study area due to the presence of suitable habitat and known records in the area (Figure 9). A total of 184.99 ha of potential suitable habitat occurs within the study area. The species is exclusively aerial and will not depend on habitat within the study area to breed or roost but may forage or disperse in the airspace above.</p> <p>The shape and scale of the project area is not sufficient to support an ecologically significant proportion of the population and the Project will not result in habitat fragmentation or barriers to movement for this highly mobile species.</p> <p>The Project does not present other potential threats to the species.</p>	1	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
Black-faced monarch	The black-faced monarch breeds in eastern coastal Australia during summer and migrates to spend the non-breeding winter period in Papua New Guinea or northern Australia. This species mainly inhabits rainforests and riparian vegetation. In wet sclerophyll forest, the species mostly frequents sheltered gullies and slopes with a dense understorey of ferns and / or shrubs. The <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act</i> , defines important habitat for the species as “wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs” (Department of the Environment, 2015b). An ecologically significant proportion of the population is 460 individuals (0.1% threshold). The lower area threshold for impacts on important habitat is 260 ha. Known threats to this species include black rats and invasive vines (e.g. rubber vine) in riparian habitats.	This species is considered a potential occurrence due to records in areas adjacent to the southern extent of the project area, and small areas of marginal habitat in dense, sheltered riparian vegetation associated with the Ross River in the same area as well as some drainage lines (Figure 12). A total of 2.46 ha of this habitat will be directly impacted by clearing activities. This habitat does not constitute important habitat and is not sufficient to support an ecologically significant proportion of the population. Immature rubber vine was present in low density within the study area, and black rat is likely to occur given the availability of records in the area and the species broad habitat tolerances. Pest and weed management measures will be implemented to manage risks of proliferation of these species.	1	Unlikely	<b>Low risk</b>
Oriental cuckoo	The oriental cuckoo is a non-breeding migrant that occurs in coastal regions across northern and eastern Australia from September to May. While in Australia, the species inhabits a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types (Department of the Environment, 2015a). The <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act</i> , defines important habitat for the species as “monsoonal rainforest, vine thickets, wet sclerophyll forest or open <i>Casuarina</i> , <i>Acacia</i> or <i>Eucalyptus</i> woodlands	This species potentially occurs within the study area based on the presence of 148.89 ha of suitable habitat and recent records scattered around the study area (Figure 6). A total of 15.46 ha of potential foraging and dispersal habitat occurs within the project area and will be impacted by vegetation clearing. The available habitat does meet the definition for important habitat, however this is well below the clearing threshold for significant impact and as such the Project's direct impact is considered to be minor. The scale of direct impacts is also insufficient to support an ecologically significant proportion of the population.	2	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	(Department of the Environment, 2015b).Frequently at edges or ecotones between habitat types". Based on estimates of population sizes within Europe, the global population may be greater than 20 million. An ecologically significant proportion of the population is 1000 individuals (0.1% threshold). The lower area threshold for impacts on important habitat is 25,000 ha. There is no information regarding known threats to this species while in Australia.	This species is highly mobile and unlikely to be sensitive to potential indirect impacts associated with the Project, nonetheless these will be managed as detailed in Section 6.0.			
Satin flycatcher	The satin flycatcher occurs from Cape York to eastern South Australia, and migrates north-south during summer. Within Queensland, this species has a scattered but widespread distribution occurring mostly in coastal regions but also on the Great Dividing Range types (Department of the Environment, 2015a). <i>The Referral guideline for 14 birds listed as migratory species under the EPBC Act, defines important habitat for the species as "Eucalypt forest and woodlands, at high elevations when breeding (Department of the Environment, 2015b). They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps".</i> An ecologically significant proportion of the population is 440 individuals (0.1% threshold). The lower area threshold for impacts on important	This species potentially occurs within the study area based on the presence of 148.89 ha of suitable habitat in open grassy woodlands, and scattered recent records in the area (Figure 6). A total of 15.46 ha of this potential habitat may be directly impacted by vegetation clearance as a result of the Project. This habitat is suitable for foraging, breeding and dispersal, and is considered important habitat for the species although. The disturbance area is well below than the lower area threshold for impacts to important habitat and is not sufficient to support 440 (the lower threshold for ecologically significant proportion of the population) individuals. This species is highly mobile and unlikely to be sensitive to potential indirect impacts associated with the Project such as temporary increases to noise and dust, given the wide availability of similar habitat in the adjacent landscape. Immature rubber vine was present in low density within the study area, and black rat is likely to occur given the availability of records in the area and the species broad habitat tolerances. Pest	2	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	habitat is 170 ha. Known threats to this species include the clearing and logging of forests in south-eastern Australia, as well as black rats and invasive vines (e.g. rubber vine) in riparian habitats.	and weed management measures will be implemented to manage risks of proliferation of these species.			
Rufous fantail	The rufous fantail occurs in coastal and near coastal districts of northern and eastern Australia. One of the two subspecies ( <i>Rhipidura rufifrons intermedia</i> ) has breeding populations occurring on and east of the Great Divide, from about the NSW-Queensland border, north to the Cairns-Atherton region, Queensland. This species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts usually with a dense shrubby understorey including ferns. The <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act</i> , defines important habitat for the species as "Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey (Department of the Environment, 2015b). When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands". Movement patterns are not fully understood, but some populations of the species in east Australia are migratory. An ecologically significant proportion of the population is 4800 individuals (0.1% threshold). Depending on the subspecies, the lower area threshold for impacts on important habitat ranges from 1100 to 2200 ha. Known threats to this species include habitat fragmentation and loss of moist forest breeding habitat, the black rat, and invasive vines (e.g. rubber vine) in riparian habitat. However, in Australia this species is considered	This species is considered a potential occurrence due to recent records in the area and 15.75 ha of marginal habitat in dense, sheltered riparian vegetation associated with the Ross River in the south of the study area and some drainage lines throughout (Figure 12). A total of 2.46 ha of potential habitat may be disturbed as a result of vegetation clearance, all of which is considered important habitat for the species. This is well below the lower area threshold for significant impact of 1,100 to 2,200 ha. An ecologically significant proportion of the population is not expected to occur within the study area given their wide distribution and the disturbance area not being much too small to support 4,800 individuals. Immature rubber vine was present in low density within the study area, and black rat is likely to occur given the availability of records in the area and the species broad habitat tolerances. Pest and weed management measures will be implemented to manage risks of proliferation of these species. The species is not considered to be vulnerable to other indirect impacts associated with the Project. The species is considered common and secure in Australia and as such impacts are considered negligible.	1	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	common and secure as there has been no evidence of population decline.				
Little curlew	<p>The little curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used (Higgins &amp; Davies, 1996).</p> <p>The species generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland Coast (Department of Agriculture Water and the Environment, 2021b). In Queensland, the little curlew is generally widespread in coastal regions with some inland records (Higgins &amp; Davies, 1996). The estimated population of the east Asian – Australian 180,000 individuals and hence an ecologically significant proportion of the population equates to 180 birds (0.1% threshold).</p> <p>Known threats to this species include habitat loss (particularly of mudflats) as well as pollutions such as organochlorines, heavy metals and agricultural pesticides being discharged into the sea. In Australia, the species' habitat is also degraded by through colonisation of invasive plants such as <i>Mimosa pigra</i>, <i>Hymenachne amplexicaulis</i> and <i>Brachiaria mutica</i>. Damage from feral pig, buffalo</p>	<p>Although the species shows preference for coastal habitat and inland wetlands, open woodland habitat with a grassy understorey in the project area may provide marginal foraging and roosting habitat (Figure 6). This is not considered to be important habitat to the species and given the low productivity of the project area for foraging, it is considered unlikely that it has the carrying capacity to support an ecologically significant proportion of the population. Regardless, a total of 15.46 ha of potential suitable habitat occurs will be impacted by the project.</p> <p>The species is highly mobile and similar habitat is widely available in the region, therefore temporary increases to noise, activity and dust may be easily avoided by this species. Contamination of sediment in the river channel or to nearby wetlands from chemical spills may present an indirect impact to foraging resources, however this will be controlled through management measures.</p> <p>Project activities are unlikely to result in the colonisation of invasive species which are harmful to the species' habitat and these species have not been recorded in the study area. Several feral species may be present such as wild dog and feral pig, however no mechanisms which may cause the proliferation of these species has been identified based on Project activities. Weed and pest management</p>	2	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	may also degrade habitat and wild dog and fox may present a threat to the species whilst feeding and roosting.	measures will be implemented to manage these risks.			
Osprey	<p>Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging (DotEE, 2019). The breeding range of the osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in New South Wales; with a second isolated breeding population on the coast of South Australia (DotEE, 2019). The <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act</i>, defines important habitat for the species as “Bays, estuaries, along tidal stretches of large coastal rivers, mangrove swamps, coral and rock reefs, terrestrial wetlands and coastal lands of tropical and temperate Australia and off shore islands (Department of the Environment, 2015b). They feed primarily in the sea or nearby estuarine waters and nest in trees (often dead or with dead tops), rocky coastlines and on artificial structures such as telecommunication towers. Ospreys are generally found on or near the coast but also range inland along large rivers, mainly in northern Australia”. Global population estimates for this species are less than 400,000 individuals. An ecologically significant proportion of the population is 24 individuals (0.1% threshold). The lower area threshold for impacts on important habitat is 84 km of coastline. Any species</p>	<p>The species is likely to occasionally use the Ross River adjacent to the site to forage or may occur over the study area when travelling to and from foraging sites (Figure 11). However, the species shows preference for coastal habitat and the study area does not meet the definition of important habitat for the species. The lower area threshold of 84 km of coastline for potential significant impact is not relevant to the study area and it cannot support an ecologically significant proportion of the population. Direct impacts via vegetation clearing are unlikely to impact this species, with 0.42 ha of foraging and dispersal habitat, and 2.11 ha of flyover habitat present within the project area. Indirect impacts to fish populations in the Ross River through creation of temporary barriers to movement or reduced water quality are unlikely to be significant to the species are will be controlled through design, management and mitigation measures.</p>	1	Highly unlikely	<b>Low risk</b>

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	that may greatly reduce fish abundance is considered a threat to the osprey.				
Estuarine crocodile	<p>Estuarine crocodiles mostly occur in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast (Department of Agriculture Water and the Environment, 2021b). Preferred nesting habitat includes elevated, isolated freshwater swamps that do not experience the influence of tidal movements. Floating rafts of vegetation also provide important nesting habitat.</p> <p>The total Australian population is currently estimated to be approximately 100,000, although some authors estimate the population is even higher; between 100,000 and 200,000 (Department of Agriculture Water and the Environment, 2021b). Therefore, even a conservative threshold for an ecologically significant proportion of the population at 0.1% would be equivalent to between 100 and 200 individuals.</p> <p>Threats to the species include mortality due to fishing nets and the effects of habitat destruction.</p>	<p>Estuarine crocodiles are known to inhabit the Ross River in low abundances, with potential suitable habitat occurring within 33.76 ha of the study area (Figure 10). Potential habitat for estuarine crocodile which may be directly impacted is limited to 0.27 ha where the project area intersects the channel and banks of the Ross River. There are no species-specific guidelines for determining important habitat for the saltwater crocodile. Therefore, the generic <i>Significant Impact Guidelines Policy Statement 1.1</i> definition of important habitat has been applied. On this basis no important habitat has been identified within the study area as it is not near the limit of the species range, it is not of critical importance to the species, it is not in an area where the species is declining and it is unlikely to support an ecologically significant proportion of the species.</p> <p>The suitable habitat within the study area is not of sufficient size or value to support an ecologically significant proportion of the population.</p> <p>The project may have a direct impact on 0.27 ha of potential habitat for this species. No indirect impacts have been identified which may impact this species.</p>	1	Unlikely	<b>Low risk</b>

## 2. Significant Impact Assessments

### 2.1 Endangered Species

#### 2.1.1 Black-throated finch (southern) (*Poephila cincta cincta*)

The black-throated finch (southern) is listed Endangered under the EPBC Act.

##### 2.1.1.1 Distribution and Habitat

The black-throated finch (southern) historically occurred from far south-eastern Queensland, near the Queensland-New South Wales border, through eastern Queensland north to the divide between the Burdekin and Lynd Rivers. The subspecies is now extinct at most sites south of Burdekin River, and is confined to a very few remaining 'pockets' of suitable habitat.

Since 1998, birds likely to be of the southern subspecies have been recorded at the following sites (Department of Agriculture Water and the Environment, 2021b):

- Townsville and its surrounds (Giru, Serpentine Lagoon, Toonpan, and near Ross River Dam)
- Ingham, and sites nearby (near Mutarnee [at Ollera Creek], and near Mount Fox)
- scattered sites in central-eastern Queensland (Great Basalt Wall, Yarrowmere Station, Moonmoo Station, Doongmabulla Station, Fortuna Station and Aramac).

The black-throated finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus*, *Corymbia* and *Melaleuca*, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water. Some of the more common species of eucalypts in woodlands and forests frequented by the subspecies include narrow-leaved ironbark (*Eucalyptus crebra*), river red gum (*Eucalyptus camaldulensis*), silver-leaved ironbark (*Eucalyptus melanophloia*), Brown's box (*Eucalyptus brownii*), yellowjacket (*Eucalyptus similis*) and forest red gum (*Eucalyptus tereticornis*).

Black-throated finches (southern) require habitat where there is access to seeding grasses and water and will utilize a variety of different habitats for foraging, particularly in north Queensland during the wet season. This subspecies feed on the seeds of grasses (such as *Urochloa mosambicensis*, *Digitaria ciliaris*, *Melinis repens*, *Chloris inflata*) and herbaceous plants. They obtain most of their food by pecking seeds from the ground. However, they will also reach or jump up to take seeds from low inflorescences, perch on stems to take seeds from inflorescences, perch on grass stems and use their body weight to bring the stems to the ground to feed and reach for inflorescences from perches other than the food plant (Black-throated Finch Recovery Team, 2007a).

##### 2.1.1.2 Species Presence and Utilisation of the study area

The study area falls within the modelled distribution of the species as well as mapped 'important areas' as identified in the Significant Impact Guidelines for the black-throated finch (southern) (Department of the Environment Water Heritage and the Arts, 2009). Known records occur within the Mount Stuart area, approximately 8 km to the east, and on the Bohle River 3 km to the west of the study area.

As per the Significant Impact Guidelines for the black-throated finch (southern), where suitable habitat is validated to exist within mapped important areas, the species should be presumed to be present. Whilst the field assessment of the study area did not confirm the presence of black-throated finch; suitable nesting, foraging and dispersal habitat resources were identified (Figure 6). Therefore, for the purposes of this assessment, black-throated finch is considered to be present within the study area and project area.

The Ross River adjacent to the study area provides a permanent water source for the species. Suitable nesting habitat within the study area and project area that is in proximity to the Ross River includes the Melaleuca woodland on alluvial plains and Eucalyptus woodland on alluvial plains. These habitats provided an abundance of suitable nesting tree species, including *Eucalyptus crebra*, *Eucalyptus platyphylla* and *Melaleuca viridiflora*. These areas, as well as all other habitat types across the study area and project area provide foraging habitat due to the presence of an abundance of preferred foraging grasses for the species, including:

- *Alloteropsis semialata*

- *Capillipedium parviflorum*
- *Chrysopogon fallax*
- *Digitaria sp*
- *Eragrostis lacunaria*
- *Eremochloa bimaclate*
- *Eriachne mucronate*
- *Heteropogon contortus*
- *Heteropogon triticeus*
- *Panicum decompositum*
- *Themeda triandra*.

Only the non-remnant alluvial plain habitat within the study area and project area provides no habitat resources for black-throated finch and is unlikely to be utilised by the species.

#### **2.1.1.3 Habitat Critical to the Survival of the Species**

Habitat critical to the survival of the species has been identified as water sources, grass seeds, and trees providing suitable nesting habitat (Black-throated Finch Recovery Team, 2007b). The study area and project area contain an abundance of suitable grass species and nesting trees, with the Ross River providing a permanent water source. As such both the study area and project area are considered to contain habitat critical to the survival of the species.

#### **2.1.1.4 Potential Impacts and Key Mitigation Measures**

Potential impacts of the Project on this species includes loss of nesting, foraging and dispersal habitat, direct mortality, proliferation of weeds or pests and altered fire regime. Approximately 148.89 ha of nesting and foraging habitat has been identified within the study area, with a total of 15.46 ha expected to impacted and cleared for Project activities.

In addition to the general measures for avoidance, minimisation, mitigation and management outlined in Section 6.0, the following species-specific mitigation measures will help to further reduce impacts to black-throated finch habitat:

- Approximately 30% of the project area will be rehabilitated with a diversity of native grasses that are known as foraging grasses for the black-throated finch in the ground layer. At a minimum, rehabilitation efforts will aim to restore the area to be suitable for foraging purposes
- Pre-clearance surveys by a spotter-catcher will be undertaken in mapped habitat areas and near water sources to ensure any nests have been vacated prior to vegetation clearance
- Any identified active nesting colonies within or adjacent to the Project alignment will be avoided during vegetation clearing with a sufficient buffer distance implemented to avoid potential disturbance and displacement until the nests have been vacated
- Weed wash down requirements for vehicles entering and exiting the Project construction site will be strictly implemented to avoid the introduction or spread of weed species into and around the construction site
- The Weed and Pest Management Plan will detail provisions to monitor and control the spread or establishment of exotic grass species which may degrade the habitat and reduce resource availability
- Sediment and erosion control plans will be required by the construction tender and prepared by the contractor for the various construction activities on site. These will be required for the entire project area and will have a strong focus on minimising impacts of works near waterways.

### 2.1.1.5 Significant Impact Assessment

An assessment against the EPBC Act *Significant Impact Guideline 1.1* for this species is provided in Table 20. The outcome of the assessment against the EPBC Act guidelines was that the Project may result in a significant impact to the species.

**Table 20 Significant Impact Assessment for Black-throated Finch (southern)**

Criterion – “is there a real chance or possibility that the Project will...”	Assessment
Lead to a long-term decrease in the size of a population?	<p><b>No.</b></p> <p>Garnett, Szabo, &amp; Dutson (2011) indicate that that Townsville has one of the largest known populations of the species and consists of no more than 600 birds. Suitable habitat was verified across the study area which is also mapped as an ‘important area’. Therefore, it is considered that black-throated finch occurs within the project area and is part of the known Townsville population.</p> <p>The Project will result in the removal of 15.46 ha of black-throated finch habitat. In the context of habitat that occurs within the study area, this removal of habitat will result in the loss of 10.4% of available nesting, foraging and dispersal habitat.</p> <p>In addition, a portion of this impacted habitat will be rehabilitated to at least restore its use for foraging purposes. Impacts on the Ross River as a permanent water source for the species is also not anticipated as a result of the Project. Based on this and the magnitude of clearing, it is considered unlikely that the Project will impact on the breeding and recruitment success of the species or the area’s carrying capacity to the extent that it would lead to a long-term decrease in the species estimated population of 600 individuals within the Townsville region.</p>
Reduce the area of occupancy of the species?	<p><b>No.</b></p> <p>The area of occupancy for black-throated finch is estimated to be 5,000 km<sup>2</sup>. Habitat removal will occur within an identified ‘important area’ containing verified suitable habitat, and is estimated to be 15.46 ha. In the context of habitat that occurs within the study area, this removal of habitat will result in the loss of 10.4% of available nesting and foraging habitat.</p> <p>In addition, a portion of this impacted habitat will be rehabilitated to at least restore its use for foraging purposes. Impacts on the Ross River as a permanent water source for the species is also not anticipated as a result of the Project. Based on this and the magnitude of clearing, it is considered unlikely that the Project will reduce the area of occupancy for the species across the study area, the surrounding area or it’s known estimate of 5,000 km<sup>2</sup>.</p>
Fragment an existing population into two or more populations?	<p><b>No.</b></p> <p>For an aerial species such as the black-throated finch (southern), the Project is considered unlikely to result in the creation of barriers to movement to, between or within habitat. Therefore, it is unlikely that the Project will fragment an existing population into two or more populations.</p>

Criterion – “is there a real chance or possibility that the Project will...”	Assessment
Adversely affect habitat critical to the survival of a species?	<p><b>Possible.</b></p> <p>Habitat critical to the survival of the species has been identified as water sources, grass seeds, and trees providing suitable nesting habitat (Black-throated Finch Recovery Team, 2007b). Water sources will not be impacted by the Project. The loss of grass seeds may occur, although a portion of this impacted habitat will be rehabilitated to at least restore its use for foraging purposes. However, the loss of suitable nesting habitat is expected to occur. Specifically, there will likely be a net loss of nesting trees within 1 km of a permanent water source. This may adversely affect habitat critical to the survival of the species.</p>
Disrupt the breeding cycle of a population?	<p><b>No.</b></p> <p>Breeding can occur throughout the year under optimal conditions. In the Townsville area, the peak breeding period is during the wet season between February and May (Department of the Environment Water Heritage and the Arts, 2009). Pre-clearance procedures will be put in place to identify and avoid any nesting colonies within or adjacent to the project alignment to avoid interference with breeding individuals.</p> <p>Suitable nesting trees will be removed for the Project, and it is likely that this will result in a net loss within 1 km of a permanent water source (Ross River). Overall 15.46 ha of potential breeding/nesting habitat will be impacted as a results of the Project. Based on this magnitude of clearing and the management of construction activities during the breeding season it is unlikely that the Project will substantially disrupt the breeding cycle of a population.</p>
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	<p><b>No.</b></p> <p>The Project will result in the removal of 15.46 ha of black-throated finch habitat. In the context of habitat that occurs within the study area, this removal of habitat will result in the loss of 10.4% of available habitat.</p> <p>In addition, a portion of this impacted habitat will be rehabilitated to at least restore its use for foraging purposes. Impacts on the Ross River as a permanent water source for the species is also not anticipated as a result of the Project. Based on this and the magnitude of clearing, it is considered unlikely that the Project will impact on the breeding and recruitment success of the species or the area’s carrying capacity to the extent that the species will likely decline.</p>
Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species’ habitat?	<p><b>No.</b></p> <p>Invasive flora species have been identified on the Species Profile and Threats (SPRAT) database as a key threat to the subspecies; however, it is unlikely that the Project will exacerbate invasive species beyond current levels. An EMP will be developed for the Project area which will outline measures to mitigate and manage the potential spread of pest flora and fauna species. Species-specific management will be undertaken for identified key weed and pest species at risk of spread through Project activities. Control efforts will be increased in areas particularly sensitive to invasion.</p>
Introduce disease that may cause the species to decline?	<p><b>No.</b></p> <p>Disease has not been identified as a main threat to the species. The EMP for the Project will detail the measures to prevent the introduction and spread of disease.</p>

Criterion – “is there a real chance or possibility that the Project will...”	Assessment
Interfere with the recovery of the species?	<p><b>No.</b></p> <p>The Recovery Plan for the black-throated finch (southern) identifies the recovery objectives to manage and protect the black-throated finch and its habitat, and to promote the recovery of the southern subspecies (Black-throated Finch Recovery Team, 2007b). The Project does not specifically contravene any of the identified recovery actions, including:</p> <ul style="list-style-type: none"> <li>• Investigating breeding requirements and threats to key breeding areas</li> <li>• Investigating feeding and other habitat requirements</li> <li>• Documenting sighting</li> <li>• Developing standard survey guidelines</li> <li>• Undertaking targeted surveys</li> <li>• Securing selected sites for conservation</li> <li>• Addressing threats on grazing land</li> <li>• Monitoring management effectiveness</li> <li>• Investigating development of other statutory planning instruments to minimise impacts of urban development on black-throated finch within the Townsville urban fringe</li> <li>• Investigating the potential for captive birds contributing to a re-introduction project</li> <li>• Increasing public awareness</li> </ul>

## 2.1.2 Northern quoll (*Dasyurus hallucatus*)

The northern quoll is listed Endangered under the EPBC Act.

### 2.1.2.1 Distribution and Habitat

The distribution of the northern quoll is discontinuous across northern Australia with core populations in rocky and / or high rainfall areas (Hill & Ward, 2010). The Northern quoll is nocturnal and occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern quoll habitat generally encompasses some form of rocky area or structurally diverse woodland for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Rocky habitats are usually of high relief, often rugged and dissected but can also include tor fields or caves in low lying areas. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes.

Northern quolls are opportunistic omnivores, consuming a wide range of prey including beetles, grasshoppers, spiders, scorpions and centipedes. They also eat fruit, nectar, and are known to feed on carrion and human refuse (Threatened Species Scientific Committee, 2005). Vertebrates eaten include 11 species of mammal (e.g. Bandicoots, Sugar gliders, Brush-tail possums and Rats), eight species of birds, reptiles (skinks and snakes) and seven species of frog. They also eat bird eggs and nectar of eucalypt and grevillea flowers. Cane toads are a food item of particular concern because their toxins appear to be a major cause of decline in Northern quoll populations.

### 2.1.2.2 Species Presence and Utilisation of the study area

The study area falls within the modelled distribution of the species and a known record occurs approximately 20 km from the study area. Field assessment of the study area did not confirm the presence of Northern quoll; however breeding / denning, foraging and dispersal habitat resources were identified (Figure 7).

Potential breeding and denning habitat is restricted to a small area within the study area. This habitat is located within a small rocky outcrop along the Ross River and consists of visible exposure of bedrock in the form of boulder piles and tors, deeply fissured rock and subterranean cavities surrounded by *Eucalyptus* woodland with a dense to mid-dense understory. This habitat does not occur within the project area and is situated approximately 50 m west of the pipeline corridor.

Larger areas of potential breeding and denning habitat occurs within the broader landscape surrounding the study area, associated with Mount Stuart. As this occurs within approximately 1 km of the study area, all woodland habitat types both within the study area and project area is considered to be foraging and dispersal habitat for northern quoll (Figure 7). The creek and drainage lines that bisect the study area and connect the rocky terrain of Mount Stuart to the east with the Ross River may be particularly preferred as dispersal pathways for the species.

Cane toads, wild dogs and feral cats were recorded within the study area during the field survey, which are a threat to northern quoll populations and impact on the quality of the habitat within the study area.

### 2.1.2.3 Habitat Critical to the Survival of the Species

Habitat critical to the survival of the northern quoll is defined in the *EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus** (Department of the Environment, 2016) as:

*'habitat within the modelled distribution of the northern quoll which provides shelter for breeding, refuge from fire / or predation and potential poisoning from cane toads. Habitat critical to the survival usually occurs in the form of:*

- *off shore islands where the northern quoll is known to exist*
- *rocky habitats such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines*
- *structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs.*

Dispersal and foraging habitat associated with or connecting *populations important for the long-term survival of the northern quoll* is also considered habitat critical to the survival of the northern quoll.'

Based on this definition, the dispersal and foraging habitat within the study area and project area could be considered habitat critical to the survival of the species as it associated with potential breeding and denning habitat located to the east at Mount Stuart. This large rocky terrain area that forms part of Mount Stuart could contain an important population of northern quoll (refer to section below).

#### 2.1.2.4 Important Populations

The *EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus** (Department of the Environment, 2016) also defines important populations for the long-term survival of the species. These include populations which are:

- high density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present
- occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water
- subject to ongoing conservation or research actions i.e. populations being monitored by government agencies or universities or subject to reintroductions or translocations.

The study area is not free of cane toads and is not subject to ongoing conservation or research actions. Field surveys did not detect Northern quoll. Furthermore, the study area and project area are not considered to contain refuge-rich habitat critical to the survival of the species. Only a small rocky outcrop potentially supporting breeding and denning habitat occurs within the study area. These habitat features are absent from the project area. Therefore, it is unlikely that the study area or project area itself contains an important population.

An important population may be supported by habitat associated with the rocky terrain areas of Mount Stuart, located approximately 1 km to the east of the study area. As discussed in the above section, the majority of habitat within the study area and project area is in the form of foraging and dispersal habitat for potential adjacent important populations.

#### 2.1.2.5 Potential Impacts and Key Mitigation Measures

Potential impacts of the Project on this species includes loss of foraging and dispersal habitat, direct mortality, proliferation of weeds and altered fire regime. Whilst potential breeding and denning habitat occurs within the study area, a very small area (0.16 ha) will be impacted and cleared within the project area. However, approximately 146.17 ha of foraging and dispersal habitat has also been identified, with 15.30 ha expected to be cleared for Project activities. The total area expected to be impacted and cleared by the project is 15.46 ha.

In addition to the general measures for avoidance, minimisation, mitigation and management outlined in Section 6.0, the following species-specific mitigation measures will help to further reduce impacts to northern quoll habitat:

- It is noted that boulder piles which provide suitable denning habitat have been avoided in design
- Hollow logs and felled hollow bearing trees should be relocated to other areas of mapped northern quoll habitat to provide denning resources
- Fuel loads of weeds should be managed to minimise the risk of high fire intensity. Inappropriate fire regimes can result in significant impact to northern quoll
- Water retaining voids or pits in the design should be avoided where these are not otherwise required for the control of stormwater run-off and erosion and sediment control measures. Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads.

### 2.1.2.6 Significant Impact Assessment

An assessment against the *EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus** (Department of the Environment, 2016) is provided in Table 21. The outcome of the assessment against the EPBC Act guidelines was that the Project will not result in a significant impact to the species subject to the implementation of the avoidance, minimisation, mitigation and management measures provided in Section 6.0.

**Table 21 Significant Impact Assessment for the Northern Quoll (*Dasyurus hallucatus*)**

EPBC Act Criteria – is there a real possibility that the Project will:	Assessment of Significance
Result in the loss of habitat critical to the survival of the northern quoll	<p><b>No.</b></p> <p>The project area contains potential foraging resources and dispersal opportunities for northern quoll. It is also located within approximately 1km of rocky terrain associated with Mount Stuart that potentially supports breeding and denning habitat for an important population of northern quoll. As such the habitat within the project area is considered habitat critical to the survival of the species as defined in the <i>EPBC Act referral guideline for the endangered northern quoll <i>Dasyurus hallucatus</i></i> (Department of the Environment, 2016).</p> <p>The Project is estimated to remove approximately 15.30 ha of habitat critical to the survival of the species. Whilst a loss of this habitat will occur, this comprises only 10.5% of foraging and dispersal habitat that is available within the study area. Within the broader landscape context and the area of available foraging habitat surrounding the study area, this percentage loss is considerably lower. Therefore, this magnitude of clearing will not significantly reduce dispersal and foraging opportunities for an important population of the northern quoll that may occur in the adjacent areas.</p>
Decrease the size of a population important for the long-term survival of the northern quoll and therefore interfere with the recovery of the species.	<p><b>No.</b></p> <p>An important population may be supported by habitat associated with the rocky terrain areas of Mount Stuart, located approximately 1 km to the east of the study area. However, as described above, a population important for the long-term survival of the species is unlikely to exist within the actual project area itself.</p> <p>Whilst approximately 15.30 ha of foraging and dispersal habitat will be cleared that may be utilised by an important population at Mount Stuart, this loss comprises only a small percentage of what will remain in the surrounding area. The magnitude of clearing is not expected to lead to significant changes to foraging opportunities or the ability of surrounding important populations to disperse. As such it is considered unlikely that the Project will lead to a long-term decrease in the size of a population northern quoll.</p>
Introduce inappropriate fire regimes or grazing activities (i.e. increasing the risk of late dry season high intensity fires to the area) that substantially degrade habitat critical to the survival of the northern quoll or decrease the size of a population important for the long-term survival of the species.	<p><b>No.</b></p> <p>Project activities will result in a 25 m wide linear clearing which will be partially reinstated with native species post construction. These areas are subject to potential proliferation of weed species which has the potential to increase fuel loads for bushfire. To reduce this risk, weeds will be managed through the development and implementation of a Project EMP. No grazing activities will take place within the Project area.</p>

EPBC Act Criteria – is there a real possibility that the Project will:	Assessment of Significance
Fragment a population important for the long-term survival into two or more populations.	<p><b>No.</b></p> <p>Habitat within the study area and project area is currently bisected with cleared access tracks, which reduces its connectivity values. The Project has been co-located as much as possible with these cleared access tracks to further reduce impacts of fragmentation. The clearing impact will result in approximately 15.30 ha of potential foraging and dispersal habitat for the species being cleared in a linear corridor no more than 25 m wide at any point. The Project will not create any barriers across the creek and drainage lines within the project area that would be the preferred dispersal pathways for northern quoll in the area. The northern quoll is highly mobile and clearing of this magnitude would not reduce its ability to disperse within and through the project area. Given the small area of disturbance and the large extent of contiguous habitat that will remain, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population of Northern quoll.</p>
Result in invasive species or increases of them that are harmful to the northern quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk. This includes actions which have inadequate quarantine measures in place for movements between the mainland and offshore islands where northern quolls occur.	<p><b>No.</b></p> <p>Weeds, feral predators and cane toads are all recognised threats to the northern quoll (Department of Agriculture Water and the Environment, 2021b). Feral cats, cane toads and wild dogs are currently present within the project area and were recorded during the field survey. However, the extent of exotic grasses is low.</p> <p>Given the limited extent of disturbance, it is unlikely that Project activities will result in the further proliferation of already occurring feral species to the extent that it will significantly increase the risk of harm to northern quoll. However, construction and operational activities if unmanaged, have the potential to introduce exotic grasses and provide opportunities for proliferation and potential spread. The Project EMP will explicitly address the management of weeds and pests during construction and operation of the Project. With the implementation of these management measures, the project is unlikely to result in a significant increase of exotic grasses and altered fire regimes.</p>

# Appendix E

## Bat Call Analysis Report



## Microbat Call Identification Report

<b>Prepared for (“Client”):</b>	AECOM
<b>Survey location name:</b>	Ross River, Townsville, NE Qld
<b>Survey dates:</b>	2 <sup>nd</sup> – 8 <sup>th</sup> February 2021
<b>Client project reference:</b>	
<b>Job no.:</b>	AEC-2103
<b>Report date:</b>	16 March 2021

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## Methods

### Data received

Balance! Environmental received 21,290 WAV format full-spectrum ultrasonic acoustic files, which were recorded on three Anabat Swift detectors (Titley Scientific, Brisbane). The detectors were each deployed at a single site for the duration of the survey. Site 1 was sampled for three nights (3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> February 2021), while Site 2 and Site 3 were sampled for seven nights (2<sup>nd</sup>-8<sup>th</sup> February). The sites were located along the eastern side of the Ross River, between Ross Dam and the Douglas Water Treatment Plant.

### Call analysis and species identification

Call analysis was performed in Anabat Insight Version 1.9.7 (Titley Scientific, Brisbane). All WAV files were processed through a Decision Tree Analysis to exclude files containing only non-bat noise and group and label the remaining files according to the similarity of the bat-calls therein. Each group was then reviewed manually to confirm or adjust species labels.

Species identification was based on comparison of call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions (Reinhold et al. 2001). Consideration was also given to the probability of species' occurrence, with reference to published distribution information (e.g. Churchill 2008; van Dyck et al. 2013) and on-line database records (e.g. <http://www.ala.org.au>).

### Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Armstrong *et al.* (2020).

## Results & Discussion

Noise filtration excluded 13,155 of the WAV files from further analysis. The other 8135 WAV files contained 8685 identifiable bat calls. Almost half (4223) of those calls were positively identified, while the other 4462 "unresolved" calls had characteristics potentially attributable to two or more species and were assigned to multi-species groups.

**Table 1** lists the species detected at each site. Where unresolved calls were recorded, all group members are listed as "possible" unless more definitive calls were positively identified.

The survey detected at least 18 species from five families, including: Rhinolophidae (1 species); Vespertilionidae (11 species); Miniopteridae (2 species); Molossidae (3 species); and Emballonuridae (1 species). The unresolved multi-species groups potentially included one additional vespertilionid species (*Scotorepens orion*) and one additional emballonurid (*Taphozous troughtoni*).

The threatened Bare-rumped Sheath-tailed bat (*Saccolaimus saccolaimus*) was recorded most nights at all three sites. No other threatened species were detected.

Sample call spectrograms of each species and unresolved call-group are shown in **Appendix 1**.

**Appendix 2** gives a breakdown of the number of calls allocated to each species and unresolved multi-species group.

**Table 1** Bats recorded during the Ross River survey, 2-8 February 2021.

◆ = Definite – at least one call from the relevant site was identified unequivocally.

□ = Possible – calls like those of the species were recorded but could not be reliably identified.

Site:	Site1	Site2	Site3
<i>Rhinolophus megaphyllus</i>	◆	◆	◆
<i>Chalinolobus gouldii</i>	◆	◆	◆
<i>Chalinolobus morio</i>	□	◆	◆
<i>Chalinolobus nigrogriseus</i>	◆	◆	◆
<i>Myotis macropus</i>	◆	◆	◆
<i>Nyctophilus sp.</i>	◆	◆	◆
<i>Scotorepens balstoni</i>	◆	◆	◆
<i>Scotorepens greyii</i>	◆	◆	◆
<i>Scotorepens orion</i>	□	□	□
<i>Scotorepens sanborni</i>	◆	◆	◆
<i>Scoteanax rueppellii</i>	◆	◆	□
<i>Vespadelus pumilus</i>	◆	◆	◆
<i>Vespadelus troughtoni</i>	◆	◆	◆
<i>Miniopterus australis</i>	◆	◆	◆
<i>Miniopterus orianae</i>	◆	◆	◆
<i>Chaerephon jobensis</i>	◆	◆	◆
<i>Ozimops lumsdenae</i>	◆	◆	◆
<i>Ozimops ridei</i>	◆	◆	◆
<i>Saccolaimus saccolaimus</i>	◆	◆	◆
<i>Taphozous troughtoni</i>	□	□	□

## References

Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). *A current taxonomic list of Australian Chiroptera*. Australasian Bat Society. Version 2020-06-09.

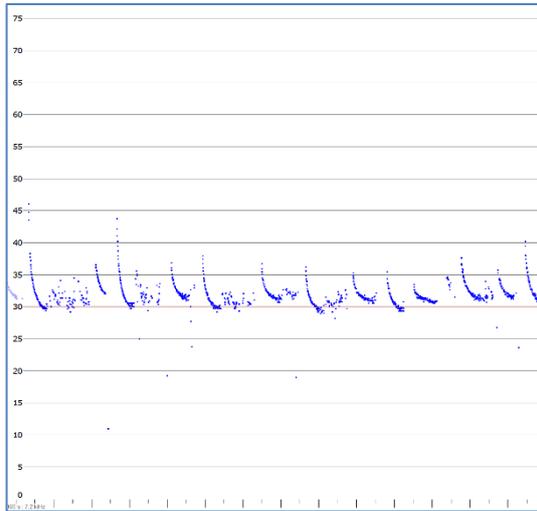
URL: <http://ausbats.org.au/species-list/4593775065>

Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.

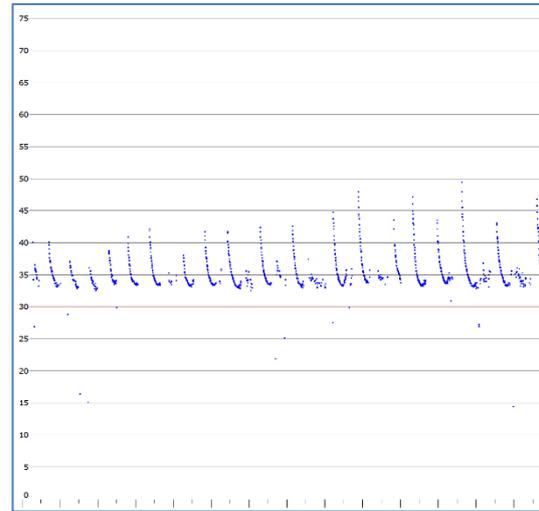
Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* 20, 41-43.

van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). *Field Companion to the Mammals of Australia*. New Holland; Sydney.

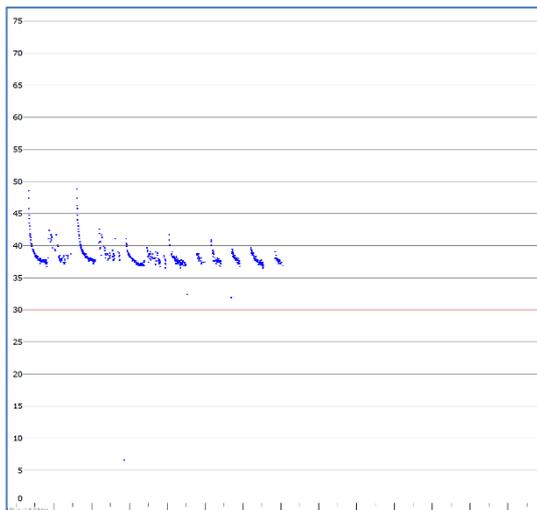
**Appendix 1** Sample spectrograms of calls recorded at Townsville, 2-8 February 2021.  
 Timescale (x-axis) = 10ms per tick-mark; time between pulses compressed



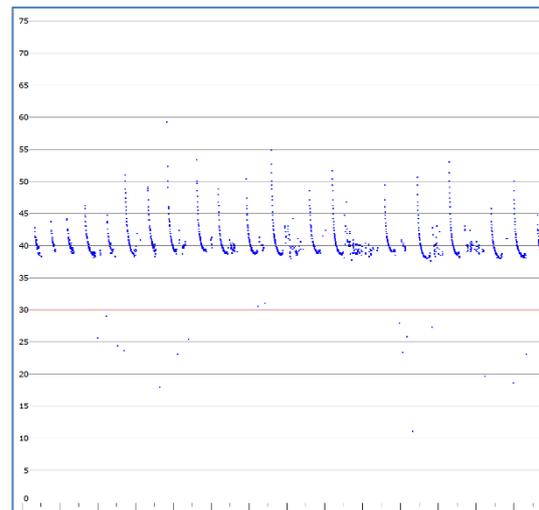
*Chalinolobus gouldii*



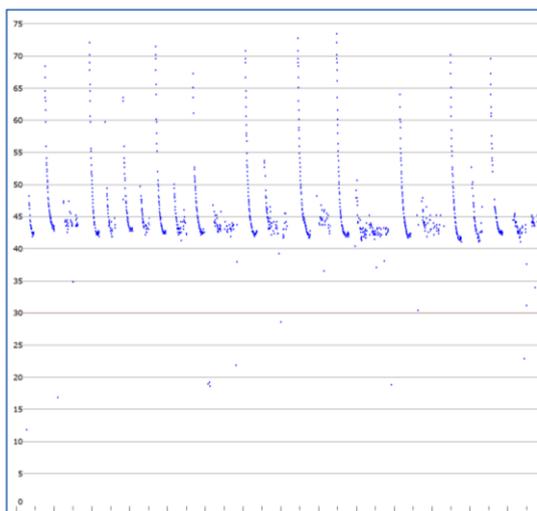
*Scotorepens balstoni*



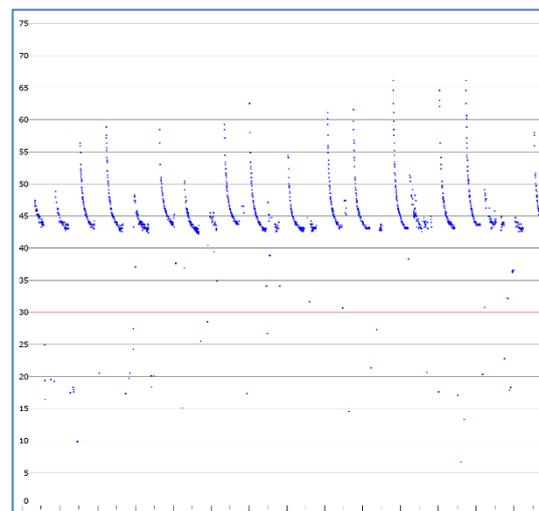
*Chalinolobus nigrogriseus*



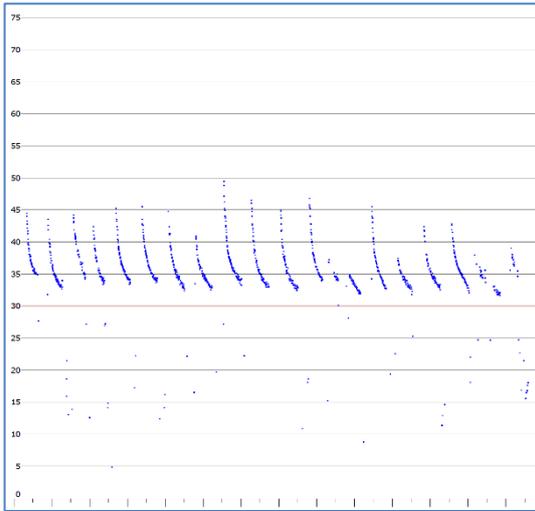
*Scotorepens greyii*



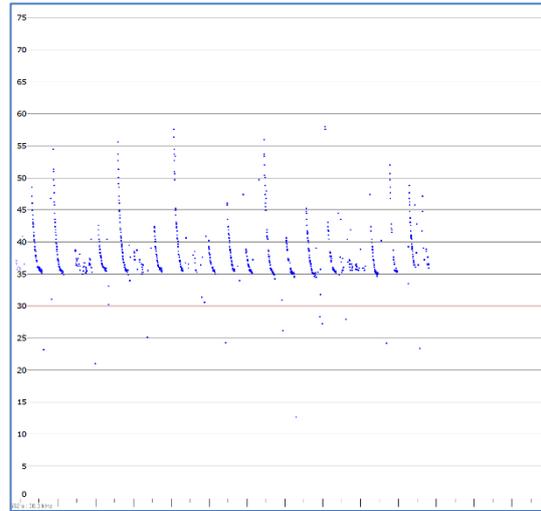
*Scotorepens sanborni*



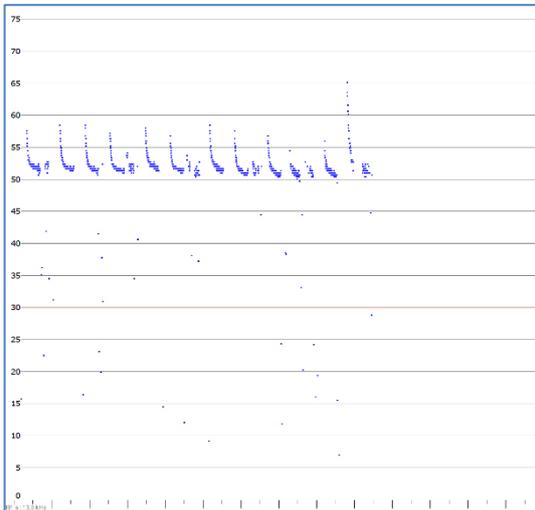
*Miniopterus orianae*



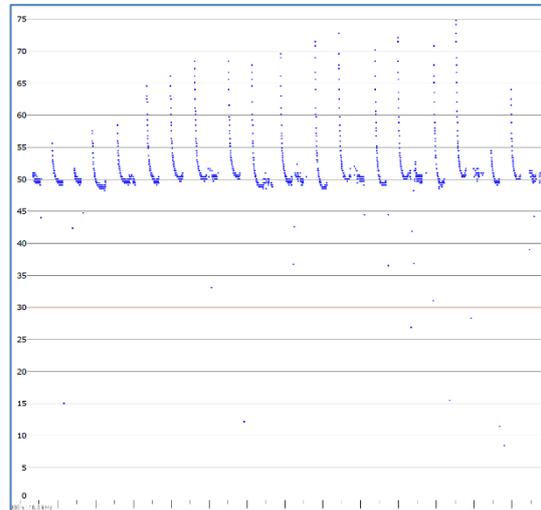
*Scoteanax rueppellii*



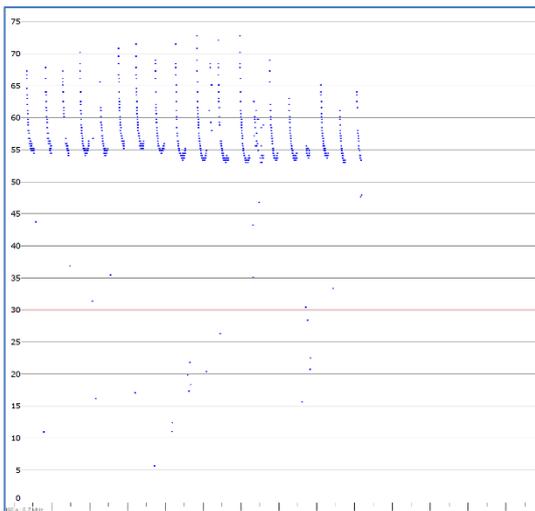
*S. rueppellii / Scotorepens orion*



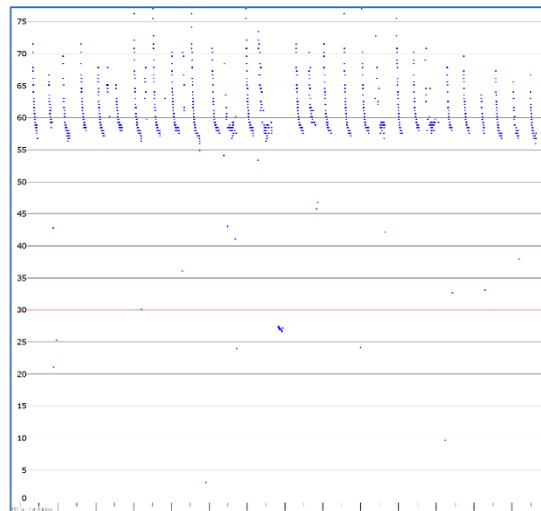
*Chalinolobus morio*



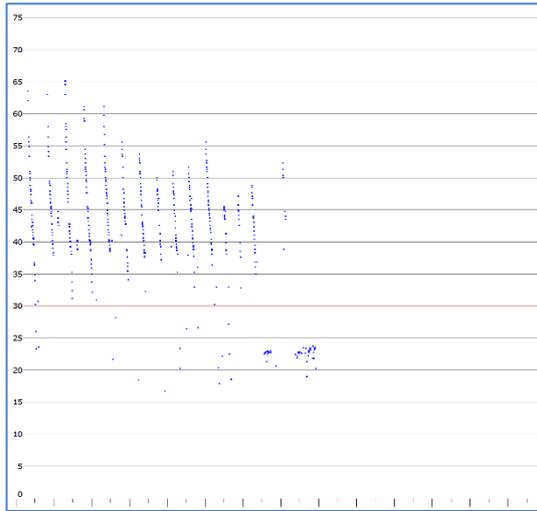
*Vespadelus troughtoni*



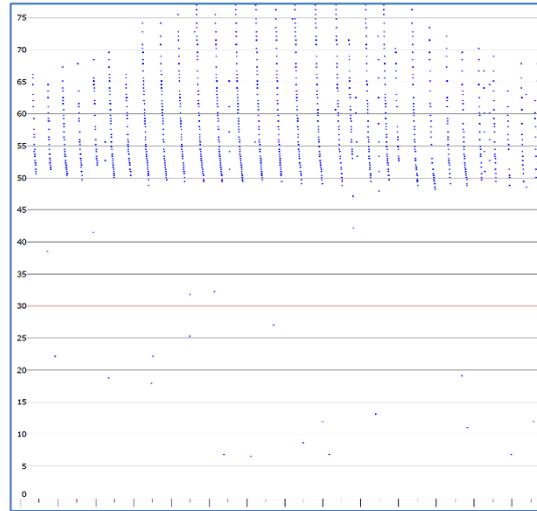
*Vespadelus pumilus*



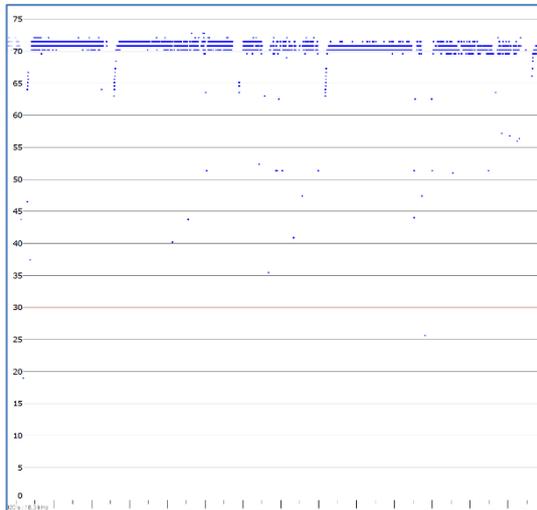
*Miniopterus australis*



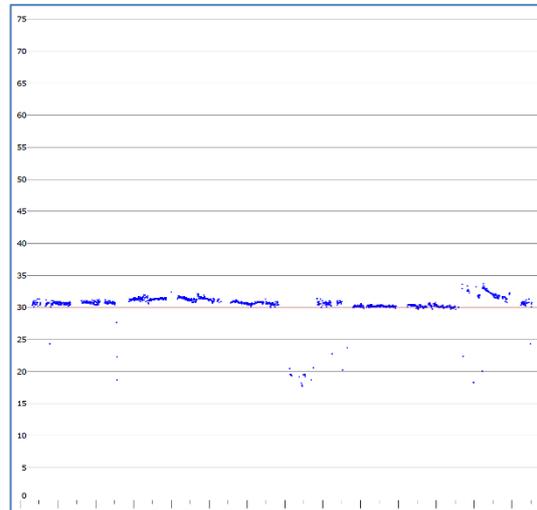
*Myotis macropus*



*Nyctophilus* sp.

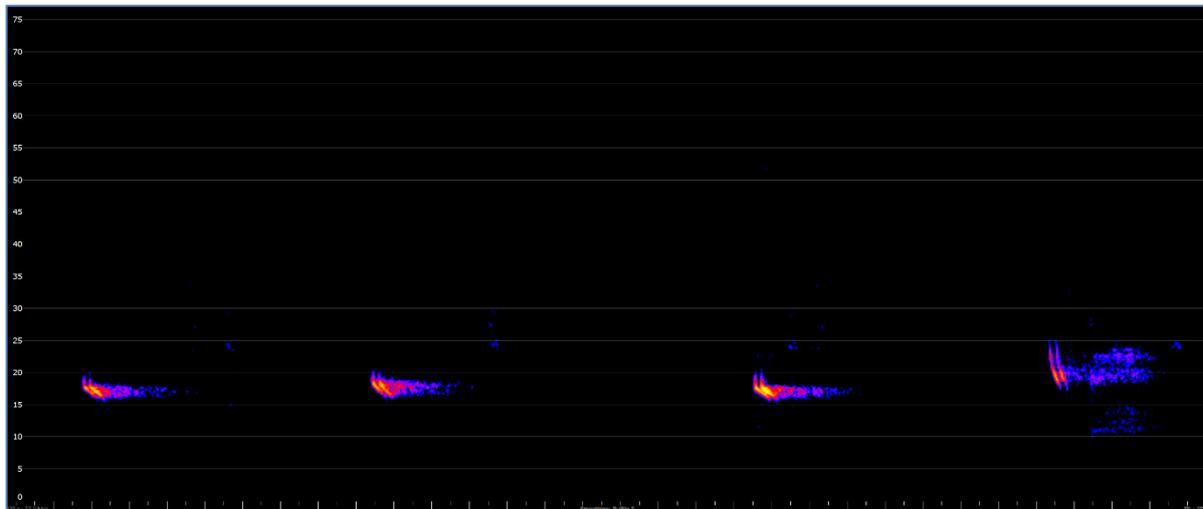


*Rhinolophus megaphyllus*

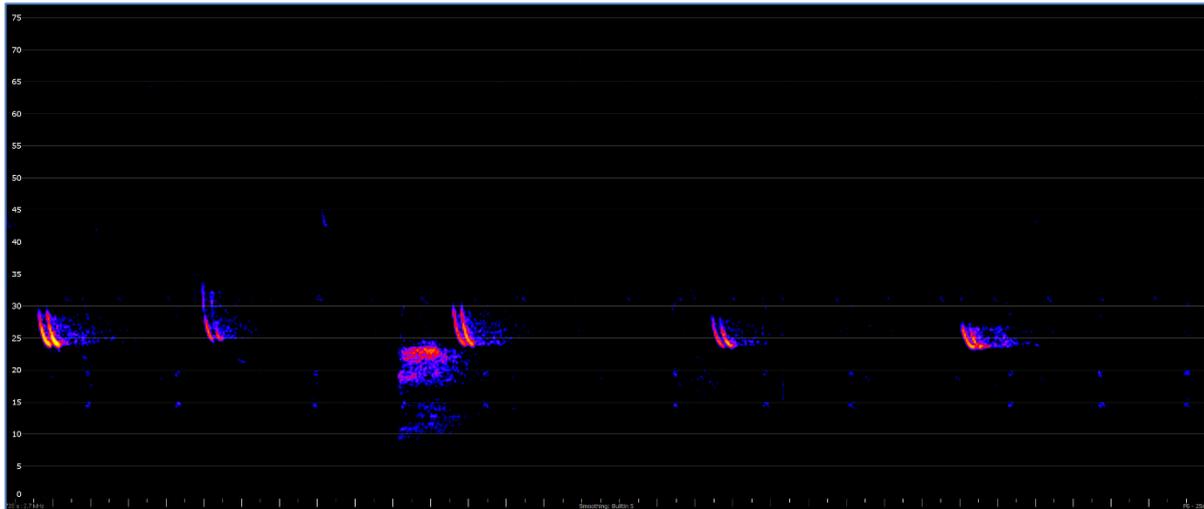


*Ozimops ridei*

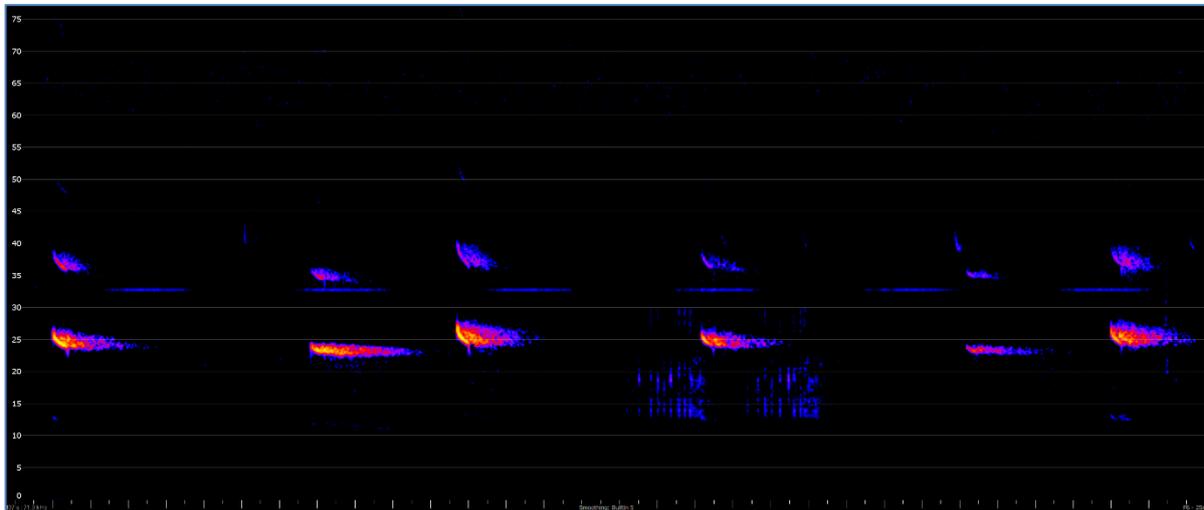
**Note:** timescale on the following full-spectrum spectrograms (25ms per tick-mark; not compressed) is different to the above ZC spectrograms



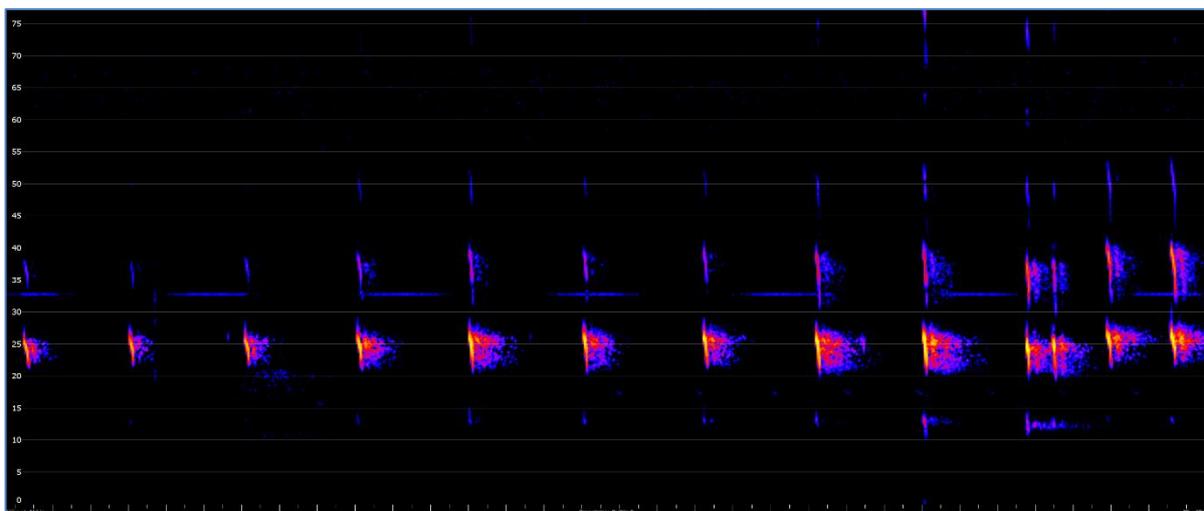
*Chaerephon jobensis*



*Ozimops lumsdenae*



*Saccolaimus saccolaimus*



*S. saccolaimus* or *Taphozous troughtoni*

**Appendix 2** Bat species detected during the Townsville survey, 2-8 February 2021.  
Number of calls attributed to each species and unresolved species group.

Site:	Site1	Site2	Site3	Species total
<b>Positively identified calls</b>				
<i>Rhinolophus megaphyllus</i>	1	1	1	3
<i>Chalinolobus gouldii</i>	60	40	36	136
<i>Chalinolobus morio</i>		34	11	45
<i>Chalinolobus nigrogriseus</i>	16	5	15	36
<i>Myotis macropus</i>	66	674	22	762
<i>Nyctophilus sp.</i>	5	1	2	8
<i>Scotorepens balstoni</i>	13	36	10	59
<i>Scotorepens greyii</i>	25	14	33	72
<i>Scotorepens sanborni</i>	131	173	100	404
<i>Scoteanax rueppellii</i>	1	2		3
<i>Vespadelus pumilus</i>	9	7	9	25
<i>Vespadelus trougtoni</i>	9	68	5	82
<i>Miniopterus australis</i>	13	69	53	135
<i>Miniopterus orianae</i>	55	31	69	155
<i>Chaerephon jobensis</i>	103	87	55	245
<i>Ozimops lumsdenae</i>	330	548	758	1636
<i>Ozimops ridei</i>	48	165	117	330
<i>Saccolaimus saccolaimus</i>	21	54	12	87
<b>Unresolved calls</b>				
<i>C. gouldii</i> / <i>O. ridei</i>	23	14	12	49
<i>C. gouldii</i> / <i>O. ridei</i> / <i>O. lumsdenae</i>		397	565	962
<i>C. gouldii</i> / <i>S. balstoni</i>	2	6	5	13
<i>M. macropus</i> / <i>Nyctophilus sp.</i>	6	125		131
<i>S. greyii</i> / <i>C. nigrogriseus</i>	87	345	544	976
<i>S. greyii</i> / <i>S. sanborni</i>	16	86	127	229
<i>S. rueppellii</i> / <i>Scotorepens orion</i>	8	46	28	82
<i>S. sanborni</i> / <i>M. orianae</i>	74	641	426	1141
<i>V. pumilus</i> / <i>M. australis</i>	10	2		12
<i>V. pumilus</i> / <i>V. trougtoni</i>	5	18	3	26
<i>V. trougtoni</i> / <i>C. morio</i>	4	353	70	427
<i>O. lumsdenae</i> / <i>C. jobensis</i>	19	36	39	94
<i>S. saccolaimus</i> / <i>O. lumsdenae</i>	25	7	1	33
<i>S. saccolaimus</i> / <i>Taphozous trougtoni</i>	20	251	16	287
Site total	1205	4336	3144	8685

# Appendix F

## Desktop Assessment Reports



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 30/03/21 15:31:02

[Summary](#)

[Details](#)

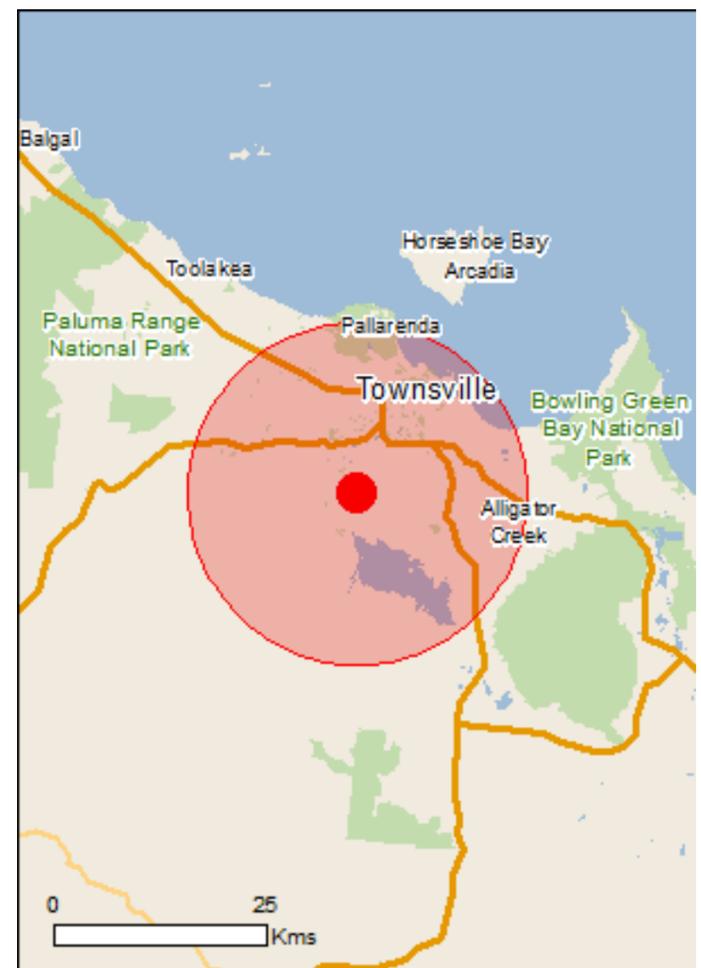
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

[Coordinates](#)

Buffer: 20.0Km



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	1
<a href="#">National Heritage Places:</a>	1
<a href="#">Wetlands of International Importance:</a>	1
<a href="#">Great Barrier Reef Marine Park:</a>	3
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	1
<a href="#">Listed Threatened Species:</a>	48
<a href="#">Listed Migratory Species:</a>	68

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	13
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	111
<a href="#">Whales and Other Cetaceans:</a>	12
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<a href="#">State and Territory Reserves:</a>	4
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	37
<a href="#">Nationally Important Wetlands:</a>	4
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

### World Heritage Properties [\[ Resource Information \]](#)

Name	State	Status
<a href="#">Great Barrier Reef</a>	QLD	Declared property

### National Heritage Properties [\[ Resource Information \]](#)

Name	State	Status
Natural		
<a href="#">Great Barrier Reef</a>	QLD	Listed place

### Wetlands of International Importance (Ramsar) [\[ Resource Information \]](#)

Name	Proximity
<a href="#">Bowling green bay</a>	Within 10km of Ramsar

### Great Barrier Reef Marine Park [\[ Resource Information \]](#)

Type	Zone	IUCN
Conservation Park	CP-19-4059	IV
Conservation Park	CP-19-4058	IV
General Use	GU-16-6004	VI

### Listed Threatened Ecological Communities [\[ Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
<a href="#">Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions</a>	Endangered	Community likely to occur within area

### Listed Threatened Species [\[ Resource Information \]](#)

Name	Status	Type of Presence
Birds		
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris tenuirostris</a> Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
<a href="#">Charadrius mongolus</a> Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
<a href="#">Erythrotriorchis radiatus</a> Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
<a href="#">Fregetta grallaria grallaria</a> White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Limosa lapponica baueri</a> Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Neochmia ruficauda ruficauda</a> Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Poephila cincta cincta</a> Southern Black-throated Finch [64447]	Endangered	Species or species habitat known to occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
<a href="#">Tyto novaehollandiae kimberli</a> Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
<b>Frogs</b>		
<a href="#">Litoria dayi</a> Australian Lace-lid, Lace-eyed Tree Frog, Day's Big-eyed Treefrog [86707]	Vulnerable	Species or species habitat likely to occur within area
<b>Mammals</b>		
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
<a href="#">Hipposideros semoni</a> Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Breeding likely to occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Mesembriomys gouldii rattoides</a> Black-footed Tree-rat (north Queensland), Shaggy Rabbit-rat [87620]	Vulnerable	Species or species habitat may occur within area
<a href="#">Petauroides volans</a> Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
<a href="#">Petrogale sharmani</a> Mount Claro Rock Wallaby, Sharman's Rock Wallaby [59281]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Pteropus conspicillatus</a> Spectacled Flying-fox [185]	Endangered	Species or species habitat likely to occur within area
<a href="#">Rhinolophus robertsi</a> Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Saccolaimus saccolaimus nudicluniatus</a> Bare-rumped Sheath-tailed Bat, Bare-rumped Sheath-tail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Xeromys myoides</a> Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
<b>Plants</b>		
<a href="#">Bulbophyllum globuliforme</a> Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Dichanthium setosum</a> bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eucalyptus paedoglauca</a> Mt Stuart Ironbark [56188]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Marsdenia brevifolia</a> [64585]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Myrmecodia beccarii</a> Ant Plant [11852]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Omphalea celata</a> [64586]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Tephrosia leveillei</a> [16946]	Vulnerable	Species or species habitat likely to occur within area
<b>Reptiles</b>		
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Breeding known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
<a href="#">Egernia rugosa</a> Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
<a href="#">Eretmochelys imbricata</a> Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Lepidochelys olivacea</a> Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
<b>Sharks</b>		
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species

Name	Status	Type of Presence
<a href="#">Pristis pristis</a> Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	habitat may occur within area Species or species habitat known to occur within area
<a href="#">Pristis zijsron</a> Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely to occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

### Listed Migratory Species [ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat likely to occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Fregata ariel</a> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
<a href="#">Fregata minor</a> Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
<a href="#">Sternula albifrons</a> Little Tern [82849]		Species or species habitat may occur within area

### Migratory Marine Species

<a href="#">Anoxypristis cuspidata</a> Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<a href="#">Carcharhinus longimanus</a> Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Breeding known to occur within area
<a href="#">Crocodylus porosus</a> Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Dugong dugon</a> Dugong [28]		Species or species habitat known to occur within area
<a href="#">Eretmochelys imbricata</a> Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Lamna nasus</a> Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
<a href="#">Lepidochelys olivacea</a> Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
<a href="#">Manta alfredi</a> Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
<a href="#">Manta birostris</a> Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
<a href="#">Orcaella heinsohni</a> Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Pristis pristis</a> Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pristis zijsron</a> Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely to occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
<a href="#">Sousa chinensis</a> Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area
<a href="#">Monarcha trivirgatus</a> Spectacled Monarch [610]		Species or species habitat known to occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat known to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Arenaria interpres</a> Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Roosting known to occur within area
<a href="#">Calidris alba</a> Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Roosting known to occur within area
<a href="#">Calidris tenuirostris</a> Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius bicinctus</a> Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius dubius</a> Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
<a href="#">Charadrius mongolus</a> Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
<a href="#">Gallinago megala</a> Swinhoe's Snipe [864]		Roosting likely to occur within area
<a href="#">Gallinago stenura</a> Pin-tailed Snipe [841]		Roosting likely to occur within area
<a href="#">Limicola falcinellus</a> Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		to occur within area  Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Roosting known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Numenius minutus</a> Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
<a href="#">Numenius phaeopus</a> Whimbrel [849]		Roosting known to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Breeding known to occur within area
<a href="#">Philomachus pugnax</a> Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Pluvialis fulva</a> Pacific Golden Plover [25545]		Roosting known to occur within area
<a href="#">Pluvialis squatarola</a> Grey Plover [865]		Roosting known to occur within area
<a href="#">Tringa brevipes</a> Grey-tailed Tattler [851]		Roosting known to occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Roosting known to occur within area
<a href="#">Tringa incana</a> Wandering Tattler [831]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<a href="#">Tringa stagnatilis</a> Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
<a href="#">Xenus cinereus</a> Terek Sandpiper [59300]		Roosting known to occur within area

## Other Matters Protected by the EPBC Act

### Commonwealth Land

[ [Resource Information](#) ]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Defence - Commonwealth Centre
Defence - DEFENCE COMMUNITY ORGANISATION
Defence - JEZZINE BARRACKS - TOWNSVILLE
Defence - LAVARACK BARRACKS - TOWNSVILLE
Defence - Mount Stuart Close Training Area
Defence - NORTH WARD TRAINING DEPOT - TOWNSVILLE
Defence - ROSS ISLAND BARRACKS
Defence - TOWNSVILLE - AP28 TACAN
Defence - TOWNSVILLE - AP37 NAVAID
Defence - TOWNSVILLE - AP40 BOHLE RIVER TRANS STATION

## Name

Defence - TOWNSVILLE - AP7 SPORTS GROUND

Defence - TOWNSVILLE - RAAF BASE

Defence - TOWNSVILLE FIELD TRAINING AREA

## Listed Marine Species

[\[ Resource Information \]](#)

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat likely to occur within area
<a href="#">Anseranas semipalmata</a> Magpie Goose [978]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Breeding known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Breeding likely to occur within area
<a href="#">Arenaria interpres</a> Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Roosting known to occur within area
<a href="#">Calidris alba</a> Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Roosting known to occur within area
<a href="#">Calidris tenuirostris</a> Great Knot [862]	Critically Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius bicinctus</a> Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius dubius</a> Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Charadrius leschenaultii</a> Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur

Name	Threatened	Type of Presence within area
<a href="#">Charadrius mongolus</a> Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
<a href="#">Charadrius ruficapillus</a> Red-capped Plover [881]		Roosting known to occur within area
<a href="#">Charadrius veredus</a> Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat known to occur within area
<a href="#">Fregata ariel</a> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
<a href="#">Fregata minor</a> Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
<a href="#">Gallinago megala</a> Swinhoe's Snipe [864]		Roosting likely to occur within area
<a href="#">Gallinago stenura</a> Pin-tailed Snipe [841]		Roosting likely to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Heteroscelus brevipes</a> Grey-tailed Tattler [59311]		Roosting known to occur within area
<a href="#">Heteroscelus incanus</a> Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Himantopus himantopus</a> Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Limicola falcinellus</a> Broad-billed Sandpiper [842]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Roosting known to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area
<a href="#">Monarcha trivirgatus</a> Spectacled Monarch [610]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat known to occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Numenius minutus</a> Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
<a href="#">Numenius phaeopus</a> Whimbrel [849]		Roosting known to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Breeding known to occur within area
<a href="#">Philomachus pugnax</a> Ruff (Reeve) [850]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Pluvialis fulva</a> Pacific Golden Plover [25545]		Roosting known to occur within area
<a href="#">Pluvialis squatarola</a> Grey Plover [865]		Roosting known to occur within area
<a href="#">Recurvirostra novaehollandiae</a> Red-necked Avocet [871]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
<a href="#">Sterna albifrons</a> Little Tern [813]		Species or species habitat may occur within area
<a href="#">Stiltia isabella</a> Australian Pratincole [818]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Roosting known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<a href="#">Tringa stagnatilis</a> Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
<a href="#">Xenus cinereus</a> Terek Sandpiper [59300]		Roosting known to occur within area
<b>Fish</b>		
<a href="#">Acentronura tentaculata</a> Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
<a href="#">Campichthys tryoni</a> Tryon's Pipefish [66193]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Choeroichthys brachysoma</a> Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
<a href="#">Choeroichthys suillus</a> Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
<a href="#">Corythoichthys amplexus</a> Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
<a href="#">Corythoichthys flavofasciatus</a> Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
<a href="#">Corythoichthys intestinalis</a> Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
<a href="#">Corythoichthys ocellatus</a> Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
<a href="#">Corythoichthys paxtoni</a> Paxton's Pipefish [66204]		Species or species habitat may occur within area
<a href="#">Corythoichthys schultzi</a> Schultz's Pipefish [66205]		Species or species habitat may occur within area
<a href="#">Cosmocampus darrosanus</a> D'Arros Pipefish [66207]		Species or species habitat may occur within area
<a href="#">Doryrhamphus excisus</a> Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
<a href="#">Festucalex cinctus</a> Girdled Pipefish [66214]		Species or species habitat may occur within area
<a href="#">Halicampus dunckeri</a> Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
<a href="#">Halicampus grayi</a> Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
<a href="#">Halicampus nitidus</a> Glittering Pipefish [66224]		Species or species habitat may occur within area
<a href="#">Halicampus spinirostris</a> Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
<a href="#">Hippichthys cyanospilos</a> Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
<a href="#">Hippichthys heptagonus</a> Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
<a href="#">Hippichthys penicillus</a> Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Hippocampus bargibanti</a> Pygmy Seahorse [66721]		Species or species habitat may occur within area
<a href="#">Hippocampus kuda</a> Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
<a href="#">Hippocampus planifrons</a> Flat-face Seahorse [66238]		Species or species habitat may occur within area
<a href="#">Hippocampus zebra</a> Zebra Seahorse [66241]		Species or species habitat may occur within area
<a href="#">Micrognathus andersonii</a> Anderson's Pipefish, Shortnose Pipefish [66253]		Species or species habitat may occur within area
<a href="#">Micrognathus brevirostris</a> thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
<a href="#">Nannocampus pictus</a> Painted Pipefish, Reef Pipefish [66263]		Species or species habitat may occur within area
<a href="#">Solegnathus hardwickii</a> Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
<a href="#">Solenostomus cyanopterus</a> Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
<a href="#">Solenostomus paradoxus</a> Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
<a href="#">Syngnathoides biaculeatus</a> Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
<a href="#">Trachyrhamphus bicoarctatus</a> Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
<a href="#">Trachyrhamphus longirostris</a> Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dugong dugon</a> Dugong [28]		Species or species habitat known to occur within area
<b>Reptiles</b>		
<a href="#">Acalyptophis peronii</a> Horned Seasnake [1114]		Species or species habitat may occur within area
<a href="#">Aipysurus duboisii</a> Dubois' Seasnake [1116]		Species or species habitat may occur within area
<a href="#">Aipysurus eydouxii</a> Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
<a href="#">Aipysurus laevis</a> Olive Seasnake [1120]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
<a href="#">Astrotia stokesii</a> Stokes' Seasnake [1122]		Species or species habitat may occur within area
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Breeding known to occur within area
<a href="#">Crocodylus porosus</a> Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
<a href="#">Disteira kingii</a> Spectacled Seasnake [1123]		Species or species habitat may occur within area
<a href="#">Disteira major</a> Olive-headed Seasnake [1124]		Species or species habitat may occur within area
<a href="#">Enhydrina schistosa</a> Beaked Seasnake [1126]		Species or species habitat may occur within area
<a href="#">Eretmochelys imbricata</a> Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Hydrophis elegans</a> Elegant Seasnake [1104]		Species or species habitat may occur within area
<a href="#">Hydrophis mcdowellii</a> null [25926]		Species or species habitat may occur within area
<a href="#">Hydrophis ornatus</a> Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
<a href="#">Lapemis hardwickii</a> Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
<a href="#">Laticauda colubrina</a> a sea krait [1092]		Species or species habitat may occur within area
<a href="#">Laticauda laticaudata</a> a sea krait [1093]		Species or species habitat may occur within area
<a href="#">Lepidochelys olivacea</a> Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding likely to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
<a href="#">Pelamis platurus</a> Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

## Whales and other Cetaceans

[ [Resource Information](#) ]

Name	Status	Type of Presence
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Mammals

Name	Status	Type of Presence
<a href="#">Balaenoptera acutorostrata</a> Minke Whale [33]		Species or species habitat may occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<a href="#">Delphinus delphis</a> Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
<a href="#">Grampus griseus</a> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Orcaella brevirostris</a> Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Sousa chinensis</a> Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
<a href="#">Stenella attenuata</a> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
<a href="#">Tursiops aduncus</a> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
<a href="#">Tursiops truncatus s. str.</a> Bottlenose Dolphin [68417]		Species or species habitat may occur within area

## Extra Information

State and Territory Reserves	[ Resource Information ]
Name	State
Cape Pallarenda	QLD
Pinnacles	QLD
Stuart Creek	QLD
Townsville Town Common	QLD

## Invasive Species

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
<b>Birds</b>		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
<b>Frogs</b>		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
<b>Mammals</b>		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species

Name	Status	Type of Presence
Vulpes vulpes		habitat likely to occur within area
Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Acacia nilotica subsp. indica		Species or species habitat may occur within area
Prickly Acacia [6196]		
Annona glabra		Species or species habitat likely to occur within area
Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		
Cabomba caroliniana		Species or species habitat likely to occur within area
Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		
Cryptostegia grandiflora		Species or species habitat likely to occur within area
Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		
Dolichandra unguis-cati		Species or species habitat likely to occur within area
Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		
Eichhornia crassipes		Species or species habitat likely to occur within area
Water Hyacinth, Water Orchid, Nile Lily [13466]		
Hymenachne amplexicaulis		Species or species habitat likely to occur within area
Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		
Jatropha gossypifolia		Species or species habitat likely to occur within area
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		
Lantana camara		Species or species habitat likely to occur within area
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		
Opuntia spp.		Species or species habitat likely to occur within area
Prickly Pears [82753]		
Parkinsonia aculeata		Species or species habitat likely to occur within area
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		
Parthenium hysterophorus		Species or species habitat likely to occur within area
Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		
Prosopis spp.		Species or species habitat likely to occur within area
Mesquite, Algaroba [68407]		
Salvinia molesta		Species or species habitat likely to occur within area
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		
Vachellia nilotica		Species or species habitat likely to occur within area
Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		
<b>Reptiles</b>		
Hemidactylus frenatus		Species or species habitat likely to occur within area
Asian House Gecko [1708]		

Name	Status	Type of Presence
Lepidodactylus lugubris Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat known to occur within area

**Nationally Important Wetlands** [ Resource Information ]

Name	State
<a href="#">Burdekin - Townsville Coastal Aggregation</a>	QLD
<a href="#">Great Barrier Reef Marine Park</a>	QLD
<a href="#">RAAF Townsville</a>	QLD
<a href="#">Ross River Reservoir</a>	QLD

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-19.3678 146.7344

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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# Queensland Government

## Wildlife Online Extract

Search Criteria: Species List for a Specified Point  
Species: All  
Type: All  
Status: Rare and threatened species  
Records: All  
Date: All  
Latitude: -19.3678  
Longitude: 146.7344  
Distance: 20  
Email: kate.brodie@aecom.com  
Date submitted: Tuesday 30 Mar 2021 14:25:46  
Date extracted: Tuesday 30 Mar 2021 14:30:05

The number of records retrieved = 35

### **Disclaimer**

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided should only be used for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through independent means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland disclaims all responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Accipitridae	<i>Erythrotriorchis radiatus</i>	red goshawk		E	V	3
animals	birds	Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail		V	V	12
animals	birds	Burhinidae	<i>Esacus magnirostris</i>	beach stone-curlew		V		106
animals	birds	Cacatuidae	<i>Lophochroa leadbeateri</i>	Major Mitchell's cockatoo		V		1
animals	birds	Charadriidae	<i>Charadrius mongolus</i>	lesser sand plover		E	E	116
animals	birds	Charadriidae	<i>Charadrius leschenaultii</i>	greater sand plover		V	V	123
animals	birds	Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)		V	V	20
animals	birds	Estrildidae	<i>Erythrura gouldiae</i>	Gouldian finch		E	E	1
animals	birds	Estrildidae	<i>Poephila cincta cincta</i>	black-throated finch (white-rumped subspecies)		E	E	215
animals	birds	Falconidae	<i>Falco hypoleucos</i>	grey falcon		V	V	1
animals	birds	Procellariidae	<i>Macronectes giganteus</i>	southern giant-petrel		E	E	1
animals	birds	Procellariidae	<i>Ardenna pacifica</i>	wedge-tailed shearwater		V		5
animals	birds	Psittacidae	<i>Cyclopsitta diophthalma macleayana</i>	Macleay's fig-parrot		V		1
animals	birds	Rostratulidae	<i>Rostratula australis</i>	Australian painted snipe		E	E	12
animals	birds	Scolopacidae	<i>Limosa lapponica baueri</i>	Western Alaskan bar-tailed godwit		V	V	313
animals	birds	Scolopacidae	<i>Numenius madagascariensis</i>	eastern curlew		E	CE	444
animals	birds	Scolopacidae	<i>Calidris tenuirostris</i>	great knot		CR	CE	207
animals	birds	Scolopacidae	<i>Calidris ferruginea</i>	curlew sandpiper		CR	CE	35
animals	birds	Scolopacidae	<i>Calidris canutus</i>	red knot		E	E	70
animals	birds	Tytonidae	<i>Tyto novaehollandiae kimberli</i>	masked owl (northern subspecies)		V	V	1
animals	mammals	Balaenopteridae	<i>Megaptera novaeangliae</i>	humpback whale		V	V	4
animals	mammals	Delphinidae	<i>Orcaella heinsohni</i>	Australian snubfin dolphin		V		26/16
animals	mammals	Delphinidae	<i>Sousa sahalensis</i>	Australian humpback dolphin		V		4/4
animals	reptiles	Carphodactylidae	<i>Phyllurus gulbaru</i>	Gulbaru gecko		CR	CE	2
animals	reptiles	Cheloniidae	<i>Chelonia mydas</i>	green turtle		V	V	3
animals	reptiles	Crocodylidae	<i>Crocodylus porosus</i>	estuarine crocodile		V		11/2
animals	reptiles	Scincidae	<i>Lampropholis mirabilis</i>	saxicoline sunskink		NT		2
plants	land plants	Acanthaceae	<i>Graptophyllum excelsum</i>			NT		1/1
plants	land plants	Byttneriaceae	<i>Commersonia reticulata</i>			V		2/2
plants	land plants	Elaeocarpaceae	<i>Dubouzetia saxatilis</i>			V		6/6
plants	land plants	Euphorbiaceae	<i>Croton magneticus</i>			V		1/1
plants	land plants	Myrtaceae	<i>Sannantha papillosa</i>			E		2/2
plants	land plants	Myrtaceae	<i>Eucalyptus paedoglauca</i>	Mt. Stuart ironbark		V	V	12/12
plants	land plants	Myrtaceae	<i>Backhousia tetraptera</i>			CR		7/7
plants	land plants	Poaceae	<i>Paspalidium udum</i>			V		3/2

#### CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).

This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.

This number is output as 999 if it equals or exceeds this value.