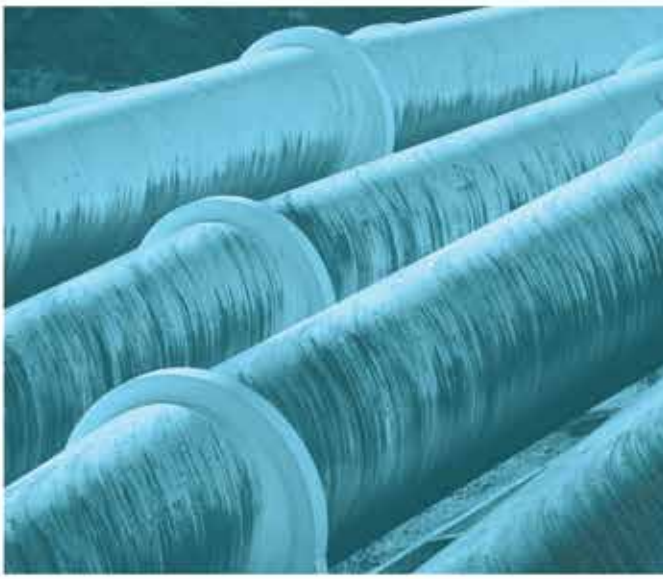
Matters of National Environmental Significance Report

No Named Road

Prepared for Townsville City Council
June 2022



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Matters of National Environmental Significance Report

No Named Road

Report Number

E210878 RP1

Client

Townsville City Council

Date

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Version

v1 Final

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2 June 2022

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2 June 2022

Executive Summary

Townsville City Council (TCC) is delivering the Lansdown Eco-Industrial Precinct (LEIP), Northern Australia's first environmentally sustainable advanced manufacturing, technology and processing hub. The LEIP will realise the objectives of the Townsville City Deal (a tri-partisan agreement spanning 15 years and all levels of government) to activate industry and export growth for Townsville and its regional partners as the Industry Powerhouse of the North.

The LEIP is approximately 2,200 hectares (ha) of freehold land owned by TCC.

Seven proponents have conditionally been allocated land in the precinct following tender processes conducted by TCC. They are:

- Queensland Pacific Metals;
- Edify Energy;
- Imperium3 Townsville;
- RTE Energy Pty Ltd;
- Origin Energy Future Fuels Pty Ltd;
- Solquartz Pty Ltd; and
- North Queensland Gas Pipeline.

To enable the facilitation of the LEIP, various forms of infrastructure are required to be built. On 25 March 2022, TCC formally endorsed the infrastructure masterplan for the LEIP. Under the masterplan, the LEIP will be developed in stages. Enabling infrastructure works will include road access to the northern part of the precinct, which is the focus of this Matters of National Environmental Significance (MNES) report.

The proposed road reserve is approximately 1.7 km in length and 20 m wide, running from Jones Road to the northern extent of the LEIP.

Two ecological surveys (completed in July 2021 and March 2022) have been undertaken to identify potential MNES in the road reserve. The surveys were supplemented by desktop assessments which informed a likelihood of occurrence at the road reserve. Following this, significant impact assessment in accordance applicable guidelines including EPBC Act Significant Impact Guidelines 1.1 (DoE 2013) were undertaken for MNES known or likely to occur.

Key results of the assessment are summarised as follows:

- no TECs were recorded;
- no flora protected under the EPBC Act were recorded;
- Squatter Pigeon (listed as Vulnerable under the EPBC Act) was identified near the northern boundary and adjacent to farm dams on surrounding properties to the road reserve;
- Bare-rumped Sheathtail Bat was identified as known to occur due to numerous recordings on Anabat devices across the road reserve and surrounding study area;

- no Black-throated Finch (southern form) were observed during surveys however habitat was identified throughout the road reserve; and
- no threatened aquatic species are considered likely to occur within the road reserve.

It is assumed that the entire road reserve area (totalling 3.37 ha) will be cleared for the construction of the road.

Significant impact assessments were carried out for MNES that are 'known' or 'likely' to occur in the road reserve.

Table 1.1 below summarises the residual impacts on MNES values and impact assessment findings. Full significant impact assessments applying the Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DoE, 2013) are presented in Section 9. The significance of impacts on MNES values have been assessed following consideration of general avoidance and mitigation measures described in Section 8, and specific mitigation relevant to each MNES described below in Sections 9.2 to 9.8.

Table 1.1 Summary of significant impact assessment

MNES	Total area of habitat within road reserve and area impacted (ha)	Significant impact assessment - conclusion
Squatter Pigeon	3.37	Not significant
Black-throated Finch (potential breeding)	2.47	Not significant
Black-throated Finch (foraging)	0.90	
Bare-rumped Sheathtail Bat (roosting)	Less than 0.01 ha	Not significant
Bare-rumped Sheathtail Bat (foraging)	3.37	
Koala	2.47	Not significant
White-throated Needletail	3.37	Not significant
Fork-tailed Swift	3.37	Not significant
Oriental Cuckoo	2.47	Not significant

No significant impacts are likely to MNES. The Project involves the loss of 3.37 ha of potential Black-throated Finch habitat. The quality of this habitat is low, and not likely to be heavily utilised by Black-throated Finch within this area, and to date there are no records from the road reserve. Although the position on the species indicated in communication with DAWE is that all suitable habitat in the Townsville region is important, and presence can be assumed if habitat is suitable and there are nearby records, the clearing is narrow and linear and falls within an existing road reserve which is currently used as a farm track (eg Photograph 6.1), albeit overgrown by grasses and weedy shrubs (eg Chinee Apple) in places. However the habitat on site is degraded (eg Photograph 6.3) and the loss of this narrow strip is not considered to be a significant impact to the species. The ability of the species to continue to use the surrounding habitats is maintained (for example the species regularly forages along roadsides on seeding grasses in the Woodstock area). Farm dams adjacent to the survey area providing a drinking resource are avoided and maintained.

Abbreviations

Table A.1 Abbreviations used in this report

Abbreviation	Term
ALA	Atlas of Living Australia
BOM	Bureau of Meteorology
DAWE	Department of Agriculture, Water and the Environment
DES	Department of Environment and Science
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DAWE)
DoE	Department of the Environment (now DAWE)
DoEE	Department of the Environment and Energy (now DAWE)
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ESCP	Erosion and Sediment Control Plan
EVNT	Endangered, vulnerable or near threatened
GTRE	Ground-truthed regional ecosystem
IECA	International Erosion Control Association
LEIP	Lansdown Eco-Industrial Precinct
MNES	Matters of National Environmental Significance
PMST	Protected matters search tool
RE	Regional ecosystem
SPRAT	Species Profile and Threats Database
TEC	Threatened ecological community
TSSC	Threatened Species Scientific Committee

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Appendices

Tables

Figures

Photographs

1 Introduction

Townsville City Council (TCC) is delivering the Lansdown Eco-Industrial Precinct (LEIP), Northern Australia's first environmentally sustainable advanced manufacturing, technology and processing hub. The LEIP will realise the objectives of the Townsville City Deal (a tri-partisan agreement spanning 15 years and all levels of government) to activate industry and export growth for Townsville and its regional partners as the Industry Powerhouse of the North.

The LEIP is approximately 2,200 hectares (ha) of freehold land owned by TCC.

Seven proponents have conditionally been allocated land in the precinct following tender processes conducted by TCC. They are:

- Queensland Pacific Metals;
- Edify Energy;
- Imperium3 Townsville;
- RTE Energy Pty Ltd;
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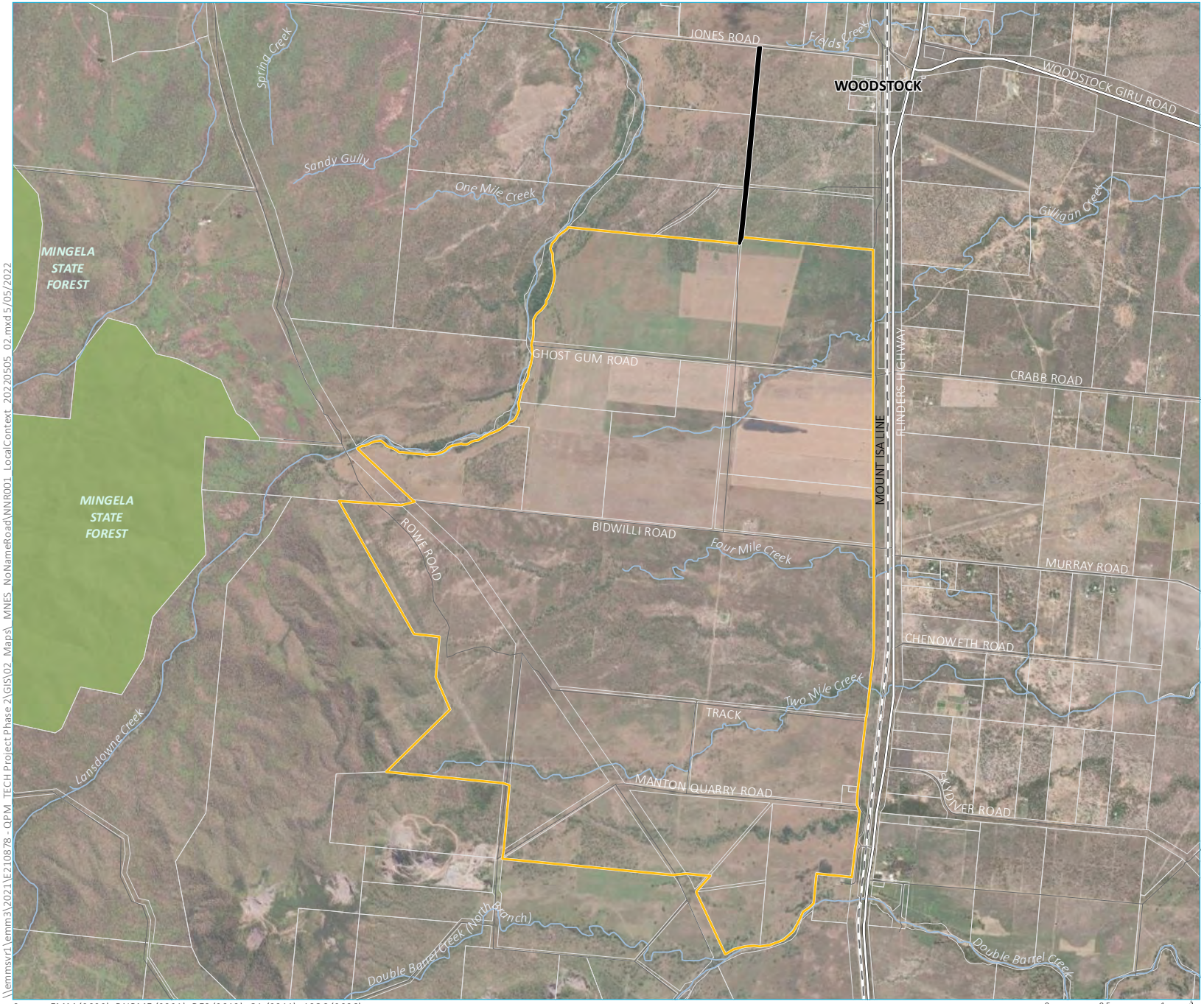
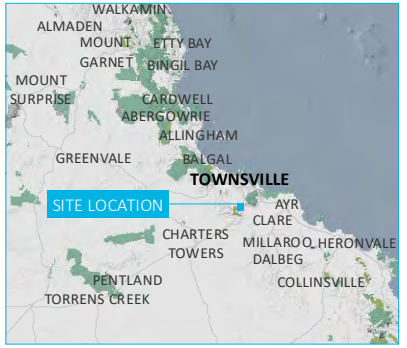
- Solquartz Pty Ltd; and
- North Queensland Gas Pipeline.

To enable the facilitation of the LEIP, various forms of infrastructure are required to be built. On 25 March 2022, TCC formally endorsed the infrastructure masterplan for the LEIP. Under the masterplan, the LEIP will be developed in stages. Enabling infrastructure works will include road access to the northern part of the precinct, which is the focus of this Matters of National Environmental Significance (MNES) report. The road access comprises a proposed access road approximately 1.7 km long which runs south from Jones Road at Woodstock.





KEY

- Survey area
- Lansdown Eco Precinct
- Rail line
- Major road
- Minor road
- Named watercourse
- Cadastral boundary
- State forest

INSET KEY

- Main road
- National park
- State forest

Source: EMM (2022); DNRME (2021); DES (2019); GA (2011); ASGC (2006)

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Local context

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 1.1

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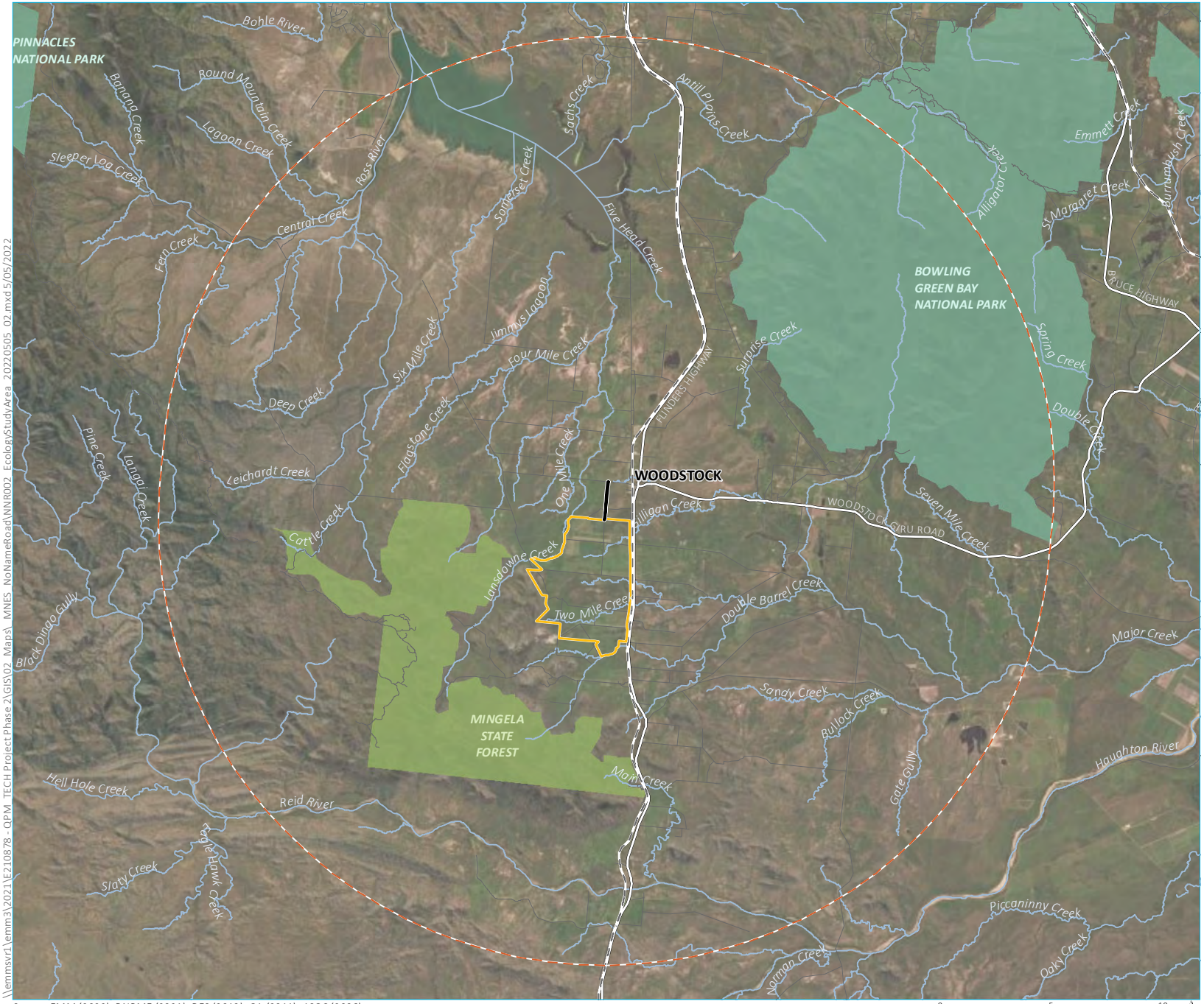

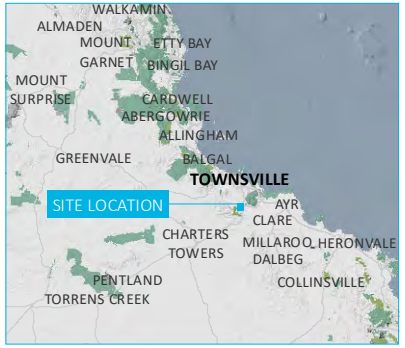

KEY

- Study area (20 km buffer)
- Survey area
- Lansdown Eco Precinct
- Rail line
- Major road
- Minor road
- Named watercourse
- National park
- State forest

INSET KEY

- Main road
- National park
- State forest

Source: EMM (2022); DNRME (2021); DES (2019); GA (2011); ASGC (2006)

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Ecology study area

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 1.2

EMM creating opportunities

2 Legislative context

A summary of the key legislation, policies and guidelines that have informed the design and implementation of field ecology surveys and impact assessments is provided in the following sections.

2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places - defined in the EPBC Act as matters of national environmental significance (MNES).

If a proposed development or other action ('proposed action') is likely to have a significant impact upon a protected matter, then it must be referred for assessment under the EPBC Act. Protected matters under EPBC Act are:

- World Heritage Properties;
- National Heritage Places;
- wetlands of international importance (listed under the Ramsar Convention);
- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- the environment, where nuclear actions are involved;
- a water resource, in relation to coal seam gas and large coal mining developments;
- the environment, where actions proposed are on, or will affect Commonwealth land and the environment; and
- the environment, where Commonwealth agencies are proposing to take an action.

Desktop and field assessments completed to date have included an assessment of the presence of threatened ecological communities (TECs) and targeted surveys for listed flora and fauna species under the EPBC Act.

2.1.1 Matters of National Environmental Significance - Significant Impact Guidelines 1.1

Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a MNES. The *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DoE 2013) outline a 'self-assessment' process, including detailed criteria, to assist persons in deciding whether or not referral may be required and if the proposed action may have a 'significant' impact on MNES.

The EPBC Act includes a requirement that where a significant impact to a MNES is assessed as likely to occur, an environmental offset is required to compensate for that impact.

2.1.2 EPBC Act Environmental Offsets Policy

Environmental offsets are required to be delivered in accordance with the *EPBC Act Environmental Offsets Policy* (DoEE 2012). The Environmental Offsets Policy outlines the Australian Government's approach to the use of environmental offsets ('offsets') under the EPBC Act. Offsets are defined as measures that compensate for the residual adverse impacts of an action on the environment. Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment under the EPBC Act (DoEE 2012).

Avoidance and mitigation measures are the primary strategies for managing the potential significant impact of a proposed action. Offsets do not reduce the likely impacts of a proposed action, but instead compensate for any residual significant impact. Where significant impacts are found to occur to MNES, and environmental offsets are required, an offsets package should be provided. An offsets package is a suite of actions that a proponent undertakes in order to compensate for the residual significant impacts to the identified MNES. It can comprise a combination of direct offsets and other compensatory measures.

Offsets should align with conservation priorities for the impacted protected matter and be tailored specifically to the attribute of the protected matter that is impacted in order to deliver a conservation gain (DoEE 2012). To support any offset assessments that may be required it will be important to evaluate the specific MNES attributes that occur within the proposed disturbance area (eg whether it is foraging habitat or breeding habitat) and the habitat quality of mapped habitat areas. This information is required to inform offset calculations.

2.2 Queensland Vegetation Management Act 1999 (VM Act)

The purpose of the VM Act is to regulate the clearing of native vegetation in a way that conserves remnant vegetation in declared areas, ensures clearing does not cause land degradation, prevents the loss of biodiversity and maintains ecological processes.

Under the VM Act REs are assigned one of three statuses which are:

- Endangered RE;
- Of Concern RE; or
- Least Concern RE.

These statuses are taken from the RE description database, and respective definitions are provided in the Act. Within this report, the definition of a RE follows that described by Sattler and Williams (1999) eg a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. Both VM Act status and biodiversity status of REs has been included.

2.3 Queensland Nature Conservation Act 1992 (NC Act)

For a proposed activity that will have an unavoidable impact on breeding places of protected animals (which include all classes of native wildlife including least concern) a Species Management Program (SMP) is required to be prepared and approved by the Department of Environment and Science (DES) under the NC Act. DES has prepared an Information Sheet that outlines when a SMP is required. Animal breeding places are defined in this document as: a bower; burrow; cave; hollow; nest; or other thing that is commonly used by the animal to incubate or rear the animal's offspring.

A Low Risk SMP can authorise tampering with animal breeding places for least concern species. A High Risk SMP will authorise tampering for all fauna breeding places including colonial breeders, special least concern and Critically Endangered, Endangered, Vulnerable and Near Threatened (CEEVNT) species. The duration of the SMP must be identified and must be relevant to the activity being undertaken and allow for a periodic review of the program. The standard term for an SMP is three years.

The purpose of an SMP is to:

- assess the threats to native animal breeding places resulting from a planned activity;
- incorporate management actions that will avoid or minimise both the immediate and the long-term impact of removing or altering an animal breeding place; and
- set monitoring and reporting requirements that demonstrate the management actions in the SMP are effectively implemented and produce the intended results.

The seasonal terrestrial ecology surveys have included habitat assessments and identification of animal breeding places. This information has been used to evaluate species' likelihood of occurrence on the site, prepare habitat mapping, and will be used at a later date to support the preparation of an SMP, as required.

2.4 Biosecurity Act 2014

The *Biosecurity Act 2014* provides a legislative framework to manage feral fauna and pest flora, diseases and environmental contaminants, to address the impacts they have on the economy, environment, agriculture, tourism and society.

The Act prohibits or restricts the introduction and spread of declared plant and animal pests within Queensland. Weeds and pests pose one of the most significant threats to native flora and fauna and agriculture within the road reserve.

Field ecology surveys have identified the presence of pest plants and animals, which are discussed in Section 6.1.3 and 6.2.3.

2.5 Survey guidelines

The timing and survey methods adopted for the seasonal flora and fauna surveys were guided by applicable State and Commonwealth survey guidelines. Vegetation community survey methods were consistent with the *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*, Version 5.1 (Neldner et al. 2020).

Targeted fauna surveys were designed and implemented in accordance with the following guidelines:

- *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland - Version 3.0* (Eyre et al. 2018);
- *Survey guidelines for Australia's threatened reptiles* (DSEWPC 2011a);
- *Survey guidelines for Australia's threatened mammals* (DSEWPC 2011b);
- *Survey guidelines for Australia's threatened birds* (DEWHA 2010a);
- *Survey guidelines for Australia's threatened bats* (DEWHA 2010b);
- *Draft referral guidelines for the nationally listed Brigalow Belt reptiles* (DSEWPC 2011c); and

- *Significant impact guidelines for the endangered black-throated finch (southern) (Poephila cincta cincta) - EPBC Act policy statement 3.13 (*DEWHA, 2009*).*

3 Project description

TCC is delivering the LEIP, Northern Australia's first environmentally sustainable advanced manufacturing, technology and processing hub in Woodstock, 40 km south of Townsville.

As noted in Section 1, to enable the facilitation of the LEIP, various forms of infrastructure are required to be built. The focus of this MNES report is the development of road access to the northern part of the precinct, currently known as No Named Road Reserve. The current road reserve is not a developed road but has been gazetted as a reserve.

The proposed road reserve is approximately 1.7 km in length.

Tie ins for the proposed road are:

- At the northern extent: Jones Road; and
- At the southern extent: the most northern extent of the LEIP. A Western Perimeter Road straddles the western extent of the Queensland Pacific Metals' Townsville Energy Chemicals Hub Project. This road has been incorporated into the EPBC Referral EPBC 2021/9033.

From the Western Perimeter Road, future roads will connect all proponents within the LEIP.

The alignment and road option for the LEIP has been collaborated between TCC and the precinct proponents. An alternative option for access into the LEIP is via Manton Quarry Road to the south, which currently provides access for light vehicles. There is, however, insufficient queuing space for multi-combination and heavy vehicles and therefore this option is not suitable for the LEIP.

The minimum road reserve width of 20 m is proposed within the LEIP for the minor internal roads and is also to be adopted to provide the corridor for the interim road section before finalisation of land acquisitions, and prior to upgrade justification based on the traffic modelling. The ultimate road reserve width is a nominal 30 m, with swales provided for longitudinal drainage in place of kerb and channel, to allow for water treatment of road run-off. The requirement for a future road reserve extension will be confirmed during the completion of enabling works at LEIP and in consultation with existing and future proponents with regards to their projected traffic volumes.

For the purpose of this MNES report, a 20 m width has been adopted to capture the full future extent of impacts (the 'survey area').

Pending approvals and final acquisitions, construction of the road is anticipated to commence in 2022.

4 Methodology

4.1 Desktop assessments

Background research and desktop ecological assessments were completed to provide an understanding of the broader ecological values, landscape features, vegetation communities and threatened species potentially associated with the road reserve.

Geographic boundaries of the searches undertaken, and the subsequent assessment results are defined as the following:

- Road reserve: the cadastral boundaries of the road reserve extending from Jones Road in the north to Lots 20 E123189 and 19 RP901592 in the south (Figure 1.1); and
- Study area: a 20 km buffer from the centre point of the road reserve extent (halfway between Jones Road in the north and Lots 20 E123189 and 19 RP901592 in the south (Figure 1.2).

The desktop assessment was completed through evaluation of a range of information sources regarding the potential ecological values that may occur across the study area. Data sources reviewed are summarised below:

- Department of Agriculture, Water and the Environment (DAWE) Protected Matter Search Tool (PMST) – search undertaken on 8 April 2022;
- DES Wildlife Online – search undertaken on 8 April 2022;
- Atlas of Living Australia (ALA);
- eBird to access records of threatened bird species and migratory birds that occur in the study area;
- DES Essential Habitat mapping;
- DES Regulated Vegetation and Regional Ecosystem mapping;
- Aerial imagery;
- Protected Plants Trigger Mapping; and
- Wetland mapping.

4.2 Field surveys

Field surveys were undertaken in July 2021 and March 2022. Field survey methods included a range of survey techniques including, deployment of Anabat detectors, diurnal bird surveys, habitat assessments, active searches and verification of vegetation community mapping by ground-truthing REs. Records were taken of incidental observations during surveys.

A walkover of the Survey area was undertaken by a team of two ecologists led by Andrew Jensen and supported by Gus Daly on 29 July 2021. A walkover of the Survey area was undertaken by a team of two ecologists led by Sandra Walters and supported by Elliot Leach on 18 March 2022.

Conditions during the July 2021 field survey ranged between 18 - 32 °c with no rain recorded. Majors Creek (the nearest weather station) received 219.4 mm of rainfall in the three months leading up to survey (BOM, 2021).

Conditions during the March 2022 field survey ranged between 22 - 33 °c with no rain recorded. Majors Creek (the nearest weather station) received 262.2 mm of rainfall in the three months leading up to survey (BOM, 2021).

The following sections outline in more detail the surveys completed, methodologies used and the total survey effort. Survey sites are illustrated in Figure 4.1.

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Source: EMM (2022); DNRME (2021)

Survey sites

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 4.1

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4.2.1 Vegetation communities and flora

The vegetation community surveys were undertaken using quaternary assessments consistent with the *Methodology for Surveying and Mapping Regional Ecosystems and Vegetation Communities in Queensland*, Version 5.1 (Neldner et al. 2020). The objective of these assessments was to ground-validate REs, determine their conditional status (remnant or non-remnant) and overall extent. Nine quaternary sites were completed in July 2021.

Data collection associated with quaternary assessments include the following:

- dominant species across all identified strata;
- height and canopy cover of the Ecologically Dominant Layer;
- condition (remnant or non-remnant);
- connectivity with nearby habitats; and
- presence of weed species.

Threatened flora species were searched for while undertaking flora and fauna surveys across the road reserve. No high-risk trigger areas are mapped within the road reserve therefore no formal protected plant surveys were required to be undertaken.

Searches for threatened flora species were completed while conducting vegetation mapping assessments and while traversing the road reserve. This included general meanders in any suitable threatened species habitat whilst on route to designated survey sites. Based on desktop review the potential for threatened plants on the road reserve was limited (refer Section 5.8.2).

4.2.2 Habitat assessments

Nine habitat assessments were completed in July 2021. The aim of habitat assessments is to identify key habitat features such as nests, tree hollows or fallen woody debris to support an assessment of threatened fauna species that may occur in the road reserve and habitat mapping.

Habitat assessments included the recording of the following habitat attributes:

- the presence of fallen logs, leaf litter, rocks;
- vegetative groundcover;
- presence of cracking soils;
- presence rocky overhangs, caves, decorticating bark;
- foraging resources such as native grasses, preferred food trees for Koalas etc;
- available water sources;
- animal breeding places such as hollow-bearing trees, dens, and nests;
- presence and abundance of weeds; and
- signs of pest animals.

Habitat assessments during July 2021 surveys focussed on habitat requirements for the Black-throated Finch, and included recording of land uses, grassland quality and composition. This included proportions of exotic/native groundcover (grass to herb ratio), areas of bare ground, presence of native and exotic grasses, connectivity and proximity to water. These were guided by the information presented in the *Significant impact guidelines for the endangered black-throated finch (southern) (Poephila cincta cincta) - EPBC Act policy statement 3.13* (DEWHA, 2009) and the *National Recovery Plan for the Black-throated Finch (southern) subspecies* (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007), specifically relating to foraging and breeding habitat requirements.

Hollow bearing trees were recorded where observed across the survey area. Data recorded included:

- tree species;
- tree diameter at breast height;
- number of hollows;
- diameter of entrance – small (<5cm), medium (5 – 20cm), large (>20cm) and very large (>40cm); and
- any observation notes (eg species using hollow).

These hollow bearing tree assessments informed the assessment of potential Bare-rumped Sheathtail Bat habitat as this species roosts in tree hollows.

4.2.3 Fauna

Informal searches for the identified potentially occurring threatened fauna species were undertaken when in suitable habitats. This included general area searches for terrestrial birds such as Squatter Pigeon and Black-throated Finch, Koala scat and scratch searches as well as looking for presence of Koalas within *Eucalyptus* trees and placement of an Anabat device to record potential calls of the Bare-rumped Sheathtail Bat. These devices are set to automatically record and store bat calls between dusk and dawn each night. The resulting library of recorded calls are then processed by an experienced technician and identified to species level where possible.

4.2.4 Survey limitations

Conditions were considered suitable for the detection of most candidate threatened flora species.

In July 2021, the survey area was very dry making specific identification of grass species challenging, with little fertile material present. However, in most instances, the species could be identified to genus, and the status (exotic or native determined and its suitability for Black-throated Finch). The potential detection of threatened grasses was reduced throughout the Survey area due to the dry conditions. However, there are no likely candidates to occur in the Survey area. Surveys in March 2022 were after rain, so identification of specific grass species was more straightforward.

4.3 Significant impact assessment

Impact assessments have been undertaken in accordance with the Matters of National Environmental Significance – Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013). Species-specific guidelines have included:

- EPBC Act significant impact guidelines for the endangered Black-throated Finch (southern) (CoA 2009).

The methods provided within the guidelines are intended to determine the level of significant impacts on MNES due to the proposed action. This is achieved through 'significant impact criteria' which are imposed on identified values and vary according to the status of each value.

5 Desktop assessment results

The following sections present the results of the desktop assessment which was completed prior to the commencement of field surveys.

5.1 Summary of PMST

A PMST query was undertaken on 24 June 2021, with a 20 km buffer added to the road reserve. A summary of the results is provided below in Table 5.1, with further detail in the sub-sections below. The PMST was updated on 8 April 2022 for the purpose of most up to date information to support this preliminary documentation report.

Table 5.1 PMST results for the study area

MNES	PMST result
World Heritage Properties	None
National Heritage Properties	None
Wetlands of International Importance	1
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed threatened ecological communities	None
Listed threatened species	34
Listed migratory species	18

5.2 World Heritage and National Heritage Properties

No World Heritage or National Heritage Properties are located within the road reserve or study area. The closest World Heritage property, the Great Barrier Reef, is located approximately 35 km northeast of the road reserve. Additionally, the southern end of the Wet Tropics of Queensland World Heritage Area is located approximately 50 km northwest of the road reserve.

5.3 Protected Area estates

No Protected Area estates are located within the road reserve. However, three Protected Areas fall within the broader Study area which includes Bowling Green Bay National Park approximately 10 km to the northeast, Mingela State Forest 3 km to the southwest and Serpentine Nature Refuge 4 km to the east of the road reserve.

5.4 Wetlands of International Importance

No Wetlands of International Importance are located within the road reserve. The closest Wetland of International Importance, Bowling Green Bay, is located approximately 25 km to the northeast of the road reserve.

5.5 Great Barrier Reef Marine Park and Commonwealth Marine Areas

The Great Barrier Reef Marine Park is located approximately 35 km north of the road reserve.

5.6 Regional ecosystems and regulated vegetation

Two REs are mapped within the road reserve. These are summarised in Table 5.2 including Vegetation Management Act class and Biodiversity Status. Both of these REs are classified as Least Concern under the VM Act and consist of eucalypt woodlands on alluvial plains.

Regulated vegetation within the road reserve based on certified mapping is illustrated in Figure 5.1.

Table 5.2 Regional ecosystems mapped in the road reserve

RE code	Description	Vegetation Management Act class	Biodiversity Status
11.3.30	*Eucalyptus crebra, Corymbia dallachiana* woodland on alluvial plains	Least concern	No concern at present
11.3.35	*Eucalyptus platyphylla, Corymbia clarksoniana* woodland on alluvial plains	Least concern	No concern at present

KEY

- Survey area
- Minor road
- Named watercourse
- Cadastral boundary

Regional ecosystem (VM status)

- Remnant - least concern
- High value regrowth - least concern

Source: EMM (2022); DNRME (2021)

0 250 500 m

GDA 1994 MGA Zone 55

N

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Regulated vegetation mapping

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 5.1

EMM
creating opportunities

5.7 Threatened Ecological Communities (TECs)

No TECs were identified as potentially occurring with the study area based on results from the PMST desktop assessment (Appendix A) and a review of the REs mapped in the road reserve and adjacent properties.

5.8 Threatened species

Results of the desktop assessment for threatened flora and fauna species under EPBC Act and NC Act are summarised in the following sections. Desktop records of all threatened species in the study area are mapped in Figure 5.2. A refined likelihood of occurrence table to identify candidate threatened species for the road reserve is provided in Appendix C.

5.8.1 Threatened fauna species

A list of the threatened fauna species identified as potentially occurring within the study area based on desktop searches is provided in Table 5.3. Those species that were not in the original PMST but were in the updated PMST conducted 8 April 2022 are appended with an asterisk (*). A tick (✓) in the 'PMST Search' or 'Wildlife Online' column indicates that the species was identified in that report. It is important to note that PMST identifies species potentially occurring based on actual records and distributional modelling, whilst Wildlife Online returns only those species that have been recorded within the search area.

Table 5.3 Threatened fauna species with potential to occur

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	PMST search	Wildlife Online
Birds					
Calidris ferruginea	Curlew Sandpiper	CE, M	CR	✓	✓
Charadrius leschenaultii	Greater Sand Plover*	V, M	V	✓	×
Erythrotriorchis radiata	Red Goshawk	V	E	✓	×
Falco hypoleucos	Grey Falcon	V	V	✓	×
Geophaps scripta scripta	Squatter Pigeon (southern)	V	V	×	✓
Hirundapus caudacutus	White-throated Needletail	V, M	V	✓	✓
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	V	V	✓	✓
Neochmia ruficauda ruficauda	Star Finch (eastern)	E	E	✓	×
Numenius madagascariensis	Eastern Curlew	CE, M	E	✓	×
Poephila cincta cincta	Southern Black-throated Finch	E	E	✓	✓
Rostratula australis	Australian Painted Snipe	E	E	✓	×
Turnix olivii	Buff-breasted Buttonquail*	E	E	✓	×
Tyto novaehollandiae kimberli	Australian Masked Owl (northern)	E	V	✓	×
Terrestrial mammals					
Dasyurus hallucatus	Northern Quoll	E	LC	✓	×
Xeromys myoides	Water Mouse*	V	V	✓	
Arboreal mammals					

Table 5.3 Threatened fauna species with potential to occur

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	PMST search	Wildlife Online
Petauroides volans volans	Greater Glider	V	E	✓	✓
Phascolarctos cinereus	Koala	E	V	✓	×
Bats					
Hipposideros semoni	Semon's Leaf-nosed Bat	V	E	✓	×
Macroderma giga	Ghost Bat	V	E	✓	×
Rhinolophus robertsi	Large-eared Horseshoe Bat	V	E	✓	×
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheath-tailed Bat	V	E	✓	×
Reptiles					
Denisonia maculata	Ornamental Snake	V	V	✓	×
Egernia rugosa	Yakka Skink	V	V	✓	×
Lerista vittata	Mount Cooper Striped Skink	V	V	✓	×
Amphibians					
Cophixalus mcdonaldi	Mount Elliot Nurseryfrog	CE	CR	✓	✓
Fish and aquatic species					
Euastacus bindal	Spiny Crayfish	CE	CR	✓	✓

1. *EPBC Act status: CE- critically endangered, E – endangered, V – vulnerable, M – migratory, Ma – marine*
2. *NC Act status: CR – critically endangered, E – endangered, V – vulnerable, NT – near threatened, SLC – special least concern*

5.8.2 Threatened flora species

A list of the threatened flora species identified as potentially occurring within the study area based on desktop assessments is provided in Table 5.4. Those species that were not in the original PMST but were in the updated PMST conducted 8 April 2022 are appended with a star.

Table 5.4 Flora species with potential to occur

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	PMST search	Wildlife Online
Bulbopyllum globuliforme	Miniature Moss-orchid	V	NT	✓	×
Dichanthium setosum	Bluegrass	V	LC	✓	×
Eucalyptus paedoglauca	Mount Stuart Ironbark	V	V	✓	✓
Eucalyptus raveretiana	Black Ironbox	V	LC	✓	×
Marsdenia brevifolia	-	V	V	✓	×
Omphalea celata	-	V	V	✓	×
Solanum graniticum	Granite Nightshade*	E	E	✓	×
Tephrosia leveillei	-	V	LC	✓	×

1. *EPBC Act status: CE- critically endangered, E – endangered, V – vulnerable, M – migratory, Ma – marine*
2. *NC Act status: CR – critically endangered, E – endangered, V – vulnerable, NT – near threatened, LC – least concern*

5.8.3 Migratory species

A list of the migratory and marine species considered to have potential to occur within the study area based on desktop assessments is provided below in Table 5.5. Those species that were not in the original PMST but were in the updated PMST conducted 8 April 2022 are appended with an asterisk.

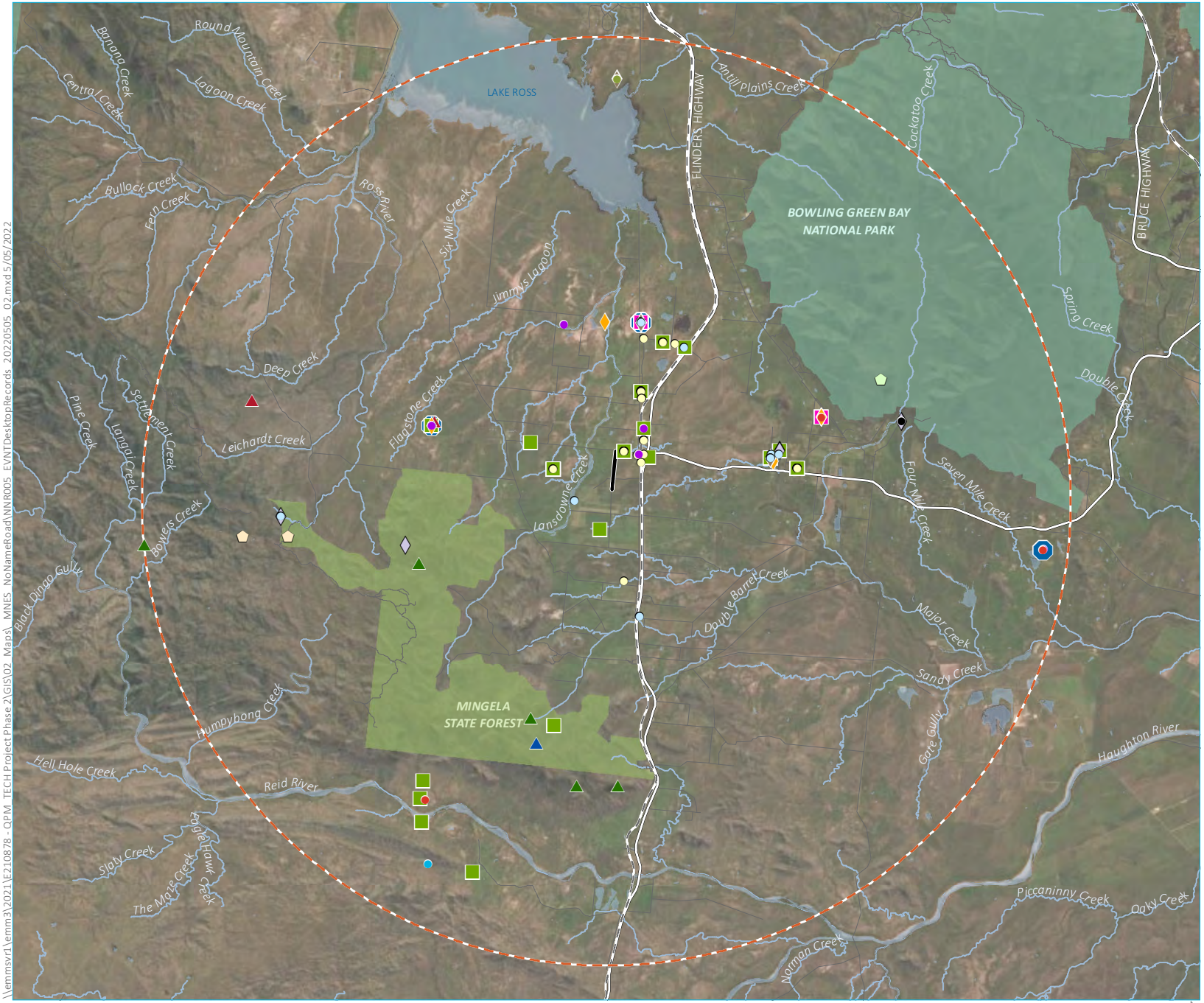
Table 5.5 Migratory species with potential to occur

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	PMST search	Wildlife Online
Migratory marine birds					
Apus pacificus	Fork-tailed Swift	Mi	SLC	✓	✓
Migratory terrestrial					
Cuculus optatus	Oriental Cuckoo	M	SLC	✓	✓
Hirundapus caudacutus	White-throated Needletail	V, M	V	✓	✓
Monarcha melanopsis	Black-faced Monarch	M	SLC	✓	✓
Monarcha trivirgatus	Spectacled Monarch	M	SLC	✓	✓
Motacilla flava	Yellow Wagtail	M	SLC	✓	×
Myiagra cyanoleuca	Satin Flycatcher	M	SLC	✓	✓
Rhipidura rufifrons	Rufous Fantail	M	SLC	✓	✓
Migratory wetlands species					
Actitis hypoleucos	Common Sandpiper	M	SLC	✓	×
Calidris acuminata	Sharp-tailed Sandpiper	M	SLC	✓	✓
Calidris ferruginea	Curlew Sandpiper	CE, M	CR	✓	✓
Calidris melanotos	Pectoral Sandpiper	M	SLC	✓	×
Calidris ruficollis	Red-necked Stint	M	SLC	×	✓
Charadrius leschenaultii	Greater Sand Plover*	V, M	V	✓	×
Charadrius veredus	Oriental Plover	M	SLC	×	✓
Chlidonias leucoptera	White-winged Black Tern	M	SLC	×	✓
Gallinago hardwickii	Latham's Snipe	M	SLC	✓	✓
Gelochilidon nilotica	Gull-billed Tern	M	SLC	×	✓
Hydroprogne caspia	Caspian Tern	M	SLC	×	✓
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	V, M	V	✓	✓
Limosa limosa	Black-tailed Godwit	M	SLC	×	✓
Numenius minutus	Little Curlew	M	SLC	×	✓
Numenius madagascariensis	Eastern Curlew	CE, M	E	✓	×
Pandion haliaetus	Osprey	M	SLC	✓	✓
Plegadis falcinellus	Glossy Ibis	M	SLC	×	✓
Pluvialis fulva	Pacific Golden Plover	M	SLC	×	✓

Table 5.5 Migratory species with potential to occur

Scientific name	Common name	EPBC Act status[1]	NC Act status[2]	PMST search	Wildlife Online
Tringa nebularia	Common Greenshank	M	SLC	✓	✓
Tringa stagnatilis	Marsh Sandpiper	M	SLC	×	✓
Migratory aquatic species					
Crocodylus porosus	Estuarine Crocodile	M	V	✓	×

1. *EPBC Act status: CE- critically endangered, E – endangered, V – vulnerable, Mi - Migratory*
2. *NC Act status: CR – critically endangered, E – endangered, V – vulnerable, NT – near threatened, SLC – special least concern*



KEY

- Study area (20 km buffer)
- Survey area
- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody
- National park/nature refuge
- State forest

Threatened species records

Plants

- *Eucalyptus paedoglauca*
- *Graptophyllum excelsum*
- *Oldenlandia polyclada*

Birds

- Australian Painted Snipe
- Black-faced Monarch
- Black-throated Finch
- Caspian Tern
- Fork-tailed Swift
- Glossy Ibis
- Latham's Snipe
- Oriental Cuckoo
- Rufous Fantail
- Satin Flycatcher
- Sharp-tailed Sandpiper
- Spectacled Monarch
- Squatter Pigeon
- White-throated Needletail
- White-winged Black Tern

Mammals

- Northern Greater Glider
- Northern Quoll

Source: EMM (2022); DNRME (2021); ALA (2021); DES (2021)

0 5 10 km

GDA 1994 MGA Zone 55

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Threatened and migratory desktop species records

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 5.2

EMM creating opportunities

5.9 Pest flora and fauna

Results of the desktop assessment (PMST and Wildlife Online) identified 12 pest flora species and 21 pest fauna species associated with the road reserve. These are summarised in Table 5.6.

Table 5.6 Pest flora and fauna

Common name	Scientific name	Biosecurity Act Status	PMST Search	Wildlife Online
Plants				
Prickly Acacia*	*Acacia nilotica* subs. *indica*	Category 3 restricted matter	✓	×
Pond Apple	*Annona glabra*	Category 3 restricted matter	✓	×
Cabomba	*Cabomba caroliniana*	Category 3 restricted matter	✓	×
Rubber Vine*	*Cryptostegia grandiflora*	Category 3 restricted matter	✓	✓
Water Hyacinth	*Eichhornia crassipes*	Category 3 restricted matter	✓	×
Hymenachne*	*Hymenachne amplexicaulis*	Category 3 restricted matter	✓	✓
Bellyache Bush*	*Jatropha gossypifolia*	Category 3 restricted matter	✓	×
Lantana*	*Lantana camara*	Category 3 restricted matter	✓	×
Parkinsonia*	*Parkinsonia aculeata*	Category 3 restricted matter	✓	×
Parthenium*	*Parthenium hysterophorus*	Category 3 restricted matter	✓	×
Mesquite	*Prosopis spp.*	Category 3 restricted matter	✓	×
Salvinia*	*Salvinia molesta*	Category 3 restricted matter	✓	×
Birds				
Common Myna	*Acridotheres tristis*	-	✓	✓
Mallard	*Anas platyryhnchos*	-	✓	×
Rock Pigeon	*Columbia livia*	-	✓	✓
Nutmeg Mannikin	*Lonchura punctulate*	-	✓	✓
House Sparrow	*Passer domesticus*	-	✓	✓
Spotted Dove	*Streptopelia chinensis*	-	✓	✓
Common Starling	*Sturnus vulgaris*	-	✓	×
Mammals				
Domestic Dog	*Canis lupis familiaris*	Category 3, 4, 6 restricted matter	✓	×
Goat	*Capra hircus*	Category 3, 4, 6 restricted matter	✓	×
Cat	*Felis catus*	Category 3, 4, 6 restricted matter	✓	×
Feral Deer	Cervidae	Category 3, 4, 6 restricted matter^	✓	×
House Mouse	*Mus musculus*	-	✓	✓
Rabbit	*Oryctolagus cuniculus*	Category 3, 4, 5, 6 restricted matter	✓	×
Pig	*Sus scrofa*	Category 3, 4, 6 restricted matter	✓	✓
Red Fox	*Vulpes vulpes*	Category 3, 4, 5, 6 restricted matter	✓	×
Brown Rat	*Rattus norvegicus*	-	✓	×

Table 5.6 Pest flora and fauna

Common name	Scientific name	Biosecurity Act Status	PMST Search	Wildlife Online
Black Rat	*Rattus rattus*	-	✓	×
Frogs				
Cane Toad	*Rhinella marina*	-	✓	✓
Reptiles				
Asian House Gecko	*Hemidactylus frenatus*	-	✓	✓
Mourning Gecko	*Lepidodactylus iugubris*	-	✓	×
Flowerpot Blind Snake	*Ramphotyphlops braminus*	-	✓	×

1. ** Weed of National Significance (WoNS)*
2. *^ hog deer (Axis porcinus) and sambar deer (Rusa unicolor syn Cervus unicolor) are Category 2, 3, 4, 5, 6 restricted matters*

5.10 Watercourses and wetlands

No mapped watercourses or wetlands occur in the road reserve based on a review of Wetland*Maps* (DES 2019).

5.11 Groundwater dependent ecosystems

According to reviews of the Bureau of Meteorology Groundwater Dependent Ecosystems Atlas (BOM 2020) and Wetland*Maps* (DES 2019), no groundwater dependent ecosystems (GDEs) (aquatic or terrestrial) are mapped within the road reserve. However, the nearby Lansdowne Creek and associated riparian corridor is mapped as a GDE. GDEs are considered under the EPBC Act for large coal and coal seam gas projects.

The Project will not have an impact on groundwater and is not expected to impact on GDEs. No groundwater is proposed to be extracted and appropriate spills response will be in place to ensure any seepage does not occur.

5.12 Connectivity and biodiversity significance

Most of the road corridor extent is within a mapped State significant biodiversity corridor which links Cape Bowling Green NP in the east and Mingela State Forest to the west, eventually meeting the mountain ranges to the north-west which mark the southern end of the Wet Tropics of Queensland World Heritage Area.

Additionally, a regionally significant corridor is mapped nearby to the road reserve. This consists of the riparian vegetation associated with Lansdowne Creek.

6 Field survey results

6.1 Flora

6.1.1 Vegetation communities

A total of seven quaternary assessments were completed in the field across the Survey area (Figure 4.1). Of these assessments, four were undertaken in remnant vegetation and the remaining three in non-remnant areas. The sites within remnant vegetation were represented by areas of least concern remnant communities including RE 11.3.30 (Photograph 6.1) and RE 11.3.35 (Photograph 6.2). The remaining areas were primarily represented by degraded, non-remnant areas varying from low open sparse woodland dominated by a weedy shrub layer, in particular Hyptis (*Mesosphaerum suaveolens*) and Chinee Apple (*Ziziphus mauritiana*) (Photograph 6.3) to areas of exotic grassland (Photograph 6.4).

The vegetation within the narrow Survey area consisted of patches of remnant vegetation interspaced by areas of cleared, primarily exotic grassland. The areas of remnant vegetation adjacent to the Survey area remain largely connected, forming a contiguous area of vegetation over 100 ha. However, conditional status and degradation of this woodland appeared to vary according to property. The southern extent of the Survey area and east of the boundary showed higher levels of degradation including increased weed encroachment. Chinee Apple (*Ziziphus mauritiana*) and Rubber Vine (*Cryptostegia grandiflora*) in these areas was much more prevalent and predominated low-level strata.

The certified vegetation mapping of the Survey area was inaccurate, with refinements to the boundaries of non-remnant and remnant vegetation made in the Survey area, although the communities present were as mapped in the regulated mapping.

Photograph 6.1 Remnant *Eucalyptus platyphylla* dominated community RE 11.3.35 (EMM 2021).

Photograph 6.2 **Remnant *Eucalyptus crebra* dominated community RE 11.3.30 (EMM 2021).**

Photograph 6.3 **Non-remnant vegetation at southern end of Survey area dominated by Hyptis (EMM 2021).**

Photograph 6.4 Non-remnant grassland at northern end of Survey area (EMM 2021).

Short descriptions of these two ground-truthed REs along with VM Act class, conditional status and ground-truthed areas within the Survey area are summarised below in Table 6.1. A map of the ground-truthed REs is provided in Figure 6.1.

Table 6.1 Ground-truthed vegetation communities

RE code	Description	VM Act class	Condition	Area (ha)
11.3.30	*Eucalyptus crebra, Corymbia dallachiana* woodland on alluvial plains	Least concern	Remnant	0.48
11.3.35	*Eucalyptus platyphylla, Corymbia clarksoniana* woodland on alluvial plains	Least concern	Remnant	0.71
Non-remnant				2.18

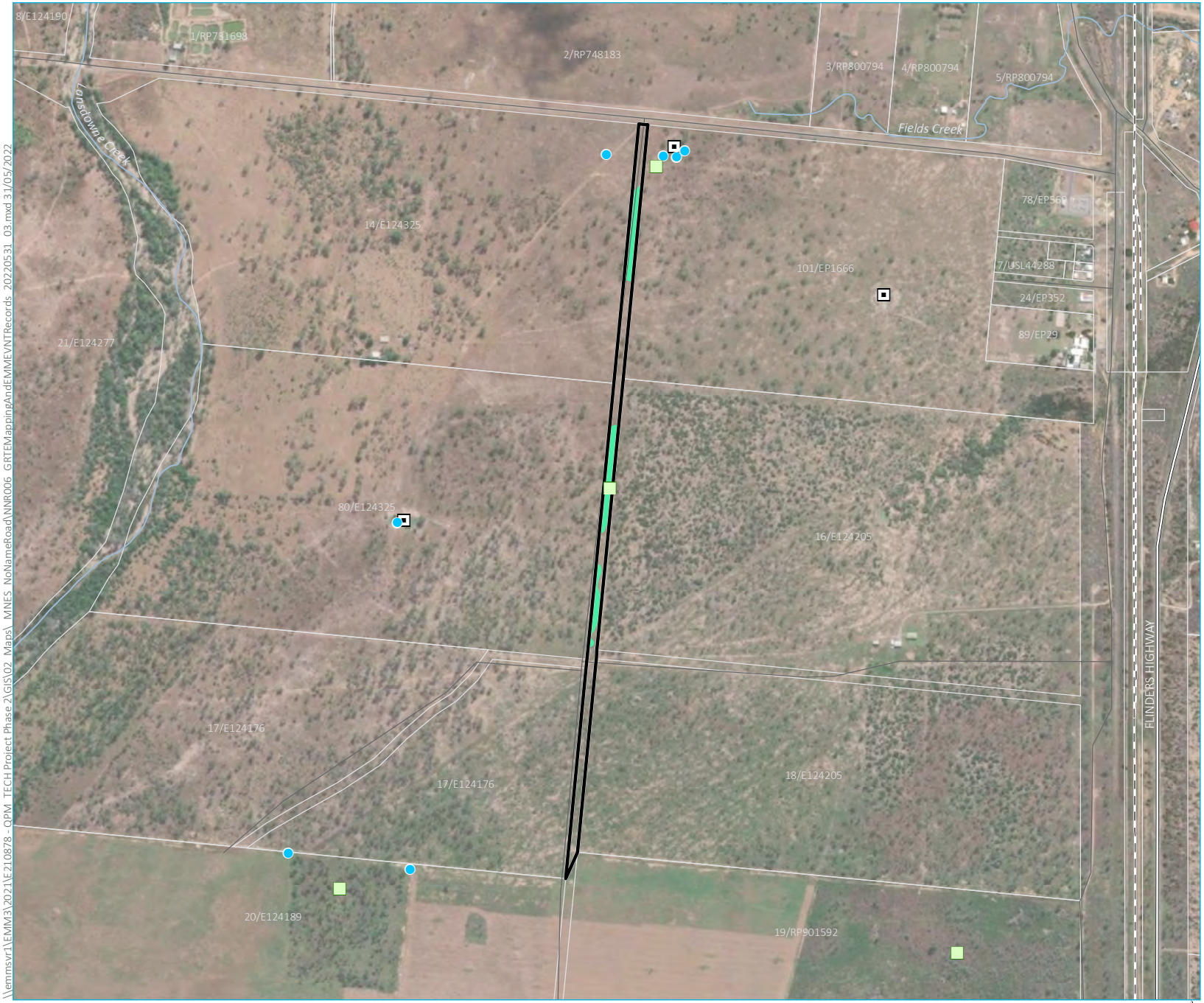
6.1.2 Threatened flora

Threatened flora species were informally searched for across the Survey area. No threatened species were recorded during these surveys.

6.1.3 Pest flora

The Survey area was noted as being very weed-dense during field assessments. Open (non-remnant) areas were dominated by herbaceous weeds, primarily Hyptis, Joyweed (*Alternathera sessilis*), Sicklepod (*Senna obtusifolia*), Chinee Apple, Rubber Vine and Siratro (*Macroptilium atropurpureum)* and some grasses including Signal Grass

(*Urochloa decumbens*) and *Chloris* spp. Chinee Apple, Rubber Vine and Sicklepod are listed as 'Category 3 restricted matters' under the *Biosecurity Act 2014.* Chinee Apple and Rubber Vine are also Weeds of National Significance (WoNS) at Commonwealth level.



KEY

- Survey area
- Rail line
- Major road
- Minor road
- Named watercourse
- Cadastral boundary

CEEVNT species recorded

- Bare-rumped Sheathtail Bat
- Southern Black-throated Finch (unconfirmed)
- Squatter Pigeon

Ground-truthed regional ecosystems (VM status)

- Remnant - least concern

Source: EMM (2022); DNRME (2021)

0 250 500 m

GDA 1994 MGA Zone 55

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\\emmsvr1\EMM3\2021\E210878 - QPM TECH Project Phase 2\GIS\02 Maps\ MNES NoNameRoad\NNR006 GRTEMappingAndEMMEVNTRecords 20220531 03.mxd 31/05/2022

GTRE mapping and
EMM CEEVNT records

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 6.1

EMM
creating opportunities

6.2 Fauna

6.2.1 General habitat assessments

A total of nine general habitat assessments were undertaken across the Survey area (Figure 4.1). Most habitat observed across the Survey area is considered to be of relatively low quality due to historical vegetation clearing, weed encroachment and grazing activity.

Four hollow bearing trees were located within the road reserve, one containing a large hollow, one with medium hollows and two with small hollows. The hollows would not be large enough to support Greater Glider and the area lacks canopy connectivity to support this species. Fallen woody debris and ground litter providing habitat for reptiles and small mammals was sparse. No gilgai or soil cracks were present, which provide refuge for a range of small ground-dwelling fauna (eg small mammals, reptiles and frogs).

A number of artificial water bodies in the form of farm dams are located within or immediately adjacent to the Survey area (for example one farm dam within the survey area at its northern end (Photograph 6.5), and another 400 m west of the road reserve from the centre of the Survey area).

Photograph 6.5 Farm dam within the survey area at northern boundary with Jones Road (EMM 2021).

6.2.2 Threatened, migratory or special least concern fauna

Two threatened fauna species were recorded over the survey period - Squatter Pigeon (Photograph 6.6) and Bare-rumped Sheathtail Bat on anabat devices.

Five Squatter Pigeon were recorded around the farm dam 50 m east of the road reserve at the northern end of the Survey area during July 2021. Two individuals were recorded at the same location in March 2022. Additionally, seven individuals were recorded at the dam 400 m west of the road reserve concurrently with the July 2021 survey

of the northern dam. It is likely that Squatter Pigeon are widespread in the open grassy woodland of the Survey area, albeit around water sources.

Bare-rumped Sheathtail Bat was recorded in two Anabat locations sampled within the Survey area with 1-2 calls per detector night.

Incidental sightings of all other vertebrate fauna species during surveys were recorded totalling 92 species. This included one reptile species, 71 bird species, 18 confirmed bat species (recorded on Anabat devices) and two non-volant mammals.

Photograph 6.6 Squatter Pigeon at farm dam 50 m east of road reserve at northern boundary with Jones Road (EMM 2021).

Potential habitat for threatened, migratory or special least concern fauna species is summarised below. The following species are considered potential to occur in the Survey area. Although potential habitat is present, it should be noted that the likelihood for some species to occur is low (eg Koala).

i Threatened species

- **Squatter Pigeon** – this species was observed at farm dams either side of the Survey area and therefore is likely to occur in woodland habitat throughout the Survey area. Habitat for the species is generally open-forests to sparse open-woodlands and scrub, dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, within 3 km of surface water. Utilised habitat in the areas around dams have low ground layer cover, typically below 33%. The species is therefore considered potential to occur across the whole Survey area.

- **Black-throated Finch** – the Black-throated Finch mainly favours grassy, open woodlands and forests, typically dominated by *Eucalyptus, Corymbia* and *Melaleuca* species, often near watercourses, or in the vicinity of water. The Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) has mapped “important areas” for the subspecies based on a 5km buffer

from reliable records post-1995. These areas are likely to contain the critical habitat features of water sources, grasslands and nesting trees. The Survey area is located entirely within this area. There are numerous records of the subspecies in the study area (see EMM 2021). In particular, the area around Jones Road and Gunnado Road are core areas of recent sightings. The landholder to the west of the Survey area anecdotally identified Black-throated Finches using his property. This property corresponds with database records from the area around Jones Road. The landholder indicated that Birdlife North Queensland/Birdlife Townsville conduct annual surveys on the property for black-throated finch, that the species breeds on his property and when it is dry, drink from dams 50 m to the east and 400 m to the west of the Survey area. As such, despite the Survey area being subject to varying levels of weed incursion (including Chinee Apple which is a recognised threat to the species), it is considered likely habitat for the species.

- **Bare-rumped Sheathtail Bat** – this species was recorded in two Anabat locations sampled within the Survey area with 1-2 calls per detector night. The species is likely to forage across the entire Survey area and roost in deep tree hollows. All confirmed Australian roosting records (albeit there are few) are from deep tree hollows in Poplar Gum, Darwin Woollybutt or Darwin Stringybark (Churchill 1998). Hollow bearing trees in the road reserve have the potential to shelter roosting individuals although only four trees with hollows were identified so the potential for roosting is low. The whole survey area forms foraging habitat.

- **Koala –** although assessed as having a low potential to occur in the road reserve this species has been conservatively assessed. DAWE has identified koala as being on a high priority list due to the extensive bushfires which occurred in 2019-20 in southern and eastern Australia and although they are not considered likely to occur in the Survey area, are scarce in the Townsville region, and have not been recorded to date, assessments have been carried out based on their potential presence.

  No individuals were recorded and no scratches or scats associated with the species were recorded. If present in the region, the species is likely to be restricted to the drainage line of Lansdowne Creek. The Survey area is largely cleared and dominated by dense weedy groundcover.

  However, conservatively and following DAWE current expectations, any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees is considered potential Koala habitat. This includes mixed Eucalypt regrowth or modified vegetation communities, or shrubland containing emergent Koala food trees. Koala food trees typically consist of the following genera in order of general preference:

  - *Eucalyptus*
  - *Corymbia*
  - *Angophora*
  - *Lophostemon*
  - *Melaleuca*

  The Survey area is dominated by weedy regrowth, although a number of small patches of vegetation were ground-truthed where emergent food trees did occur (typically Poplar Gum (*Eucalyptus platyphylla*) and Narrow-leaved Ironbark (*Eucalyptus crebra*).

  Although food trees are present and therefore potential habitat occurs, the Survey area does not contain contiguous eucalypt woodland, or retain connectivity to such areas. As such, the habitat mapped has been assessed as marginal for the species as it is highly fragmented and limited in extent, and the likelihood of the species occurring on a regular basis is low.

White-throated Needletail – no habitat mapping has been undertaken for White-throated Needletail as this species could occur in any airspace over the Survey area. It is a migratory species that occurs in Australia only during the summer months but is highly aerial and only rarely alights while in Australia (roosting in the canopy of mature trees). Potential roosting habitat is generally absent in the Survey area.

ii Migratory species

- **Fork-tailed Swift** – this species was observed by EMM on the adjacent QPM site in March 2021. This species is almost exclusively aerial and occurs mainly over inland plains. Habitats include riparian woodland, heathland and low scrub areas. They also occur in coastal areas over cliffs and beaches. The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, moving further south as the summer progresses. No habitat mapping has been undertaken for Fork-tailed Swift as this species could occur in any airspace over the Survey area.

- **Oriental Cuckoo** – this species was observed by EMM on the adjacent QPM site in March 2021 in riparian vegetation associated with Lansdowne Creek. The Oriental Cuckoo occurs in a wide range of woodlands, particularly in the ecotones of denser riparian communities. The species does not breed in Australia. As such, any remnant or regrowth woodlands are mapped as potential foraging/dispersal habitat for the species.

Three migratory species (Black-faced Monarch, Spectacled Monarch and Rufous Fantail) were recorded at Lansdowne Creek in July 2021. These species prefer dense rainforest and/or riparian vegetation, and are considered unlikely to occur within the open, disturbed habitat of the road reserve. Remaining candidate species are considered unlikely to occur within the road reserve (eg migratory wader species such as sandpipers, Common Greenshank, Far Eastern Curlew, Greater Sand Plover) based on lack of suitable habitat such as intertidal wetlands and coastal mudflats.

6.2.3 Pest fauna

No introduced terrestrial vertebrate species were recorded within the Survey area, although Cane Toad (*Rhinella marina*), Rabbit (*Oryctolagus cuniculus*), Wild Dog (*Canis lupus familiaris*) and Feral Cat (*Felis catus*) are all likely to occur along with a number of introduced bird species. Three of these species (Feral Cat, Rabbit and Wild Dog) are listed as 'restricted matters' under the *Biosecurity Act 2014* (refer Table 5.6).

6.3 Candidate species and communities

A refined likelihood of occurrence was prepared for the potential MNES associated with the Project based on EMM's desktop assessment and findings (see full likelihood of occurrence table in Appendix C). This assessment was informed by the results of the background research, database searches and field work conducted by EMM.

Definitions used for the refined likelihood of occurrence are described below:

1. **Known** – records of the species exist in the road reserve or within 1 km of the road reserve and suitable habitat is present in the road reserve.

2. **Likely** – species records exist within the study area and suitable habitat is present within the road reserve.

3. **Potential** – species records exist within the study area, suitable habitat for the species exists within study area, but there is insufficient information to categorise the species as likely, or unlikely to occur, in the road reserve.

4. **Unlikely** – no records in study area and a low to very low probability that a species will occur in the road reserve due to the lack of suitable habitat or is outside the species known geographical range.

The refined likelihood of occurrence assessments are provided in Appendix C and those species identified as 'known', 'likely' or have 'potential' to occur in the road reserve are summarised in following sections.

6.3.1 List of candidate fauna species

A refined likelihood of occurrence assessment was completed for the 26 threatened fauna species identified from the results of the desktop analysis and field surveys. As a result, this refined assessment determined that two threatened species are known to occur, two are likely to occur, and one species were assessed as having potential to occur. Candidate fauna species are listed in Table 6.2.

Table 6.2 Candidate threatened fauna species

Species name	Common name	EPBC Act[1]	NC Act[2]	Likelihood of occurrence	Rationale
Birds					
Geophaps scripta scripta	Squatter Pigeon (southern)	V	V	Known	Multiple records of this species exist within the study area. Field surveys identified this species as being present in the road reserve and as such the species is considered known to occur.
Hirundapus caudacutus	White-throated Needletail	V Mi	V	Likely	Multiple records of this species occur within the study area Although the species was not recorded during field surveys, it is considered likely to occur.

Table 6.2 Candidate threatened fauna species

Species name	Common name	EPBC Act[1]	NC Act[2]	Likelihood of occurrence	Rationale
Poephila cincta cincta	Southern Black-throated Finch	E	E	Likely	Multiple records of this species occur within the study area. The stronghold for this species is the Townsville/Charters Towers region, where it is locally common in places. Records around Townsville are centred on the Lake Ross, Woodstock area just north of the road reserve. Potential habitat including grasslands and open woodlands near water are present in the road reserve although the quality of habitat for this species is reduced by the weedy nature of the road reserve. Although the species was not recorded during field surveys, it is considered likely to occur based on the proximity of nearby records and the nearby farm dams as a drinking resource.
Mammals					
Phascolarctos cinereus	Koala	E	V	Potential	No records of Koala exist within the study area. However, eucalypt woodlands in the road reserve and surrounding area is considered suitable habitat for the species. Koala is considered to have a low potential to occur in the road reserve, and more likely to occur along major creek lines. No evidence of Koala presence was found during field surveys.
Saccolaimus saccolaimus undecylenates	Bare-rumped Sheathtail Bat	V	E	Known	There are a number of records from the Townsville region (eg surveys for the Townsville ring road, Majors Creek solar farm). Despite there being few records of the species it is potentially under-recorded in the region. It occurs in lowland forest including gallery forest. Numerous calls recorded on Anabat devices in July 2021 were positively assigned to this species.

3. EPBC Act status: E – endangered, V – vulnerable, Mi - migratory
1. NC Act status: E – endangered, V – vulnerable

6.3.2 List of candidate flora species

A refined likelihood of occurrence assessment was completed for the eight threatened flora species based on results of the desktop analysis and field surveys. This assessment determined that none of the threatened flora species are likely to occur within the road reserve.

Further rationale behind remaining species identified in the desktop analysis being classified as unlikely to occur is provided in Appendix C.

6.3.3 List of candidate migratory species

A refined likelihood of occurrence assessment was completed for the 29 listed migratory species based on results of the desktop analysis and results from field surveys (Table 6.3). The assessment determined that two migratory species are likely to occur. Candidate migratory species are listed below in Table 6.3.

Further justification for the remaining species identified in the desktop analysis being classified as unlikely to occur is provided in Appendix C.

Table 6.3 Candidate migratory species

Species name	Common name	EPBC Act[1]	NC Act[2]	Likelihood of occurrence	Rationale
Migratory terrestrial birds					
Cuculus optatus	Oriental Cuckoo	Mi	SLC (Mi)	Likely	Multiple records of this species exist within the study area and suitable habitat occurs within the road reserve. This species was identified in the riparian vegetation near to the road reserve; therefore, the species is considered as likely to occur.
Migratory marine birds					
Apus pacificus	Fork-tailed Swift	Mi	SLC (Mi)	Likely	Multiple records of this species are represented within the study area and habitat is present within the road reserve. During surveys this species was identified adjacent to the road reserve in a riparian corridor; therefore, it is considered as likely to occur.

1. EPBC Act status: M – migratory, Ma – marine
2. NC Act status: SLC – special least concern, Mi – migratory

6.4 Threatened and migratory species habitat mapping

Habitat constraints mapping has been prepared for those MNES that have been identified (post consideration of desktop assessments and field ecology surveys results) as being 'known' or 'likely' to occur in the survey area (as summarised in Section 6.3). This also includes mapping of habitats for Koala, which was assigned a likelihood of 'potential'. DAWE has identified this species as being on a high priority list due to the extensive bushfires which occurred in 2019-20 summer in southern and eastern Australia. The latest high priority list was released by DAWE on 20 March 2020 and identified species requiring urgent management intervention. The fires covered an unusually large area, and in many places, they have burnt with unusually high intensity. The priority animals were identified based on the extent to which their range has potentially been burnt, how imperilled they were before the fires (for example, whether they were already listed as vulnerable, endangered or critically endangered), and the physical, behavioral and ecological traits which influence their vulnerability to fire (DAWE 2020a). Although Koala is considered a low potential likelihood to occur, a conservative assessment of the potential for significant residual impact is provided.

Habitat mapping is based on EMM's site assessments, spatial datasets, and best available information about a species' habitat requirements. Vegetation community mapping combined with required habitat features and other environmental attributes (such as distance to permanent water or land zones) has been applied to model potential habitats. Relevant habitat suitability information was also used where available such as SPRAT profiles, Recovery Plans and Conservation Advice Statements.

The habitat modelling is conservative. Whilst certain habitat types and likely distributions across the survey area can be extrapolated from survey findings (eg potential occurrence of Squatter Pigeon close to water sources and/or areas dominated by more alluvial sandy soils) other potential species distributions that were not detected are more difficult to accurately predict based purely on the field survey results. Specific habitat attributes according to species preferences as well as habitat mapping methods and field survey results are summarised in subsequent sections.

6.4.1 Squatter Pigeon

Squatter Pigeon can utilise a broad range of habitats including remnant, regrowth, non-remnant, and modified vegetation communities with nearby access to permanent surface water (typically within 1–3 km). Generally, they are recorded in open *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* dominated communities, and occur in their highest densities in those habitats with abundant and diverse native grasses (primary foraging resource).

The species also shows soil and landscape associations with foraging and breeding primarily recorded from flat alluvial plains, gently sloping and undulating plains, as well as low hilly terrain with well-drained, sandy, or loamy soils. Breeding in these areas only generally occurs within 1 km of a permanent water source (artificial or natural) (Squatter Pigeon Workshop 2011).

Soil landscapes are good indicators of where natural, foraging and breeding habitats for the Squatter Pigeon (southern) occur (Squatter Pigeon Workshop 2011). Well-draining, gravelly, sandy or loamy soils support the open-forest to woodland communities with patchy, tussock-grassy understories that support the subspecies' foraging and breeding requirements. Given that the subspecies nests in shallow depressions on the ground, it requires well-draining soils. The species foraging and breeding habitats are known to be associated with land zones 3, 5 and 7 of which only land zone 3 occurs in the survey area.

As such, the following criteria provided by DAWE is used to map Squatter Pigeon habitat in the survey area (DAWE criteria provided in italics with further commentary in non-italic text):

- **Breeding habitat** - *any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by Eucalyptus, Corymbia, Acacia or Callitris species, on sandy or gravelly soils (including but not limited to areas mapped as Queensland land zones 3, 5, 7) and within 1 km of a suitable, permanent or seasonal waterbody*.

  Waterbodies have been mapped to include stream order 1 and above as well as dams identified on site and through aerial imagery – waterbodies primarily comprise Lansdowne Creek and Gilligan Creek as well as a dam in the north of the survey area and a dam on the adjacent property to the west (but within 1 km). The majority of the survey area therefore forms breeding habitat.

- **Foraging habitat** - *any remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by Eucalyptus, Corymbia, Acacia or Callitris species, on sandy or gravelly soils (including but not limited to areas mapped as Queensland land zones 3, 5, 7) and within 3 km of a suitable, permanent or seasonal waterbody*.

  Waterbodies have been mapped to include stream order 1 and above as well as dams identified on site and through aerial imagery – waterbodies primarily comprise Lansdowne Creek and Gilligan Creek as well as a dam in the north of the survey area and a dam on the adjacent property to the west (but within 3 km). The majority of mapped Squatter Pigeon habitat in the survey area has been classified as potential breeding habitat following DAWE's guidelines, being within 1km of permanent or temporary water source. Therefore, potential foraging habitat is limited on the survey area (as most areas of potential habitat are within 1 km of water). Areas considered unsuitable for the species (dense weedy groundcover) have been excluded from mapping entirely.

- **Dispersal habitat** – *any forest or woodland occurring between patches of foraging or breeding habitat that facilitates movement between patches of foraging habitat, breeding habitat and/or waterbodies, and areas of cleared land less than 100 metres wide linking areas of suitable breeding and/or foraging habitat.*

  As well as mapped remnant and regrowth vegetation communities (using ground-truthed mapping in the survey area) some non-remnant areas have been mapped as dispersal habitat for this species, as scrub is present, and the species could move through these areas between patches of breeding or foraging habitat.

Other habitat factors described above restrict the suitability for the species. Squatter Pigeon are unlikely to move far from woodland trees which provide shelter (Squatter Pigeon Workshop 2011). Where scattered trees occur, and the distance of cleared land between patches of habitat does not exceed 100 m, individuals may be found foraging or dispersing across modified environments (Squatter Pigeon Workshop 2011).

As the entire survey area is within 1 km of a water source (farm dams or Lansdowne Creek), the whole area constitutes potential breeding habitat.

Potential habitat is mapped in Figure 6.2a.

6.4.2 Bare-rumped Sheathtail Bat

This species occurs mainly in lowland areas, in a range of woodland environments. it is poorly known, and its echolocation call is difficult to distinguish from other sheathtail species.

The species is likely to roost in deep tree hollows. All confirmed Australian roosting records (albeit there are few) are from deep tree hollows in Poplar Gum, Darwin Woollybutt or Darwin Stringybark (Churchill 1998).

In the Townsville region, there have been recent records (through Anabat recordings) on other development projects such as the Townsville Ring Road and Majors Creek Solar Farm near Woodstock (GHD, 2005; AECOM, 2012; RPS, 2013; DTMR, 2018; EcoSM, 2017; AECOM, 2019). Records in the region have been in Poplar Gum woodlands and open forest habitats, which are present on the survey area.

As calls attributed to this species were recorded at two locations within or adjacent to the survey area (and the species is a high-flying species), the entire survey area is mapped as foraging habitat.

Due to the presence of hollow bearing trees on the survey area, areas with suitable hollow bearing trees present are also mapped as potential roosting habitat. The majority of hollows were less than 200 mm in diameter which is consistent with the general lack of mature vegetation on the survey area. Only one hollow was identified greater than 200 mm in diameter within the survey area and this is mapped as potential roosting habitat.

Little is known about the roosting habits of the species (see Section 9.4.2) although for the purposes of this assessment, any large old Eucalypt or similar tree with hollows over 150 mm+ in diameter) over 8 m above the ground is considered a potential roost tree. Based on other species of tree roosting bats it is likely the species uses a number of roosts within its range and moves regularly between them.

Based on the above criteria, one tree with a large hollow that was potentially suitable for the Bare-rumped Sheathtail Bat was identified in the survey area. This will be subject to preclearance survey prior to clearing (see Section 8). This potentially suitable roosting tree was mapped as potential roosting habitat.

Based on known preferences of other tree roosting bats (which typically have multiple roosts), it is likely that if the species roosts in this area, it will also use other day roosts in nearby areas of vegetation along Lansdowne Creek or the adjacent properties.

The species has been suggested to forage over forest edges, but this is poorly known (DAWE 2021d), and has been recorded in melaleuca dominated swamps (Woinarski et al, 2014). It is a high-flying species and will forage over the forest canopy and along features such as watercourses. Foraging habitat for the species has been split into vegetated areas and cleared areas, with cleared areas of the survey area likely to be of low value to the species.

Potential Bare-rumped Sheathtail Bat habitat is mapped in Figure 6.3b.

6.4.3 Southern Black-throated Finch

The Black-throated Finch mainly favours grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca species, often near watercourses, or in the vicinity of water (DAWE 2021c).

The National Recovery Plan for the Black-throated Finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007) states that the subspecies is likely to need a mosaic of different habitats in which to find seed, and that access to seeding grasses and water is necessary.

The Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) identifies that the subspecies requires access to three key resources for survival and breeding, namely:

- Water sources – permanent water sources are the most critical limiting resource, providing habitat during the dry season but ephemeral sources also allow access to areas of foraging and nesting habitat during the wet season;

- Grass seeds – the subspecies feeds on a variety of grass species, predominantly on fallen grass seed. Grass seed availability early in the wet season (November to December) is a critical bottleneck. Perennial grasses appeared to be favoured; and

- Trees providing suitable nesting habitat – typically within 400 m of a water source, but up to 1 km as discussed below.

The relationship between the above three factors is a critical limitation in the distribution of the subspecies. While each individual factor is reasonably common, the availability of water sources and suitable foraging grasses is more limited and limits the distribution of the subspecies.

Black-throated Finch are rarely observed in modified environments, unless suitable seeding grasses exist (Commonwealth of Australia, 2009). Perennial grasses dominate the subspecies' diet including *Urochloa mosambicensis, Enteropogon acicularis, Panicum decompositum, Panicum effusum, Dichanthium sericeum, Alloteropsis semialata, Eragrostis sororia* and *Themeda triandra* (Mitchell 1996; NRA 2007). Invasion of exotic weeds may degrade habitat and reduce resource availability (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007). The subspecies requires an appropriate density and diversity of grasses, with seeds accessible on the surface. The subspecies predominantly feeds on fallen seed. Therefore, the subspecies ideally requires a diversity of annual and perennial grass species which provide sufficient spacing for bare areas to form.

The subspecies only appears to be capable of travelling over uninhabitable areas if the distance is less than 1 km (Commonwealth of Australia, 2009).

As such, areas of remnant and regrowth REs on the survey area are mapped as potential habitat for the subspecies, as well as non-remnant areas where suitable habitat factors are present (eg proximity to water and foraging grass species). All REs mapped on the survey area are included in the Recovery Plan as being REs in which the subspecies has been recorded (RE 11.3.30 and 11.3.35). This includes REs in a study by Rechetelo *et al* (2016) at Lake Ross where Narrow-leaved Red Ironbark woodland (RE 11.3.30) and Poplar Gum woodland (RE 11.3.35) were favoured over non-remnant modified habitats. Poplar Gum woodlands are also recognised as a preferred habitat for the subspecies (Black-throated Finch Recovery Team, 2007).

The Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) has mapped "important areas" for the subspecies based on a 5km buffer from reliable records post 1995. These areas are likely to contain the critical habitat configuration between water sources, grasslands and nesting trees.

It should be noted that the survey area is located within the southern extent of the mapped "Important Areas" for the subspecies in the Significant Impact Guidelines. There are numerous records of the subspecies in the study area (see Appendix A). In particular, the area around Jones Road (immediately to the north of the survey area) and Gunnado Road (approximately 3 km to the north-east) are core areas of recent sightings. Therefore, conservatively following this principle, the survey area is considered an "important area" based on the Jones Road records, despite no records within the survey area and the subspecies not being detected during field surveys.

The landholder to the west of the Survey area anecdotally identified Black-throated Finches using his property. This property corresponds with database records from the area around Jones Road. The landholder indicated that Birdlife North Queensland/Birdlife Townsville conduct annual surveys on the property for black-throated finch, that

the species breeds on his property and when it is dry, drink from dams 400 m to the west of the Survey area and 50 m east of the survey area bordering on to Jones Road. As such, despite the Survey area being subject to varying levels of weed incursion (including Chinee Apple which is a recognised threat to the species), it is considered likely habitat for the species.

The Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) recommends that habitat assessment is undertaken assessing key characteristics of the site. This is summarised for the survey area below:

- **Current land use and site history (for example grazing, cropping)** – the survey area is currently used for grazing.

- **Grassland quality and composition (that is rough proportions of exotic, native, perennial and annual species)** –

  The vegetation within the narrow Survey area consisted of patches of remnant vegetation interspaced by areas of cleared, primarily exotic grassland. The areas of remnant vegetation adjacent to the Survey area remain largely connected, forming a contiguous area of vegetation over 100 ha in size. However, conditional status and degradation of this vegetative area appeared to vary according to property. The southern extent of the Survey area and east of the boundary showed higher degradation including increased weed encroachment. Chinee Apple (*Ziziphus mauritiana*) and Rubber Vine (*Cryptostegia grandiflora*) in these areas was much more prevalent and dominated low-level strata in some areas. Groundcover was over 90% at all habitat assessment sites, with less than 10% native groundcover in the majority of instances. Herbs dominated grasses, although some grasses were present. Grass species present were dominated by Chloris sp, although some native Eragrostis sp, Panicum sp, *Alloteropsis semialata* and *Heteropogon contortus* were present.

- **Grass density (amount of bare ground)** – the majority of the survey area has a dense weedy ground cover dominated by Stylo with minor grasses in the ground layer. Most habitat assessments recorded ground cover of 90% or more and dominated by herbaceous weeds. As shown above few preferred foraging grass species for Black-throated Finch were observed and they formed a very small proportion of the ground layer. Therefore, the survey area seems to be depauperate for preferred foraging species and offers very low-quality habitat.

- **Number of water sources within five km, and the water retention dynamics (permanent vs. seasonal) and types of available water sources on site (natural vs. artificial) and the distance from nesting trees and foraging habitat (which may be offsite)** – there are two small dams 400 m to the west of the Survey area and 50 m east of the survey area bordering on to Jones Road. As the area is dominated by grazing, there are a number of other farm dams within a 5 km radius of the survey area.

- **Number, location and characteristics of known nesting trees (nest height, tree species, tree structure etc)** – there are no known nesting trees located in the survey area. There are no known records from the survey area and the subspecies was not recorded in surveys carried out for the Project. Nonetheless, the subspecies is known from just north of the survey area.

- **Number, location and characteristics of potential nesting trees (tree species, tree structure)** – the species is known to nest in a range of structures, and location is predominantly driven by proximity to a water source (typically within 400 m in the Townsville region, but up to 1 km (Commonwealth of Australia, 2009)). Within the survey area, suitable nesting habitat is restricted to woodlands within the vicinity of farm dams. However, no nests were recorded during ecological survey at the appropriate time of year (the subspecies nests between January and July in the Townsville region) and there are no records from the survey area.

- **Connectivity of the site to other areas of black-throated finch (southern) habitat** – it is likely that the survey area is not core habitat for the subspecies, as there are no records, and the subspecies has not been encountered in survey effort to date. Nonetheless, the survey area is on the southern limit of the mapped "Important Areas" for the subspecies in the Significant Impact Guidelines (Figure 2) and presence is possible, particularly in the vicinity of farm dams.

Based on the weedy nature of the survey area, the survey area although offering low potential habitat is not considered likely to support preferred breeding habitat (although it has been conservatively mapped within 1 km of farm dams in woodland areas). Black-throated Finch habitat on the survey area is therefore defined as:

Marginal breeding habitat – the Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) states that the subspecies nest in trees located within 1 km of seasonal water sources (NRA, 2007). Remnant woodland within 1 km of the farm dams adjacent to the survey area is mapped as potential breeding habitat due to the presence of suitable nesting trees and the proximity to retained areas of open grassy woodland outside the survey area – additionally areas of regrowth are also captured. However, the limiting factor of suitable foraging habitat near the potential breeding areas should be noted and the weedy nature of these areas. Therefore it is considered unlikely that these areas support preferred breeding habitat for the subspecies in the study area but consistent with the guidelines these areas are conservatively mapped as potential.

- **Foraging habitat** – all remaining areas of grassy woodland within 3 km of potential breeding habitat consistent with Mitchell (1996) where suitable habitat factors are present (eg foraging grass species, bare ground on which seed can be gleaned).

Potential Black-throated Finch habitat is mapped in Figure 6.2c.

6.4.4 Koala

Although assessed as having a low potential to occur in the survey area (Section 6.3) this species has been conservatively assessed in the significant residual impact assessments. DAWE has identified this species as being on a high priority list due to the extensive bushfires which occurred in 2019-20 in southern and eastern Australia and although they are not considered likely to occur on site, and have not been recorded to date, assessments have been carried out based on their potential presence.

No individuals were recorded and no scratches or scats associated with the species were recorded.

Conservatively, any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees (following the now superseded EPBC Act referral guidelines for the vulnerable Koala (DoE 2014)) is considered potential Koala habitat. This includes mixed Eucalypt regrowth or modified vegetation communities, or shrubland containing emergent Koala food trees. Koala food trees typically consist of the following genera in order of general preference:

- *Eucalyptus;*
- *Corymbia;*
- *Angophora;*
- *Lophostemon; and*
- *Melaleuca.*

The DAWE guideline provides a 'koala habitat assessment tool' to assist in the determining the sensitivity, value and quality of lands potentially impacted under development proposals. Formal assessments of Koala habitat in the survey area following the EPBC Act referral guidelines (DoE 2014) are provided in Section 9.6.

Koala habitat varies in quality throughout the study area, with higher quality areas of habitat in the riparian corridors, although even in these areas, preferred food trees are not dominant. This involves woodland REs associated with Gilligan Creek and Lansdowne Creek. This includes areas of contiguous eucalypt dominated open forest or woodland where primary or secondary food trees are dominant in the canopy. Primary or secondary Koala food trees within or adjacent to the survey area include *E. platyphylla*. This is a deciduous species in the dry season therefore its availability as a resource for Koala is limited seasonally. It is likely that any local Koala population will be centred on watercourses where eucalypt species are present such as *C. tessellaris* and *E. platyphylla*.

Lansdowne Creek is dominated by a Melaleuca dominated community (RE 11.3.25b) bordering the survey area, with emergent *Corymbia tessellaris* and *E. platyphylla*, although this habitat is outside the survey area and Project footprint.

Within the survey area, there are areas of *C. tessellaris* and *E. platyphylla* dominated woodland (RE 11.3.35). Areas of woodland containing *E. crebra* (RE 11.3.30) which is also a food tree for the species, are also mapped as habitat although the other dominant tree in this community (*Corymbia dallachiana*) is generally not favoured.

Potential Koala habitat is mapped in Figure 6.2d.

6.4.5 White-throated Needletail

No habitat map has been prepared for this species as it is an aerial insectivore that spends most of its time aloft, and could occur anywhere over the survey area, therefore the whole survey area is considered potential foraging habitat.

The species does not breed in Australia, and as a wide-ranging nomadic species, foraging habitat also provides a surrogate for dispersal habitat.

There is limited potential for roosting habitat in the survey area. It is thought that the number of references to Needletails roosting in trees possibly over-emphasizes such occurrences (DAWE 2021b). Potential roosting habitat is likely to be limited as trees within the survey area are generally small in stature.

6.4.6 Fork-tailed Swift

No habitat map has been prepared for this species as it is an aerial insectivore that spend most of their time aloft, and could occur anywhere over the survey area, therefore the whole survey area is considered potential foraging habitat. The species does not breed in Australia, and as a wide-ranging nomadic species, foraging habitat also provides a surrogate for dispersal habitat.

6.4.7 Oriental Cuckoo

The Oriental Cuckoo occurs in a wide range of woodlands, particularly in the ecotones of denser riparian communities.

The species does not breed in Australia. Foraging habitat is also considered to be complementary to dispersal habitat, as the species is likely to occur on a transitory basis, and will be limited to areas of wooded habitats, not occurring in cleared areas.

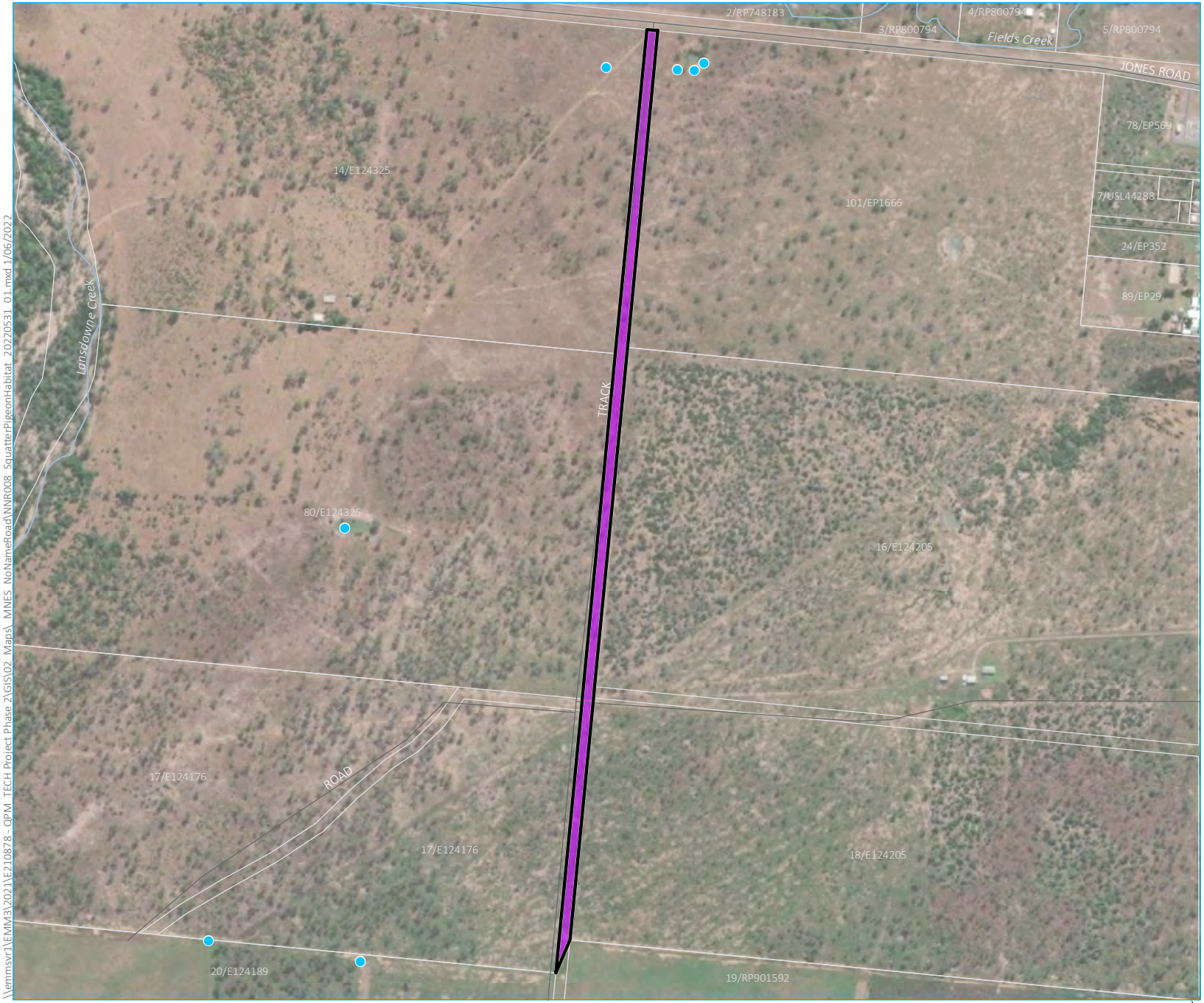
Utilising the definition of important habitat from DoE (2015b), areas of vine thicket, wet sclerophyll forest or open *Casuarina, Acacia* or *Eucalyptus* woodlands are considered to be potential foraging habitat.

As such, any remnant or regrowth woodlands are mapped as potential foraging/dispersal habitat for the species. Potential Oriental Cuckoo habitat is mapped in Figure 6.2e.

Threatened fauna habitat is summarised in Table 6.4.

Table 6.4 Threatened fauna species habitats

Species	Habitat	Total (ha)
Squatter Pigeon	Breeding	3.37
	Foraging	0
	Dispersal	0
	Total	3.37
Black-throated Finch	Breeding	2.47
	Foraging	0.89
	Total	3.37
Bare-rumped Sheathtail Bat	Roosting	Less than 0.01
	Foraging (vegetated areas)	2.47
	Foraging (cleared areas)	0.90
	Total	3.37
Koala	Total	2.47
White-throated Needletail	Foraging – aerial species above the whole Survey area	3.37
Fork-tailed Swift	Foraging – aerial species above the whole Survey area	3.37
Oriental Cuckoo	Foraging	2.47



KEY

- Survey area
- Minor road
- Named watercourse
- Cadastral boundary
- Squatter Pigeon record (EMM)
- Squatter Pigeon breeding habitat

\\emmsvr1\EMM3\2021\E210878 - QPM TECH Project Phase 2\GIS\02 Maps\ MNES NoNameRoad\NNR008 SquatterPigeonHabitat 20220531 01.mxd 1/06/2022

Source: EMM (2022); DNRME (2021)

0 250 500 m

GDA 1994 MGA Zone 55

N

Habitat mapping
Squatter Pigeon

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 6.2a

EMM
creating opportunities

KEY

- Survey area
- Minor road
- Named watercourse
- Cadastral boundary
- Bare-rumped Sheathtail Bat record (EMM)

Bare-rumped Sheathtail Bat habitat

- Roosting
- Foraging

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Source: EMM (2022); DNRME (2021)

0 250 500 m

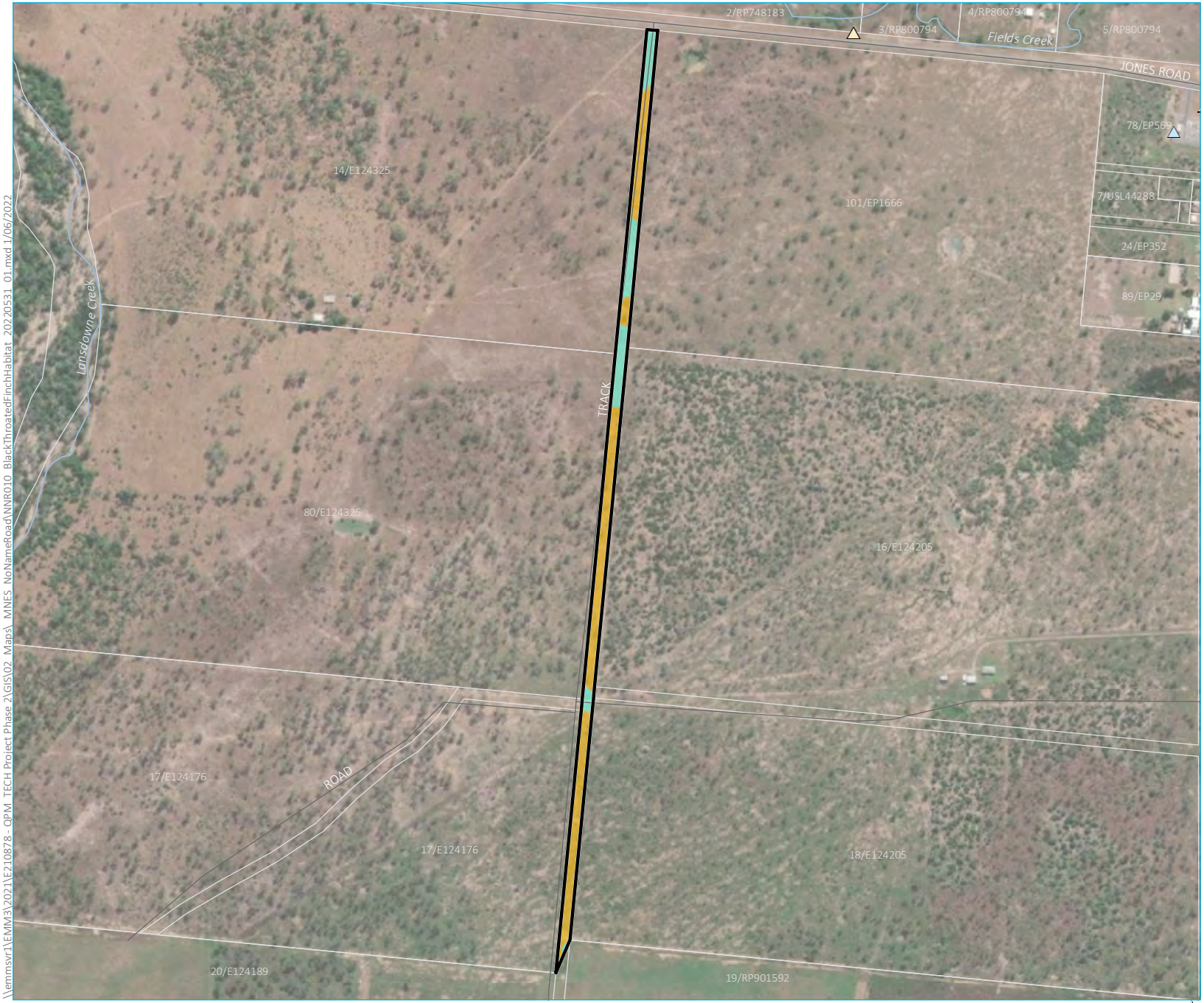
GDA 1994 MGA Zone 55

N

Habitat mapping
Bare-rumped Sheathtail Bat

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 6.3b

EMM
creating opportunities



KEY

- Survey area
- Minor road
- Named watercourse
- Cadastral boundary

Southern Black-throated Finch records

- eBird Australia
- Naturalist Australia

Southern Black-throated Finch habitat

- Breeding
- Foraging

\\emmsvr1\EMM3\2021\E210878 - QPM TECH Project Phase 2\GIS\02 Maps\ MNES NoNameRoad\NNR010 BlackThroatedFinchHabitat 20220531 01.mxd 1/06/2022

Source: EMM (2022); DNRME (2021)

0 250 500 m

GDA 1994 MGA Zone 55

N

Habitat mapping
Southern Black-throated Finch

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 6.4c

EMM creating opportunities

KEY

- Survey area
- Minor road
- Named watercourse
- Cadastral boundary
- Koala habitat

\\emmsvr1\EMM3\2021\E210878 - QPM TECH Project Phase 2\GIS\02 Maps\ MNES NoNameRoad\NNR011 KoalaHabitat 20220531 01.mxd 1/06/2022

Source: EMM (2022); DNRME (2021)

0 250 500 m

GDA 1994 MGA Zone 55

N

Habitat mapping

Koala

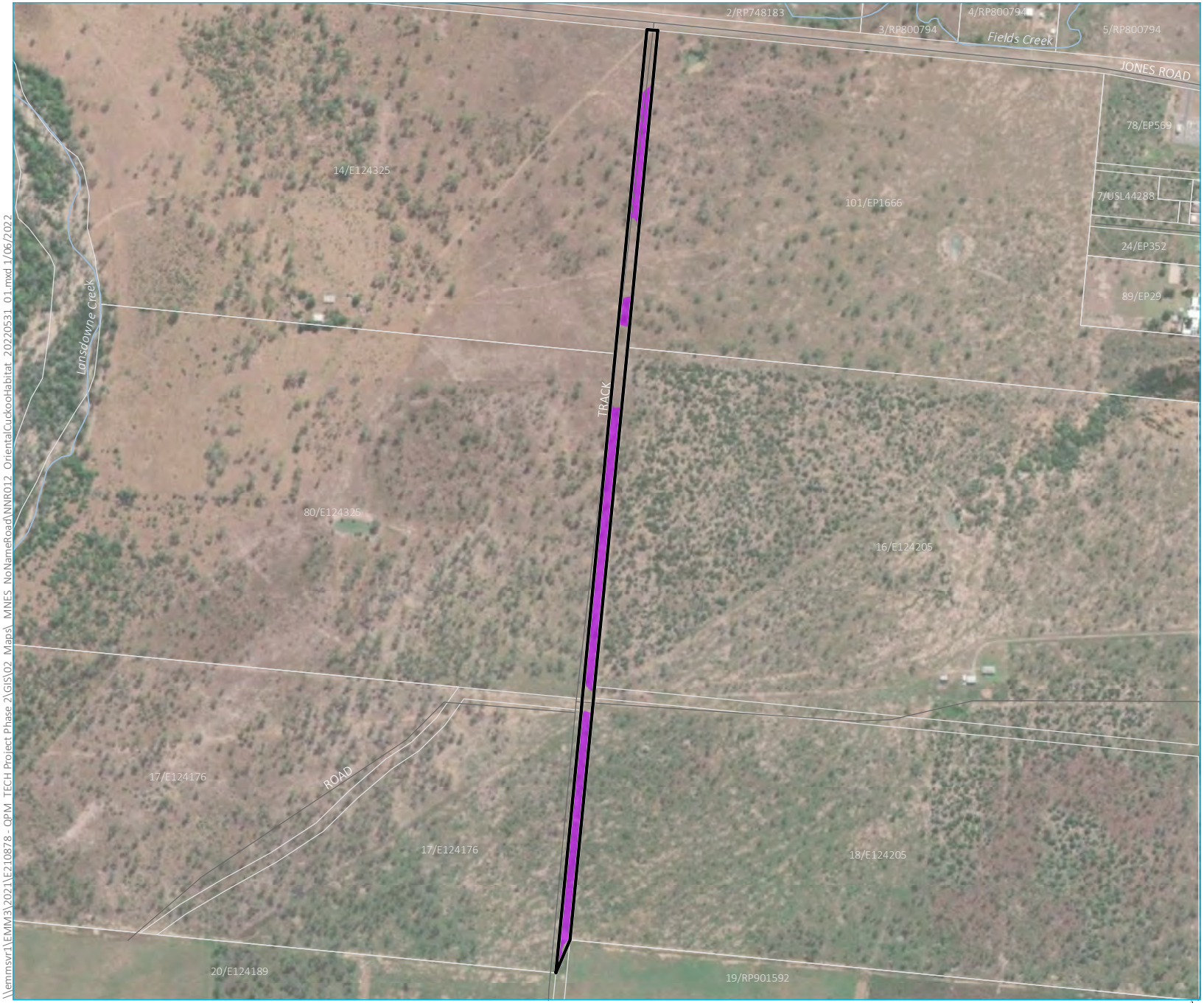
Lansdown Industrial Precinct

Northern access road

MNES report - No named road

Figure 6.5d

EMM creating opportunities



KEY

- Survey area
- Minor road
- Named watercourse
- Cadastral boundary
- Oriental Cuckoo foraging habitat

\\emmsvr1\EMM3\2021\E210878 - QPM TECH Project Phase 2\GIS\02 Maps\ MNES NoNameRoad\NNR012 OrientalCuckooHabitat 20220531 01.mxd 1/06/2022

Source: EMM (2022); DNRME (2021)

0 250 500 m

GDA 1994 MGA Zone 55

N

Habitat mapping
Oriental Cuckoo

Lansdown Industrial Precinct
Northern access road
MNES report - No named road
Figure 6.6e

EMM
creating opportunities

7 Impact assessment

7.1 Conventions, recovery plans and threat abatement plans

International and national environmental conventions, recovery plans and threat abatement plans that Australia have obligations under and how the Project satisfies these obligations are discussed in the following sections.

7.1.1 International conventions

i Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations (CBD 2022).

Article 14 Impact Assessment and Minimizing Adverse Impacts in the CBD encourages projects requiring an environmental impact assessment that are likely to have significant adverse effects on biological diversity to adequately avoid or minimise these effects as far as practicably possible (CBD 2022).

This Project demonstrates that appropriate measures to conserve biodiversity have been undertaken and are outlined in Section 8. Therefore, this Project is consistent with the CBD's obligations.

ii Convention on Conservation of Nature in the South Pacific (Apia Convention)

The main objective of the Convention on Conservation of Nature in the South Pacific (Apia Convention) is to commit the Parties to take action for the conservation, utilisation and development of the natural resources of the South Pacific region through careful planning and management for the benefit of present and future generations (SPREP 2022).

The Apia Convention's objectives include creating protected areas, committing to not alter national parks, and listing and protecting threatened native flora and fauna (SPREP 2022).

All flora and fauna species recorded during ecology field surveys are listed in Appendix D. Comprehensive surveys have been completed to document native flora and fauna species, as well as threatened communities and species in the road reserve. No protected areas will be impacted as a result of the Project. Therefore, this Project is consistent with the Apia Convention's obligations.

iii Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival (CITES 2022).

MNES discussed in this report are not listed under CITES and no trade of these species will occur as a result of the Project.

7.1.2 National recovery plans and threat abatement plans

i Threat abatement plan for predation by feral cats, Threat abatement plan for competition and land degradation by rabbits and Threat abatement plan for predation by European red fox

The Threat abatement plans for predation by feral cats (DoE 2015b), rabbits (DoE 2016) and European red fox (DEWHA 2008) establishes a national framework to guide and coordinate Australia's response to the impacts of these feral animals on biodiversity. They identify the research, management and other actions needed to ensure the long-term survival of native species and ecological communities affected by these feral animals.

Feral cats and foxes are a known threat to Squatter Pigeon. Habitat degradation and alteration by rabbits are a known threat to Southern Black-throated Finch. Feral animal management is discussed in Section 8.9.

ii Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses

The Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPC 2012) provides a framework for prioritising investment in threat abatement and identifies actions required to ensure the long-term survival of native species and ecological communities affected by the five grasses - (Gamba Grass (*Andropogon gayanus*), Para Grass (*Urochloa mutica*), Olive Hymenachne (*Hymenachne amplexicaulis*), Mission Grass (*Cenchrus polystachios*) and Annual Mission Grass (*Cenchrus pedicellatus*)).

Southern Black-throated Finch is listed as a species under immediate threat from the five listed grasses. Para Grass was recorded during field surveys. Weed management and mitigation measures are discussed in Section 8.9.

7.2 Impact assessments

Impact assessments have been undertaken in accordance with the Matters of National Environmental Significance – Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

The methods provided within the guidelines are intended to determine the level of significant impacts on MNES due to the proposed action. This is achieved through 'significant impact criteria' which are imposed on identified values and vary according to the status of each value.

This section summarises the overall potential impact mechanisms on MNES as a result of the Project (including direct, indirect and facilitated impacts). Section 8 summarises impact management and mitigation measures to reduce impacts.

The MNES assessment results considering these impact mechanisms using the Significant Impact Guidelines (DoE 2013) with full significant residual impact assessments, are provided in Section 10.

7.3 Project footprint and disturbance areas

The Project disturbance footprint has been defined based on the Project Description in Section 3, to provide a maximum direct impact area. The Project footprint mapped and assessed within this report includes areas permanently required for infrastructure.

The total Project footprint is approximately 3.37 ha. The proposed road utilises an existing road reserve which has been historically cleared and currently forms a farm track. The proposed road will use this existing track as a centreline.

7.4 Potential impacts from the Project

The construction and operation of the road has the potential to impact MNES values through the following activities:

- loss of habitat as a result of vegetation clearing;
- habitat fragmentation;
- fauna injury or mortality during vegetation clearing;
- fauna injury or mortality as a result of vehicle strike;
- disturbance to wildlife during construction as a result of noise, light and vibration;
- erosion and sedimentation which may impact on water quality; and
- increase in numbers of pest animals and weeds due to increased vehicle movements and opening up areas of remnant vegetation from clearing for infrastructure.

7.4.1 Direct impacts

Direct impacts occur as a direct result of a project's activities (Franks et al. 2010). This may include impacts from vegetation/habitat clearance or direct mortality of fauna from vehicle strike. Further detail on potential direct impacts that may occur to MNES are summarised below.

i Vegetation/habitat clearance

The vegetation within the narrow Survey area consisted of patches of remnant vegetation interspaced by areas of cleared, primarily exotic grassland.

Clearing of woodland habitat will reduce breeding, foraging and sheltering habitat for fauna and flora species, and the process of vegetation clearing has potential to result in injury or mortality of native fauna species. Some species which are more sedentary (eg reptiles) are more prone to impact than others. Conversely, mobile species such as Squatter Pigeon and migratory birds, with broader habitat preferences, are unlikely to be impacted from vegetation clearing as they are more mobile and can disperse more easily.

The total estimated area of vegetation clearing is 1.19 ha of remnant vegetation and 2.18 ha of non-remnant (previously cleared) vegetation.

Table 7.1 Estimated clearance of MNES habitat

Species	Habitat	Total (ha)
Squatter Pigeon	Breeding	3.37
	Foraging	0
	Dispersal	0
	Total	3.37
Black-throated Finch	Breeding	2.47
	Foraging	0.89
	Total	3.37
Bare-rumped Sheathtail Bat	Roosting	Less than 0.01
	Foraging (vegetated areas)	2.47
	Foraging (cleared areas)	0.90
	Total	3.37
Koala	Total	2.47
White-throated Needletail	Foraging – aerial species above the whole Survey area	3.37
Fork-tailed Swift	Foraging – aerial species above the whole Survey area	3.37
Oriental Cuckoo	Foraging	2.47

ii Species mortality

Direct fauna mortality may occur as a result of the Project during vegetation clearing (eg through removal of mature trees containing hollows), digging up breeding places such as reptiles residing under rocks, or vehicle collision.

Increased traffic around the road reserve has the potential to kill or injure fauna on impact. Ground-dwelling or slow-moving species may be particularly susceptible to traffic impacts.

Direct mortality of flora may occur through trampling or destruction of individuals from uncontrolled vehicle or personnel movement.

7.4.2 Indirect and facilitated impacts

Indirect impacts can be produced away from the Project or as a result of a complex impact pathway (Franks et al. 2010). Such indirect impacts include fragmentation, bushfire risk, extreme environmental events, erosion and water quality loss, noise and lighting pollution, reduced air quality, weeds, pest fauna and alienation. Facilitated impacts result from further actions (including actions by third parties) which are made possible or facilitated by the action. This is included as an indirect impact.

Further detail on potential indirect and facilitated impacts that may occur to MNES during construction are summarised below.

i Fragmentation

Terrestrial habitat connectivity may be reduced as a result of a Project due to clearing which has potential to reduce fauna movement between areas of retained remnant or regrowth vegetation. Such habitat fragmentation is more

prominent where clearing widths are larger, such as over 100m, and intersect intact areas of vegetation. Clearing linear widths through habitats also has the potential to increase edge effects (additional light entering forest, weed encroachment, feral animal abundance may increase and increased risk of bushfire) which has a negative impact on ecological functions for those areas.

Some species are more prone to this fragmentation of habitat. Other species such as Squatter Pigeon are not likely to be impacted by these cleared areas as they are known to disperse quite readily across non-remnant areas and have commonly been found on existing dirt access roads. Species such as Black-throated Finch in the Woodstock region also continue to forage along existing roads and tracks.

Habitat of up to 20 m wide will be cleared for the already gazetted road reserve, the majority of which has been cleared historically. It is not anticipated that significant fragmentation will occur as a result. Large areas of habitat will not be impacted and retained, including the riparian corridor associated with Lansdowne Creek to the west which is a biodiversity corridor. Farm dams on site will also be maintained. This will ensure the EVNT species likely to utilise the survey area still have large areas that be utilised as corridors, including to habitats outside the survey area.

ii Changes in water quality and hydrology

During construction activities, sediment may be mobilised and transported by surface water during rainfall events, ultimately discharging into watercourses and drainage lines and potentially reducing water quality in downstream aquatic habitats. Increased suspended sediments can reduce light penetration into the water column, reducing photosynthesis of aquatic macrophytes, and decreasing dissolved oxygen levels. However, many creek lines in the study area are ephemeral (including Lansdowne Creek), which may reduce the magnitude of these impacts. All Project infrastructure is set back at least 800 m from Lansdowne Creek, therefore retained vegetation in between will act as a further buffer to potential sedimentation impacts.

During construction and operation, the accidental release of pollutants (including spills from construction vehicles and plant, leaks and other uncontrolled releases) into the surrounding environment and waterways has the potential to degrade aquatic habitat quality in the road reserve and impact vegetation communities and terrestrial fauna utilising these areas. This includes direct toxic impacts on fauna from ingestion or inhalation. Without mitigation, contaminants may enter waterways including oily wastewater (from heavy equipment cleaning), contaminated runoff from chemical or fuel storage areas and general washdown water.

iii Bushfire risk

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. However, changes in the natural fire regime may result in changes in the species composition and / or structure of the vegetation. The increased presence of construction vehicles and personnel in the road reserve may increase fire risk through use of machinery that may generate sparks and idling vehicles being present in areas of ground vegetation.

iv Noise and lighting

Noise may adversely affect fauna by interfering with communication (eg territorial bird song), masking the sound of predators and prey, causing avoidance reactions and displacement from habitat. Construction noise will be generated by the Project through the use of machinery, plant, and vehicles and will vary from short intermittent noise from plant and equipment to more persistent noise from generators. The generation of construction noise may be in areas which have the potential to support threatened fauna species. Many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle 2007). Individuals that occur on or near the road reserve may leave the area of impact. Project construction works and therefore potential noise impacts will be temporary.

Artificial lighting from infrastructure and machinery may impact fauna within the road reserve during construction. Artificial lighting can have a range of impacts which vary between species. Artificial light can disrupt patterns of both nocturnal and diurnal species by eliciting responses. Some species may avoid brightly lit areas, potentially due to the perception of increased risk of predation.

Conversely, some species such as nocturnal reptiles, frogs and bats may congregate at artificial light sources to feed on insects attracted to light.

Site lighting will be kept to the minimum needed for safety during construction. Wherever practicable, construction activities will be limited to daylight hours to reduce the need for lighting and resultant light spill into adjacent habitat.

v Reduced air quality and dust emissions

Increased dust from vegetation clearing, soil stripping and vehicle movements during construction has the potential to temporarily and locally impact flora and fauna values in the vicinity of the Project footprint. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity (also resulting in reduced habitat quality for fauna), impact on respiratory systems of fauna, alter soil properties impacting on plant species assemblages and reduce water quality in aquatic habitats.

Dust is expected to potentially be an issue during vegetation clearing and construction. Dust levels will be monitored and when needed dust suppression implemented such as wetting down of dirt roads or reducing vehicle speeds. These measures will be further defined within the Project CEMP.

vi Weeds and pests

Project activities have the potential to increase the abundance of pest flora in the road reserve and facilitate dispersal of species to previously unimpacted areas. Uncontrolled movement of vehicles, equipment and personnel throughout the road reserve is the key vector of transmission, in particular vehicles and equipment sourced from regions beyond the road reserve which may introduce new species. Many weed species thrive on ground disturbance and will rapidly colonise disturbed areas in advance of native species recolonisation.

Increased pest flora abundance has adverse impacts on native vegetation and biodiversity, as well as potential negative economic effects on local land uses such as grazing activities.

Project related activities may also increase pest fauna abundance in the road reserve. This can lead to increased competition with, and predation of native fauna. In addition, habitat degradation may occur through vegetation trampling (eg Feral Pig wallowing). Creation of new access points into areas of intact vegetation may create pathways for feral fauna species to disperse. In addition, the creation of artificial water sources may increase the capacity of the area to support feral species such as Cane Toads. Uncontained waste sources may also attract feral fauna such as Wild Dog.

8 Impact management and mitigation

All MNES management measures will be developed to be consistent with the S.M.A.R.T principle, to ensure that measures are:

- Specific – prescriptive, with no uncertainty or ambiguity around their purpose or implementation;
- Measurable – the status (eg success or failure) and outcomes/results can be measured;
- Achievable – through the chosen method of implementation, by the responsible personnel and within the specified timeframe;
- Relevant – to the action/impact being controlled and to the protected matter; and
- Time bound – Measures were given specific and achievable timeframes for implementation in relation to specific development activities or stages.

The approach used to assess Project impacts and identify mitigation measures has used measures proven to be successful or are considered standard practice. Mitigation measures which have not been proven, or are not known to be successful, have not been identified in the management actions outlined below. Without evidence of the effectiveness of mitigation, the precautionary principle is applied. Avoidance and minimisation have been prioritised as the most effective measure.

8.1 Avoidance and minimisation

The following general measures will be implemented to avoid and minimise environmental impacts to the greatest practical extent:

- Habitat of up to 20 m wide will be cleared for the already gazetted road reserve, the majority of which has been cleared historically.
- Vegetation clearing will be limited to those areas required for earthworks and construction of the Project. Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as soon as practicable following construction.
- The approved disturbance area will be clearly demarcated prior to clearing to avoid unnecessary clearing of vegetation and to ensure personnel and vehicles stay within the approved footprint. Measures to ensure clearing limits are adhered to will be documented in the CEMP and addressed in site inductions.
- Clearing limits will be clearly demarcated on site, including through use of temporary fencing (eg flagging tape to mark out areas or plastic mesh fencing installed with star pickets) to avoid unintentional access to retained sensitive environmental areas.
- Sequential clearing of remnant vegetation will occur to minimise impacts on native fauna, particularly arboreal fauna which may be using tree hollows.
- Access will be limited to approved access roads and tracks.

8.2 Vegetation and habitat clearance

The following measures, listed in Table 8.1, will be implemented to mitigate and manage impacts as much as practicable during vegetation clearing.

Table 8.1 Vegetation and habitat clearance mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
Develop a Species Management Program (SMP) (required by DES under the NC Act when impacting on animal breeding places) to identify specific measures to be implemented that will mitigate impacts to threatened fauna species and animal breeding places during clearing, as well as operation of the Project. Measures will include sequential clearing, presence of a fauna spotter catcher and reducing vehicle speeds to minimise any wildlife injuries.	SMP—requirements for tampering with a protected animal breeding place in Queensland	All MNES
• Prior to any clearing activities, pre-clearance surveys will be undertaken by a suitably qualified ecologist to: – identify MNES and other native fauna species habitats and clearly demarcate the habitats being retained to ensure no direct or indirect impacts occur during clearing and construction; – identify and mark hollow-bearing trees to ensure they are managed by the fauna spotter catcher during clearing phase; – identify and mark any other active breeding places such as nests, burrows etc to ensure they are managed by the fauna spotter catcher during clearing phase; – identify suitable release sites should any fauna species need to be captured and released during clearing phase; and – identify presence of weed species and identify if any require treatment prior to clearing.	N/A	All MNES
• A suitably qualified fauna spotter-catcher will be present during clearing activities, working under a DES approved SMP under the NC Act. The fauna spotter-catcher will be responsible to check an area immediately prior to any clearing for; presence of any native fauna including searches of all potential habitats such as terrestrial microhabitats and hollows, etc. Any captured species (excluding Koalas) will be relocated to an agreed release site. The fauna spotter-catcher will then advise the ground staff as to measures that need to be taken to avoid impacts on breeding places and fauna species. Specific threatened species pre-clearance activities within the Project footprint will include: – canopy searches in suitable foraging tree species for Koala; – searches for suitable hollow-bearing trees as potential roost sites for Bare-rumped Sheathtail Bat; and – searches of open woodland habitat for Squatter Pigeon nests.	SMP—requirements for tampering with a protected animal breeding place in Queensland Damage mitigation permit (removal and relocation of wildlife) under NC Act (Qld)	All MNES
• Suitable hollow bearing trees to be cleared that are potential roost sites for Bare-rumped Sheathtail Bat will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season which is when maternal roosting is suspected to occur. Only one potentially suitable tree has been identified within the survey area.	National recovery plan for the Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus nudicluniatus* (Schulz and Thomson, 2007);	Bare-rumped Sheathtail Bat

Table 8.1 Vegetation and habitat clearance mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Sequential clearing will occur in areas where remnant vegetation is to be cleared. Key steps as part of sequential clearing are summarised below and will be formalised in a protocol as part of the SMP to be prepared under the NC Act: – the first phase will consist of removing understorey vegetation and smaller juvenile trees only. Juvenile trees are under 4 m in height or trunk circumference of less than 31.5 cm at 1.3 m above the ground. No hollow-bearing trees will be cleared in Phase 1; – after 48 hours the second phase can commence which is to clear the remaining larger trees, including those with hollows. Hollow bearing trees will be "tapped" by the machine prior to felling to encourage fauna to leave, and where practicable hollow bearing trees are to be "soft felled" to minimise the risk to hollow dwelling fauna. They will then be inspected by the fauna spotter-catcher post-felling to ensure no wildlife remain in the hollow. Where practicable fauna will be caught and released into suitable recipient sites once clearing has stopped. If roosting bats are located, they are to be "roosted" during the day in a safe, cool, dark space and released at night in areas of habitat to be retained. – if any native fauna are injured, they will be taken to a local vet/wildlife carer for treatment. – it is important the clearing is done in such a way that arboreal fauna are given the opportunity to disperse from the area once clearing has commenced under their own volition. – any confirmed Koalas will be identified by putting flagging tape and/or marking spray on the tree they are in, and any nearby trees with overlapping crowns or those trees that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. In most situations the Koala will move from the area overnight. – fell trees away from retained areas of vegetation where practicable. Where trees unavoidably fall into retained areas, leave in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna. – micro-habitats such as fallen logs and rocks will be moved into adjacent habitat.	Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013);	Koala

8.3 Fragmentation

The following measures, listed in Table 8.2, will be implemented to mitigate and manage impacts of fragmentation as much as practicable during the construction and operational phases.

Table 8.2 Fragmentation mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• All fencing on site, including security fencing, will consider the movement of fauna where practicable. Fencing design will consider allowing fauna to move through or over it and not using barbed wire on the top strand of fences if security or land management practices allow.	DTMR's Fauna sensitive road design manual Vol 2	Koala Squatter Pigeon

Table 8.2 Fragmentation mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Undertake staged clearing of native vegetation, and retain habitat trees where practicable, to minimise impacts to native fauna species.	Significant impact guidelines 1.1 *Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).	All MNES
• Implement weed and pest control across the road reserve to reduce degradation of habitats and edge effects as a result of the Project.	N/A	All MNES

8.4 Erosion and sedimentation

The following measures, listed in Table 8.3, will be implemented to mitigate and manage impacts of erosion and sediment as much as practicable during the construction and operational phases.

Table 8.3 Erosion and sedimentation mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Erosion in active construction areas cannot be eliminated but can be controlled. As part of the construction planning a certified Erosion and Sediment Control Plan (ESCP) will be prepared prior to construction and implemented during on-site activities. Sediment and erosion control measures to prevent soil loss will be developed consistent with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control (BPESC) document. The ESCP will form part of the overall CEMP. Particular focus will be given to managing runoff in the vicinity of watercourses.	IECA BPESC document	All MNES
• As a minimum standard, access tracks will be constructed in accordance with EHP publication: "Erosion control on property roads and tracks—managing runoff".	IECA BPESC document Erosion control on property roads and tracks—managing runoff	All MNES
• No equipment or materials will be stored across flow paths.	N/A	All MNES
• The extent of the area required to carry out the permitted activity must be limited to the minimum area necessary to reasonably carry out the works.	N/A	All MNES

8.5 Changes to water quality

The following measures listed in Table 8.4 will be implemented to mitigate and manage impacts of changing water quality as much as practicable during the construction and operational phases.

Table 8.4 Changes to water quality mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Construction equipment is to be maintained to minimise risk of spill or leakage.	N/A	All MNES
• All refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (eg *AS 1940: The storage and handling of flammable and combustible liquids*). Materials will be stored within bunded areas with a storage capacity of 110% of the storage vessel. Bunding will have floors and walls lined with impermeable material. These areas must be adequately protected from rainfall and stormwater.	AS 1940	All MNES
• Refuelling will not take place within 50 m of a watercourse.	N/A	All MNES
• Spill control materials such as booms and absorbent materials will be maintained on site, commensurate with the types and volumes of materials in use, and in place where hazardous materials are stored or used.	N/A	All MNES
• Personnel will receive appropriate spill clean-up training.	N/A	All MNES

8.6 Bushfire

The following measures, listed in Table 8.5, will be implemented to mitigate and manage impacts from bushfire risks as much as practicable during the construction and operational phases.

Table 8.5 Bushfire risk mitigation and management actions during construction

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• As part of the construction planning a certified Bushfire Management Plan will be prepared prior to construction and implemented during on-site activities. This will include details of controlled burning requirements, appropriate to the vegetation types present on the road reserve. This will seek to manage the fuel load to reduce the risk of high-intensity fires occurring. The Bushfire Plan key provisions will include: – Asset protection zones; – Maintaining access tracks to provide a fire break and defendable space to assist in arresting fires; – Bushfire risk mapping (considering slope, vegetation, aspect etc); – Firefighting equipment being on site; and – Emergency Evacuation.	QFES guidelines	All MNES
• During the bushfire season, the fire danger rating will be monitored daily through the Queensland Fire and Emergency Service (QFES) website.	QFES guidelines	All MNES
• Engagement with QFES to manage fire risk on site (access tracks, firebreaks etc). Bushfire buffers consistent with state requirements have been incorporated into design and are based on vegetation height around built infrastructure (other than roads).	QFES guidelines	All MNES

Table 8.5 Bushfire risk mitigation and management actions during construction

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• For "hot-work" activities, a risk assessment will be completed considering forecast weather, fire hazard ratings and site conditions.	N/A	All MNES
• Vehicles may not idle or be parked in areas of long grass.	N/A	All MNES
• Access tracks and fence lines will be used as firebreaks within the road reserve and regularly maintained during construction and operation of the Project.	N/A	All MNES
• Smoking is not permitted on site aside from in a designated safe zone.	N/A	All MNES
• Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.	Bushfire Management Plan	All MNES
• The Bushfire Management Plan will consider the requirements of the Southern Black-throated Finch in its development. In the Townsville region, cool burns between June and September, no more than one every three years, are most suitable for the Black-throated Finch (southern) (DEWHA, 2009). Biomass reduction (for example mowing, slashing, fire etc.) will be avoided during the early wet season resource bottleneck if practicable and safe to do so (eg unless required for firebreak maintenance etc).	Significant impact guidelines for the endangered Black-throated Finch (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (DEWHA, 2009) The National Recovery Plan for the Black-throated Finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007).	Southern Black-throated Finch

8.7 Noise and lighting

The following measures, listed in Table 8.6, will be implemented to mitigate and manage impacts from noise and lighting as much as practicable during the construction and operational phases.

Table 8.6 Noise and lighting mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Lighting from Project activities will be minimised at night to reduce light spill disturbance to nocturnal fauna.	N/A	All MNES
• Night lighting will mainly be limited to that required for safety and security. Project lighting will be minimised (eg low luminance) as far as possible.	N/A	All MNES
• Directional lighting will be away from environmentally sensitive areas.	N/A	All MNES

Table 8.6 Noise and lighting mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• All equipment will be properly maintained onsite in accordance with manufacturers specifications.	N/A	All MNES
• Implement noise control techniques in accordance with standard industry noise suppression techniques.	N/A	All MNES

8.8 Dust emissions

The following measures, listed in Table 8.7, will be implemented to mitigate and manage impacts from dust as much as practicable during the construction phase.

Table 8.7 Dust mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Areas which have potential to generate airborne dust will be wetted down regularly.	N/A	All MNES
• Low speed limits will be implemented on site to minimise dust generation.	N/A	All MNES
• Machinery and vehicle tyres will be regularly cleaned to reduce wheel entrained dust emissions or consider use of vibration grids.	N/A	All MNES
• Design access roads to have a less erodible surface.	N/A	All MNES
• Water spraying of nearby sensitive vegetation will be considered if visible significant dust sedimentation is observed.	N/A	All MNES

8.9 Weeds and pests

The following measures, listed in Table 8.8 will be implemented to mitigate and manage impacts from weeds and pest animals as much as practicable during the construction phase.

Table 8.8 Weed and pest mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• A Weed and Pest Management Plan will be developed for the Project with specific advice for key identified species. The plan will include management of weed spread, management of pest infestations, and monitoring effectiveness of control measures. The road reserve is currently subject to high levels of weed infestation.	Biosecurity Act requirements and DAF guidelines Significant impact guidelines for the endangered Black-throated Finch (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (DEWHA, 2009)	All MNES

Table 8.8 Weed and pest mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Weed hygiene protocols will be implemented such as a dedicated vehicle and machinery cleaning bay at the main entrance to the site. This will not be placed near a watercourse and runoff will be contained and the area treated.	Biosecurity Act requirements and DAF guidelines	All MNES
• Hygiene protocols will be implemented to reduce the potential for introduction or spread of weeds. Measures will include: – hygiene checks will focus on ensuring no weed plant material/ seed / mud / soil material enters the site (or leaves known infestation areas within the site), with all machinery, vehicles and equipment including footwear will be cleaned prior to entering the site, and when working within a known contaminated area within the site, prior to exiting the contaminated area.	Biosecurity Act requirements and DAF guidelines	All MNES
• Access into retained areas of habitat during construction will be limited.	N/A	All MNES
• Onsite waste disposal (especially food waste) to discourage presence of pest fauna. Waste will be stored in covered bins/skips to prevent fauna access.	Biosecurity Act requirements and DAF guidelines	All MNES
• Any herbicides used on site must be dispensed by an appropriately trained and qualified weed sprayer.	Biosecurity Act requirements and DAF guidelines	All MNES
• Any materials brought into site (such as gravel) will be certified as weed and disease free.	Biosecurity Act requirements and DAF guidelines	All MNES

8.10 Species mortality

The following measures, listed in Table 8.9, will be implemented to prevent species mortality during the construction and operational phases.

Table 8.9 Species mortality mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• All vehicles associated with construction will travel at slow speeds to minimise the chance of any fauna strikes occurring. Speed limit signage will be placed at the entrance to the site and other key points.	N/A	All MNES
• A suitably qualified fauna spotter/catcher will be present during clearing activities associated with the vegetation clearance, working under a SMP. The spotter/catcher will be responsible to check an area prior to any slashing, minor vegetation removal, or ground disturbance occurring for; animal breeding places (such as hollow bearing trees, nests, dens and fallen logs) and presence of any fauna species (such as checking for reptiles under fallen logs, and Koalas within eucalypt trees).	SMP—requirements for tampering with a protected animal breeding place in Queensland Damage mitigation permit (removal and relocation of wildlife) under NC Act (Qld)	All MNES
• All contractors will be educated on the presence of native fauna including threatened species and need to travel slowly and look out for fauna when driving (especially Squatter Pigeon). This training will form part of mandatory inductions.	N/A	All MNES

Table 8.9 Species mortality mitigation and management actions

Avoidance and mitigation measures	Relevant guideline/case study	Relevant MNES
• Construction vehicle traffic will be confined to designated roads and access tracks.	N/A	All MNES
• All fauna encountered (eg vehicle strike or during clearing activities) will be recorded in a central register by the Project Environment Manager. Any injured fauna will be reported as required in the SMP that will be in place for the Project.	SMP—requirements for tampering with a protected animal breeding place in Queensland Damage mitigation permit (removal and relocation of wildlife) under NC Act (Qld)	All MNES
• Appropriate procedures for managing injured wildlife will be developed and included in the CEMP and OEMP.	SMP—requirements for tampering with a protected animal breeding place in Queensland Damage mitigation permit (removal and relocation of wildlife) under NC Act (Qld)	All MNES
• All fencing on site will consider the movement of fauna. Fencing design must consider allowing fauna to move through or over it and not using barbed wire on the top strand of fences if practicable, or not required for security or stock management.	DTMR's Fauna sensitive road design manual Vol 2	Koala Squatter Pigeon

8.11 Rehabilitation

The following measures will be implemented to facilitate rehabilitation within the road reserve of any areas used for construction but not required for operation.

Table 8.11 Rehabilitation actions

Actions	Relevant guideline/case study	Relevant MNES	Timing
• Those areas which are not required for the ongoing operation and maintenance of the Project will be rehabilitated as soon as practicable following construction.	N/A	All MNES	During clearing and construction
• Woody debris, logs and rocks will be retained for use in rehabilitation	N/A	All MNES	During clearing and construction
• Where seeding and/or revegetation is required select plant species that are found in similar adjacent habitat on site. This may include use of an inert initial colonisation species to assist in groundcover and stabilisation.	N/A	All MNES	During clearing and construction

9 Significant impact assessment

9.1 Summary

Significant impact assessments have been carried out for MNES that are 'known' or 'likely' to occur in the road reserve.

Table 9.1 below summarises the residual impacts on MNES values and impact assessment findings. Full significant impact assessments applying the *Significant Impact Guidelines 1.1: Matters of National Environmental Significance (DoE, 2013)* are presented in subsequent sections. The significance of impacts on MNES values have been assessed following consideration of general avoidance and mitigation measures described in Section 8, and specific mitigation relevant to each MNES described below in Sections 9.2 to 9.8.

Table 9.1 Summary of significant impact assessment

MNES	Total area of habitat within road reserve and area impacted (ha)	Significant impact assessment - conclusion
Squatter Pigeon	3.37	Not significant
Black-throated Finch (potential breeding)	2.47	Not significant
Black-throated Finch (foraging)	0.90	
Bare-rumped Sheathtail Bat (roosting)	Less than 0.01 ha	Not significant
Bare-rumped Sheathtail Bat (foraging)	3.37	
Koala	2.47	Not significant
White-throated Needletail	3.37	Not significant
Fork-tailed Swift	3.37	Not significant
Oriental Cuckoo	2.47	Not significant

9.2 Squatter Pigeon

9.2.1 Relevant Departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440;
- Conservation Advice *Geophaps scripta scripta* squatter pigeon (southern) (TSSC 2015); and
- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b).

There is no Listing Advice or adopted or made Recovery Plan in place for this species. The following Threat Abatement Plans are relevant to this species:

- threat abatement plan for predation by feral cats (DoE 2015b);
- threat abatement plan for competition and land degradation by rabbits (DoE 2016); and
- threat abatement plan for predation by the European red fox (DoE 2008).

9.2.2 Ecology, habitat, distribution

Squatter Pigeon can utilise a broad range of habitats including remnant, regrowth, non-remnant, and modified vegetation communities with nearby access to permanent surface water (typically within 1−3 km). Generally, they are recorded in open *Eucalyptus, Corymbia, Acacia* or *Callitris* dominated communities, and occur in their highest densities in those with abundant and diverse native grasses (primary foraging resource). Utilised habitat in these areas have low ground layer cover, typically below 33%. Soils in these areas consist of sandy substrates dissected with low gravely ridges (DAWE 2021a).

The species also shows soil and landscape associations with foraging and breeding primarily recorded from flat alluvial plains, gently sloping and undulating plains, as well as low hilly terrain with well-drained, sandy, or loamy soils. Breeding in these areas only generally occurs within 1 km of a permanent water source (artificial or natural) (Squatter Pigeon Workshop 2011). The species is frequently observed around disturbed areas such as access tracks and cattle yards.

Soil landscapes are good indicators of where natural, foraging and breeding habitats for the Squatter Pigeon occur (Squatter Pigeon Workshop 2011). Well-draining, gravelly, sandy or loamy soils support the open-forest to woodland communities with patchy, tussock-grassy understories that support the subspecies' foraging and breeding requirements. Given that the subspecies nests in shallow depressions in the ground, it requires well-draining soils. The species' foraging and breeding habitats are known to be associated with land zones 3, 5 and 7 of which only land zone 3 occurs in the road reserve.

Squatter Pigeons can breed throughout most of the year if conditions are good, however, optimal conditions for breeding success are likely to be regulated by the abundance of food resources. The generation length is estimated to be five years. Squatter Pigeons usually breed in solitary pairs and pairs may produce two broods of young per season (DAWE 2021a).

The Squatter Pigeon is a medium-sized, highly terrestrial pigeon that occurs from Cape York to southern Queensland (formally to northern New South Wales) (DAWE 2021a). The distribution of the southern subspecies overlaps with the distribution of the northern subspecies, *Geophaps scripta peninsulae*. The intergrade zone extends from the Delta Downs area of south-western Cape York, east to Chillagoe, south-east to Halifax Bay and along the east coast to just north of Mackay, and west to Hughenden (DAWE 2021a).

9.2.3 Important populations

Important populations have been identified (Squatter Pigeon Workshop 2011) as being small, isolated and sparsely distributed populations occurring south of the Carnarvon ranges in central Queensland. This includes:

- populations occurring in the Condamine River catchment and Darling Downs of southern Queensland;
- the populations known to occur in the Warwick-Inglewood-Texas region of southern Queensland; and
- any populations potentially occurring in northern NSW.

North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Squatter Pigeon Workshop 2011). As such, the population in the road reserve is not considered to be an important population.

9.2.4 Threats to the species

The main threats to species relate to the loss and fragmentation of habitat due to clearing for agricultural purposes (including degradation of habitat through overgrazing). Degradation of habitat from invasive weeds, such as Buffel Grass which has been widely introduced as an improved pasture species, is also a key threat (DAWE 2021a).

Predation by feral predators such as cats and foxes are another threat to the species.

No recovery or threat abatement plans are in place for this species. The Commonwealth's Approved Conservation Advice for Squatter Pigeon (southern) (TSSC 2015) lists the following priority conservation actions:

- Protect and rehabilitate areas of vegetation that support important sub-populations;
- Protect sub-populations of the listed subspecies through the development of covenants, conservation agreements or inclusion in reserve tenure;
- Develop and implement a stock management plan for key sites; and
- Raise awareness of the squatter pigeon (southern) within the local community, particularly among land managers.

9.2.5 Distribution within the road reserve and habitat mapping

Multiple records of this species exist within the study area and suitable habitat is present in the road reserve. Squatter Pigeons were observed during active diurnal bird surveys and while traversing the road.

Approximately 3.37 ha of potential breeding habitat is proposed to be cleared for the road reserve.

9.2.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to Squatter Pigeon from construction and operation of the Project are described in Table 9.2.

Table 9.2 Potential impacts on Squatter Pigeon

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	Approximately 3.37 ha of potential breeding habitat is proposed to be cleared for the road reserve.	No additional mitigation beyond the general measures presented in Section 8 is proposed.
Species mortality	This species frequently forages close to roads and access tracks and is susceptible to vehicle strike. Increased vehicular presence on site is a risk to the species at the road reserve.	Mitigation measures presented in Section 8 relating to vehicle speeds on site and restrictions around movement on site will reduce the risk of vehicle strike to Squatter Pigeon.

Table 9.2 Potential impacts on Squatter Pigeon

Potential construction impacts	Discussion	Proposed mitigation
Indirect and facilitated impacts		
Fragmentation	3.37 ha of potential breeding habitat will be cleared, within a landscape that is already significantly disturbed. Clearing for the road reserve will not prevent movement of squatter pigeon between areas of suitable habitat within the study area. No clearing will be required during operation and maintenance. It is not anticipated that operational and maintenance activities will result in any displacement of Squatter Pigeon from retained areas of habitat.	No additional mitigation beyond the general measures presented in Section 8 is proposed.
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated.	No additional mitigation beyond the general measures presented in Section 8 is proposed. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this species habitat.	No additional mitigation beyond the general measures presented in Section 8 is required.
Erosion and water quality	Squatter Pigeon is unlikely to be directly impacted by impacts from erosion and reduced water quality resulting from Project construction. During construction, there is potential for reduced water quality to impact on the health of the habitats in which this species occurs, unless adequately mitigated. Spills, increased erosion and sedimentation may all affect the quality of retained habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Erosion and sediment control measures will be put in place to ensure erosion and sediment runoff does not occur into sensitive environmental areas including watercourses.
Noise and lighting	There is limited scope for indirect impacts such as noise and lighting on this species resulting from Project construction. The species may be temporarily displaced from areas of Project construction. The species is expected to continue to forage adjacent to access tracks.	No additional mitigation beyond the general measures presented in Section 8 is required.
Reduced air quality	The species regularly forages in dusty areas around access tracks and cattle yards therefore it is unlikely to be impacted by reduced air quality	No additional mitigation beyond the general measures presented in Section 8 is required.

Table 9.2 Potential impacts on Squatter Pigeon

Potential construction impacts	Discussion	Proposed mitigation
Weeds and pests	Degradation of habitat from invasive weeds and predation by feral predators such as dogs are threats to the species. The Project has the potential to facilitate the spread of weeds and pest fauna through machinery, vehicles and materials being bought in from outside the road reserve although the road reserve is already subject to weed and pest impacts. The road reserve has high levels of weed infestation.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.2.7 Significant impact assessment

The MNES significant impact assessment for Squatter Pigeon using the Significant Impact Guidelines (DoE 2013) is summarised in Table 9.3.

Table 9.3 Significant impact assessment – Squatter Pigeon

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Lead to a long-term decrease in size of an important population	Important populations have been identified (Squatter Pigeon Workshop 2011) as being small, isolated and sparsely distributed populations occurring south of the Carnarvon ranges in central Queensland. North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Squatter Pigeon Workshop 2011). As such, the population in the road reserve is not considered to be an important population. It is expected that individuals disturbed by construction activities will temporarily move away from the area of disturbance into extensive areas of retained habitat bordering and within the road reserve. Retained habitat along Lansdowne Creek will offer refuge for the species and extensive areas of grassy woodland occurs surrounding the road reserve. Connectivity to these area will be maintained. The Project is unlikely to lead to a long-term decrease in an important population.
Reduce the area of occupancy of an important population	No important population is present at the road reserve. Database records indicate the species occurs widely across the local and wider region. Clearing for the Project is expected to remove up to 3.37 ha of habitat for the species. The Project will reduce the area of occupancy in the local area to a very minor extent. The ability of the road reserve to support this species will be maintained. As such the Project will not reduce the area of occupancy of an important population (and no important population is present on the road reserve).

Table 9.3 Significant impact assessment – Squatter Pigeon

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Fragment an existing important population into two or more populations	There is no important population in the study area or road reserve. The species is sparsely distributed across a wide range. Clearing for the Project is expected to remove up to 3.37 ha of habitat for the species. Roads and access tracks are unlikely to cause fragmentation of the local population. The species regularly forages alongside and on access tracks, and in other disturbed habitats. Access tracks throughout the site will have strict speed limits in place. The impact on movement across the road reserve will be negligible. The Project is unlikely to fragment an existing important population.
Adversely affect habitat critical to the survival of a species	No critical habitat for the species is defined. The species occurs in grassy woodlands which remain abundant across much of its range including the road reserve. Squatter Pigeon also occur in disturbed areas cleared for cattle grazing and along access tracks. It is not considered that the road reserve supports habitat critical to the survival of the species. The ability of the road reserve to support this species will be maintained and significant areas of habitat are maintained in the surrounding area including access to farm dams. As such the Project is not expected to adversely affect habitat critical to the survival of the species. *The Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013)* state that critical habitat can include "areas that are necessary for activities such as foraging, breeding, roosting, or dispersal" (DoE 2013). As a previously cleared road reserve, although forming potential breeding habitat due to the proximity of water sources, the cleared nature of the existing track means that Squatter Pigeon are unlikely to use the road reserve for breeding preferentially over more suitable habitat in the surrounding woodlands which offers more shelter. Noting the other definitions of critical habitat (DoE 2013), specifically areas that are necessary: • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community It is unlikely that the survey area meets these criteria. As such the Project is not expected to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	Pre-clearance surveys will identify breeding places for this species, and should breeding sites be encountered, an exclusion zone will be placed around the nest until young have fledged consistent with the requirements of an approved Species Management Program under which the fauna spotter catcher(s) will be working.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The project will involve the removal of up to 3.37 ha of potential breeding habitat, which is generally low quality due to the prevalence of exotic grass and forb species. This is a minor impact in context of the availability of habitat for the species, and as such unlikely to cause the species' decline.

Table 9.3 Significant impact assessment – Squatter Pigeon

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Degradation of habitat from invasive weeds and predation by feral predators such as cats and foxes are threats to the species. The Project has the potential to facilitate the spread of weeds and pest fauna through machinery, vehicles and materials being bought in from outside the road reserve although the road reserve is already subject to extensive weed and pest impacts. Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.
Introduce disease that may cause the species to decline	Disease is not a known threat to the species, and it is unlikely that the Project will introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	There is no State or Commonwealth recovery plan for this species. *The Approved Conservation Advice for Squatter Pigeon (TSSC 2015*) outlines the main threats to species as relating to the loss and fragmentation of habitat due to clearing for agricultural purposes (including degradation of habitat through overgrazing). Degradation of habitat from invasive weeds, such as Buffel Grass (*Cenchrus ciliaris*) which has been widely introduced as an improved pasture species, is also a key threat. Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape. The long-term survival and recovery of the species depends on (Squatter Pigeon Workshop, 2011): • the protection of habitat critical to the survival of the subspecies throughout its range • the restoration of habitat which is potentially critical to the survival of the subspecies, especially in northern NSW and southern Queensland where there is a greater threat of a further contraction in the subspecies' range • the alleviation of mortality caused by predators, particularly cats and foxes, and • the development of a greater understanding of the subspecies' ecology and use of modified landscapes for foraging, breeding and dispersal. The Project will not conflict with any of these objectives.
Conclusion	Based on an evaluation of all criteria, the Project is not expected to have a significant residual impact on Squatter Pigeon. No important population is present at the road reserve. The Project will result in the loss of up to 3.37 ha of potential breeding habitat, although no important populations are present on the site.

9.3 Southern Black-throated Finch

9.3.1 Relevant Departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64447;
- Significant impact guidelines for the endangered Black-throated Finch (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (DEWHA, 2009);

- Commonwealth Listing Advice for Southern Black-throated Finch *(Poephila cincta cincta)* (TSSC 2005a); and
- The National Recovery Plan for the Black-throated Finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007).

There is no Conservation Advice or Threat Abatement Plan in place for this subspecies.

9.3.2 Ecology, habitat, distribution

The Black-throated Finch mainly favours grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca species, often near watercourses, or in the vicinity of water (DAWE 2021c).

The National Recovery Plan for the Black-throated Finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007) states that the subspecies is likely to need a mosaic of different habitats in which to find seed, and that access to seeding grasses and water is necessary.

The Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) identifies that the subspecies requires access to three key resources for survival and breeding, namely:

- Water sources – permanent water sources are the most critical limiting resource, providing habitat during the dry season but ephemeral sources also allow access to areas of foraging and nesting habitat during the wet season;
- Grass seeds – the subspecies feeds on a variety of grass species, predominantly on fallen grass seed. Grass seed availability early in the wet season (November to December) is a critical bottleneck. Perennial grasses appeared to be favoured; and
- Trees providing suitable nesting habitat – typically within 400m of a water source.

The relationship between the above three factors is a critical limitation in the distribution of the subspecies. While each individual factor is reasonably common, the availability of water sources and suitable foraging grasses is more limited and limits the distribution of the subspecies.

Black-throated Finch are rarely observed in modified environments, unless suitable seeding grasses exist (Commonwealth of Australia, 2009). Perennial grasses dominate the subspecies' diet including *Urochloa mosambicensis, Enteropogon acicularis, Panicum decompositum, Panicum effusum, Dichanthium sericeum, Alloteropsis semialata, Eragrostis sororia* and *Themeda triandra* (Mitchell 1996; NRA 2007). Invasion of exotic weeds may degrade habitat and reduce resource availability (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007). The subspecies requires an appropriate density and diversity of grasses, with seeds accessible on the surface. The subspecies predominantly feeds on fallen seed. Therefore the subspecies ideally requires a diversity of annual and perennial grass species which provide sufficient spacing for bare areas to form.

The subspecies only appears to be capable of travelling over uninhabitable areas if the distance is less than 1 km (Commonwealth of Australia, 2009).

The stronghold for this subspecies is the Townsville/Charters Towers region, where it is locally common in places. Records around Townsville are centred on the Lake Ross, Woodstock area just north of the road reserve.

9.3.3 Important populations

The Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) has mapped "important areas" for the subspecies based on a 5km buffer from reliable records post 1995. These areas are likely to contain the critical habitat configuration between water sources, grasslands and nesting trees.

The road reserve is at the southern limit of the mapped "Important Areas" for the subspecies in the Significant Impact Guidelines. There are numerous records of the subspecies in the study area (see Appendix C). In particular, the area around Jones Road (immediately north of the road reserve) and Gunnado Road (approximately 3 km to the north-east) are core areas of recent sightings.

Additionally there are no database records going south from the road reserve, so it is likely that this distribution is an accurate one with the population around Woodstock not extending further south, with the area around the road reserve being marginal habitat on the very southern edge of the distribution.

Conservatively following the Significant Impact Guidelines, the road reserve is considered an "important area" based on the Jones Road records, despite no records within the road reserve and the subspecies not being detected during field surveys. There is potential that foraging will occur within the survey area and road reserve although perhaps not extensively.

9.3.4 Threats to the subspecies

Known threats to the Black-throated Finch include (DAWE 2021c):

- Clearance and fragmentation of woodlands, riparian habitats and wattle shrublands (BTF Recovery Team 2004; NRA 2005);
- Degradation of habitat by domestic livestock and rabbits, including the alteration of fuel loads, vegetation structure and the availability of food during the wet season (BTF Recovery Team 2004; NRA 2005);
- Alteration of habitat by changes in fire regimes (BTF Recovery Team 2004; NRA 2005);
- Invasion of habitat by exotic weeds, including exotic grasses and Chinee Apple (BTF Recovery Team 2004);
- Illegal trapping (BTF Recovery Team 2004);
- Predation by introduced predators (BTF Recovery Team 2004); and
- Hybridization with the northern subspecies (BTF Recovery Team 2004).

9.3.5 Distribution within the road reserve and habitat mapping

Potential nesting and foraging habitat occurs within the road reserve, however this habitat is of moderate quality and not likely to be heavily utilised by Black-throated Finch within this area, as evidenced by a lack of records from the road reserve across spatial and temporal variation (three separate surveys spanning two years in different seasons).

The area around Jones Road (immediately to the north of the Survey area) and Gunnado Road (approximately 3 km to the north-east) are core areas of recent sightings. The landholder to the west of the Survey area anecdotally identified he had Black-throated Finches using his property. This property corresponds with database records from the area around Jones Road. He anecdotally confirmed that Birdlife North Queensland/Birdlife Townsville had come onto his property on a yearly basis to survey for the finches. He stipulated the Black-throated Finches breed on his

property and when it is dry, drink from dams 50 m to the east and 400 m to the west of the Survey area. As such, despite the Survey area being subject to varying levels of weed incursion (including Chinee Apple which is a recognised threat to the species), it is considered potential habitat for the species.

Marginal breeding habitat comprises all remnant and regrowth woodland within 1 km of the farm dams adjacent to the survey area, due to the presence of suitable nesting trees and the proximity to retained areas of open grassy woodland outside the survey area. However, the limiting factor of suitable foraging habitat near the potential breeding areas should be noted and the weedy nature of these areas. Therefore it is considered unlikely that these areas support preferred breeding habitat for the subspecies in the study area but consistent with the guidelines these areas are conservatively mapped as potential.

Foraging habitat comprises all remaining areas of grassy woodland within 3 km of potential breeding habitat consistent with Mitchell (1996) where suitable habitat factors are present (eg foraging grass species, bare ground on which seed can be gleaned).

The entire road reserve (3.37 ha) is likely to be habitat (2.47 ha of potential breeding habitat, 0.9 ha of foraging habitat).

9.3.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to Black-throated Finch from construction and operation of the Project are described below in Table 9.4.

Table 9.4 Potential impacts on Black-throated Finch

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	Potential nesting and foraging habitat occurs within the road reserve; however this habitat is of low quality and not likely to be heavily utilised by Black-throated Finch within this area, and to date there are no records from the road reserve. Potential nesting habitat is restricted to areas of remnant vegetation within the road reserve. The subspecies is unlikely to be reliant on the limited and degraded foraging resources within the road reserve. However, conservatively due to the road reserve being within the mapped Important Areas for the subspecies (which are based on a 5 km buffer around known records) the subspecies is assumed to occur on a sporadic basis. More favoured habitats are located within riparian corridors which support critical habitat factors of proximity to water, seeding grasses and breeding trees. The road reserve is not within this higher quality habitat.	No additional mitigation beyond the general measures presented in Section 8 is required.

Table 9.4 Potential impacts on Black-throated Finch

Potential construction impacts	Discussion	Proposed mitigation
Species mortality	Potential nesting habitat occurs within the road reserve, within remnant woodland vegetation. However, breeding habitat is likely to preferentially be creek lines and associated riparian vegetation or where suitable trees and habitat factors (such as seeding grasses and proximity to water) are more likely to be present. Species mortality may occur during clearing of vegetation containing an occupied nest.	Any clearing of potential Black-throated Finch habitat will occur sequentially and further details on sequential clearing and use of fauna spotter-catchers during clearing are outlined in Section 8. This will include checking potential nesting tree sites for this subspecies.
Indirect and facilitated impacts		
Fragmentation	More favoured habitats are located within riparian corridors of which the road reserve avoids. Up to 3.37 ha of potential Black-throated Finch habitat will be cleared for the road. Land surrounding the road reserve is already heavily modified in particular the lot/plan to the south which is cleared of remnant vegetation. By retaining these corridors, it is unlikely that the Project will result in significant fragmentation impacts, as existing corridors are maintained.	A Vegetation Management Plan will be prepared and include: • Control of access, interference or damage to vegetation unless approved by the Site Manager; vehicles and equipment are to remain on defined roads and designated areas. • Vegetation Clearing Plan – requiring the staged clearing of vegetation during construction. • Bushfire risk – banning the lighting of fires on site unless permitted by the Site Manager (eg welding, hot works under permit etc). • Weed species management – requiring all plant and equipment to be free of soil and weed seeds prior to entering the site; minimising the use of chemicals and fertilisers. • Limiting the disturbance of vegetation – flagging of buffer areas to prevent incursion into retained vegetation; No collection of timber or firewood from areas to be protected. • Dust mitigation to reduce the impact to and functioning of vegetation buffering the road reserve, and on surrounding properties.
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.

Table 9.4 Potential impacts on Black-throated Finch

Potential construction impacts	Discussion	Proposed mitigation
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this subspecies' habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Erosion and water quality	Black-throated Finch is unlikely to be directly impacted by impacts from erosion and reduced water quality resulting from Project construction. During construction, there is potential for reduced water quality to impact on the health of the habitats in which this subspecies occurs, unless adequately mitigated. Spills, increased erosion and sedimentation may all affect the quality of retained habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Erosion and sediment control measures will be put in place to ensure erosion and sediment runoff does not occur into sensitive environmental areas including watercourses.
Noise and lighting	There is limited scope for indirect impacts such as noise and lighting on this subspecies resulting from Project construction. The subspecies may be temporarily displaced from areas of Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Reduced air quality	There is limited scope for indirect impacts from reduced air quality on this subspecies resulting from Project construction. There is potential for dust from construction activities and vehicular movement to spread into nearby areas of retained habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Appropriate speed limits will be enforced when moving around the road reserve, to reduce the potential for dust to spread.
Weeds and pests	There is limited scope for indirect impacts such as weed and pest interaction with this subspecies resulting from Project construction. Pest fauna such as cats are a potential threat to the subspecies, but cats are certainly already present in the study area and the likelihood of the Project facilitating spread is low. The potential for the Project to further facilitate the spread of weeds to impact on the quality of foraging habitat is low. Habitats in the road reserve are already heavily weed infested, with riparian areas having Rubber Vine, Sicklepod and Chinee Apple, and open areas infested by Hyptis.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.3.7 Significant impact assessment

The Significant impact guidelines for the endangered Black-throated finch (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (DEWHA, 2009), lists actions that may lead to the loss, degradation and/or fragmentation of black-throated finch (southern) habitat and may have a significant impact on the subspecies. These are listed below along with a brief statement of applicability to the Project:

- **clearing of grassland and/or grassy woodland –** preferred grassland or grassy woodland habitats are located within riparian corridors, of which the road reserve avoids;
- **damming or disrupting the natural flows of creeks and rivers –** not applicable to the Project;
- **earthworks or excavation –** earthworks to support Project infrastructure will be undertaken;
- **pasture improvement –** not applicable to the Project;
- **changes in biomass management regimes, for example burning, slashing or changes in intensity of grazing regimes, especially during the resource bottleneck period (November to December)** – Project maintenance and rehabilitation activities will have consideration for the requirements of Black-throated Finch in regard to vegetation control, including fire breaks;
- **construction of roads, structures and/or hard surfaces –** construction of hard surfaces to support Project infrastructure will be undertaken. Disturbance avoids key areas of habitat including water sources;
- **construction of temporary or permanent structures for storage and accommodation –** not applicable to the Project;
- **the introduction of domestic and agricultural animals –** not applicable to the Project;
- **the introduction of exotic plants, particularly exotic grasses** – the Project will not introduce exotic plants, particularly exotic grasses. Rehabilitation will comprise local Indigenous species and will consider requirements for native grasses for the Black-throated Finch; and
- **increases in human traffic and/or recreational activities (for example trail bike riding, dog walking etc.)** – the Project is not likely to increase human traffic and/or recreational activities.

The MNES significant impact assessment for Black-throated Finch using the Significant Impact Guidelines (DoE 2013) is summarised below in Table 9.5.

Table 9.5 Significant impact assessment – Black-throated Finch

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Response
Lead to a long-term decrease in size of a population	The road reserve is within the southern extent of the mapped "Important Areas" for the subspecies in the Significant Impact Guidelines. More favoured habitats are located within riparian corridors which support critical habitat factors of proximity to water, seeding grasses and breeding trees. Up to 3.37 ha of Black-throated Finch foraging habitat will be cleared for construction. It is unlikely however that the road reserve is heavily utilised and as such the action is unlikely to lead to a long-term decrease in the size of the population. The majority of core habitat for the species is further to the north.

Table 9.5 Significant impact assessment – Black-throated Finch

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Response
Reduce the area of occupancy of the species	Potential nesting and foraging habitat occurs within the road reserve although this area has been subject to a history of clearing, grazing and weed invasion. Whilst the species has not been recorded within the road reserve, anecdotal and confirmed records occur in close proximity, so it reasonable to expect they may occur within the area, albeit sporadically. Therefore, clearing of the road reserve has the potential to reduce the area of occupancy of the species by 3.37 ha.
Fragment an existing population into two or more populations	The road reserve is already heavily fragmented as a result of historical and contemporary vegetation clearance for agriculture, predominantly grazing. The Project design will maintain linkages to surrounding retained habitat, including retention of the regionally significant riparian corridor associated with Lansdowne Creek. Vegetation clearance will not impede the movement of any Black-throated Finch using the road reserve. The road reserve is largely cleared and is dominated by weeds, which would otherwise impede existing opportunities for the species. Land surrounding the road reserve is already heavily modified in particular the lot/plan to the south which is cleared of native vegetation. By retaining these corridors, it is unlikely that the Project will result in significant fragmentation impacts, as existing corridors are maintained, and existing movement across the road reserve is already heavily constrained by the cleared land and dense weed cover present in the centre of the road reserve. Areas of continuous similar habitat exist around the periphery of the road reserve and connectivity to more suitable habitat to the north (around Woodstock and Lake Ross) where the majority of records occur, is maintained. The Project is unlikely to fragment an existing important population.

Table 9.5 Significant impact assessment – Black-throated Finch

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Response
Adversely affect habitat critical to the survival of a species	It is considered unlikely that the survey area regularly supports Black-throated Finch, but consistent with the guidelines this area was conservatively mapped as potential. The vegetation within the narrow survey area consists of patches of remnant vegetation interspaced by areas of cleared, primarily exotic grassland. The areas of remnant vegetation adjacent to the Survey area remain largely connected, forming a contiguous area of vegetation over 100 ha in size. However, conditional status and degradation of this vegetative area appeared to vary according to property. The southern extent of the Survey area and east of the boundary showed higher degradation including increased weed encroachment. Chinee Apple (*Ziziphus mauritiana*) and Rubber Vine (*Cryptostegia grandiflora*) in these areas was much more prevalent and dominated low-level strata in some areas. Groundcover was over 90% at all habitat assessment sites, with less than 10% native groundcover in the majority of instances. Herbs dominated grasses, although some grasses were present. Grass species present were dominated by Chloris sp, although some native Eragrostis sp, Panicum sp, *Alloteropsis semialata* and *Heteropogon contortus* were present. The majority of the survey area has a dense weedy ground cover dominated by Stylo with minor grasses in the ground layer. Most habitat assessments recorded ground cover of 90% or more and dominated by herbaceous weeds. As shown above few preferred foraging grass species for Black-throated Finch were observed and they formed a very small proportion of the ground layer. Therefore, the survey area seems to be depauperate for preferred foraging species and offers very low-quality habitat. The subspecies is unlikely to be reliant on the limited and degraded foraging resources within the survey area. As such the Project is unlikely to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	As stated above, it is unlikely the road reserve supports a breeding population due to the limitations on key habitat factors present. Should any breeding individuals occur, they are likely to be close to the watercourses nearby and as such in retained areas of habitat. Pre-clearance surveys will identify any breeding places for this species, and should breeding sites be encountered, an exclusion zone will be placed around the nest until young have fledged consistent with the requirements of an approved Species Management Program under which the fauna spotter catcher(s) will be working.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The condition of potential foraging habitat throughout the road reserve is low. The road reserve has been subject to a history of clearing, grazing and weed invasion. Higher quality vegetation areas to the north of the road reserve in the Woodstock and Lake Ross areas provide better quality habitat for the subspecies and the majority of records are from 2 km and further north of the road reserve. The subspecies is unlikely to be reliant on the limited and degraded foraging resources within the road reserve. However, conservatively due to the road reserve being within the mapped Important Areas for the subspecies (which are based on a 5 km buffer around known records) the subspecies is assumed to occur on a sporadic basis. Biomass reduction (for example mowing, slashing, fire etc.) will be avoided during the early wet season resource bottleneck if practicable and safe to do so (eg unless required for firebreak maintenance etc). Therefore the impacts to potential black-throated finch habitat are considered unlikely to contribute to the decline of the species.

Table 9.5 Significant impact assessment – Black-throated Finch

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	**Response**
Result in invasive species that are harmful to a critically endangered species or endangered species becoming established in the endangered or critically endangered species' habitat	Degradation of habitat from invasive weeds and predation by feral predators such as cats are threats to the subspecies. The Project has the potential to facilitate the spread of weeds and pest fauna through machinery, vehicles and materials being bought in from outside the road reserve although the road reserve is already subject to extensive weed and pest impacts. Weed and pest control measures as outlined in Section 9.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape. The Project through clearing of vegetation, has the potential to increase light and open up areas which may then increase weed invasion. Weeds such as Hyptis and Rubber Vine have the potential to reduce the quality of habitat for this species, although the road reserve is already subject to extensive weed infestation. Hygiene protocols in the operational areas will be implemented to reduce any weeds or disease being introduced to the site or spread from the site. Therefore the action is considered unlikely to result in invasive species that are harmful to the species becoming established.
Introduce disease that may cause the species to decline	Disease is not a known threat to the subspecies. The Project is unlikely to introduce diseases that cause the subspecies to decline.
Interfere with the recovery of the species	The *National Recovery Plan for the Black-throated Finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW)* and *Queensland Parks and Wildlife Service, 2007)* lists the following main objectives for the subspecies' recovery: • Investigate breeding requirements • Investigate feeding and other habitat requirements • Document sightings • Develop standard survey guidelines • Undertake mapping and habitat modelling • Undertake targeted surveys • Secure selected sites for conservation • Address threats on grazing lands • Monitor management effectiveness • Investigate development of other statutory planning instruments to minimise impacts of development on black-throated finch • Determine suitability of birds currently in captivity for reintroduction Project • Increase public awareness. The project is unlikely to interfere with any of these actions which support the recovery of the species.
Additionally, the following thresholds have been listed in the Significant impact guidelines for the endangered Black-throated finch (southern) (*Poephila cincta cincta*) - EPBC Act policy statement 3.13 (DEWHA, 2009), and are assessed for applicability against the Project below. The character and quality of the habitat may be significantly diminished if an action results in:	
Net loss or degradation of water sources (either permanent or seasonal) in the locality	The Project will not involve creation of new water sources outside of artificial waterbodies within the Project footprint, and there are no water sources in the road reserve.

Table 9.5 Significant impact assessment – Black-throated Finch

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Response
Widespread or indiscriminate loss of trees, including known nesting trees within one km of a water source	The clearing for the road reserve is narrow and linear and falls within an existing road reserve which is currently used as a farm track (eg Photograph 6.1), albeit overgrown by grasses and weedy shrubs (eg Chinee Apple) in places. The habitat is degraded (eg Photograph 6.3) and the loss of this narrow strip is not considered to be a significant impact to the species. The ability of the species to continue to use the surrounding habitats is maintained (extensive areas of open grassy woodland are present either side of the road reserve).
A decrease in tree recruitment capacity which limits the area's ability to be self-sustaining	The road reserve has been subject to clearing activities since at least the 1960s and 1970s and as such, the recruitment capacity of the road reserve was already heavily compromised. Currently, habitat on the road reserve is largely unsuitable for the species with high levels of weed infestation in particular.
The degradation of foraging habitat (grassland) where known black-throated finch (southern) records exist, including the intensification of biomass reduction or stocking rates	Project maintenance and rehabilitation activities will have consideration for the requirements of Black-throated Finch in regard to vegetation control, including fire breaks.

Table 9.5 Significant impact assessment – Black-throated Finch

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Response
Conclusion	The Project footprint will result in the loss of 3.37 ha of potential habitat. This comprises low quality potential breeding and foraging habitat. As stated above the quality of this habitat is low, and not likely to be heavily utilised by Black-throated Finch within this area, and to date there are no records from the road reserve. Higher quality vegetation areas to the north of the road reserve in the Woodstock and Lake Ross areas provide better quality habitat for the subspecies and the majority of records are from 2 km and further north of the road reserve. The subspecies is unlikely to be reliant on the limited and degraded foraging resources within the road reserve. However, conservatively due to the road reserve being within the mapped Important Areas for the subspecies (which are based on a 5 km buffer around known records) the subspecies is assumed to occur on a sporadic basis. More favoured habitats are located within riparian corridors which support some habitat features although as noted above habitat quality on the road reserve is compromised by high weed cover and is considered low quality. As such, the road reserve is not likely to be heavily utilised by Black-throated Finch within the region. This report has mapped habitat consistent with the species profile on SPRAT database, Significant impact guidelines for the endangered Black-throated Finch (southern) (DEWHA, 2009) and The National Recovery Plan for the Black-throated Finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007). Based on habitat assessments carried out in July 2021 (see Appendix H) the density of ground cover rarely fell below 90% with ground cover almost exclusively made up of herbaceous weeds and invasive grasses and as such the habitat was considered low value, albeit mapped conservatively. There are no records within the road reserve, and no database records south of the road reserve, and the road reserve is on the margins of the core range to the north. Although the position on the species indicated in communication with DAWE is that all suitable habitat in the Townsville region is important, and presence can be assumed if habitat is suitable and there are nearby records, the clearing is narrow and linear and falls within an existing road reserve which is currently used as a farm track (eg Photograph 6.1), albeit overgrown by grasses and weedy shrubs (eg Chinee Apple) in places. However the habitat on site is degraded (eg Photograph 6.3) and the loss of this narrow strip is not considered to be a significant impact to the species. The ability of the species to continue to use the surrounding habitats is maintained (for example the species regularly forages along roadsides on seeding grasses in the Woodstock area). Farm dams adjacent to the survey area providing a drinking resource are avoided and maintained.

9.4 Bare-rumped Sheathtail Bat

9.4.1 Relevant Departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66889;

- Conservation Advice *Saccolaimus saccolaimus nudicluniatus* (TSSC 2016a);
- National recovery plan for the Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus nudicluniatus* (Schulz and Thomson, 2007); and
- Threatened Species of the Northern Territory Bare-rumped Sheathtail Bat *Saccolaimus saccolaimus* (Milne and Woinarski, 2006).

There is no Listing Advice in place for this species.

9.4.2 Ecology, habitat, distribution

A large, high-flying bat that is rarely caught in harp traps and forages above the canopy. Its echolocation call is hard to distinguish from other freetail bat species (TSSC 2016a) therefore it is potentially under-recorded. Full spectrum echolocation recordings in recent years have led to an increase in records. As previously discussed, this includes multiple records in the Townsville region from various infrastructure projects (GHD, 2005; AECOM, 2012; RPS, 2013; DTMR, 2018; EcoSM, 2017; AECOM, 2019).

The species is mostly recorded in eucalypt forests and woodlands in near-coastal areas and is also known to be associated with coastal lowland rainforest (eg Iron Range on Cape York). Surveys of caves in Queensland and the Northern Territory (Schulz and Thomson, 2007) have failed to record the species and all roosts have been found in deep tree hollows of Poplar Gum, Darwin Woolybutt (*Eucalyptus miniata*), Darwin Stringybark (*E. tetrodonta*) and Weeping Paperbark (*Melaleuca leucadendra*) (TSSC 2016a). Hollows in these trees have also been used for maternity roosts. South of Townsville at Jerona Fauna Sanctuary, individuals were recorded roosting in Poplar Gums that were cleared. Trees were typical stunted forms, with pipes 18-29 cm in diameter in the trunks, with an entrance approximately 7 m above ground level. Anecdotal evidence suggests the species occurs at low densities with intensive inspections of potential roosts in some areas (eg Iron Range) failing to detect evidence of occurrence.

The species forages for insects high above the canopy and has been observed over gallery forest and melaleuca swamps. Little information is available on foraging habitat due to the lack of direct observations, but habitat adjacent to roosting locations in the Townsville region has included Poplar Gum woodland on alluvial plains. At Iron Range roosts were located in Darwin Stringybark woodland adjacent to gallery forest and nearby rainforest. No information is available on foraging habitat shifts between the dry and wet seasons (Schulz and Thomson, 2007).

There are two distinct populations in Australia although the taxonomic status of these populations is uncertain. North-eastern Australian populations in Queensland are referred to as *S.s.nudicluniatus*, although it is not clear whether this should apply to the Northern Territory population (Duncan et al, 1999). There are very few confirmed records in the Northern Territory but McKean et al (1981) asserted it was likely to be widespread in the north. However, there have been few records since despite substantial survey effort. Northern Territory individuals appear to be slightly larger and darker than Queensland specimens. However, both populations are treated as *S.s.nudicluniatus* under the EPBC Act and that one taxon occurs in Australia.

In Queensland, the species is known to occur from Ayr to the Iron Range with most records being near-coastal (TSSC 2016a). Extralimital occurrence is from Solomon Islands to India including New Guinea (Churchill, 2008) and has the largest known distribution of any bat occurring in Australia (Schulz and Thomson, 2007).

9.4.3 Important populations

DAWE does not specify what constitutes an important population for Bare-rumped Sheathtail Bat. As such, the *EPBC Act Significant Impact Guidelines 1.1* (DoE 2013) are used, which define an important population of a 'vulnerable' species as being populations that are:

- key source populations either for breeding or dispersal;
- necessary for maintaining genetic diversity; and/or
- near the limit of the species range.

There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species. The road reserve is located near the edge of the species' range with known records south to Ayr (just south of Townsville) and as such any occurrence on site may be considered an important population.

9.4.4 Threats to the species

Although poorly known, potential threats to the species listed in the Conservation Advice (TSSC 2016a) include:

- habitat loss and fragmentation;
- competition for tree hollows by birds (native and non-native) and bees; and
- too frequent burning particularly with potential impacts on availability of roosting trees.

Additionally, disease is cited as a possible threat given similar species are known to carry the Australian Bat Lyssavirus.

9.4.5 Distribution within the road reserve and habitat mapping

During July 2021, this species was recorded in two Anabat locations sampled within the Survey area with 1-2 calls per detector night. The species is likely to forage across the entire Survey area and roost in deep tree hollows. Hollow bearing trees in the road reserve have the potential to shelter roosting individuals, although only two suitable trees were noted.

The road reserve contains 3.37 ha of suitable habitat for Bare-rumped Sheathtail Bat, of which less than 0.01 ha is potential roosting habitat (one suitable hollow bearing tree present).

9.4.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to Bare-rumped Sheathtail Bat from the Project are described in Table 9.6.

Table 9.6 Potential impacts on Bare-rumped Sheathtail Bat

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	Potential roosting habitats are located within Eucalypt woodland which support preferred roosting tree species including Poplar Gum. Less than 0.01 ha (one potentially suitable tree) of potential roosting habitat will be cleared for construction. Additionally, up to 2.47 ha of Bare-rumped Sheathtail Bat foraging habitat within vegetated areas will be cleared for construction.	The Project will have no impact on riparian vegetation and the majority of remnant areas in the vicinity will be avoided. Any clearing of potential Bare-rumped Sheathtail Bat habitat (roosting) will occur sequentially and further details on sequential clearing and use of fauna spotter-catchers during clearing are outlined in Section 8. This will include checking potential hollow bearing tree roost sites for this species. The whole road reserve is mapped as potential foraging habitat for the species and based on other records in the region (eg Majors Creek) the study area is considered to comprise foraging habitat.
Species mortality	Potential roosting habitat is likely to where suitable hollow bearing trees are present – only one potentially suitable tree was identified in the survey.	Any clearing of potential Bare-rumped Sheathtail Bat habitat (roosting) will occur sequentially and further details on sequential clearing and use of fauna spotter-catchers during clearing are outlined in Section 8. This will include checking potential hollow bearing tree roost sites for this species.
Indirect and facilitated impacts		
Fragmentation	Potential roosting habitats are located within riparian corridors which support preferred roosting tree species including Poplar Gum. Less than 0.01 ha (one potentially suitable tree) of potential roosting habitat will be cleared for construction. Additionally, up to 2.47 ha of Bare-rumped Sheathtail Bat foraging habitat within vegetated areas will be cleared for construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated. Bushfire has been identified as a risk to retention of suitable hollow bearing tree roost sites for this species.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services. Bushfire buffers consistent with state requirements have been incorporated into the Project design and are based on vegetation height around built infrastructure (other than roads).

Table 9.6 Potential impacts on Bare-rumped Sheathtail Bat

Potential construction impacts	Discussion	Proposed mitigation
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this species habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Erosion and water quality	Bare-rumped Sheathtail Bat is unlikely to be directly impacted by impacts from erosion and reduced water quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Noise and lighting	Bare-rumped Sheathtail Bat is unlikely to be impacted noise and lighting resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Reduced air quality	Bare-rumped Sheathtail Bat is unlikely to be impacted by impacts from reduced air quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Weeds and pests	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from Project construction. The potential for weeds to impact on the quality of foraging habitat is low.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.4.7 Significant impact assessment

The MNES significant impact assessment for Bare-rumped Sheathtail Bat using the Significant Impact Guidelines (DoE 2013) is summarised below in Table 9.7.

Table 9.7 Significant impact assessment – Bare-rumped Sheathtail Bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Lead to a long-term decrease in size of an important population	There is potential for an important population in the study area or road reserve, as the species is close to the edge of its known range at the road reserve, occurring south to Ayr. Potential roosting habitats are predominantly located within riparian corridors, which the road reserve avoids. Mitigation measures will be adopted, including staging of clearing and checking of any potential roost trees to be cleared. The species will still be able to forage across the road reserve. The area will be cleared and developed so foraging opportunities are likely to be reduced although as a high-flying species it could still occur above the development foraging on insects attracted by site lighting. It is likely that foraging habitat occurs widely throughout the study area and region, as the species was even recorded on the road reserve feeding over cleared paddocks. Connectivity to these areas will be maintained. The Project is unlikely to lead to a long-term decrease in an important population.
Reduce the area of occupancy of an important population	There is potential for an important population in the study area or road reserve, as the species is close to the edge of its known range at the road reserve, occurring south to Ayr. The Project footprint will result in the loss of 3.37 ha of potential foraging habitat (including less than 0.01 ha of potential roosting habitat – one potentially suitable tree). Potential roosting habitats in the region are largely located within riparian corridors, of which the road reserve avoids. There are multiple records of Bare-rumped Sheathtail Bat across the site from a number of Anabat devices during ecological surveys. The loss of foraging habitat is unlikely to be significant given the extensive areas of retained habitat, and the species may still forage over the road reserve during operation. Any potential for SRI would relate to clearing of potential roosting habitat, although at this stage no known roosts have been identified. It has conservatively been assumed that areas with suitable HBT may provide roosting habitat and as such these areas have been mapped. Based on known preferences of other tree roosting bats (which typically have multiple roosts), it is likely that if the species roosts in this area, it will also use other day roosts in nearby areas of vegetation along Lansdowne Creek or the property to the north and move regularly between them. Large areas of roosting habitat are avoided by the development, and suitable hollow bearing trees to be cleared that are potential roost sites for Bare-rumped Sheathtail Bat will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season which is when maternal roosting is suspected to occur. Due to the avoidance of the main areas of potential roosting habitat and through mitigation measures to be put in place, including staging of clearing and checking of any potential roost trees to be cleared, the Project is not expected to reduce the area of occupancy of an important population. The species will still be able to forage across the survey area and roosting habitat across the survey area is likely to be largely restricted to creek line vegetation which will be avoided.

Table 9.7 Significant impact assessment – Bare-rumped Sheathtail Bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Fragment an existing important population into two or more populations	Across its global range, the Bare-rumped Sheathtail Bat is considered to be tolerant of some level of disturbance (Csorba et al., 2008). There is potential for an important population in the study area or road reserve, as the species is close to the edge of its known range at the road reserve, occurring south to Ayr. The road reserve is already heavily fragmented as a result of historical and more contemporary clearing for agriculture, predominantly grazing. The Project does not impact on the regionally significant riparian corridor associated with Lansdowne Creek. Vegetation clearance will not impede the movement of any Bare-rumped Sheathtail Bat present in the road reserve. It is unlikely the potentially important population is restricted to the road reserve given the occurrence of similar continuous open woodland habitat adjoining the road reserve, and widespread detections on Anabat recorders in the region (GHD, 2005; AECOM, 2012; RPS, 2013; DTMR, 2018; EcoSM, 2017; AECOM, 2019). The species has been recorded on a number of other projects in the region in recent years. Areas of continuous similar habitat exist around the periphery of the road reserve outside any likely zone of disturbance, which could be utilised by the species. The Project is unlikely to fragment an existing important population.
Adversely affect habitat critical to the survival of a species	Critical habitat for this species has not been defined (TSSC 2016a; Schulz and Thomson, 2007). Little is known about roosting and foraging habitat, although habitat in the road reserve appears to be consistent with that of other records in the Townsville region, namely Poplar Gum woodland and to a lesser degree, Melaleuca woodland. Large areas of eucalypt woodlands are being retained on the boundaries of the road reserve adjacent to higher quality habitat present in the riparian corridors. The majority of habitat in the road reserve has lower potential to be utilised by Bare-rumped Sheathtail Bat being dominated by weeds and with little woody vegetation, although the species has been found to be likely to forage across the whole site with Anabat devices at two separate locations recording definitive or likely calls of the species over both seasons of sampling. It is unlikely weedy, cleared areas in the centre of the road reserve will provide significant foraging opportunities, although the species will still be able to transit these areas between retained patches of woodland. Additionally, the lights of the facility may provide a foraging resource in attracting insects. As such the Project is unlikely to adversely affect habitat critical to the survival of the species.

Table 9.7 Significant impact assessment – Bare-rumped Sheathtail Bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Disrupt the breeding cycle of an important population	One young is born during the wet season however the exact periods of breeding are unknown (Hall 1995, Schulz and Thomson, 2007). Project activities are not expected to disrupt the breeding cycle of an important population. Areas of habitat will be retained outside the road reserve and immediate surrounds, including areas of higher quality potential habitat in riparian areas, and movement corridors will be retained. The road reserve contains only two suitable roosting trees, so the removal of this habitat is unlikely to disrupt the breeding cycle of an important population. Fauna spotter-catchers will be present to identify if Bare-rumped Sheathtail Bat are present during the clearing process and ensure they are not harmed during as works progress (eg through felling of trees or movement of machinery). This will include protocols for roost searches prior to clearing and relocation if necessary. Clearing of woodland in the road reserve will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan. This will include requirements for soft felling of hollow bearing trees. Suitable hollow bearing trees to be cleared will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season when maternal roosting is suspected to occur.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project footprint will result in the loss of less than 0.01 ha of potential roosting habitat and 2.47 ha of vegetated foraging habitat. Indirect impacts may occur to Bare-rumped Sheathtail Bat from the Project as a result of opening up further areas an increase in weeds to adjacent bushland. Vegetation that is retained in the road reserve will be actively managed for weeds and pest animals to assist in maintaining retained habitat in its current ecological condition.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Project through clearing of vegetation, has the potential to increase light and open up areas which may then increase weed invasion and numbers of pest animals to adjacent retained areas of potential habitat. However, the road reserve is already subject to extensive weed infestation and pest fauna presence. Hygiene protocols in the operational areas will also be implemented to reduce any weeds or disease being introduced to the site or spread from the site. Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species habitat.
Introduce disease that may cause the species to decline	No diseases have been recorded in this species in Australia. Disease is cited as a possible threat given similar species are known to carry the Australian Bat Lyssavirus (Schulz and Thomson, 2007). It has been recorded in other sheathtail species and may also occur in the Bare-rumped Sheathtail Bat. The Project is unlikely to introduce diseases that cause the species to decline. Hygiene protocols will be implemented to ensure soil borne disease which may impact on foraging habitat, is not introduced or spread.

Table 9.7 Significant impact assessment – Bare-rumped Sheathtail Bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Interfere substantially with the recovery of the species	The specific objectives of this recovery plan have been adapted from Coles *et al.* (1999) in Woinarski and Milne (2006) and are summarised below along with applicability to the proposed action: • **developing more effective detection techniques and undertaking systematic surveys to enable a more effective assessment of distribution, population size, status and habitat preferences –** not applicable to the action • **increasing protection of known roosts both on and outside reserved lands** – applicable to the action, it is noted that there are no confirmed roosts in the site. Only one potentially suitable tree is present. • **determining the roosting and foraging requirements of the species, including seasonal and distributional differences –** not applicable to the action • **identifying of threatening processes –** not applicable to the action • **establishing monitoring sites to investigate population trends in the species –** not applicable to the action • **further clarifying the taxonomic status of the species –** not applicable to the action. Given the relatively minor extent of clearing involved in relation to retained habitat in the region, any potential impact on Bare-rumped Sheathtail Bat habitat will be minor. Only one potential roost tree was identified, and it was considered unlikely to form a roost (despite being of sufficient size for roosting microbats) due to the exposed nature of its location in direct sun. Nonetheless, clearing of potential roosting habitat will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan. This will include requirements for soft felling of hollow bearing trees. Suitable hollow bearing trees to be cleared will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season when maternal roosting is suspected to occur.
Conclusion	Although the species was widely recorded foraging across the road reserve on Anabat detectors, the clearance of this foraging habitat in the context of the available habitat surrounding the road reserve is minimal. Potential roosting habitat is largely avoided by the footprint, with only one potentially suitable tree identified in the road reserve. Clearing in this area will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan. Potential impacts to large areas of foraging habitat does not conflict with the recovery objectives for the species, and foraging habitat is extensive in the region and within retained areas of the road reserve. It is likely that the species will continue to be able to forage over the road reserve during construction and operation. Therefore there is unlikely to be a significant residual impact on this species.

9.5 White-throated Needletail

9.5.1 Relevant Departmental documents

The following documents were co in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682;
- Conservation Advice *Hirundapus caudacutus* White-throated Needletail (TSSC 2019a); and
- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015a).

There is no Listing Advice or adopted or made Recovery Plan in place for this species.

9.5.2 Ecology, habitat, distribution

In Australia, the White-throated Needletail is almost exclusively aerial, occurring from heights of less than 1 m up to more than 1,000 m above the ground. The species is capable of ascending to altitudes of over 3,000 m (Tarburton 2014).

White-throated Needletail are predominantly aerial, and although they occur over most types of habitat including cleared areas, are recorded most often above wooded areas (DAWE 2021b). The species has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows (Corben et al. 1982).

The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, favouring eastern and south-eastern areas of the country and moving further south as the summer progresses (DAWE 2021b).

The White-throated Needletail is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of QLD and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE 2021b).

9.5.3 Important populations

DAWE does not specify what constitutes an important population for White-throated Needletail. As such, the *EPBC Act Significant Impact Guidelines 1.1* (DoE 2013) are used, which define an important population of a 'vulnerable' species as being populations that are:

- key source populations either for breeding or dispersal;
- necessary for maintaining genetic diversity; and/or
- near the limit of the species range.

The species occurs widely across eastern Australia, although does not breed in the country. The road reserve is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species.

9.5.4 Threats to the species

There are no significant threats to White-throated Needletail in Australia. Deforestation may contribute to a decline in roosting habitat and/or food availability (Tarburton 2009). Individuals occasionally collide with wind turbines, overhead wires, windows and lighthouses (DAWE 2021b).

No recovery or threat abatement plans are in place for this species. The Commonwealth's Approved Conservation Advice for White-throated Needletail (TSSC 2019a) lists the following priority conservation actions:

- Work with governments in East Asia to minimise destruction of breeding habitat.
- Identify and protect important habitats in Australia.
- Enhance existing monitoring programs.
- Improve knowledge of potential threatening processes such as wind turbines and overhead wires.

9.5.5 Distribution within the road reserve and habitat mapping

Multiple records of this species occur within the study area. Although the species was not recorded during field surveys, it is considered likely to occur.

No habitat map has been prepared for this species as it is an aerial insectivore that spends most of its time aloft, and could occur anywhere over the road reserve, therefore the whole road reserve is considered potential foraging habitat.

The species does not breed in Australia, and as a wide-ranging nomadic species, foraging habitat also provides a surrogate for dispersal habitat.

There is some potential for roosting habitat in the road reserve although any mature woodland could provide potential roosting habitat. It is thought that the number of references to Needletails roosting in trees possibly over-emphasizes such occurrences (DAWE 2021b). Potential roosting habitat is likely to be restricted to Lansdowne Creek which is outside the Project footprint.

9.5.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to White-throated Needletail from the Project are described below in Table 9.8.

Table 9.8 Potential impacts on White-throated Needletail

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	As White-throated Needletail is almost exclusively aerial, direct impacts from clearance of their habitat are not expected to occur as a result of Project construction. White-throated Needletail frequently forage over cleared or urban landscapes and the Project is unlikely to impact on their foraging resources during construction.	No additional mitigation beyond the general measures presented in Section 8 is required.

Table 9.8 Potential impacts on White-throated Needletail

Potential construction impacts	Discussion	Proposed mitigation
Species mortality	The potential for species mortality during construction of the Project is low. White-throated Needletail is a high-flying species and unlikely to interact with Project vehicles.	No additional mitigation beyond the general measures presented in Section 8 is required.
Indirect and facilitated impacts		
Fragmentation	As swifts are almost exclusively aerial, impacts from fragmentation of their habitat are not expected to occur as a result of Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this species habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Erosion and water quality	White-throated Needletail is unlikely to be directly impacted by impacts from erosion and reduced water quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Noise and lighting	White-throated Needletail is unlikely to be impacted noise and lighting resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 9 is required.
Reduced air quality	White-throated Needletail is unlikely to be impacted by impacts from reduced air quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Weeds and pests	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from Project construction. Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of roosting individuals being taken by cats, the frequency of such events is likely to be low. The potential for weeds to impact on the quality of foraging habitat is low.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.5.7 Significant impact assessment

The MNES significant impact assessment for White-throated Needletail using the Significant Impact Guidelines (DoE 2013) is summarised in Table 9.9.

Table 9.9 Significant impact assessment – White-throated Needletail

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Lead to a long-term decrease in size of an important population	White-throated Needletail is a non-breeding visitor to Australia arriving in October and departing by April. Numbers fluctuate on an annual basis and the species is widespread across the east coast, moving in response to foraging and weather conditions. The species migrates down the Great Dividing Range, and the road reserve is a small component of this broader area. White-throated Needletail is an aerial insectivore that spends most of its time aloft, and could occur anywhere over the road reserve, therefore the whole road reserve is considered potential foraging habitat. As White-throated Needletail are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of vegetation clearance for the Project. There is limited potential the species could roost in an area of woodland across the road reserve, although this use will be sporadic, temporary and across a broad area (ie not involving regular or repeated roost sites). Following the draft referral guidelines for migratory species under the EPBC Act (DoE 2015a) an ecologically significant proportion of the population of White-throated Needletail is estimated to be 10 birds (0.1% of the total population using the lower population estimate of 10,000 birds). As White-throated Needletail arrive and disperse over a broad front across northern and eastern Australia, it is not expected that the number of birds using the road reserve will place an ecologically significant proportion of the population at risk. Further, the mechanisms for the Project to impact on this species are absent.
Reduce the area of occupancy of an important population	The Project will not result in clearing of breeding habitats for the species, as they do not breed in Australia. The species roosts in dense forest canopies or occasionally on rock faces. Large tracts of vegetation will be retained surrounding the road reserve and loss of roosting habitat for such a widespread and mobile species will be negligible. Foraging habitat will be maintained above the road reserve. The impact arising from the Project will not result in a detectable decrease in the area of occupancy for an important population.
Fragment an existing important population into two or more populations	The species is almost exclusively aerial in Australia across a wide range of habitats. It is not expected that the Project will fragment the habitat for this species. The species regularly forages up to 1,000 m ASL.
Adversely affect habitat critical to the survival of a species	Important habitat for the species is broad as it is found over a range of habitats, but more often over wooded areas where it is almost exclusively aerial (DoE, 2015). The species does not breed in Australia so there is no impact on breeding habitat. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. As described above, as White-throated Needletail are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project. White-throated Needletail arrive and disperse over a broad front across northern and eastern Australia, moving down the Great Dividing Range on migration, and the road reserve is a small proportion of this migratory corridor.
Disrupt the breeding cycle of an important population	This species does not breed in Australia; therefore, the Project will not disrupt the breeding cycle of the White-throated Needletail.

Table 9.9 Significant impact assessment – White-throated Needletail

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Response
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Important habitat for the species is broad as it is found over a range of habitats, but more often over wooded areas where it is almost exclusively aerial (DoE, 2015). The species does not breed in Australia so there is no impact on breeding habitat. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although some vegetation clearing will occur during Project construction, there are extensive areas of retained vegetation surrounding the road reserve, and cleared habitats are still utilised by the species. The majority of the road reserve will remain as suitable foraging and roosting habitat for the species. As described above, as White-throated Needletail are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of roosting individuals being taken by cats, the frequency of such events is likely to be small. The potential for weeds to impact on the quality of foraging habitat is low. Nonetheless, weeds will be identified during preclearance surveys. Hygiene protocols, such as wash-down facilities, will also be put in place to ensure weeds are not brought in with vehicles or machinery.
Introduce disease that may cause the species to decline	This species is not known to be threatened by disease. The Project is unlikely to introduce diseases that cause the species to decline.
Interfere substantially with the recovery of the species	There is no State or Commonwealth recovery plan for this species. The Approved Conservation Advice for White-throated Needletail (TSSC 2019a) outlines conservation actions intended to aid the recovery of the species (identification of important habitat in Australia, improve knowledge of threatening processes and quantify levels of organochlorines in individuals and prey species). Given the relatively minor extent of clearing involved in relation to retained habitat in the region, and the large distances covered by this species, any potential impact on White-throated Needletail habitat will be minor and is considered unlikely to interfere with the recovery of the species or any of the actions outlined in the Approved Conservation Advice.
Conclusion	The Project is not expected to have a significant residual impact on White-throated Needletail.

9.6 Koala

Although the likelihood of Koala occurring on the road reserve was assessed as potential (but not likely) and the assessment of habitat in Section 6.2.2 determined that critical habitat for the species is not present, conservatively a significant residual impact assessment has been prepared. On 12 February 2022 the Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) was listed as endangered. Following this listing event, the 'EPBC Act referral guidelines for the vulnerable koala' and associated policy documents are no longer current. Therefore, the Significant Impact Guidelines 1.1 have been utilised in determining whether a significant impact on koala is likely.

9.6.1 Relevant Departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=85104;

- Matters of National Environmental Significance Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (DoE 2013);
- Conservation Advice for *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (the Koala Conservation Advice, DAWE 2022);
- Commonwealth Listing Advice for *Phascolarctos cinereus* (Koala) (TSSC 2012b); and
- Adams-Hosking, C, Grantham, H, Rhodes, J, McAlpine, C, & Moss, P (2011). Modelling climate-change-induced shifts in the distribution of the koala. *Wildlife Research* 38, 122-130.

There is no Recovery Plan or Threat Abatement Plan in place for this species.

No formal Queensland or Federal survey guidelines exist for Koala, although survey effort principles within the now superseded EPBC Referral Guidelines for the vulnerable Koala were referenced.

9.6.2 Ecology, habitat, distribution

Koala food trees typically consist of species from *Eucalyptus*, *Corymbia* and *Angophora* genera. Any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees, within the known distribution of the species is considered potential Koala habitat.

During the breeding season, males will attempt to establish dominance over the home ranges of a number of females, and on average, male Koalas usually have larger home ranges than females (DAWE 2021f).

Female Koalas can potentially produce one offspring each year, with births occurring between October and May. Young Koalas are independent from about 12 months of age. The generation length of Koalas has been estimated at six years however, longevity in the wild is more than 15 years for females and more than 12 years for males (DAWE 2021f).

Koalas occur throughout north-east, central and southeast Queensland, extending south through Victoria into South Australia. The density of Koalas is generally higher towards the coast (DAWE 2021f).

Home range sizes are variable, with those in poorer habitats being larger than in higher quality habitats. Home ranges overlap although the species is generally solitary. Koalas generally move little under most conditions, however longer movements through dispersing individuals (mostly young males) are recorded, with movements of several kilometres over land with little vegetation reported (DAWE 2021f).

Forecasting models predict that under 2070 climate projections, Koala distributions will contract to the south and east as heat stressors (summer temperatures, water availability and humidity) render areas of habitat unsuitable for the species (Adams-Hosking et al. 2011). Habitat critical to the survival of the species has not been specifically identified in the Koala Conservation Advice, however this habitat for a species, generally is defined as areas that the species relies on to avoid or halt decline and promote recovery of the species.

An assessment of potential Koala habitat in the survey area following the no longer current '*referral guidelines for the vulnerable Koala'* (DoE 2014) under the EPBC Act is summarised in Table 9.10. The criteria assessed still form a useful summary of the value of habitat to be assessed.

Habitat mapping criteria is provided in Section 6.4.

Table 9.10 Critical habitat assessment

Attribute	Score (coastal)	Status within survey area
Koala occurrence	+2 (high) – evidence of one or more Koalas in the last 2 years +1 (medium) – evidence of one or more Koalas within 2 km of the edge of the impact area within the last 5 years 0 (low) – none of the above	No sightings of scat, scratches or the Koala itself were recorded in the survey area. Database searches (ALA and Biomaps) found no Koala records within 20 km of the survey area. The closest record is from Mingela in 1987 and approximately 35 km to the southwest although there is another record from Townsville approximately 35 km to the north from 2018. **Therefore, the survey area scores +0 for this attribute.**
Vegetation composition	+2 (high) – Has forest or woodland with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata. +1 (medium) – Has forest or woodland with only 1 species of known koala food tree present 0 (low) – none of the above	The majority of vegetation communities in the survey area are dominated by *Eucalyptus* and species that form food trees for the species. However, high quality habitat (ie River Red Gum dominated riparian woodland) is not present within the survey area as no riverine habitat is present. Eucalypt species within the survey area (including *E. crebra* and *E. platyphylla*) are not primary feed for Koala (although *E.platyphylla* is favoured in the regional context) but are still considered food trees. **The survey area scores +2 for this attribute** due to presence of two or more *Eucalyptus*, *Corymbia*, *Lophostemon*, and *Melaleuca* species.
Habitat connectivity	+2 (high) – area is part of a contiguous landscape ≥ 500 ha. +1 (medium) – area is part of a contiguous landscape < 500 ha, but ≥ 300 ha. 0 (low) – none of the above	The survey area is mostly cleared however areas of vegetation fringing the east, north and west area a part of a contiguous landscape greater than 500 ha, albeit the vegetation is sparse. **The survey area scores +2 for this attribute**.
Key existing threats	+2 (high) – little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present +1 (medium) – evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, OR Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present. 0 (low) – evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, OR Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	There were no signs of Koalas during surveys and no desktop Koala records within 20 km of the survey area. If Koalas are present within the survey area, there is a significant risk of vehicle strike as a major highway and side roads are adjacent. Additionally, Wild Dog are a significant threat around the region and have been observed on site (SHG, 2020). **The survey area therefore scores +0 for this attribute.**

Table 9.10 Critical habitat assessment

Attribute	Score (coastal)	Status within survey area
Recovery value	+2 (high) – habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	Low quality Koala habitat was observed along in the Eucalypt woodland across the survey area. Eucalypt woodlands in the survey area are dominated by secondary or tertiary species such as Poplar Gum and Narrow-leaved Ironbark. These communities are not the dominant vegetation across the survey area as 2/3 of the survey area has been ground-truthed as non-remnant. The survey area does not form a part of a corridor as a highway and cultivated/cleared land fragment the vegetation. The survey area is unlikely to be important in achieving interim recovery objectives. **The** survey area **therefore scores +0 for this attribute.**
	+1 (medium) – uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	
	0 (low) - habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the guidelines.	
Total score	A total score of four **(4)** has been recorded using the criteria above. A habitat score of 5 or greater is the trigger at which a site may be considered as 'critical habitat' and a score of 8 triggers the requirement of a referral. No Koalas or secondary signs, such as scat or scratches, were identified during surveys across the survey area and no Koalas were identified within 10km during desktop assessments. Koala habitat is very limited in the survey area. The scarcity of records within the study area is potentially indicative of the low-quality habitat in the area, however a conservative approach has been taken in addressing the above criteria for the same reason.	

Although the habitat in the survey area scores four (4), the guidelines provide further points to consider when assessing the potential impact of an action.

These points are discussed in the context of the survey area below:

- The score calculated for the impact area (higher score = greater risk of significant impact) – Koala habitat scored 4 out of 10. Koalas have been conservatively assessed with potential to occur due to presence of eucalypt woodlands however their habitat is recognised as limited on site and movement highly constrained due to abundance of weeds;

- Amount of Koala habitat being cleared (more habitat cleared = greater risk of significant impact) – based on the Project footprint it is estimated a total of 2.47 ha of potential habitat will be impacted;

- Method of clearing (eg clear-felling has greater risk of significant impact than selective felling with understorey and koala food tree retention) – vegetation clearing will be conducted in stages and sequentially to avoid and minimise impacts on Koalas. Clearing will be undertaken in the presence of a fauna spotter-catcher to ensure any Koalas present are not harmed during clearing process. If Koalas are observed, the tree and adjacent trees will not be cleared until the Koala has moved from the area of its own volition and safe passage from clearing area is maintained;

- The density or abundance of Koalas (relatively high density or abundance for the region means greater risk of significant impact) – no Koalas were observed during surveys. Based on there being no observed scratches and the paucity of records in the region, the species is considered likely to be restricted to riparian corridors if present. When they are present within the survey area, they are likely to be in very low densities and on a sporadic basis; and

- Level of fragmentation caused by the clearing (greater degree of fragmentation has greater risk of significant impact) (DoE 2014) – clearing will be limited to a narrow (20 m wide) area dominated by weedy groundcover with few mature trees. Large tracts of adjacent woodlands are being retained. Koalas will be able to move across or around these clearings into adjacent habitat. Vehicle movements will be very low and speed reduced due to topography therefore risk from vehicle strike is very low.

9.6.3 Important populations

Assessment of impacts to Koala are addressed within the *Conservation Advice for Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DAWE 2022b). Important populations are identified as:

- Genetically important populations;
- Climate sensitive populations; and
- Source populations for dispersal.

Within Queensland, genetically important populations occur north of the Clarence River Valley, which is over 1,000 km south of the study area. Climate-sensitive populations in Queensland are those at the western edge of their range. At the Survey area latitude, the western limit is approximately 200 km inland of the Survey area. Source populations are defined as climate-robust populations, large populations that exist in contiguous habitats, and populations that may link two larger populations.

9.6.4 Threats to the species

The threats to the Koala, as identified in the Koala Conservation Advice (DAWE 2022b) include:

- Climate change driven processes and drivers, including:
  - Loss of climatically suitable habitat;
  - Increased intensity / frequency of drought;
  - Increased intensity / frequency of heatwaves;
  - Increased intensity / frequency of bushfires; and
  - Declining nutritional value of foliage.
- Human related activities, including:
  - Clearing and degradation of koala habitat; and
  - Encounter mortality with vehicles and dogs.
- Disease and health.

No recovery or threat abatement plans are in place for this species. The Koala Conservation Advice lists six strategies containing 38 separate actions to assist the species' recovery. These strategies are:

- Strategy 1: Build and share knowledge;

- Strategy 2: Strong community engagement and partnerships;
- Strategy 3: Increase habitat protection;
- Strategy 4: Koala conservation is integrated into policy, and statutory and land-use plans;
- Strategy 5: Strategic habitat restoration; and
- Strategy 6: Active metapopulation management.

The proposed mitigation strategies and significant impact assessment for Koala has consideration for the threats and conservation strategies outlined in the Koala Conservation Advice.

9.6.5 Distribution within the road reserve and habitat mapping

This species has not been recorded within the road reserve or within the study area. It is generally scarce in the Townsville region with the exception of an introduced population on Magnetic Island.

Conservatively it is considered as having potential to occur on the road reserve despite there being no historical records, or evidence of presence (scratches or scats on or near habitat trees) during field surveys.

Up to 2.47 ha of potential habitat is to be cleared for the purpose of the road reserve. This habitat occurs within the mapped eucalypt woodland as shown in Figure 6.2. Areas outside of the woodland habitat are severely degraded with high density of weeds in parts. However, these areas have been mapped conservatively.

9.6.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to Koala from the Project are described in Table 9.11.

Table 9.11 Potential impacts on Koala

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	Potential habitat is predominantly located within riparian corridors outside of the road reserve, which support foraging tree species including *E. platyphylla, E.crebra* and *C. tessellaris*. Up to 2.47 ha of potential Koala habitat will be cleared for the road	Any clearing of potential Koala habitat will occur sequentially and further details on sequential clearing and use of fauna spotter-catchers during clearing are outlined in Section 8.

Table 9.11 Potential impacts on Koala

Potential construction impacts	Discussion	Proposed mitigation
Species mortality	This species is susceptible to vehicle strike. Increased vehicular presence on site is a risk to the species at the road reserve. Additionally, during vegetation clearance there is a potential for direct mortality of Koala if the species is present in vegetation due to be cleared.	Mitigation measures presented in Section 8 relating to vehicle speeds on site and restrictions around movement on site will reduce the risk of vehicle strike to Koala. Mitigation measures relating to vegetation clearance in potential Koala habitat are described below. Develop procedures for Koala pre-clearing inspections and safe relocation outside the clearing area should Koalas be recorded during clearing operations. Any clearing would take place in a way to allow Koalas (if present) to move into adjacent areas of retained vegetation. This will include setting clearing limits per day and allowing escape paths to retained vegetation to be maintained. If Koalas are encountered, they are to be left in-situ, works stop in the area, and wait for the animal to move to retained habitat. This will entail: a) Leaving a 30 m buffer of vegetation around the tree in which the Koala is located and a corridor of vegetation to retained habitat. b) Monitoring the Koala location and if the animal appears stressed. c) Allowing the Koala to relocate without assistance unless the animal is in immediate danger or is injured. Ongoing presence will be managed by the fauna spotter catcher under the Species Management Program.

Table 9.11 Potential impacts on Koala

Potential construction impacts	Discussion	Proposed mitigation
Indirect and facilitated impacts		
Fragmentation	Potential habitat is predominantly located within riparian corridors which support preferred foraging tree species including *E. platyphylla, E.crebra* and *C. tessellaris*. Up to 2.47 ha of potential Koala habitat will be cleared for the road. Vegetation clearance will not impede the movement of any Koalas present in the study area. The road reserve is largely cleared with a dense shrub and ground layer which would impede existing movements of the species. Land surrounding the road reserve is already heavily modified in particular the lot/plan to the south which is cleared of remnant vegetation. By retaining these corridors, it is unlikely that the Project will result in significant fragmentation impacts, as existing corridors are maintained, and existing movement across the road reserve is already heavily constrained by the cleared land and dense weed cover present in the centre of the road reserve.	A vegetation management plan will be prepared and include: • Control of access, interference or damage to vegetation unless approved by the Site Manager; vehicles and equipment are to remain on defined roads and designated areas. • Vegetation Clearing Plan – requiring the staged clearing of vegetation during construction. • Bushfire risk – banning the lighting of fires on site unless permitted by the Site Manager (eg welding, hot works under permit etc). • Weed species management – requiring all plant and equipment to be free of soil and weed seeds prior to entering the site; minimising the use of chemicals and fertilisers. • Limiting the disturbance of vegetation – flagging of buffer areas to prevent incursion into retained vegetation; No collection of timber or firewood from areas to be protected; retaining riparian vegetation. • Dust mitigation to reduce the impact to and functioning of vegetation buffering the road reserve, and on surrounding properties. • Revegetation and rehabilitation practices – salvaging topsoil for use in rehabilitation activities; revegetation or regeneration of areas that will not continue to be disturbed by site operations; revegetation with indigenous plant species.
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this species habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.

Table 9.11 Potential impacts on Koala

Potential construction impacts	Discussion	Proposed mitigation
Erosion and water quality	Koala is unlikely to be directly impacted by impacts from erosion and reduced water quality resulting from Project construction. During construction, there is potential for reduced water quality to impact on the health of the habitats in which this species occurs, unless adequately mitigated. Spills, increased erosion and sedimentation may all affect the quality of retained habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Erosion and sediment control measures will be put in place to ensure erosion and sediment runoff does not occur into sensitive environmental areas including watercourses.
Noise and lighting	Any Koala present adjacent to the construction footprint may be temporarily displaced from areas of Project construction. Noise associated with construction activities, may cause minor disruption to surrounding areas.	No additional mitigation beyond the general measures presented in Section 8 is required.
Reduced air quality	There is limited scope for indirect impacts from reduced air quality on this species resulting from Project construction. There is potential for dust from construction activities and vehicular movement to spread into nearby areas of retained Koala habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Appropriate speed limits will be enforced when moving around the road reserve, to reduce the potential for dust to spread.
Weeds and pests	Degradation of habitat from invasive weeds and predation by feral predators such as dogs are threats to the species. The Project has the potential to facilitate the spread of weeds and pest fauna through machinery, vehicles and materials being bought in from outside the road reserve although the road reserve is already subject to weed and pest impacts. The road reserve has high levels of weed infestation and Wild Dog are considered to be a significant threat to Koala in the region.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.6.7 Significant impact assessment

The MNES significant impact assessment for Koala using the Significant Impact Guidelines (DoE 2013) is summarised in Table 9.12.

Table 9.12 Significant impact assessment – Koala

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	Response
Lead to a long-term decrease in size of a population	No individual Koala have been recorded in the road reserve or within the surrounding study area. Indirect evidence (scat and scratches) was not recorded. In accordance with the current Koala Conservation Advice, any population within the road reserve would not be considered an important population in terms of genetics, climate sensitivity or dispersal potential. The Project footprint will result in the loss of 2.47 ha of habitat. All higher quality habitat associated with preferred foraging resources such as *C. tessellaris* or *E. platyphylla* woodland in riparian areas is avoided. Areas not mapped as habitat within the road reserve include non-remnant areas that have been largely cleared of woody vegetation and are dominated by dense areas of herbaceous weeds, or where regrowth scrub comprises *Grevillea striata* and *Atalaya hemiglauca*. The planned sequential clearing of habitat in any mapped woodland to be cleared will provide any Koalas present the opportunity to safely move into adjacent habitats. A sequential clearing protocol where fauna spotter-catchers are present during clearing will ensure Koalas are not harmed during clearing and there are safe movement opportunities. This sequential clearing protocol is summarised below: • Any clearing would take place in a way to allow Koalas (if present) to move into adjacent areas of retained vegetation. This will include setting clearing limits per day and allowing escape paths to retained vegetation to be maintained. If Koalas are encountered they are to be left in-situ, works stop in the area, and wait for the animal to move to retained habitat. This will entail: – Leaving a 30 m buffer of vegetation around the tree in which the Koala is located and a corridor of vegetation to retained habitat. – Monitoring the Koala location and if the animal appears stressed – Allowing the Koala to relocate without assistance unless the animal is in immediate danger or is injured. Indirect impacts may occur to Koalas from the Project as a result of noise and lighting associated with construction activities. Additionally, by opening up further areas of habitat there is the potential for an increase in weeds and pest animals to infiltrate adjacent bushland although the road reserve is already subject to extensive weed infestation and pest fauna presence. Due to the low likelihood of Koala being present, and as a result of the large areas of potential Koala habitat to be retained, mitigation measures to be put in place (including staging of clearing), the Project is not expected to result in a long-term decrease in the size of a Koala population. The ability of the road reserve and surrounding area to offer breeding opportunities, dispersal function and genetic diversity, and additionally to act as a potential climate refugia as temperatures are predicted to rise and the species potentially contracts in range coastwards, will be maintained. Significant areas of habitat for this species will be retained in the road reserve, and connectivity to the broader landscape will be maintained (including retention of the regionally significant riparian corridor associated with Lansdowne Creek).

Table 9.12 Significant impact assessment – Koala

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	Response
Reduce the area of occupancy of the species	No Koalas have been recorded in the road reserve or within the surrounding study area. Indirect evidence (scat and scratches) which provide characteristic evidence of presence, was not recorded during field survey. The species has the potential to utilise eucalypt woodlands within the road reserve although any presence is likely to be sporadic and infrequent. Potential habitat is predominantly located outside of the road reserve within riparian corridors which support preferred foraging tree species including *E. platyphylla* and *C. tessellaris*. Due to the low likelihood of the species being present, avoidance of areas of habitat which offer a higher potential of Koala being present and through mitigation measures to be put in place, including staging of clearing, the Project is not expected to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	It is recognised that roads and development fragment Koala habitats and increase threats to Koala populations. Threats arise from habitat loss and fragmentation, vehicle strike, dog attack, and increased stress on populations which then increases the chance of disease. The road reserve is already heavily fragmented as a result of historical clearing for agriculture and grazing. The Project design will maintain linkages to surrounding retained habitat (including retention of the regionally significant riparian corridor associated with Lansdowne Creek). Vegetation clearance is unlikely to impede movement of Koalas between Lansdowne Creek and Gilligan Creek to the south of the road reserve, as there is currently no connectivity between them due to previous land modifications. By retaining these corridors, it is unlikely that the Project will result in fragmentation impacts, as existing corridors are maintained, and existing movement across the road reserve is already heavily constrained by the cleared land and dense weed cover present in the centre of the road reserve.
Adversely affect habitat critical to the survival of a species	Under the EPBC Act, habitat critical to the survival of a species is defined as the areas that the species relies on to avoid or halt decline and promote the recovery of the species. The following actors and any other relevant factors may be considered when identifying habitat that is critical to the survival of a species: (a) whether the habitat is used during periods of stress (examples: flood, drought or fire); (b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes); (c) the extent to which the habitat is used by important populations; (d) whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development; (e) whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements; (f) whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation; (g) any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community. There is no evidence to support a Koala population being present within the road reserve. However, if they were to occur, it would be sporadic and not considered to be an important population, as described above. As such the Project is unlikely to adversely affect habitat critical to the survival of the species.

Table 9.12 Significant impact assessment – Koala

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	Response
Disrupt the breeding cycle of a population	Female Koalas can potentially produce one offspring each year, with births occurring between October and May (McLean, 2003). Project activities are not expected to disrupt the breeding cycle of a Koala population. Areas of habitat will be retained in the immediate surrounds of the road reserve, including areas of higher quality potential habitat in riparian areas, and movement corridors will be retained. Fauna spotter-catchers will be present to identify if Koalas are present during the clearing process and ensure they are not harmed during as works progress (eg through felling of trees or movement of machinery). If a Koala is observed, the tree in which it is located, and adjacent trees will not be cleared to ensure the animal is not harmed and permitted to move from the area of its own accord, before clearing in that area can recommence. Clearing will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan and summarised under Criteria 1 above. It is unlikely that the Project will further impact on connectivity for the species and disrupt the breeding cycle of the population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project footprint will result in the loss of 2.47 ha of potential habitat, as defined in Section 6.4. Indirect impacts may occur to Koalas from the Project as a result of noise associated with construction activities, and by opening up further areas an increase in weeds and pest animals to adjacent bushland. Vegetation that is retained in areas surrounding the road reserve will be actively managed for weeds and pest animals to assist in maintaining retained habitat in its current ecological condition. Pest animal management will include wild dog control which are a recognised threat to the species. While the Project will result in a minor loss of low-quality Koala habitat it is not expected to an extent that will cause the species population to decline, due to the apparent lack of utilisation of the study area and large areas of available retained habitat.
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	The Project through clearing of vegetation, has the potential to increase light and open up areas which may then increase weed invasion and numbers of pest animals to adjacent retained areas of potential habitat. Weeds such as Hyptis and Rubber Vine have the potential to reduce the ability for Koala to move between areas of habitat, and feral animals such as Wild Dog prey on Koalas. This may increase in cleared areas as the predation by wild dogs may become more efficient in these areas. However, the road reserve is already subject to extensive weed infestation and pest fauna presence. Hygiene protocols in the operational areas will also be implemented to reduce any weeds or disease being introduced to the site or spread from the site. Active pest management will also reduce the risk from wild dogs. Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species habitat.

Table 9.12 Significant impact assessment – Koala

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	Response
Introduce disease that may cause the species to decline	The most well-known disease present in the Koala population is associated with particular strains of Chlamydia. Koala Retrovirus was recently identified and is thought to be responsible for a range of conditions, including leukaemia and an immunodeficiency syndrome (DAWE 2022b). The Project is not likely to directly result in an increase in Chlamydia in Koalas. This is a broader issue for the population. Fauna spotter-catchers will be present during clearing to identify Koalas and ensure they are not harmed during clearing process or as works progress (eg movement of machinery). If a Koala is observed the tree in which it is located, and adjacent trees will not be cleared to ensure the animal is not harmed and permitted to move from the area of its own accord. Clearing will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan. Additionally, animals showing signs of stress or disease will be transported to a vet for treatment. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere with the recovery of the species	The Koala Conservation Advice identifies a number of recovery and conservation objectives as described in Section 9.6.4. The Project will not interfere substantially with any of these objectives. The ability of the road reserve and immediate surrounds to offer breeding opportunities, dispersal function and genetic diversity, and additionally to act as a potential climate refugia as temperatures are predicted to rise as the species potentially contracts in range coastwards, will be maintained. Connectivity to the broader landscape will be maintained (including retention of the regionally significant riparian corridor associated with Lansdowne Creek.
Conclusion	The Project footprint will result in the loss of 2.47 ha of potential habitat. The majority of higher quality habitat associated with preferred foraging resources such as *C.tessellaris* or *E.platyphylla* woodland is avoided. Potential foraging habitat to be cleared comprises predominantly *Eucalyptus*-dominated woodland which presents as sparse communities across the road reserve which has been impacted by previous land clearing, or areas of patchy regrowth. This marginal habitat also includes small areas of non-remnant habitat dominated by degraded and previously cleared scrub containing Eucalypt species. Areas not mapped as habitat within the road reserve that have been largely cleared of woody vegetation and are dominated by dense areas of herbaceous weeds, or where regrowth scrub comprises *Grevillea striata* and *Atalaya hemiglauca*. Koala has not been recorded within the road reserve or within the study area. It is generally scarce in the Townsville region with the exception of an introduced population on Magnetic Island. Conservatively it is considered as having potential to occur in the road reserve despite there being no evidence of scratches or scats during field surveys. Through the identified mitigation measures such as staged clearing, retaining Koala habitat on site including riparian corridors, and managing these retained habitats to improve condition and reduce threats, the Project will ensure impacts on any local Koala population are minimised. Any population that may occur within the road reserve is unlikely to 'important', as defined in the Koala Conservation Advice. The Project is not expected to have a significant residual impact on Koala.

9.7 Fork-tailed Swift

9.7.1 Relevant Departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678; and
- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015a).

There is no Listing Advice, Conservation Advice or adopted or made Recovery Plan in place for this species.

9.7.2 Ecology, habitat, distribution

The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. It is almost exclusively aerial and occurs over inland plains and sometimes above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found in treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (DAWE 2021g).

The species breeds in northern Asia and spends the non-breeding season (typically October – March inclusive) in Australia, moving further south as the summer progresses. In their breeding range, they nest on mountain cliffs or island rock caves, inside narrow crevices or in cracks on vertical cliff faces (DAWE 2021g).

The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In Queensland, there are many coastal records of this species between Cooktown and Townsville, and they are also commonly found in drier habitat inland as far west as Longreach. In eastern Australia, it is recorded in all coastal regions of QLD and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DAWE 2021g).

9.7.3 Ecologically significant proportion of the population

DAWE does not specify what constitutes an important population for Fork-tailed Swift. In lieu of this, an assessment of an ecologically significant proportion of a population is required for a migratory species. As such, the *EPBC Act Significant Impact Guidelines 1.1* (DoE 2013) are used, which define an ecologically significant proportion of a population of a 'migratory' species as being defined as:

- Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species-specific behavioural patterns (for example, site fidelity and dispersal rates.

The species occurs widely across Australia, although does not breed in the country. The road reserve is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species. Migratory swifts are widely dispersed depending on weather and feeding patterns, and as such no site fidelity is expected. As such the species' occurrence in the road reserve is unlikely to constitute an ecologically significant proportion of the population.

'Important habitat' for a migratory species is defined as:

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

The species occurs across Australia. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species.

As the species' occurrence in the road reserve, is unlikely to constitute an important population or important habitat.

9.7.4 Threats to the species

There are no significant threats to swifts in Australia. Deforestation may contribute to a decline in roosting habitat and/or food availability (Tarburton 2014). Individuals occasionally collide with overhead wires, windows and lighthouses (DAWE 2021g). No recovery or threat abatement plans are in place for this species. There is no approved conservation advice for this species.

9.7.5 Distribution within the road reserve and habitat mapping

Multiple records of this species are represented within the study area and habitat is present within the road reserve.

As this species is an aerial insectivore that spends most of its time aloft, and could occur anywhere over the road reserve, the whole road reserve is considered potential foraging habitat. The species does not breed in Australia, and as a wide-ranging nomadic species, foraging habitat also provides a surrogate for dispersal habitat.

9.7.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to Fork-tailed Swift from the Project are described in Table 9.13.

Table 9.13 Potential impacts on Fork-tailed Swift

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	As swifts are almost exclusively aerial, direct impacts from clearance of their habitat are not expected to occur as a result of Project construction. Fork-tailed Swift frequently forage over cleared or urban landscapes and the Project is unlikely to impact on their foraging resources during construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Species mortality	The potential for species mortality during construction of the Project is low. Fork-tailed Swift is a high-flying species and unlikely to interact with Project vehicles.	No additional mitigation beyond the general measures presented in Section 8 is required.

Table 9.13 Potential impacts on Fork-tailed Swift

Potential construction impacts	Discussion	Proposed mitigation
Indirect and facilitated impacts		
Fragmentation	As swifts are almost exclusively aerial, impacts from fragmentation of their habitat are not expected to occur as a result of Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services. Bushfire buffers consistent with state requirements have been incorporated into the Project design and are based on vegetation height around built infrastructure (other than roads).
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this species habitat.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Erosion and water quality	Fork-tailed Swift is unlikely to be impacted by impacts from erosion and reduced water quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Noise and lighting	Fork-tailed Swift is unlikely to be impacted noise and lighting resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Reduced air quality	Fork-tailed Swift is unlikely to be impacted by impacts from reduced air quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Weeds and pests	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from Project construction. Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of roosting individuals being taken by cats, the frequency of such events is likely to be small. The potential for weeds to impact on the quality of foraging habitat is low.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.7.7 Residual impacts and significant impact assessment

The MNES significant impact assessment for Fork-tailed Swift using the Significant Impact Guidelines (DoE 2013) is summarised in Table 9.14.

Table 9.14 Significant impact assessment – Fork-tailed Swift

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Important habitat for the species is broad as it is found over a range of habitats, from inland plains to wooded areas (DoE 2015a). The species does not breed in Australia so there is no impact on breeding habitat. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although some vegetation clearing will occur during Project construction, there are areas of retained vegetation surrounding the road reserve, and cleared habitats are still utilised by the species. The species is likely to occur on a sporadic basis over the summer months within the study area. Within the core range of the species, numbers can vary from 0 on one day to over 1,000 the next day with seemingly little pattern, presumably driven by weather and foraging conditions. As Fork-tailed Swift arrive and disperse over a broad front across the whole of Australia, but mainly over inland plains, it is impossible to predict on a long-term basis any patterns of utilisation of a given site, although focal features such as wetlands which may attract a large number of insect prey, could result in an increase in numbers of the species. There are no such wetlands within the road reserve. As described above, as swifts are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Pest fauna such as cats are not known as a major threat to the species. The potential for weeds to impact on the quality of foraging habitat is low. Nonetheless, weeds will be identified during preclearance surveys. Hygiene protocols, such as wash-down facilities, will also be put in place to ensure weeds are not brought in with vehicles or machinery.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	This species does not breed in Australia; therefore, the Project will not disrupt the breeding cycle of the Fork-tailed Swift. As an aerial feeder, habitats for foraging are diverse and occur over woodland, cleared areas, urban environments etc. Although some vegetation clearing will occur during Project construction, there are areas of retained vegetation surrounding the road reserve, and cleared habitats are still utilised by the species. As described above, as swifts are almost exclusively aerial, direct impacts to their habitat are not expected to occur as a result of the Project.
Conclusion	The Project will not have a significant residual impact on Fork-tailed Swift habitat and the risk of an impact on an ecologically significant proportion of the population (defined by DoE 2015a as being 100 birds or 0.1% of the population) is considered to be low.

9.8 Oriental Cuckoo

9.8.1 Relevant Departmental documents

The following documents were considered in the preparation of this report:

- species profile on SPRAT database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=86651; and
- Draft referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015a).

There is no Listing Advice, Conservation Advice or adopted or made Recovery Plan in place for this species.

9.8.2 Ecology, habitat, distribution

Oriental Cuckoos use a wide range of dense to open woodlands and forests, especially the edges of riparian forests (Menkhorst et al. 2019).

The Oriental Cuckoo breeds in Asia and is a brood parasite, mainly choosing to lay its eggs in the nests of Eurasian warblers belonging to the genus Phylloscopus (including the Arctic warbler, willow warbler and chiffchaff) (Seabrook-Davison 2017).

Important habitat for the species is defined (DoE 2015a) as being monsoonal rainforest, vine thickets, wet sclerophyll forest or open *Casuarina, Acacia* or *Eucalyptus* woodlands (frequently on ecotones).

The species is a non-breeding visitor to Australia and migrates to Australia from Asia between September and May (Menkhorst et al. 2019).

9.8.3 Ecologically significant proportion of the population

DAWE does not specify what constitutes an important population for Oriental Cuckoo. In lieu of this, an assessment of an ecologically significant proportion of a population is required. As such, the *EPBC Act Significant Impact Guidelines 1.1* (DoE 2013) are used, which define an ecologically significant proportion of a population of a 'migratory' species as being defined as:

- Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species-specific behavioural patterns (for example, site fidelity and dispersal rates.

The species occurs across north-eastern Australia in the summer months, although does not breed in the country. The road reserve is not located near the edge of the species range. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species. As such the species' presence in the road reserve, it is unlikely to constitute an ecologically significant proportion of the population.

'Important habitat' for a migratory species is defined as:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- habitat that is of critical importance to the species at particular life-cycle stages; and/or

- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

The species occurs across north-eastern Australia. There is no evidence to indicate a population in the area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species.

As the species' occurrence in the road reserve, is unlikely to constitute an important population or important habitat.

9.8.4 Threats to the species

The main threat is likely to relate to fragmentation and clearing of core breeding habitat (DAWE 2021h). No recovery or threat abatement plans are in place for this species. There is no approved conservation advice for this species.

9.8.5 Distribution within the road reserve and habitat mapping

This species was recorded directly south-west of the road reserve in an area of woodland along Lansdowne Creek. Approximately 2.47 ha of habitat is mapped within the road reserve.

9.8.6 Potential impacts and relevant mitigation measures

Potential direct, indirect and facilitated impacts to Oriental Cuckoo from construction and operation of the Project are described below in Table 9.15.

Table 9.15 Potential impacts on Oriental Cuckoo

Potential construction impacts	Discussion	Proposed mitigation
Direct impacts		
Vegetation/habitat clearance	Oriental Cuckoo are widespread although nowhere common in northern and eastern Australia and habitats used on a yearly basis will vary. They are a relatively mobile species, moving from one area of vegetation to another. The potential for species mortality during operation and maintenance of the Project is low. Oriental Cuckoo is unlikely to interact with Project vehicles or plant.	Clearing of potential Oriental Cuckoo habitat will occur sequentially and further details on sequential clearing is outlined in Section 8.3.
Species mortality	The potential for species mortality during construction of the Project is low. Oriental Cuckoo is unlikely to interact with Project vehicles.	No additional mitigation beyond the general measures presented in Section 8 is required.
Indirect and facilitated impacts		
Fragmentation	Oriental Cuckoo are widespread although nowhere common in northern and eastern Australia and habitats used on a yearly basis will vary. They are a relatively mobile species, moving from one area of vegetation to another.	No additional mitigation beyond the general measures presented in Section 8 is required.

Table 9.15 Potential impacts on Oriental Cuckoo

Potential construction impacts	Discussion	Proposed mitigation
Bushfire risk	The increased presence of construction personnel, vehicles and machinery in the road reserve during construction could lead to elevated bushfire risk unless adequately mitigated.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Extreme environmental events	Extreme environmental events, including drought, floods and large-scale bushfires, could lead to the destruction of this species habitat and/or species mortality.	No additional mitigation beyond the general measures presented in Section 8 is required. Bushfire management in proximity to the Project will seek to reduce the risk of high-intensity bushfires occurring. Management of bushfire risk will be incorporated into a certified Bushfire Management Plan developed in conjunction with local rural fire services.
Erosion and water quality	Oriental Cuckoo is unlikely to be directly impacted by impacts from erosion and reduced water quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Noise and lighting	Oriental Cuckoo is unlikely to be directly impacted by impacts from noise and lighting resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Reduced air quality	Oriental Cuckoo is unlikely to be directly impacted by impacts from reduced air quality resulting from Project construction.	No additional mitigation beyond the general measures presented in Section 8 is required.
Weeds and pests	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from Project construction. Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of individuals being taken by cats, the frequency of such events is likely to be small. The potential for weeds to impact on the quality of foraging habitat is low. Oriental Cuckoo have frequently been observed in weedy habitat such as those infested with a shrub layer of Lantana. Habitats in the road reserve are already heavily weed infested, with riparian areas having Rubber Vine present, and Chinee Apple.	Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.

9.8.7 Significant impact assessment

The MNES significant impact assessment for Oriental Cuckoo using the Significant Impact Guidelines (DoE 2013) is summarised below in Table 9.16.

Table 9.16 Significant impact assessment – Oriental Cuckoo

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	Response
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Important habitat for the species is defined (DoE 2015a) as being monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands (frequently on ecotones). The species does not breed in Australia so there is no impact on breeding habitat. Habitats for foraging are diverse and occur over a range of woodland types.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	There is limited scope for indirect impacts such as weed and pest interaction with this species resulting from Project construction. Pest fauna such as cats are not known as a major threat to the species. Although there is the possibility of individuals being taken by cats, the frequency of such events is likely to be low. The potential for weeds to impact on the quality of foraging habitat is low. Oriental Cuckoo have frequently been observed in weedy habitat such as those infested with a shrub layer of Lantana. Weed and pest control measures as outlined in Section 8.9 will be in place to minimise the risk of Project activities further facilitating the spread of weeds and pests across the landscape.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	This species does not breed in Australia; therefore, the Project will not disrupt the breeding cycle of the Oriental Cuckoo. Habitats for foraging are diverse and occur throughout various woodland types, including regrowth areas. Although some vegetation clearing will occur during Project construction, there are areas of retained vegetation surrounding the road reserve. It is unlikely that the Project will disrupt the lifecycle of an ecologically significant proportion of the population – DoE (2015) define an ecologically significant proportion of the population as being 1,000 birds (0.1% of the population). Any population in the road reserve over the summer months would number a handful of birds.
Conclusion	Approximately 2.47 ha of potential habitat will be cleared during construction. The Project will not have a significant residual impact on Oriental Cuckoo and the risk of an impact on an ecologically significant proportion of the population (defined by DoE 2015a as being 1,000 birds or 0.1% of the population) is considered to be low.

10 Conclusion

TCC is proposing to construct a 1.7 km road as part of the access solution to the LEIP, located 40 km south of Townsville.

Key results of this MNES assessment are summarised as follows:

- no TECs were recorded;
- no flora protected under the EPBC Act were recorded;
- Squatter Pigeon (listed as Vulnerable under the EPBC Act) was identified near the northern boundary and adjacent to farm dams on surrounding properties to the road reserve;
- Bare-rumped Sheathtail Bat was identified as known to occur due to numerous recordings on Anabat devices across the road reserve;
- two species of migratory birds were observed, being Fork-tailed Swift, and Oriental Cuckoo;
- no Black-throated Finch (southern form) were observed during surveys however habitat was identified throughout the road reserve; and
- no threatened aquatic species are considered likely to occur within the study area.

A significance of residual impacts assessment was undertaken of the Project's potential impacts on MNES that have been confirmed present or are considered likely to occur within the road reserve. The assessment was made against the EPBC Act Significant Impact Guidelines 1.1 (DoE 2013).

No significant impacts are likely to MNES. The Project involves the loss of 3.37 ha of potential Black-throated Finch habitat. The quality of this habitat is low, and not likely to be heavily utilised by Black-throated Finch within this area, and to date there are no records from the road reserve. Although the position on the species indicated in communication with DAWE is that all suitable habitat in the Townsville region is important, and presence can be assumed if habitat is suitable and there are nearby records, the clearing is narrow and linear and falls within an existing road reserve which is currently used as a farm track (eg Photograph 6.1), albeit overgrown by grasses and weedy shrubs (eg Chinee Apple) in places. However the habitat on site is degraded (eg Photograph 6.3) and the loss of this narrow strip is not considered to be a significant impact to the species. The ability of the species to continue to use the surrounding habitats is maintained (for example the species regularly forages along roadsides on seeding grasses in the Woodstock area). Farm dams adjacent to the survey area providing a drinking resource are avoided and maintained.

Key mitigation measures to be implemented to ensure significant, residual impacts do not occur to MNES are:

- The road is sited within an existing road reserve, and avoids areas of higher ecological value to MNES (eg riparian zones nearby in Lansdowne Creek);
- Develop a Species Management Program (required by DES under the NC Act when impacting on animal breeding places) to identify specific measures to be implemented that will mitigate impacts to threatened fauna species and animal breeding places during clearing, as well as operation of the Project.
- Sequential clearing is to be implemented. This will ensure impacts to fauna during clearing are avoided and minimised. A suitably qualified fauna spotter-catcher will be present during clearing to ensure native fauna

are not impacted. The potentially suitable hollow bearing tree for Bare-rumped Sheathtail Bat will be checked under this process.

- Potential indirect impacts to MNES will be managed through implementation of measures such as weed hygiene protocols, managing weeds in retained bushland areas, reducing noise and lighting.

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Appendix A

Desktop searches

Australian Government
Department of Agriculture, Water and the Environment

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. Please see the caveat for interpretation of information provided here.

Report created: 08-Apr-2022

Summary

Matters of National Environment 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.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	34
Listed Migratory Species:	18

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

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.

Commonwealth Lands:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	23
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	2
EPBC Act Referrals:	20
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands)		[Resource Information]
Ramsar Site Name	Proximity	Buffer Status
Bowling green bay	Within 10km of Ramsar site	In feature area

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii			
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Erythrotriorchis radiatus			
Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area	In feature area
Falco hypoleucos			
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Limosa lapponica baueri			
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Neochmia ruficauda ruficauda			
Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Numenius madagascariensis](#)			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Poephila cincta cincta](#)			
Southern Black-throated Finch [64447]	Endangered	Species or species habitat known to occur within area	In feature area
[Rostratula australis](#)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area	In feature area
[Turnix olivii](#)			
Buff-breasted Button-quail [59293]	Endangered	Species or species habitat may occur within area	In buffer area only
[Tyto novaehollandiae kimberli](#)			
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area	In feature area
CRUSTACEAN			
[Euastacus bindal](#)			
freshwater crayfish, spiny crayfish [86598]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
FROG			
[Cophixalus mcdonaldi](#)			
McDonald's Frog, Mt Elliot Nursery-frog [1791]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
MAMMAL			
[Dasyurus hallucatus](#)			
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area	In feature area
[Hipposideros semoni](#)			
Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Macroderma gigas](#)			
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Petauroides volans			
Greater Glider [254]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area	In feature area
Rhinolophus robertsi			
Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Saccolaimus saccolaimus nudicluniatus			
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Xeromys myoides			
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
PLANT			
Bulbophyllum globuliforme			
Miniature Moss-orchid, Hoop Pine Orchid [6649]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Dichanthium setosum			
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus paedoglauca			
Mt Stuart Ironbark [56188]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Eucalyptus raveretiana			
Black Ironbox [16344]	Vulnerable	Species or species habitat known to occur within area	In feature area
Marsdenia brevifolia			
[64585]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Myrmecodia beccarii			
Ant Plant [11852]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Omphalea celata [64586]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Solanum graniticum Granite Nightshade [84819]	Endangered	Species or species habitat may occur within area	In buffer area only
Tephrosia leveillei [16946]	Vulnerable	Species or species habitat may occur within area	In feature area
REPTILE			
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area	In feature area
Lerista vittata Mount Cooper Striped Skink, Mount Cooper Striped Lerista [1308]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Listed Migratory Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat known to occur within area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus			
Osprey [952]		Breeding known to occur within area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - Mount Stuart Close Training Area [31858]	QLD	In buffer area only
Defence - Mount Stuart Close Training Area [31854]	QLD	In buffer area only
Defence - Mount Stuart Close Training Area [31856]	QLD	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anseranas semipalmata			
Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Breeding known to occur within area	In buffer area only
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Reptile			
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Bowling Green Bay	National Park	QLD	In buffer area only
Serpentine	Nature Refuge	QLD	In buffer area only

Nationally Important Wetlands		[Resource Information]
Wetland Name	State	Buffer Status
Ross River Reservoir	QLD	In buffer area only
The Serpentine Aggregation	QLD	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
"The Oaks" Planned Residential Community	2009/4711	Controlled Action	Further Information Request	In buffer area only
275kV and 132 kV transmission line from Ross Substation to Townsville South Substation	2001/221	Controlled Action	Post-Approval	In buffer area only
CopperString Transmission Line Project, Nth Qld	2019/8416	Controlled Action	Assessment Approach	In buffer area only
Final Stages of Oak Valley Subdivision	2007/3762	Controlled Action	Post-Approval	In buffer area only
Gas pipeline	2002/728	Controlled Action	Post-Approval	In feature area
Port of Townsville Ltd Marine Armour Stone Quarry	2010/5461	Controlled Action	Post-Approval	In buffer area only
Private House Construction	2008/4339	Controlled Action	Post-Approval	In buffer area only
Queensland Pacific Metals - Townsville Energy Chemicals Hub TECH Project	2021/9033	Controlled Action	Assessment Approach	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
To develop stages 2-6 of the Laudham Park Development, Pinnacles, Townsville, QLD	2014/7177	Controlled Action	Further Information Request	In buffer area only
Not controlled action				
Haughton Pipeline Duplication Project, QLD	2015/7606	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Majors Creek Solar Farm, south of Townsville, Queensland	2017/7963	Not Controlled Action	Completed	In buffer area only
Re-opening of Marathon Quarry	2009/4877	Not Controlled Action	Completed	In buffer area only
Riverway project	2003/1152	Not Controlled Action	Completed	In buffer area only
Ross River Dam Upgrade Project - Stages 2-5	2005/2246	Not Controlled Action	Completed	In buffer area only
Toonpan Water Treatment Plant and Distribution Pipeline	2007/3675	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
275kV Transmission Line from Ross substation to Strathmore Substation (approx 180km)	2008/4390	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Construction of residence including pool, driveway, gardens and shed	2009/4724	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Construct residence and access road on Lot 5 on SP189975 Chisholm Trail	2009/5096	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Lot 5 Chisholm Trail	2009/4940	Referral Decision	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Queensland status: All
Records: All
Date: All
Latitude: -19.6005
Longitude: 146.8248
Distance: 20
Email: gdaly@emmconsulting.com.au
Date submitted: Friday 08 Apr 2022 15:15:39
Date extracted: Friday 08 Apr 2022 15:20:06

The number of records retrieved = 1011

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			54
animals	amphibians	Hylidae	*Cyclorana alboguttata*	greenstripe frog		C		4
animals	amphibians	Hylidae	*Cyclorana brevipes*	superb collared frog		C		1
animals	amphibians	Hylidae	*Cyclorana novaehollandiae*	eastern snapping frog		C		12
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		35
animals	amphibians	Hylidae	*Litoria fallax*	eastern sedgefrog		C		23
animals	amphibians	Hylidae	*Litoria gracilenta*	graceful treefrog		C		2
animals	amphibians	Hylidae	*Litoria inermis*	bumpy rocketfrog		C		72
animals	amphibians	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog		C		1
animals	amphibians	Hylidae	*Litoria lesueuri sensu lato*	stony creek frog		C		6
animals	amphibians	Hylidae	*Litoria nasuta*	striped rocketfrog		C		17
animals	amphibians	Hylidae	*Litoria rothii*	northern laughing treefrog		C		66
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		70
animals	amphibians	Hylidae	*Litoria wilcoxii*	eastern stony creek frog		C		2
animals	amphibians	Limnodynastidae	*Limnodynastes convexiusculus*	marbled frog		C		14
animals	amphibians	Limnodynastidae	*Limnodynastes terraereginae*	scarlet sided pobblebonk		C		2/2
animals	amphibians	Limnodynastidae	*Notaden melanoscaphus*	brown shovelfoot		C		2
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		21
animals	amphibians	Microhylidae	*Cophixalus mcdonaldi*	Mount Elliot nurseryfrog		CR	CE	8/1
animals	amphibians	Microhylidae	*Cophixalus sp.*			C		2/2
animals	amphibians	Myobatrachidae	*Crinia deserticola*	chirping froglet		C		15
animals	birds	Acanthizidae	*Acanthiza reguloides*	buff-rumped thornbill		C		1
animals	birds	Acanthizidae	*Gerygone magnirostris*	large-billed gerygone		C		13
animals	birds	Acanthizidae	*Gerygone mouki*	brown gerygone		C		3
animals	birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone		C		45
animals	birds	Acanthizidae	*Gerygone palpebrosa*	fairy gerygone		C		31
animals	birds	Acanthizidae	*Sericornis citreogularis*	yellow-throated scrubwren		C		2
animals	birds	Acanthizidae	*Sericornis frontalis*	white-browed scrubwren		C		15
animals	birds	Acanthizidae	*Sericornis magnirostra*	large-billed scrubwren		C		3
animals	birds	Acanthizidae	*Smicrornis brevirostris*	weebill		C		12
animals	birds	Accipitridae	*Accipiter cirrocephalus*	collared sparrowhawk		C		14
animals	birds	Accipitridae	*Accipiter fasciatus*	brown goshawk		C		50
animals	birds	Accipitridae	*Accipiter novaehollandiae*	grey goshawk		C		2
animals	birds	Accipitridae	*Aquila audax*	wedge-tailed eagle		C		133
animals	birds	Accipitridae	*Aviceda subcristata*	Pacific baza		C		19
animals	birds	Accipitridae	*Circus approximans*	swamp harrier		C		13
animals	birds	Accipitridae	*Circus assimilis*	spotted harrier		C		18
animals	birds	Accipitridae	*Elanus axillaris*	black-shouldered kite		C		30
animals	birds	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle		C		68
animals	birds	Accipitridae	*Haliastur indus*	brahminy kite		C		10
animals	birds	Accipitridae	*Haliastur sphenurus*	whistling kite		C		219
animals	birds	Accipitridae	*Hamirostra melanosternon*	black-breasted buzzard		C		1
animals	birds	Accipitridae	*Hieraaetus morphnoides*	little eagle		C		6
animals	birds	Accipitridae	*Lophoictinia isura*	square-tailed kite		C		3
animals	birds	Accipitridae	*Milvus migrans*	black kite		C		255
animals	birds	Accipitridae	*Pandion cristatus*	eastern osprey		SL		7

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Acrocephalidae	*Acrocephalus australis*	Australian reed-warbler		C		8
animals	birds	Aegothelidae	*Aegotheles cristatus*	Australian owlet-nightjar		C		14
animals	birds	Alaudidae	*Mirafra javanica*	Horsfield's bushlark		C		32
animals	birds	Alcedinidae	*Ceyx azureus*	azure kingfisher		C		25
animals	birds	Alcedinidae	*Ceyx pusillus*	little kingfisher		C		3
animals	birds	Anatidae	*Anas gracilis*	grey teal		C		52
animals	birds	Anatidae	*Anas superciliosa*	Pacific black duck		C		151
animals	birds	Anatidae	*Aythya australis*	hardhead		C		69
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck		C		49
animals	birds	Anatidae	*Cygnus atratus*	black swan		C		55
animals	birds	Anatidae	*Dendrocygna arcuata*	wandering whistling-duck		C		42
animals	birds	Anatidae	*Dendrocygna eytoni*	plumed whistling-duck		C		74
animals	birds	Anatidae	*Malacorhynchus membranaceus*	pink-eared duck		C		11
animals	birds	Anatidae	*Nettapus coromandelianus*	cotton pygmy-goose		C		40
animals	birds	Anatidae	*Nettapus pulchellus*	green pygmy-goose		C		35
animals	birds	Anatidae	*Spatula rhynchotis*	Australasian shoveler		C		3
animals	birds	Anatidae	*Stictonetta naevosa*	freckled duck		C		1
animals	birds	Anhingidae	*Anhinga novaehollandiae*	Australasian darter		C		133
animals	birds	Anseranatidae	*Anseranas semipalmata*	magpie goose		C		102
animals	birds	Apodidae	*Aerodramus terraereginae*	Australian swiftlet		C		22
animals	birds	Apodidae	*Apus pacificus*	fork-tailed swift		SL		5
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	8
animals	birds	Ardeidae	*Ardea alba modesta*	eastern great egret		C		113
animals	birds	Ardeidae	*Ardea intermedia*	intermediate egret		C		90
animals	birds	Ardeidae	*Ardea pacifica*	white-necked heron		C		93
animals	birds	Ardeidae	*Ardea sumatrana*	great-billed heron		C		1
animals	birds	Ardeidae	*Bubulcus ibis*	cattle egret		C		67
animals	birds	Ardeidae	*Butorides striata*	striated heron		C		2
animals	birds	Ardeidae	*Egretta garzetta*	little egret		C		51
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		137
animals	birds	Ardeidae	*Egretta picata*	pied heron		C		2
animals	birds	Ardeidae	*Egretta sacra*	eastern reef egret		C		1
animals	birds	Ardeidae	*Ixobrychus dubius*	Australian little bittern		C		1
animals	birds	Ardeidae	*Ixobrychus flavicollis*	black bittern		C		9
animals	birds	Ardeidae	*Nycticorax caledonicus*	nankeen night-heron		C		19
animals	birds	Artamidae	*Artamus cinereus*	black-faced woodswallow		C		115/3
animals	birds	Artamidae	*Artamus cyanopterus*	dusky woodswallow		C		3
animals	birds	Artamidae	*Artamus leucorynchus*	white-breasted woodswallow		C		131
animals	birds	Artamidae	*Artamus minor*	little woodswallow		C		27
animals	birds	Artamidae	*Artamus personatus*	masked woodswallow		C		9
animals	birds	Artamidae	*Artamus superciliosus*	white-browed woodswallow		C		16
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		199
animals	birds	Artamidae	*Cracticus torquatus*	grey butcherbird		C		82
animals	birds	Artamidae	*Gymnorhina tibicen*	Australian magpie		C		248
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		94
animals	birds	Burhinidae	*Burhinus grallarius*	bush stone-curlew		C		34

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		195
animals	birds	Cacatuidae	*Cacatua sanguinea*	little corella		C		1
animals	birds	Cacatuidae	*Calyptorhynchus banksii*	red-tailed black-cockatoo		C		160
animals	birds	Cacatuidae	*Eolophus roseicapilla*	galah		C		62
animals	birds	Cacatuidae	*Nymphicus hollandicus*	cockatiel		C		28
animals	birds	Campephagidae	*Coracina maxima*	ground cuckoo-shrike		C		3
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		200
animals	birds	Campephagidae	*Coracina papuensis*	white-bellied cuckoo-shrike		C		228
animals	birds	Campephagidae	*Edolisoma tenuirostre*	common cicadabird		C		13
animals	birds	Campephagidae	*Lalage leucomela*	varied triller		C		65
animals	birds	Campephagidae	*Lalage tricolor*	white-winged triller		C		93
animals	birds	Caprimulgidae	*Caprimulgus macrurus*	large-tailed nightjar		C		14
animals	birds	Casuariidae	*Dromaius novaehollandiae*	emu		C		9
animals	birds	Charadriidae	*Charadrius ruficapillus*	red-capped plover		C		12
animals	birds	Charadriidae	*Charadrius veredus*	oriental plover		SL		1
animals	birds	Charadriidae	*Elseyornis melanops*	black-fronted dotterel		C		71
animals	birds	Charadriidae	*Erythrogonys cinctus*	red-kneed dotterel		C		5
animals	birds	Charadriidae	*Pluvialis fulva*	Pacific golden plover		SL		2
animals	birds	Charadriidae	*Vanellus miles*	masked lapwing		C		136
animals	birds	Charadriidae	*Vanellus tricolor*	banded lapwing		C		27
animals	birds	Ciconiidae	*Ephippiorhynchus asiaticus*	black-necked stork		C		60
animals	birds	Cisticolidae	*Cisticola exilis*	golden-headed cisticola		C		76
animals	birds	Climacteridae	*Climacteris picumnus*	brown treecreeper		C		6
animals	birds	Climacteridae	*Cormobates leucophaea minor*	white-throated treecreeper (northern)		C		1
animals	birds	Columbidae	*Chalcophaps longirostris*	Pacific emerald dove		C		14
animals	birds	Columbidae	*Columba leucomela*	white-headed pigeon		C		2
animals	birds	Columbidae	*Columba livia*	rock dove	Y			1
animals	birds	Columbidae	*Ducula bicolor*	pied imperial-pigeon		C		1
animals	birds	Columbidae	*Geopelia cuneata*	diamond dove		C		24
animals	birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove		C		98
animals	birds	Columbidae	*Geopelia placida*	peaceful dove		C		332
animals	birds	Columbidae	*Geophaps scripta*	squatter pigeon		C		99
animals	birds	Columbidae	*Geophaps scripta scripta*	squatter pigeon (southern subspecies)		V	V	6
animals	birds	Columbidae	*Lopholaimus antarcticus*	topknot pigeon		C		9
animals	birds	Columbidae	*Macropygia amboinensis*	brown cuckoo-dove		C		14
animals	birds	Columbidae	*Ocyphaps lophotes*	crested pigeon		C		170
animals	birds	Columbidae	*Phaps chalcoptera*	common bronzewing		C		58
animals	birds	Columbidae	*Phaps histrionica*	flock bronzewing		C		1
animals	birds	Columbidae	*Ptilinopus magnificus*	wompoo fruit-dove		C		8
animals	birds	Columbidae	*Ptilinopus regina*	rose-crowned fruit-dove		C		3
animals	birds	Columbidae	*Ptilinopus superbus*	superb fruit-dove		C		4
animals	birds	Columbidae	*Streptopelia chinensis*	spotted dove	Y			1
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		92
animals	birds	Corcoracidae	*Corcorax melanorhamphos*	white-winged chough		C		27
animals	birds	Corcoracidae	*Struthidea cinerea*	apostlebird		C		68
animals	birds	Corvidae	*Corvus coronoides*	Australian raven		C		165

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		141/5
animals	birds	Corvidae	*Corvus sp.*			C		4
animals	birds	Cuculidae	*Cacomantis flabelliformis*	fan-tailed cuckoo		C		21
animals	birds	Cuculidae	*Cacomantis pallidus*	pallid cuckoo		C		36
animals	birds	Cuculidae	*Cacomantis variolosus*	brush cuckoo		C		84
animals	birds	Cuculidae	*Centropus phasianinus*	pheasant coucal		C		163
animals	birds	Cuculidae	*Chalcites basalis*	Horsfield's bronze-cuckoo		C		33
animals	birds	Cuculidae	*Chalcites lucidus*	shining bronze-cuckoo		C		5
animals	birds	Cuculidae	*Chalcites minutillus*	little bronze-cuckoo		C		24
animals	birds	Cuculidae	*Chalcites minutillus barnardi*	Eastern little bronze-cuckoo		C		1
animals	birds	Cuculidae	*Chalcites minutillus russatus*	Gould's bronze-cuckoo		C		8
animals	birds	Cuculidae	*Chalcites osculans*	black-eared cuckoo		C		1
animals	birds	Cuculidae	*Cuculus optatus*	oriental cuckoo		SL		3
animals	birds	Cuculidae	*Eudynamys orientalis*	eastern koel		C		50
animals	birds	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo		C		63
animals	birds	Dicruridae	*Dicrurus bracteatus*	spangled drongo		C		167
animals	birds	Estrildidae	*Heteromunia pectoralis*	pictorella mannikin		C		10
animals	birds	Estrildidae	*Lonchura castaneothorax*	chestnut-breasted mannikin		C		381
animals	birds	Estrildidae	*Lonchura punctulata*	nutmeg mannikin	Y			6
animals	birds	Estrildidae	*Neochmia modesta*	plum-headed finch		C		38
animals	birds	Estrildidae	*Neochmia phaeton*	crimson finch		C		91
animals	birds	Estrildidae	*Neochmia temporalis*	red-browed finch		C		30
animals	birds	Estrildidae	*Poephila cincta cincta*	black-throated finch (white-rumped subspecies)		E	E	179
animals	birds	Estrildidae	*Taeniopygia bichenovii*	double-barred finch		C		191
animals	birds	Estrildidae	*Taeniopygia guttata*	zebra finch		C		62
animals	birds	Eurostopodidae	*Eurostopodus argus*	spotted nightjar		C		12
animals	birds	Eurostopodidae	*Eurostopodus mystacalis*	white-throated nightjar		C		15
animals	birds	Falconidae	*Falco berigora*	brown falcon		C		109
animals	birds	Falconidae	*Falco cenchroides*	nankeen kestrel		C		116
animals	birds	Falconidae	*Falco longipennis*	Australian hobby		C		43
animals	birds	Falconidae	*Falco peregrinus*	peregrine falcon		C		10
animals	birds	Falconidae	*Falco subniger*	black falcon		C		1
animals	birds	Glareolidae	*Stiltia isabella*	Australian pratincole		C		10
animals	birds	Gruidae	*Antigone rubicunda*	brolga		C		70
animals	birds	Halcyonidae	*Dacelo leachii*	blue-winged kookaburra		C		243
animals	birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra		C		185
animals	birds	Halcyonidae	*Tanysiptera sylvia*	buff-breasted paradise-kingfisher		C		3
animals	birds	Halcyonidae	*Todiramphus macleayii*	forest kingfisher		C		200
animals	birds	Halcyonidae	*Todiramphus pyrrhopygius*	red-backed kingfisher		C		45
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		90
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		46
animals	birds	Hirundinidae	*Petrochelidon ariel*	fairy martin		C		69
animals	birds	Hirundinidae	*Petrochelidon nigricans*	tree martin		C		58
animals	birds	Jacanidae	*Irediparra gallinacea*	comb-crested jacana		C		122
animals	birds	Laridae	*Chlidonias hybrida*	whiskered tern		C		15

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animals	birds	Laridae	*Chlidonias leucopterus*	white-winged black tern		SL		1
animals	birds	Laridae	*Chroicocephalus novaehollandiae*	silver gull		C		9
animals	birds	Laridae	*Gelochelidon nilotica*	gull-billed tern		SL		20
animals	birds	Laridae	*Hydroprogne caspia*	Caspian tern		SL		37
animals	birds	Maluridae	*Malurus melanocephalus*	red-backed fairy-wren		C		185
animals	birds	Megaluridae	*Cincloramphus cruralis*	brown songlark		C		3
animals	birds	Megaluridae	*Cincloramphus mathewsi*	rufous songlark		C		55
animals	birds	Megaluridae	*Cincloramphus timoriensis*	tawny grassbird		C		30
animals	birds	Megaluridae	*Poodytes gramineus*	little grassbird		C		1
animals	birds	Megapodiidae	*Alectura lathami*	Australian brush-turkey		C		69
animals	birds	Megapodiidae	*Megapodius reinwardt*	orange-footed scrubfowl		C		2
animals	birds	Meliphagidae	*Acanthagenys rufogularis*	spiny-cheeked honeyeater		C		3
animals	birds	Meliphagidae	*Acanthorhynchus tenuirostris*	eastern spinebill		C		1
animals	birds	Meliphagidae	*Bolemoreus frenatus*	bridled honeyeater		C		2
animals	birds	Meliphagidae	*Caligavis chrysops*	yellow-faced honeyeater		C		7
animals	birds	Meliphagidae	*Cissomela pectoralis*	banded honeyeater		C		1
animals	birds	Meliphagidae	*Conopophila rufogularis*	rufous-throated honeyeater		C		45
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater		C		182
animals	birds	Meliphagidae	*Epthianura tricolor*	crimson chat		C		1
animals	birds	Meliphagidae	*Gavicalis virescens*	singing honeyeater		C		1
animals	birds	Meliphagidae	*Lichmera indistincta*	brown honeyeater		C		115
animals	birds	Meliphagidae	*Manorina flavigula*	yellow-throated miner		C		113
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		7
animals	birds	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater		C		119
animals	birds	Meliphagidae	*Meliphaga notata*	yellow-spotted honeyeater		C		25
animals	birds	Meliphagidae	*Melithreptus albogularis*	white-throated honeyeater		C		216
animals	birds	Meliphagidae	*Melithreptus gularis*	black-chinned honeyeater		C		20
animals	birds	Meliphagidae	*Melithreptus lunatus*	white-naped honeyeater		C		1
animals	birds	Meliphagidae	*Myzomela obscura*	dusky honeyeater		C		34
animals	birds	Meliphagidae	*Myzomela sanguinolenta*	scarlet honeyeater		C		48
animals	birds	Meliphagidae	*Philemon buceroides*	helmeted friarbird		C		31
animals	birds	Meliphagidae	*Philemon citreogularis*	little friarbird		C		219
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird		C		119
animals	birds	Meliphagidae	*Ptilotula fusca*	fuscous honeyeater		C		49
animals	birds	Meliphagidae	*Ramsayornis fasciatus*	bar-breasted honeyeater		C		8
animals	birds	Meliphagidae	*Ramsayornis modestus*	brown-backed honeyeater		C		61
animals	birds	Meliphagidae	*Stomiopera flava*	yellow honeyeater		C		260
animals	birds	Meliphagidae	*Stomiopera unicolor*	white-gaped honeyeater		C		7
animals	birds	Meliphagidae	*Xanthotis macleayanus*	Macleay's honeyeater		C		1
animals	birds	Meropidae	*Merops ornatus*	rainbow bee-eater		C		224
animals	birds	Monarchidae	*Arses kaupi*	pied monarch		C		1
animals	birds	Monarchidae	*Carterornis leucotis*	white-eared monarch		C		1
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		253
animals	birds	Monarchidae	*Monarcha melanopsis*	black-faced monarch		SL		8
animals	birds	Monarchidae	*Myiagra cyanoleuca*	satin flycatcher		SL		7
animals	birds	Monarchidae	*Myiagra inquieta*	restless flycatcher		C		20

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Monarchidae	*Myiagra rubecula*	leaden flycatcher		C		194
animals	birds	Monarchidae	*Symposiachrus trivirgatus*	spectacled monarch		SL		36
animals	birds	Motacillidae	*Anthus novaeseelandiae*	Australasian pipit		C		67
animals	birds	Nectariniidae	*Cinnyris jugularis*	olive-backed sunbird		C		69
animals	birds	Nectariniidae	*Dicaeum hirundinaceum*	mistletoebird		C		88
animals	birds	Neositticidae	*Daphoenositta chrysoptera*	varied sittella		C		7
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		88
animals	birds	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird		C		103
animals	birds	Otididae	*Ardeotis australis*	Australian bustard		C		86
animals	birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush		C		13
animals	birds	Pachycephalidae	*Colluricincla megarhyncha*	little shrike-thrush		C		69
animals	birds	Pachycephalidae	*Pachycephala pectoralis*	golden whistler		C		7
animals	birds	Pachycephalidae	*Pachycephala rufiventris*	rufous whistler		C		184
animals	birds	Pachycephalidae	*Pachycephala simplex peninsulae*	grey whistler		C		1
animals	birds	Paradisaeidae	*Ptiloris victoriae*	Victoria's riflebird		C		3
animals	birds	Pardalotidae	*Pardalotus punctatus*	spotted pardalote		C		18
animals	birds	Pardalotidae	*Pardalotus rubricatus*	red-browed pardalote		C		1
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		172
animals	birds	Passeridae	*Passer domesticus*	house sparrow	Y			1
animals	birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican		C		76
animals	birds	Petroicidae	*Eopsaltria australis*	eastern yellow robin		C		1
animals	birds	Petroicidae	*Heteromyias cinereifrons*	grey-headed robin		C		11
animals	birds	Petroicidae	*Microeca fascinans*	jacky winter		C		13
animals	birds	Petroicidae	*Microeca flavigaster*	lemon-bellied flycatcher		C		127
animals	birds	Petroicidae	*Petroica goodenovii*	red-capped robin		C		2
animals	birds	Petroicidae	*Poecilodryas superciliosa*	white-browed robin		C		31
animals	birds	Petroicidae	*Tregellasia capito*	pale-yellow robin		C		5
animals	birds	Phalacrocoracidae	*Microcarbo melanoleucos*	little pied cormorant		C		117
animals	birds	Phalacrocoracidae	*Phalacrocorax carbo*	great cormorant		C		27
animals	birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	little black cormorant		C		89
animals	birds	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant		C		29
animals	birds	Phasianidae	*Coturnix pectoralis*	stubble quail		C		1
animals	birds	Phasianidae	*Pavo cristatus*	Indian peafowl	Y			4
animals	birds	Phasianidae	*Synoicus ypsilophorus*	brown quail		C		47
animals	birds	Pittidae	*Pitta versicolor*	noisy pitta		C		12
animals	birds	Podargidae	*Podargus strigoides*	tawny frogmouth		C		12
animals	birds	Podicipedidae	*Podiceps cristatus*	great crested grebe		C		16
animals	birds	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian grebe		C		109
animals	birds	Pomatostomidae	*Pomatostomus temporalis*	grey-crowned babbler		C		39
animals	birds	Psittacidae	*Aprosmictus erythropterus*	red-winged parrot		C		132
animals	birds	Psittacidae	*Melopsittacus undulatus*	budgerigar		C		16
animals	birds	Psittacidae	*Parvipsitta pusilla*	little lorikeet		C		2
animals	birds	Psittacidae	*Platycercus adscitus*	pale-headed rosella		C		224
animals	birds	Psittacidae	*Platycercus adscitus adscitus*	pale-headed rosella (northern form)		C		1
animals	birds	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet		C		103
animals	birds	Psittacidae	*Trichoglossus moluccanus*	rainbow lorikeet		C		182

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animals	birds	Ptilonorhynchidae	*Chlamydera maculata*	spotted bowerbird		C		1
animals	birds	Ptilonorhynchidae	*Chlamydera nuchalis*	great bowerbird		C		119
animals	birds	Ptilonorhynchidae	*Scenopoeetes dentirostris*	tooth-billed bowerbird		C		4
animals	birds	Rallidae	*Amaurornis cinerea*	white-browed crake		C		5
animals	birds	Rallidae	*Amaurornis moluccana*	pale-vented bush-hen		C		8
animals	birds	Rallidae	*Fulica atra*	Eurasian coot		C		25
animals	birds	Rallidae	*Gallinula tenebrosa*	dusky moorhen		C		1
animals	birds	Rallidae	*Gallirallus philippensis*	buff-banded rail		C		7
animals	birds	Rallidae	*Porphyrio melanotus*	purple swamphen		C		3
animals	birds	Rallidae	*Porzana fluminea*	Australian spotted crake		C		1
animals	birds	Rallidae	*Tribonyx ventralis*	black-tailed native-hen		C		1
animals	birds	Rallidae	*Zapornia pusilla*	Baillon's crake		C		1
animals	birds	Rallidae	*Zapornia tabuensis*	spotless crake		C		2
animals	birds	Recurvirostridae	*Himantopus himantopus*	black-winged stilt		C		25
animals	birds	Rhipiduridae	*Rhipidura albiscapa*	grey fantail		C		203
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		184
animals	birds	Rhipiduridae	*Rhipidura rufifrons*	rufous fantail		SL		28
animals	birds	Rhipiduridae	*Rhipidura rufiventris*	northern fantail		C		3
animals	birds	Scolopacidae	*Calidris acuminata*	sharp-tailed sandpiper		SL		4
animals	birds	Scolopacidae	*Calidris ferruginea*	curlew sandpiper		CR	CE	1
animals	birds	Scolopacidae	*Calidris ruficollis*	red-necked stint		SL		3
animals	birds	Scolopacidae	*Gallinago hardwickii*	Latham's snipe		SL		6
animals	birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit		V	V	2
animals	birds	Scolopacidae	*Limosa limosa*	black-tailed godwit		SL		2
animals	birds	Scolopacidae	*Numenius minutus*	little curlew		SL		1
animals	birds	Scolopacidae	*Tringa nebularia*	common greenshank		SL		2
animals	birds	Scolopacidae	*Tringa stagnatilis*	marsh sandpiper		SL		3
animals	birds	Strigidae	*Ninox boobook*	southern boobook		C		29
animals	birds	Strigidae	*Ninox connivens*	barking owl		C		38
animals	birds	Strigidae	*Ninox rufa queenslandica*	rufous owl (southern subspecies)		C		2
animals	birds	Sturnidae	*Acridotheres tristis*	common myna	Y			3
animals	birds	Threskiornithidae	*Platalea flavipes*	yellow-billed spoonbill		C		67
animals	birds	Threskiornithidae	*Platalea regia*	royal spoonbill		C		75
animals	birds	Threskiornithidae	*Plegadis falcinellus*	glossy ibis		SL		29
animals	birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis		C		94
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		192
animals	birds	Timaliidae	*Zosterops lateralis*	silvereye		C		11
animals	birds	Turnicidae	*Turnix maculosus*	red-backed button-quail		C		8
animals	birds	Turnicidae	*Turnix pyrrhothorax*	red-chested button-quail		C		16
animals	birds	Turnicidae	*Turnix varius*	painted button-quail		C		1
animals	birds	Turnicidae	*Turnix velox*	little button-quail		C		1
animals	birds	Tytonidae	*Tyto javanica*	eastern barn owl		C		11
animals	insects	Coenagrionidae	*Ischnura heterosticta heterosticta*	common bluetail				1
animals	insects	Nymphalidae	*Euploea corinna*	common crow				1
animals	insects	Nymphalidae	*Hypolimnas bolina nerina*	varied eggfly				1
animals	insects	Nymphalidae	*Junonia hedonia zelima*	chocolate argus				1

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animals	insects	Nymphalidae	*Melanitis leda bankia*	evening brown				1
animals	insects	Nymphalidae	*Mycalesis perseus perseus*	dingy bush-brown				2
animals	insects	Papilionidae	*Cressida cressida cressida*	clearwing swallowtail				3
animals	insects	Papilionidae	*Papilio aegeus*					1
animals	malacostracans	Palaemonidae	*Macrobrachium sp.*					1
animals	malacostracans	Parastacidae	*Cherax sp.*					4
animals	malacostracans	Parastacidae	*Euastacus bindal*	Mt Elliot crayfish		CR	CE	1
animals	mammals	Canidae	*Canis familiaris (dingo)*	dingo				1
animals	mammals	Dasyuridae	*Dasyurus hallucatus*	northern quoll		C	E	10
animals	mammals	Dasyuridae	*Planigale maculata*	common planigale		C		2
animals	mammals	Equidae	*Equus caballus*	horse	Y			1
animals	mammals	Macropodidae	*Lagorchestes conspicillatus*	spectacled hare-wallaby		C		1
animals	mammals	Macropodidae	*Macropus giganteus*	eastern grey kangaroo		C		10
animals	mammals	Macropodidae	*Notamacropus agilis*	agile wallaby		C		12
animals	mammals	Macropodidae	*Notamacropus parryi*	whiptail wallaby		C		2
animals	mammals	Macropodidae	*Osphranter robustus*	common wallaroo		C		2
animals	mammals	Macropodidae	*Petrogale assimilis*	allied rock-wallaby		C		6
animals	mammals	Muridae	*Hydromys chrysogaster*	water rat		C		1
animals	mammals	Muridae	*Melomys cervinipes*	fawn-footed melomys		C		9
animals	mammals	Muridae	*Mus musculus*	house mouse	Y			2
animals	mammals	Muridae	*Rattus fuscipes*	bush rat		C		8
animals	mammals	Muridae	*Uromys caudimaculatus*	giant white-tailed rat		C		1
animals	mammals	Muridae	*Zyzomys argurus*	common rock-rat		C		1
animals	mammals	Peramelidae	*Isoodon macrourus*	northern brown bandicoot		C		1
animals	mammals	Petauridae	*Petaurus norfolcensis*	squirrel glider		C		1
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		2
animals	mammals	Potoroidae	*Aepyprymnus rufescens*	rufous bettong		C		3
animals	mammals	Pseudocheiridae	*Petauroides volans sensu lato*	greater glider		V	V	2
animals	mammals	Pteropodidae	*Nyctimene robinsoni*	eastern tube-nosed bat		C		2
animals	mammals	Pteropodidae	*Pteropus alecto*	black flying-fox		C		2
animals	mammals	Rhinolophidae	*Rhinolophus megaphyllus*	eastern horseshoe-bat		C		2
animals	mammals	Suidae	*Sus scrofa*	pig	Y			9
animals	mammals	Vespertilionidae	*Nyctophilus bifax*	northern long-eared bat		C		1
animals	ray-finned fishes	Ambassidae	*Ambassis agrammus*	sailfin glassfish				2
animals	ray-finned fishes	Anguillidae	*Anguilla reinhardtii*	longfin eel				2
animals	ray-finned fishes	Apogonidae	*Glossamia aprion*	mouth almighty				2
animals	ray-finned fishes	Atherinidae	*Craterocephalus stercusmuscarum*	flyspecked hardyhead				4
animals	ray-finned fishes	Belonidae	*Strongylura krefftii*	freshwater longtom				1
animals	ray-finned fishes	Centropomidae	*Lates calcarifer*	barramundi				1
animals	ray-finned fishes	Cichlidae	*Oreochromis mossambica*	Mozambique mouthbrooder	Y			1
animals	ray-finned fishes	Clupeidae	*Nematalosa erebi*	bony bream				2
animals	ray-finned fishes	Eleotridae	*Hypseleotris compressa*	empire gudgeon				2
animals	ray-finned fishes	Eleotridae	*Hypseleotris sp.*					2
animals	ray-finned fishes	Eleotridae	*Mogurnda adspersa*	southern purplespotted gudgeon				2
animals	ray-finned fishes	Eleotridae	*Oxyeleotris lineolata*	sleepy cod				2
animals	ray-finned fishes	Kuhliidae	*Kuhlia rupestris*	jungle perch				1

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animals	ray-finned fishes	Melanotaeniidae	*Melanotaenia splendida splendida*	eastern rainbowfish				5
animals	ray-finned fishes	Plotosidae	*Neosilurus ater*	black catfish				1
animals	ray-finned fishes	Plotosidae	*Neosilurus hyrtlii*	Hyrtl's catfish				2
animals	ray-finned fishes	Poeciliidae	*Gambusia holbrooki*	mosquitofish	Y			1
animals	ray-finned fishes	Poeciliidae	*Poecilia reticulata*	guppy	Y			2
animals	ray-finned fishes	Terapontidae	*Amniataba percoides*	barred grunter				2
animals	ray-finned fishes	Terapontidae	*Bidyanus bidyanus*	silver perch			CE	1
animals	ray-finned fishes	Terapontidae	*Leiopotherapon unicolor*	spangled perch				2
animals	reptiles	Agamidae	*Diporiphora australis*	tommy roundhead		C		7/3
animals	reptiles	Boidae	*Liasis fuscus*	water python		C		1
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		5
animals	reptiles	Carphodactylidae	*Phyllurus amnicola*	Mount Elliot broad-tailed gecko		V		2/1
animals	reptiles	Chelidae	*Chelodina canni*	Cann's longneck turtle		C		1
animals	reptiles	Chelidae	*Emydura macquarii krefftii*	Krefft's river turtle		C		4/1
animals	reptiles	Chelidae	*Wollumbinia latisternum*	saw-shelled turtle		C		1
animals	reptiles	Colubridae	*Boiga irregularis*	brown tree snake		C		1
animals	reptiles	Colubridae	*Tropidonophis mairii*	freshwater snake		C		2
animals	reptiles	Diplodactylidae	*Amalosia rhombifer*	zig-zag gecko		C		2/1
animals	reptiles	Diplodactylidae	*Diplodactylus platyurus*	eastern fat-tailed gecko		C		1/1
animals	reptiles	Diplodactylidae	*Oedura castelnaui*	northern velvet gecko		C		1/1
animals	reptiles	Elapidae	*Acanthophis antarcticus*	common death adder		V		3
animals	reptiles	Elapidae	*Cryptophis nigrostriatus*	black-striped snake		C		1/1
animals	reptiles	Elapidae	*Demansia psammophis*	yellow-faced whipsnake		C		4
animals	reptiles	Elapidae	*Demansia torquata*	collared whipsnake		C		1
animals	reptiles	Elapidae	*Demansia vestigiata*	lesser black whipsnake		C		1
animals	reptiles	Elapidae	*Furina diadema*	red-naped snake		C		1/1
animals	reptiles	Elapidae	*Pseudonaja nuchalis sensu lato*	western brown snake		C		1
animals	reptiles	Elapidae	*Suta suta*	myall snake		C		1/1
animals	reptiles	Gekkonidae	*Gehyra dubia*	dubious dtella		C		5
animals	reptiles	Gekkonidae	*Gehyra sp.*			C		1
animals	reptiles	Gekkonidae	*Hemidactylus frenatus*	house gecko	Y			3
animals	reptiles	Gekkonidae	*Heteronotia binoei*	Bynoe's gecko		C		4/1
animals	reptiles	Pygopodidae	*Delma tincta*	excitable delma		C		1/1
animals	reptiles	Pygopodidae	*Lialis burtonis*	Burton's legless lizard		C		2/1
animals	reptiles	Scincidae	*Bellatorias frerei*	major skink		C		1
animals	reptiles	Scincidae	*Carlia decora*	elegant rainbow skink		C		4/4
animals	reptiles	Scincidae	*Carlia jarnoldae*	lined rainbow-skink		C		3
animals	reptiles	Scincidae	*Carlia pectoralis sensu lato*			C		1
animals	reptiles	Scincidae	*Carlia rhomboidalis*	blue-throated rainbow-skink		C		2
animals	reptiles	Scincidae	*Carlia vivax*	tussock rainbow-skink		C		1
animals	reptiles	Scincidae	*Concinnia brachysoma*	northern bar-sided skink		C		1
animals	reptiles	Scincidae	*Cryptoblepharus virgatus sensu lato*			C		1
animals	reptiles	Scincidae	*Ctenotus spaldingi*	straight-browed ctenotus		C		1
animals	reptiles	Scincidae	*Ctenotus taeniolatus*	copper-tailed skink		C		2
animals	reptiles	Scincidae	*Cyclodomorphus gerrardii*	pink-tongued lizard		C		3
animals	reptiles	Scincidae	*Eulamprus quoyii*	eastern water skink		C		4

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animals	reptiles	Scincidae	*Glaphyromorphus clandestinus*	Mt Elliot skink		C		1
animals	reptiles	Scincidae	*Lampropholis elliotensis*			C		5/4
animals	reptiles	Scincidae	*Lampropholis mirabilis*	saxicoline sunskink		NT		6
animals	reptiles	Scincidae	*Lampropholis sp.*			C		1
animals	reptiles	Scincidae	*Morethia taeniopleura*	fire-tailed skink		C		1/1
animals	reptiles	Scincidae	*Praeteropus gowi*	speckled worm-skink		C		1
animals	reptiles	Scincidae	*Pygmaeascincus timlowi*	dwarf litter-skink		C		1
animals	reptiles	Scincidae	*Saproscincus basiliscus*	basilisk shadeskink		C		6/1
animals	reptiles	Typhlopidae	*Anilios affinis*	small-headed blind snake		C		4/4
animals	reptiles	Typhlopidae	*Anilios ligatus*	robust blind snake		C		1/1
animals	reptiles	Typhlopidae	*Anilios torresianus*	north-eastern blind snake		C		1
animals	reptiles	Varanidae	*Varanus scalaris*	spotted tree monitor		C		1/1
animals	reptiles	Varanidae	*Varanus tristis*	black-tailed monitor		C		1
animals	reptiles	Varanidae	*Varanus varius*	lace monitor		C		4
animals	uncertain	Indeterminate	*Indeterminate*	Unknown or Code Pending				14/1
plants	land plants	Acanthaceae	*Brunoniella acaulis subsp. acaulis*			C		1/1
plants	land plants	Acanthaceae	*Graptophyllum excelsum*			NT		2/2
plants	land plants	Acanthaceae	*Harnieria hygrophiloides*	white karambal		C		2/2
plants	land plants	Acanthaceae	*Hypoestes floribunda var. floribunda*			C		1/1
plants	land plants	Acanthaceae	*Nelsonia campestris*			C		1/1
plants	land plants	Acanthaceae	*Rostellularia adscendens*			C		1/1
plants	land plants	Acanthaceae	*Rostellularia adscendens subsp. dallachyi*			C		1/1
plants	land plants	Amaranthaceae	*Alternanthera ficoidea*		Y			1/1
plants	land plants	Amaranthaceae	*Amaranthus interruptus*			C		1/1
plants	land plants	Amaranthaceae	*Amaranthus spinosus*	needle burr	Y			1/1
plants	land plants	Amaranthaceae	*Deeringia amaranthoides*	redberry		C		2/2
plants	land plants	Amaranthaceae	*Gomphrena humilis*			C		1/1
plants	land plants	Anacardiaceae	*Euroschinus falcatus var. angustifolius*			C		1/1
plants	land plants	Anacardiaceae	*Euroschinus falcatus var. falcatus*			C		1/1
plants	land plants	Annonaceae	*Fitzalania heteropetala*			C		1/1
plants	land plants	Annonaceae	*Huberantha nitidissima*			C		1/1
plants	land plants	Annonaceae	*Xylopia maccreae*			C		1/1
plants	land plants	Apiaceae	*Centella asiatica*			C		1/1
plants	land plants	Apiaceae	*Mackinlaya macrosciadea*	mackinlaya		C		2/2
plants	land plants	Apocynaceae	*Alyxia ruscifolia*			C		1/1
plants	land plants	Apocynaceae	*Alyxia spicata*			C		2/2
plants	land plants	Apocynaceae	*Asclepias curassavica*	red-head cottonbush	Y			1/1
plants	land plants	Apocynaceae	*Carissa lanceolata*			C		1
plants	land plants	Apocynaceae	*Cryptostegia grandiflora*	rubber vine	Y			6
plants	land plants	Apocynaceae	*Cynanchum pedunculatum*			C		1/1
plants	land plants	Apocynaceae	*Parsonsia lanceolata*	northern silkpod		C		1/1
plants	land plants	Apocynaceae	*Parsonsia lenticellata*	narrow-leaved parsonsia		C		3/3
plants	land plants	Apocynaceae	*Parsonsia plaesiophylla*			C		1/1
plants	land plants	Apocynaceae	*Vincetoxicum erectum*			C		1/1
plants	land plants	Apocynaceae	*Vincetoxicum williamsii*			C		1/1
plants	land plants	Apocynaceae	*Wrightia saligna*			C		1/1

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plants	land plants	Aquifoliaceae	*Ilex arnhemensis subsp. ferdinandi*			C		1/1
plants	land plants	Araceae	*Typhonium flagelliforme*			C		1/1
plants	land plants	Araliaceae	*Cephalaralia cephalobotrys*	climbing panax		C		1/1
plants	land plants	Araliaceae	*Trachymene montana*			C		1/1
plants	land plants	Arecaceae	*Archontophoenix cunninghamiana*	piccabeen palm		C		1/1
plants	land plants	Argophyllaceae	*Argophyllum lejourdanii*			C		2/2
plants	land plants	Aspleniaceae	*Asplenium australasicum*			C		1/1
plants	land plants	Asteraceae	*Acmella grandiflora var. brachyglossa*			C		1/1
plants	land plants	Asteraceae	*Adenostemma macrophyllum*			C		1/1
plants	land plants	Asteraceae	*Ageratum conyzoides subsp. conyzoides*		Y			1/1
plants	land plants	Asteraceae	*Blumea benthamiana*			C		1/1
plants	land plants	Asteraceae	*Blumea saxatilis*			C		1/1
plants	land plants	Asteraceae	*Camptacra barbata*			C		1/1
plants	land plants	Asteraceae	*Centipeda borealis*			C		3/3
plants	land plants	Asteraceae	*Chromolaena odorata*	Siam weed	Y			3/3
plants	land plants	Asteraceae	*Chrysocephalum apiculatum*	yellow buttons		C		2/2
plants	land plants	Asteraceae	*Coronidium lanuginosum*			C		1/1
plants	land plants	Asteraceae	*Coronidium rupicola*			C		1/1
plants	land plants	Asteraceae	*Cyanthillium cinereum*			C		4/4
plants	land plants	Asteraceae	*Eclipta prostrata*	white eclipta	Y			1/1
plants	land plants	Asteraceae	*Eleutheranthera ruderalis*		Y			1/1
plants	land plants	Asteraceae	*Eschenbachia leucantha*			C		1/1
plants	land plants	Asteraceae	*Euchiton sphaericus*			C		1/1
plants	land plants	Asteraceae	*Ozothamnus cassinioides*			C		1/1
plants	land plants	Asteraceae	*Peripleura bicolor*			C		2/2
plants	land plants	Asteraceae	*Peripleura hispidula var. hispidula*			C		1/1
plants	land plants	Asteraceae	*Peripleura hispidula var. setosa*			C		2/2
plants	land plants	Asteraceae	*Peripleura scabra*			C		4/4
plants	land plants	Asteraceae	*Phacellothrix cladochaeta*			C		1/1
plants	land plants	Asteraceae	*Praxelis clematidea*		Y			1/1
plants	land plants	Asteraceae	*Pseudognaphalium luteoalbum*	Jersey cudweed		C		2/2
plants	land plants	Asteraceae	*Pterocaulon ciliosum*			C		2/2
plants	land plants	Asteraceae	*Pterocaulon intermedium*			C		1/1
plants	land plants	Asteraceae	*Pterocaulon serrulatum var. serrulatum*			C		1/1
plants	land plants	Asteraceae	*Sigesbeckia orientalis*	Indian weed		C		1/1
plants	land plants	Asteraceae	*Sphaeromorphaea subintegra*			C		1/1
plants	land plants	Asteraceae	*Streptoglossa odora*			C		1/1
plants	land plants	Asteraceae	*Symphyotrichum subulatum*		Y			1/1
plants	land plants	Asteraceae	*Xerochrysum bracteatum subsp. (Mount Elliot A.R.Bean 3593)*			C		2/2
plants	land plants	Balanopaceae	*Balanops australiana*			C		1/1
plants	land plants	Bignoniaceae	*Pandorea nervosa*			C		1/1
plants	land plants	Bignoniaceae	*Pandorea pandorana*	wonga vine		C		1/1
plants	land plants	Blechnaceae	*Blechnum cartilagineum*	gristle fern		C		1/1
plants	land plants	Blechnaceae	*Blechnum neohollandicum*			C		1/1
plants	land plants	Blechnaceae	*Blechnum patersonii*			SL		1/1

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plants	land plants	Boraginaceae	*Ehretia grahamii*			C		1/1
plants	land plants	Boraginaceae	*Heliotropium ovalifolium*			C		1/1
plants	land plants	Boraginaceae	*Trichodesma zeylanicum var. zeylanicum*			C		1/1
plants	land plants	Byttneriaceae	*Commersonia reticulata*			V		1/1
plants	land plants	Campanulaceae	*Lobelia concolor*			SL		1/1
plants	land plants	Campanulaceae	*Lobelia quadrangularis*			SL		1/1
plants	land plants	Carpodetaceae	*Abrophyllum ornans*			C		1/1
plants	land plants	Casuarinaceae	*Allocasuarina luehmannii*	bull oak		C		1/1
plants	land plants	Celastraceae	*Celastraceae*					1
plants	land plants	Celastraceae	*Denhamia celastroides*	broad-leaved boxwood		C		1/1
plants	land plants	Celastraceae	*Elaeodendron melanocarpum*			C		1/1
plants	land plants	Celastraceae	*Euonymus australiana*			C		3/3
plants	land plants	Celastraceae	*Hedraianthera porphyropetala*	hedrianthera		C		2/2
plants	land plants	Centrolepidaceae	*Centrolepis exserta*			C		2/2
plants	land plants	Ceratophyllaceae	*Ceratophyllum*					1/1
plants	land plants	Chenopodiaceae	*Chenopodium album*	fat-hen	Y			1/1
plants	land plants	Chenopodiaceae	*Chenopodium murale*	green fat-hen	Y			1/1
plants	land plants	Cleomaceae	*Arivela viscosa*			C		1/1
plants	land plants	Commelinaceae	*Commelina diffusa*	wandering jew		C		1/1
plants	land plants	Commelinaceae	*Commelina ensifolia*	scurvy grass		C		1/1
plants	land plants	Convolvulaceae	*Argyreia nervosa*		Y			2/2
plants	land plants	Convolvulaceae	*Bonamia dietrichiana*			C		1/1
plants	land plants	Convolvulaceae	*Ipomoea abrupta*			C		1/1
plants	land plants	Convolvulaceae	*Ipomoea brassii*			C		1/1
plants	land plants	Convolvulaceae	*Ipomoea polymorpha*			C		2/2
plants	land plants	Convolvulaceae	*Jacquemontia paniculata*			C		1/1
plants	land plants	Convolvulaceae	*Polymeria marginata*			C		1/1
plants	land plants	Convolvulaceae	*Xenostegia tridentata*			C		1/1
plants	land plants	Cornaceae	*Alangium polyosmoides subsp. tomentosum*			C		3/3
plants	land plants	Cunoniaceae	*Ackama australiensis*			C		1/1
plants	land plants	Cyatheaceae	*Alsophila australis*			C		1/1
plants	land plants	Cyatheaceae	*Alsophila rebeccae*			C		1/1
plants	land plants	Cycadaceae	*Cycas*					1
plants	land plants	Cycadaceae	*Cycas media subsp. media*			SL		1/1
plants	land plants	Cyperaceae	*Carex maculata*			C		1/1
plants	land plants	Cyperaceae	*Cyperus aquatilis*			C		2/2
plants	land plants	Cyperaceae	*Cyperus brevifolius*	Mullumbimby couch	Y			1/1
plants	land plants	Cyperaceae	*Cyperus castaneus*			C		1/1
plants	land plants	Cyperaceae	*Cyperus concinnus*			C		1/1
plants	land plants	Cyperaceae	*Cyperus conicus var. conicus*			C		1/1
plants	land plants	Cyperaceae	*Cyperus dietrichiae*			C		1/1
plants	land plants	Cyperaceae	*Cyperus difformis*	rice sedge		C		3/3
plants	land plants	Cyperaceae	*Cyperus distans*			C		2/2
plants	land plants	Cyperaceae	*Cyperus gracilis*			C		1/1
plants	land plants	Cyperaceae	*Cyperus haspan subsp. haspan*			C		2/2
plants	land plants	Cyperaceae	*Cyperus javanicus*			C		2/2

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plants	land plants	Cyperaceae	*Cyperus leptocarpus*			C		1/1
plants	land plants	Cyperaceae	*Cyperus perangustus*			C		2/2
plants	land plants	Cyperaceae	*Cyperus platystylis*			C		1/1
plants	land plants	Cyperaceae	*Cyperus polystachyos*			C		1/1
plants	land plants	Cyperaceae	*Cyperus polystachyos var. laxiflorus*			C		2/2
plants	land plants	Cyperaceae	*Cyperus procerus*			C		2/2
plants	land plants	Cyperaceae	*Cyperus pulchellus*			C		1/1
plants	land plants	Cyperaceae	*Cyperus squarrosus*	bearded flatsedge		C		1/1
plants	land plants	Cyperaceae	*Cyperus trinervis*			C		1/1
plants	land plants	Cyperaceae	*Eleocharis geniculata*			C		1/1
plants	land plants	Cyperaceae	*Eleocharis setifolia subsp. setifolia*			C		1/1
plants	land plants	Cyperaceae	*Fimbristylis acicularis*			C		1/1
plants	land plants	Cyperaceae	*Fimbristylis cinnamometorum*			C		1/1
plants	land plants	Cyperaceae	*Fimbristylis depauperata*			C		2/2
plants	land plants	Cyperaceae	*Fimbristylis dolera*			C		1/1
plants	land plants	Cyperaceae	*Fimbristylis littoralis*			C		2/2
plants	land plants	Cyperaceae	*Fimbristylis microcarya*			C		2/2
plants	land plants	Cyperaceae	*Fimbristylis nuda*			C		1/1
plants	land plants	Cyperaceae	*Fimbristylis sieberiana*			C		1/1
plants	land plants	Cyperaceae	*Fuirena ciliaris*			C		2/2
plants	land plants	Cyperaceae	*Lepidosperma laterale*			C		1/1
plants	land plants	Cyperaceae	*Rhynchospora heterochaeta*			C		1/1
plants	land plants	Cyperaceae	*Schoenoplectiella articulata*			C		1/1
plants	land plants	Cyperaceae	*Schoenoplectiella mucronata*			C		2/2
plants	land plants	Cyperaceae	*Schoenus falcatus*			C		1/1
plants	land plants	Cyperaceae	*Scleria biflora subsp. biflora*			C		1/1
plants	land plants	Cyperaceae	*Scleria brownii*			C		1/1
plants	land plants	Cyperaceae	*Scleria levis*			C		1/1
plants	land plants	Cyperaceae	*Scleria novae-hollandiae*			C		1/1
plants	land plants	Cyperaceae	*Scleria sphacelata*			C		2/2
plants	land plants	Cyperaceae	*Tetraria capillaris*			C		1/1
plants	land plants	Davalliaceae	*Davallia denticulata var. denticulata*			C		3/3
plants	land plants	Dennstaedtiaceae	*Histiopteris incisa*	bats-wing fern		C		1/1
plants	land plants	Dennstaedtiaceae	*Pteridium esculentum*	common bracken		C		1/1
plants	land plants	Dioscoreaceae	*Dioscorea transversa*	native yam		C		1/1
plants	land plants	Droseraceae	*Drosera finlaysoniana*			SL		1/1
plants	land plants	Dryopteridaceae	*Elaphoglossum queenslandicum*	tongue fern		SL		1/1
plants	land plants	Dryopteridaceae	*Lastreopsis tenera*			SL		1/1
plants	land plants	Ebenaceae	*Diospyros geminata*	scaly ebony		C		2/2
plants	land plants	Ebenaceae	*Diospyros laurina*			C		3/3
plants	land plants	Elaeocarpaceae	*Elaeocarpus foveolatus*			C		2/2
plants	land plants	Elaeocarpaceae	*Elaeocarpus largiflorens subsp. largiflorens*			C		2/2
plants	land plants	Elaeocarpaceae	*Elaeocarpus obovatus subsp. obovatus*			C		1/1
plants	land plants	Elaeocarpaceae	*Elaeocarpus sericopetalus*			C		3/3
plants	land plants	Eriocaulaceae	*Eriocaulon pygmaeum*			C		2/2
plants	land plants	Escalloniaceae	*Polyosma alangiacea*			C		1/1

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plants	land plants	Escalloniaceae	*Polyosma rhytophloia*			C		1/1
plants	land plants	Euphorbiaceae	*Claoxylon tenerifolium subsp. tenerifolium*			C		1/1
plants	land plants	Euphorbiaceae	*Croton insularis*	Queensland cascarilla		C		1/1
plants	land plants	Euphorbiaceae	*Croton phebalioides*	narrow-leaved croton		C		1/1
plants	land plants	Euphorbiaceae	*Euphorbia bifida*			C		1/1
plants	land plants	Euphorbiaceae	*Euphorbia macdonaldii var. macdonaldii*			C		1/1
plants	land plants	Euphorbiaceae	*Euphorbia tannensis subsp. eremophila*			C		1/1
plants	land plants	Euphorbiaceae	*Mallotus philippensis*	red kamala		C		1
plants	land plants	Euphorbiaceae	*Mallotus polyadenos*			C		2/2
plants	land plants	Fissidentaceae	*Fissidens*					1/1
plants	land plants	Gentianaceae	*Canscora diffusa*			C		3/3
plants	land plants	Gesneriaceae	*Boea hygroscopica*			SL		1/1
plants	land plants	Goodeniaceae	*Goodenia mystrophylla*			C		1/1
plants	land plants	Goodeniaceae	*Scaevola spinescens*	prickly fan flower		C		1/1
plants	land plants	Haloragaceae	*Gonocarpus teucrioides*			C		1/1
plants	land plants	Haloragaceae	*Myriophyllum*					1/1
plants	land plants	Helicteraceae	*Helicteres semiglabra*			C		1/1
plants	land plants	Hemerocallidaceae	*Dianella caerulea*			C		1/1
plants	land plants	Hydrocharitaceae	*Hydrilla verticillata*	hydrilla		SL		2/2
plants	land plants	Hydrocharitaceae	*Vallisneria annua*			SL		1/1
plants	land plants	Hymenophyllaceae	*Hymenophyllum walleri*			SL		1/1
plants	land plants	Icacinaceae	*Apodytes brachystylis*			C		2/2
plants	land plants	Johnsoniaceae	*Tricoryne anceps subsp. pterocaulon*			C		2/2
plants	land plants	Lamiaceae	*Anisomeles moschata*			C		2/2
plants	land plants	Lamiaceae	*Basilicum polystachyon*			C		1/1
plants	land plants	Lamiaceae	*Clerodendrum floribundum*			C		1/1
plants	land plants	Lamiaceae	*Coleus australis*			C		1/1
plants	land plants	Lamiaceae	*Coleus congestus*			C		1/1
plants	land plants	Lamiaceae	*Coleus diversus*			C		1/1
plants	land plants	Lamiaceae	*Gmelina leichhardtii*	white beech		C		1/1
plants	land plants	Lamiaceae	*Pityrodia salviifolia*	pityrodia		C		1/1
plants	land plants	Lamiaceae	*Teucrium modestum*			C		1/1
plants	land plants	Lauraceae	*Beilschmiedia collina*			C		2/2
plants	land plants	Lauraceae	*Cinnamomum laubatii*			C		1/1
plants	land plants	Lauraceae	*Cinnamomum oliveri*	Oliver's sassafras		C		1/1
plants	land plants	Lauraceae	*Cryptocarya angulata*	ivory laurel		C		1/1
plants	land plants	Lauraceae	*Cryptocarya bidwillii*	yellow laurel		C		1/1
plants	land plants	Lauraceae	*Cryptocarya corrugata*			C		1/1
plants	land plants	Lauraceae	*Cryptocarya densiflora*			C		1/1
plants	land plants	Lauraceae	*Cryptocarya glaucescens*			C		1/1
plants	land plants	Lauraceae	*Cryptocarya grandis*			C		2/2
plants	land plants	Lauraceae	*Cryptocarya hypospodia*	north Queensland purple laurel		C		1/1
plants	land plants	Lauraceae	*Cryptocarya leucophylla*			C		1/1
plants	land plants	Lauraceae	*Cryptocarya macdonaldii*	McDonald's laurel		C		1/1
plants	land plants	Lauraceae	*Cryptocarya onoprienkoana*			C		1/1
plants	land plants	Lauraceae	*Cryptocarya triplinervis var. triplinervis*			C		1/1

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plants	land plants	Lauraceae	*Endiandra bessaphila*			C		1/1
plants	land plants	Lauraceae	*Endiandra cowleyana*	northern rose walnut		C		2/2
plants	land plants	Lauraceae	*Endiandra discolor*	domatia tree		C		1/1
plants	land plants	Lauraceae	*Endiandra wolfei*			C		2/2
plants	land plants	Lauraceae	*Litsea fawcettiana*			C		3/3
plants	land plants	Lauraceae	*Litsea glutinosa*			C		2/2
plants	land plants	Lauraceae	*Litsea leefeana*			C		1/1
plants	land plants	Laxmanniaceae	*Cordyline murchisoniae*			SL		1/1
plants	land plants	Laxmanniaceae	*Lomandra filiformis subsp. filiformis*			C		1/1
plants	land plants	Laxmanniaceae	*Lomandra multiflora subsp. multiflora*			C		1/1
plants	land plants	Leguminosae	*Acacia hemsleyi*			C		1/1
plants	land plants	Leguminosae	*Acacia holosericea*			C		1/1
plants	land plants	Leguminosae	*Acacia jackesiana*			C		4/3
plants	land plants	Leguminosae	*Acacia julifera subsp. julifera*			C		1/1
plants	land plants	Leguminosae	*Acacia leptostachya*	Townsville wattle		C		1/1
plants	land plants	Leguminosae	*Acacia salicina*	doolan		C		1/1
plants	land plants	Leguminosae	*Acaciella*					1/1
plants	land plants	Leguminosae	*Acaciella angustissima*	white ball acacia	Y			5/5
plants	land plants	Leguminosae	*Aeschynomene indica*	budda pea		C		1/1
plants	land plants	Leguminosae	*Aeschynomene villosa*		Y			1/1
plants	land plants	Leguminosae	*Albizia*					1/1
plants	land plants	Leguminosae	*Albizia procera*			C		1/1
plants	land plants	Leguminosae	*Alysicarpus aurantiacus*			C		1/1
plants	land plants	Leguminosae	*Archidendron grandiflorum*	lace flower tree		C		1/1
plants	land plants	Leguminosae	*Archidendropsis thozetiana*			C		3/3
plants	land plants	Leguminosae	*Butea monosperma*		Y			1/1
plants	land plants	Leguminosae	*Cajanus marmoratus*			C		4/4
plants	land plants	Leguminosae	*Cajanus reticulatus var. reticulatus*			C		4/4
plants	land plants	Leguminosae	*Cajanus scarabaeoides var. scarabaeoides*			C		2/2
plants	land plants	Leguminosae	*Chamaecrista mimosoides*	dwarf cassia		C		2/2
plants	land plants	Leguminosae	*Crotalaria goreensis*	gambia pea	Y			1/1
plants	land plants	Leguminosae	*Crotalaria juncea*	sunhemp	Y			1/1
plants	land plants	Leguminosae	*Crotalaria laburnifolia*		Y			2/2
plants	land plants	Leguminosae	*Crotalaria mitchellii subsp. mitchellii*			C		1/1
plants	land plants	Leguminosae	*Crotalaria spectabilis*	showy rattlepod	Y			1/1
plants	land plants	Leguminosae	*Crotalaria verrucosa*			C		3/3
plants	land plants	Leguminosae	*Cullen badocanum*			C		3/3
plants	land plants	Leguminosae	*Desmodium trichostachyum*			C		1/1
plants	land plants	Leguminosae	*Erythrina vespertilio subsp. vespertilio*			C		1/1
plants	land plants	Leguminosae	*Falcataria toona*			C		2/2
plants	land plants	Leguminosae	*Flemingia parviflora*	flemingia		C		3/3
plants	land plants	Leguminosae	*Flemingia trifoliata*			C		3/3
plants	land plants	Leguminosae	*Galactia*					1/1
plants	land plants	Leguminosae	*Galactia tenuiflora forma sericea*			C		1/1
plants	land plants	Leguminosae	*Galactia tenuiflora var. lucida*			C		2/2
plants	land plants	Leguminosae	*Glycine tomentella*	woolly glycine		C		3/3

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plants	land plants	Leguminosae	*Hovea longipes*	brush hovea		C		1/1
plants	land plants	Leguminosae	*Indigofera hirsuta*	hairy indigo		C		1/1
plants	land plants	Leguminosae	*Indigofera linifolia*			C		1/1
plants	land plants	Leguminosae	*Indigofera polygaloides*			C		1/1
plants	land plants	Leguminosae	*Indigofera pratensis*			C		1/1
plants	land plants	Leguminosae	*Indigofera tryonii*			C		2/2
plants	land plants	Leguminosae	*Kennedia rubicunda*	red Kennedy pea		C		2/2
plants	land plants	Leguminosae	*Leucaena leucocephala*		Y			12
plants	land plants	Leguminosae	*Leucaena leucocephala subsp. glabrata*		Y			1/1
plants	land plants	Leguminosae	*Macrotyloma uniflorum var. stenocarpum*		Y			1/1
plants	land plants	Leguminosae	*Millettia pinnata*			C		1/1
plants	land plants	Leguminosae	*Rhynchosia minima*			C		1/1
plants	land plants	Leguminosae	*Rhynchosia minima var. minima*			C		1/1
plants	land plants	Leguminosae	*Senegalia*					3/3
plants	land plants	Leguminosae	*Senna coronilloides*			C		1/1
plants	land plants	Leguminosae	*Senna gaudichaudii*			C		1/1
plants	land plants	Leguminosae	*Senna occidentalis*	coffee senna	Y			1/1
plants	land plants	Leguminosae	*Stylosanthes viscosa*		Y			1/1
plants	land plants	Leguminosae	*Tephrosia astragaloides*			C		2/2
plants	land plants	Leguminosae	*Tephrosia brachyodon*			C		1/1
plants	land plants	Leguminosae	*Tephrosia brachyodon var. brachyodon*			C		2/2
plants	land plants	Leguminosae	*Tephrosia brachyodon var. longifolia*			C		1/1
plants	land plants	Leguminosae	*Tephrosia juncea*			C		1/1
plants	land plants	Leguminosae	*Tephrosia macrostachya*			C		1/1
plants	land plants	Leguminosae	*Tephrosia sp. (Miriam Vale E.J.Thompson+ MIR33)*			C		1/1
plants	land plants	Leguminosae	*Uraria lagopodioides*			C		1/1
plants	land plants	Leguminosae	*Vachellia bidwillii*			C		2/2
plants	land plants	Leguminosae	*Vigna radiata var. sublobata*			C		2/2
plants	land plants	Leguminosae	*Vigna vexillata var. youngiana*			C		1/1
plants	land plants	Leguminosae	*Zornia dyctiocarpa var. filifolia*			C		1/1
plants	land plants	Leguminosae	*Zornia muelleriana subsp. muelleriana*			C		1/1
plants	land plants	Leguminosae	*Zornia muriculata subsp. angustata*			C		1/1
plants	land plants	Leguminosae	*Zornia muriculata subsp. muriculata*			C		1/1
plants	land plants	Lentibulariaceae	*Utricularia*					1/1
plants	land plants	Lentibulariaceae	*Utricularia aurea*	golden bladderwort		SL		2/2
plants	land plants	Lentibulariaceae	*Utricularia blackmanii*			SL		1/1
plants	land plants	Lentibulariaceae	*Utricularia minutissima*			SL		1/1
plants	land plants	Lindsaeaceae	*Lindsaea ensifolia subsp. agatii*			C		1/1
plants	land plants	Loganiaceae	*Mitrasacme nummularia*			C		1/1
plants	land plants	Loganiaceae	*Mitrasacme prolifera*			C		1/1
plants	land plants	Loganiaceae	*Strychnos psilosperma*	strychnine tree		C		1/1
plants	land plants	Loranthaceae	*Dendrophthoe vitellina*	long-flowered mistletoe		C		3/3
plants	land plants	Lycopodiaceae	*Phlegmariurus harmsii*			SL		1/1
plants	land plants	Lythraceae	*Ammannia multiflora*	jerry-jerry		C		3/3
plants	land plants	Lythraceae	*Lythrum paradoxum*			C		1/1
plants	land plants	Malpighiaceae	*Stigmaphyllon australiense*			C		3/3

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plants	land plants	Malvaceae	*Abelmoschus moschatus subsp. tuberosus*			C		1/1
plants	land plants	Malvaceae	*Abutilon auritum*	Chinese lantern		C		1/1
plants	land plants	Malvaceae	*Abutilon guineense*		Y			1/1
plants	land plants	Malvaceae	*Abutilon micropetalum*			C		3/3
plants	land plants	Malvaceae	*Hibiscus heterophyllus*			C		1/1
plants	land plants	Malvaceae	*Hibiscus meraukensis*	Merauke hibiscus		C		1/1
plants	land plants	Malvaceae	*Hibiscus phyllochlaenus*			C		1/1
plants	land plants	Malvaceae	*Hibiscus townsvillensis*			C		4/4
plants	land plants	Malvaceae	*Hibiscus vitifolius*			C		1/1
plants	land plants	Malvaceae	*Urena lobata*	urena weed	Y			1/1
plants	land plants	Marattiaceae	*Ptisana oreades*			C		1/1
plants	land plants	Marsileaceae	*Marsilea crenata*			C		1/1
plants	land plants	Meliaceae	*Turraea pubescens*	native honeysuckle		C		2/2
plants	land plants	Menispermaceae	*Hypserpa decumbens*			C		1/1
plants	land plants	Menispermaceae	*Stephania japonica var. timoriensis*			C		1/1
plants	land plants	Mniaceae	*Pohlia*					1/1
plants	land plants	Molluginaceae	*Glinus oppositifolius*			C		1/1
plants	land plants	Monimiaceae	*Steganthera laxiflora subsp. laxiflora*			C		1/1
plants	land plants	Monimiaceae	*Wilkiea pubescens*			C		2/2
plants	land plants	Moraceae	*Ficus henneana*			C		1/1
plants	land plants	Moraceae	*Ficus rubiginosa forma rubiginosa*			C		1/1
plants	land plants	Moraceae	*Ficus virens var. virens*			C		1/1
plants	land plants	Myrsinaceae	*Lysimachia ovalis*			C		1/1
plants	land plants	Myrsinaceae	*Myrsine ireneae subsp. ireneae*			C		1/1
plants	land plants	Myrsinaceae	*Myrsine porosa*			C		1/1
plants	land plants	Myrsinaceae	*Myrsine variabilis*			C		1/1
plants	land plants	Myrsinaceae	*Tapeinosperma pseudojambosa*	tapeinosperma		C		2/2
plants	land plants	Myrtaceae	*Acmena resa*	red Eungella satinash		C		2/2
plants	land plants	Myrtaceae	*Archirhodomyrtus beckleri*	rose myrtle		C		1/1
plants	land plants	Myrtaceae	*Backhousia angustifolia*	narrow-leaved backhousia		C		1/1
plants	land plants	Myrtaceae	*Backhousia citriodora*	lemon ironwood		C		1/1
plants	land plants	Myrtaceae	*Corymbia clarksoniana*			C		1/1
plants	land plants	Myrtaceae	*Corymbia intermedia*	pink bloodwood		C		2/2
plants	land plants	Myrtaceae	*Corymbia lamprophylla*			C		1/1
plants	land plants	Myrtaceae	*Corymbia peltata*	yellowjacket		C		1/1
plants	land plants	Myrtaceae	*Eucalyptus acmenoides*			C		1/1
plants	land plants	Myrtaceae	*Eucalyptus brownii*	Reid River box		C		2/2
plants	land plants	Myrtaceae	*Eucalyptus drepanophylla*			C		3/1
plants	land plants	Myrtaceae	*Eucalyptus exserta*	Queensland peppermint		C		1/1
plants	land plants	Myrtaceae	*Eucalyptus grandis*	flooded gum		C		1/1
plants	land plants	Myrtaceae	*Eucalyptus paedoglauca*	Mt. Stuart ironbark		V	V	4/4
plants	land plants	Myrtaceae	*Eucalyptus persistens*			C		1/1
plants	land plants	Myrtaceae	*Eucalyptus platyphylla*	poplar gum		C		2/2
plants	land plants	Myrtaceae	*Eucalyptus portuensis*			C		1/1
plants	land plants	Myrtaceae	*Eucalyptus resinifera*	red mahogany		C		1/1
plants	land plants	Myrtaceae	*Eucalyptus shirleyi*			C		2/2

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plants	land plants	Myrtaceae	*Eucalyptus xanthoclada*	yellow-branched ironbark		C		2/2
plants	land plants	Myrtaceae	*Eugenia reinwardtiana*	beach cherry		C		2/2
plants	land plants	Myrtaceae	*Gossia bidwillii*			C		1/1
plants	land plants	Myrtaceae	*Leptospermum anfractum*			C		2/2
plants	land plants	Myrtaceae	*Leptospermum neglectum*			C		1/1
plants	land plants	Myrtaceae	*Lophostemon confertus x Lophostemon grandiflorus*			C		2/2
plants	land plants	Myrtaceae	*Lophostemon grandiflorus subsp. riparius*			C		2/2
plants	land plants	Myrtaceae	*Melaleuca bracteata*			C		1/1
plants	land plants	Myrtaceae	*Melaleuca leucadendra*	broad-leaved tea-tree		C		1/1
plants	land plants	Myrtaceae	*Melaleuca nervosa*			C		1/1
plants	land plants	Myrtaceae	*Melaleuca recurva*			C		3/3
plants	land plants	Myrtaceae	*Melaleuca trichostachya*			C		1/1
plants	land plants	Myrtaceae	*Melaleuca viminalis*			C		2/1
plants	land plants	Myrtaceae	*Melaleuca viridiflora var. viridiflora*			C		1/1
plants	land plants	Myrtaceae	*Rhodamnia costata*			C		1/1
plants	land plants	Myrtaceae	*Rhodomyrtus trineura subsp. trineura*			C		1/1
plants	land plants	Myrtaceae	*Sannantha papillosa*			E		5/5
plants	land plants	Myrtaceae	*Syzygium australe*	scrub cherry		C		1/1
plants	land plants	Myrtaceae	*Syzygium cryptophlebium*			C		2/2
plants	land plants	Myrtaceae	*Syzygium endophloium*			C		2/2
plants	land plants	Myrtaceae	*Syzygium papyraceum*	paperbark satinash		C		1/1
plants	land plants	Najadaceae	*Najas*					2/2
plants	land plants	Najadaceae	*Najas browniana*			SL		1/1
plants	land plants	Nephrolepidaceae	*Nephrolepis brownii*			C		1/1
plants	land plants	Nyctaginaceae	*Boerhavia pubescens*			C		1/1
plants	land plants	Nymphaeaceae	*Nymphaea gigantea*			SL		3/2
plants	land plants	Nymphaeaceae	*Nymphaea immutabilis*			SL		1/1
plants	land plants	Nymphaeaceae	*Nymphaea jacobsii*			SL		1/1
plants	land plants	Nymphaeaceae	*Nymphaea violacea*			SL		3/3
plants	land plants	Oleaceae	*Jasminum dallachii*	soft jasmine		C		1/1
plants	land plants	Oleaceae	*Jasminum didymum subsp. racemosum*			C		2/2
plants	land plants	Oleaceae	*Notelaea microcarpa*			C		2/2
plants	land plants	Orchidaceae	*Bulbophyllum schillerianum*	red rope orchid		SL		1/1
plants	land plants	Orchidaceae	*Cestichis nugentiae*			SL		1/1
plants	land plants	Orchidaceae	*Cymbidium madidum*			SL		1/1
plants	land plants	Orobanchaceae	*Rhamphicarpa australiensis*			C		2/1
plants	land plants	Passifloraceae	*Passiflora aurantia var. aurantia*			C		1/1
plants	land plants	Pentapetaceae	*Melhania oblongifolia*			C		1/1
plants	land plants	Phyllanthaceae	*Actephila sessilifolia*			C		1/1
plants	land plants	Phyllanthaceae	*Cleistanthus xerophilus*			C		1/1
plants	land plants	Phyllanthaceae	*Flueggea virosa subsp. melanthesoides*			C		1/1
plants	land plants	Phyllanthaceae	*Glochidion apodogynum*			C		1/1
plants	land plants	Phyllanthaceae	*Glochidion harveyanum var. harveyanum*			C		1/1
plants	land plants	Phyllanthaceae	*Glochidion lobocarpum*			C		1/1
plants	land plants	Phyllanthaceae	*Phyllanthus carpentariae*			C		1/1
plants	land plants	Phyllanthaceae	*Phyllanthus novae-hollandiae*			C		1/1

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plants	land plants	Phyllanthaceae	*Poranthera microphylla*	small poranthera		C		1/1
plants	land plants	Phyllanthaceae	*Synostemon albiflorus*			C		1/1
plants	land plants	Picrodendraceae	*Dissiliaria indistincta*			C		1/1
plants	land plants	Pittosporaceae	*Pittosporum revolutum*	yellow pittosporum		C		2/2
plants	land plants	Plantaginaceae	*Bacopa floribunda*			C		2/2
plants	land plants	Plantaginaceae	*Limnophila brownii*			C		4/4
plants	land plants	Plantaginaceae	*Scoparia dulcis*	scoparia	Y			2/2
plants	land plants	Poaceae	*Alloteropsis semialata*	cockatoo grass		C		1/1
plants	land plants	Poaceae	*Andropogon gayanus*	gamba grass	Y			5/5
plants	land plants	Poaceae	*Aristida gracilipes*			C		1/1
plants	land plants	Poaceae	*Aristida hygrometrica*			C		1/1
plants	land plants	Poaceae	*Aristida personata*			C		1/1
plants	land plants	Poaceae	*Aristida queenslandica var. dissimilis*			C		1/1
plants	land plants	Poaceae	*Aristida spuria*			C		1/1
plants	land plants	Poaceae	*Aristida superpendens*			C		1/1
plants	land plants	Poaceae	*Aristida warburgii*			C		1/1
plants	land plants	Poaceae	*Arthragrostis deschampsioides*			C		1/1
plants	land plants	Poaceae	*Arundinella nepalensis*	reedgrass		C		3/3
plants	land plants	Poaceae	*Arundinella setosa*			C		1/1
plants	land plants	Poaceae	*Bothriochloa bladhii subsp. bladhii*			C		3/3
plants	land plants	Poaceae	*Bothriochloa pertusa*		Y			1/1
plants	land plants	Poaceae	*Cenchrus caliculatus*	hillside burrgrass		C		1/1
plants	land plants	Poaceae	*Chionachne cyathopoda*	river grass		C		1/1
plants	land plants	Poaceae	*Chloris inflata*	purpletop chloris	Y			1/1
plants	land plants	Poaceae	*Chloris lobata*			C		1/1
plants	land plants	Poaceae	*Chrysopogon filipes*			C		2/2
plants	land plants	Poaceae	*Cymbopogon ambiguus*	lemon grass		C		1/1
plants	land plants	Poaceae	*Cymbopogon queenslandicus*			C		1/1
plants	land plants	Poaceae	*Cynodon aethiopicus*		Y			1/1
plants	land plants	Poaceae	*Dactyloctenium buchananensis*			C		1/1
plants	land plants	Poaceae	*Dichanthium annulatum*	sheda grass	Y			1/1
plants	land plants	Poaceae	*Dichanthium aristatum*	angleton grass	Y			1/1
plants	land plants	Poaceae	*Dichanthium fecundum*	curly bluegrass		C		1/1
plants	land plants	Poaceae	*Dichanthium sericeum subsp. polystachyum*			C		1/1
plants	land plants	Poaceae	*Digitaria bicornis*			C		1/1
plants	land plants	Poaceae	*Digitaria parviflora*			C		1/1
plants	land plants	Poaceae	*Dinebra decipiens var. asthenes*			C		2/2
plants	land plants	Poaceae	*Echinochloa colona*	awnless barnyard grass	Y			1/1
plants	land plants	Poaceae	*Ectrosia leporina*			C		1/1
plants	land plants	Poaceae	*Enneapogon lindleyanus*			C		1/1
plants	land plants	Poaceae	*Enteropogon unispiceus*			C		1/1
plants	land plants	Poaceae	*Eragrostis exigua*			C		1/1
plants	land plants	Poaceae	*Eragrostis leptostachya*			C		1/1
plants	land plants	Poaceae	*Eragrostis parviflora*	weeping lovegrass		C		1/1
plants	land plants	Poaceae	*Eragrostis sororia*			C		1/1
plants	land plants	Poaceae	*Eulalia aurea*	silky browntop		C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Poaceae	*Heteropogon contortus*	black speargrass		C		1/1
plants	land plants	Poaceae	*Heteropogon triticeus*	giant speargrass		C		2/2
plants	land plants	Poaceae	*Hymenachne amplexicaulis 'Olive'*		Y			1/1
plants	land plants	Poaceae	*Hyparrhenia rufa subsp. rufa*		Y			1/1
plants	land plants	Poaceae	*Megathyrsus maximus var. maximus*		Y			1/1
plants	land plants	Poaceae	*Melinis repens*	red natal grass	Y			1/1
plants	land plants	Poaceae	*Mnesithea formosa*			C		1/1
plants	land plants	Poaceae	*Oplismenus aemulus*	creeping shade grass		C		1/1
plants	land plants	Poaceae	*Oryza*					2/2
plants	land plants	Poaceae	*Oryza australiensis*			C		2/2
plants	land plants	Poaceae	*Panicum paludosum*	swamp panic		C		1/1
plants	land plants	Poaceae	*Panicum simile*			C		1/1
plants	land plants	Poaceae	*Panicum trichoides*			C		2/2
plants	land plants	Poaceae	*Paspalidium distans*	shotgrass		C		1/1
plants	land plants	Poaceae	*Paspalidium gracile*	slender panic		C		1/1
plants	land plants	Poaceae	*Paspalidium scabrifolium*			C		1/1
plants	land plants	Poaceae	*Pseudopogonatherum contortum*			C		1/1
plants	land plants	Poaceae	*Pseudoraphis spinescens*	spiny mudgrass		C		2/2
plants	land plants	Poaceae	*Sacciolepis indica*	Indian cupscale grass		C		1/1
plants	land plants	Poaceae	*Sarga plumosum*			C		1
plants	land plants	Poaceae	*Schizachyrium occultum*			C		1/1
plants	land plants	Poaceae	*Schizachyrium pseudeulalia*			C		3/3
plants	land plants	Poaceae	*Setaria oplismenoides*			C		1/1
plants	land plants	Poaceae	*Setaria surgens*			C		2/2
plants	land plants	Poaceae	*Sorghum bicolor*	forage sorghum	Y			1/1
plants	land plants	Poaceae	*Sorghum halepense*	Johnson grass	Y			1/1
plants	land plants	Poaceae	*Sorghum nitidum forma aristatum*			C		2/2
plants	land plants	Poaceae	*Sporobolus jacquemontii*		Y			1/1
plants	land plants	Poaceae	*Themeda quadrivalvis*	grader grass	Y			1
plants	land plants	Poaceae	*Themeda triandra*	kangaroo grass		C		1/1
plants	land plants	Poaceae	*Triodia stenostachya*			C		1/1
plants	land plants	Poaceae	*Urochloa panicoides var. panicoides*		Y			1/1
plants	land plants	Poaceae	*Urochloa pubigera*			C		2/2
plants	land plants	Podocarpaceae	*Podocarpus grayae*			C		1/1
plants	land plants	Polygonaceae	*Polygonum plebeium*	small knotweed		C		2/2
plants	land plants	Polypodiaceae	*Drynaria sparsisora*			SL		2/2
plants	land plants	Polypodiaceae	*Platycerium veitchii*	silver elkhorn		SL		2/2
plants	land plants	Polypodiaceae	*Pyrrosia rupestris*	rock felt fern		SL		1/1
plants	land plants	Polypodiaceae	*Scleroglossum wooroonooran*			SL		1/1
plants	land plants	Polypodiaceae	*Selliguea simplicissima*			SL		1/1
plants	land plants	Portulacaceae	*Portulaca pilosa*		Y			1/1
plants	land plants	Potamogetonaceae	*Potamogeton*					1/1
plants	land plants	Potamogetonaceae	*Potamogeton tepperi*			SL		3/2
plants	land plants	Proteaceae	*Grevillea parallela*			C		2/1
plants	land plants	Proteaceae	*Grevillea striata*	beefwood		C		1
plants	land plants	Proteaceae	*Helicia glabriflora*	pale oak		C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Psilotaceae	*Tmesipteris truncata*			SL		2/2
plants	land plants	Pteridaceae	*Adiantum atroviride*			SL		2/2
plants	land plants	Pteridaceae	*Adiantum hispidulum var. hypoglaucum*			SL		3/3
plants	land plants	Pteridaceae	*Cheilanthes nitida*			C		1/1
plants	land plants	Pteridaceae	*Haplopteris ensiformis*			SL		1/1
plants	land plants	Pteridaceae	*Pellaea falcata*			SL		1/1
plants	land plants	Pteridaceae	*Pellaea muelleri*			SL		3/3
plants	land plants	Pteridaceae	*Pteris tremula*			SL		1/1
plants	land plants	Putranjivaceae	*Drypetes deplanchei*	grey boxwood		C		1/1
plants	land plants	Rhamnaceae	*Pomaderris argyrophylla*			C		3/3
plants	land plants	Rhamnaceae	*Ventilago viminalis*	supplejack		C		1/1
plants	land plants	Rhamnaceae	*Ziziphus mauritiana*	Indian jujube	Y			6/1
plants	land plants	Rhizophoraceae	*Carallia brachiata*	carallia		C		1/1
plants	land plants	Rubiaceae	*Aidia racemosa*			C		4/4
plants	land plants	Rubiaceae	*Cyclophyllum multiflorum*			C		1/1
plants	land plants	Rubiaceae	*Dentella repens*	dentella		C		3/3
plants	land plants	Rubiaceae	*Galium binifolium subsp. binifolium*			C		1/1
plants	land plants	Rubiaceae	*Gardenia ovularis*			C		1/1
plants	land plants	Rubiaceae	*Gynochthodes umbellata*			C		1/1
plants	land plants	Rubiaceae	*Larsenaikia ochreata*			C		4/4
plants	land plants	Rubiaceae	*Nauclea orientalis*	Leichhardt tree		C		1/1
plants	land plants	Rubiaceae	*Opercularia hispida*	hairy stinkweed		C		1/1
plants	land plants	Rubiaceae	*Pavetta australiensis var. australiensis*			C		1/1
plants	land plants	Rubiaceae	*Psychotria fitzalanii*			C		2/2
plants	land plants	Rubiaceae	*Psychotria poliostemma*			C		2/2
plants	land plants	Rubiaceae	*Psydrax odorata forma foveolata*			C		1/1
plants	land plants	Rubiaceae	*Psydrax odorata subsp. australiana*			C		2/2
plants	land plants	Rubiaceae	*Psydrax saligna forma saligna*			C		1/1
plants	land plants	Rubiaceae	*Scleromitrion galioides*			C		2/2
plants	land plants	Rubiaceae	*Scleromitrion polycladum*			NT		4/4
plants	land plants	Rubiaceae	*Spermacoce*					1/1
plants	land plants	Rubiaceae	*Spermacoce brachystema*			C		2/2
plants	land plants	Rubiaceae	*Timonius timon var. timon*			C		1/1
plants	land plants	Rutaceae	*Coatesia paniculata*			C		1/1
plants	land plants	Rutaceae	*Dinosperma erythrococcum*			C		1/1
plants	land plants	Rutaceae	*Dinosperma melanophloium*			C		1/1
plants	land plants	Rutaceae	*Geijera salicifolia*	brush wilga		C		2/2
plants	land plants	Rutaceae	*Glycosmis trifoliata*			C		1/1
plants	land plants	Rutaceae	*Zieria smithii*			C		1/1
plants	land plants	Salicaceae	*Homalium alnifolium*	homalium		C		2/2
plants	land plants	Santalaceae	*Dendrotrophe varians*			C		1/1
plants	land plants	Sapindaceae	*Alectryon connatus*	grey birds-eye		C		1/1
plants	land plants	Sapindaceae	*Alectryon reticulatus*	wild quince		C		1/1
plants	land plants	Sapindaceae	*Alectryon tomentosus*			C		2/2
plants	land plants	Sapindaceae	*Arytera divaricata*	coogera		C		1/1
plants	land plants	Sapindaceae	*Dodonaea lanceolata var. subsessilifolia*			C		2/2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Sapindaceae	*Dodonaea stenophylla*			C		1/1
plants	land plants	Sapindaceae	*Dodonaea viscosa subsp. cuneata*			C		1/1
plants	land plants	Sapindaceae	*Elattostachys bidwillii*			C		1/1
plants	land plants	Sapindaceae	*Guioa acutifolia*	northern guioa		C		1/1
plants	land plants	Sapindaceae	*Harpullia pendula*			C		3/3
plants	land plants	Sapindaceae	*Lepiderema punctulata*			C		2/2
plants	land plants	Sapotaceae	*Amorphospermum antilogum*			C		3/3
plants	land plants	Sapotaceae	*Pleioluma queenslandica*			C		1/1
plants	land plants	Schizaeaceae	*Schizaea bifida*	forked comb fern		SL		1/1
plants	land plants	Scrophulariaceae	*Myoporum acuminatum*	coastal boobialla		C		3/3
plants	land plants	Selaginellaceae	*Selaginella ciliaris*			C		1/1
plants	land plants	Sematophyllaceae	*Sematophyllum*					1/1
plants	land plants	Simaroubaceae	*Brucea javanica*			C		1/1
plants	land plants	Smilacaceae	*Smilax australis*	barbed-wire vine		C		1
plants	land plants	Solanaceae	*Nicotiana glauca*	tree tobacco	Y			1/1
plants	land plants	Solanaceae	*Solanum cookii*			C		3/3
plants	land plants	Sparrmanniaceae	*Corchorus aestuans*			C		1/1
plants	land plants	Sparrmanniaceae	*Corchorus olitorius*	jute		C		1/1
plants	land plants	Sparrmanniaceae	*Corchorus trilocularis*			C		1/1
plants	land plants	Sparrmanniaceae	*Grewia*					1/1
plants	land plants	Sparrmanniaceae	*Grewia australis*			C		3/3
plants	land plants	Sparrmanniaceae	*Grewia papuana*			C		1/1
plants	land plants	Sparrmanniaceae	*Grewia savannicola*			C		1/1
plants	land plants	Sparrmanniaceae	*Triumfetta pilosa*		Y			2/2
plants	land plants	Sphenostemonaceae	*Sphenostemon lobosporus*			C		2/2
plants	land plants	Sterculiaceae	*Sterculia quadrifida*	peanut tree		C		1/1
plants	land plants	Stylidiaceae	*Stylidium alsinoides*			SL		1/1
plants	land plants	Stylidiaceae	*Stylidium rotundifolium*			SL		1/1
plants	land plants	Stylidiaceae	*Stylidium tenerum*			SL		1/1
plants	land plants	Symplocaceae	*Symplocos gittinsii*			C		1/1
plants	land plants	Symplocaceae	*Symplocos paucistaminea*			C		1/1
plants	land plants	Thelypteridaceae	*Christella dentata*	creek fern		SL		1/1
plants	land plants	Thymelaeaceae	*Pimelea cornucopiae*			C		1/1
plants	land plants	Thymelaeaceae	*Pimelea latifolia*			C		1/1
plants	land plants	Thymelaeaceae	*Pimelea sericostachya*			C		3/3
plants	land plants	Ulmaceae	*Trema orientalis*	tree peach		C		1/1
plants	land plants	Ulmaceae	*Trema tomentosa*			C		1
plants	land plants	Urticaceae	*Pipturus argenteus*	white nettle		C		1/1
plants	land plants	Violaceae	*Pigea enneasperma*			C		1/1
plants	land plants	Vitaceae	*Causonis clematidea*			C		1/1
plants	land plants	Vitaceae	*Cissus cardiophylla*			C		1/1
plants	land plants	Vitaceae	*Cissus oblonga*			C		1/1
plants	land plants	Vitaceae	*Cissus penninervis*			C		1/1
plants	land plants	Vitaceae	*Clematicissus opaca*			C		5/5
plants	land plants	Vitaceae	*Tetrastigma petraeum*			C		1/1
plants	land plants	Vitaceae	*Tetrastigma thorsborneorum*			C		1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	land plants	Winteraceae	*Tasmannia insipida*	brush pepperbush		C		2/2

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 (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

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

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Queensland Government

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
Longitude: 146.824885 Latitude: -19.600509 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website https://www.dnrme.qld.gov.au/

Please direct queries about these reports to: Queensland.Herbarium@qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

Table of Contents

Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: Longitude: 146.824885 Latitude: -19.600509 with 2 kilometre radius

Size (ha)	1,256.55
Local Government(s)	Townsville City
Bioregion(s)	Brigalow Belt
Subregion(s)	Townsville Plains
Catchment(s)	Haughton, Ross

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.0	0.0
Of concern	61.51	4.9
No concern at present	597.7	47.57
Total remnant vegetation	659.21	52.46

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2020) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

https://www.dnrme.qld.gov.au/

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

*****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.*

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
11.3.25b	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Of concern	61.51	4.9
11.3.30	Eucalyptus crebra, Corymbia dallachiana woodland on alluvial plains	No concern at present	307.59	24.48
11.3.35	Eucalyptus platyphylla, Corymbia clarksoniana woodland on alluvial plains	No concern at present	290.11	23.09
non-remnant	None	None	597.34	47.54

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
11.3.25b	Pre-clearing 804000 ha; Remnant 2019 519000 ha	22c	Riverine	Low
11.3.30	Pre-clearing 105000 ha; Remnant 2019 70000 ha	18b	Not a Wetland	Low
11.3.35	Pre-clearing 183000 ha; Remnant 2019 108000 ha	9e	Not a Wetland	Low
non-remnant	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
11.3.25b	Shown to be associated with a high fauna species richness in the Taroom area (Venz et al. 2002). Within parts of the Fitzroy catchment, this RE is known habitat for the threatened freshwater turtle Rheodytes leukops. Known to be important habitat for other riparian freshwater turtle species. This ecosystem is also known to provide suitable habitat for koalas (Phascolarctos cinereus).
11.3.30	Potential habitat for NCA listed species: Eucalyptus paedoglauca
11.3.35	None
non-remnant	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

https://publications.qld.gov.au/dataset/redd/resource/

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	597.34	47.54
18b	Woodlands dominated Eucalyptus crebra (sens. lat.) (narrow-leaved red ironbark) frequently with Corymbia spp. or Callitris spp. on flat to undulating plains. (land zones 5, 3) (BRB, DEU, EIU, GUP, CYP)	307.59	24.48
22c	Open forests dominated by Melaleuca spp. (M. argentea (silver tea-tree), M. leucadendra (broad-leaved tea-tree), M. dealbata (swamp tea-tree) or M. fluviatilis), fringing major streams with Melaleuca saligna or M. bracteata (black tea-tree) in minor streams. (land zone 3) (CYP, GUP, EIU, BRB, CQC, DEU, NWH, WET, [SEQ])	61.51	4.9
9e	Open forests, woodlands and open woodlands dominated by Corymbia clarksoniana (grey bloodwood) (or C. novoguinensis or C. intermedia (pink bloodwood) or C. polycarpa (long-fruited bloodwood)) frequently with Erythrophleum chlorostachys (red ironwood) or Eucalyptus platyphylla (poplar gum) predominantly on coastal sandplains and alluvia. (land zones 3, 5, 2) (CYP, BRB, CQC, WET, EIU)	290.11	23.09

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

The descriptions are compiled using site survey data from the Queensland Herbarium's CORVEG database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2020 (PDF))* section 3.3 of:

https://publications.qld.gov.au/dataset/redd/resource/

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

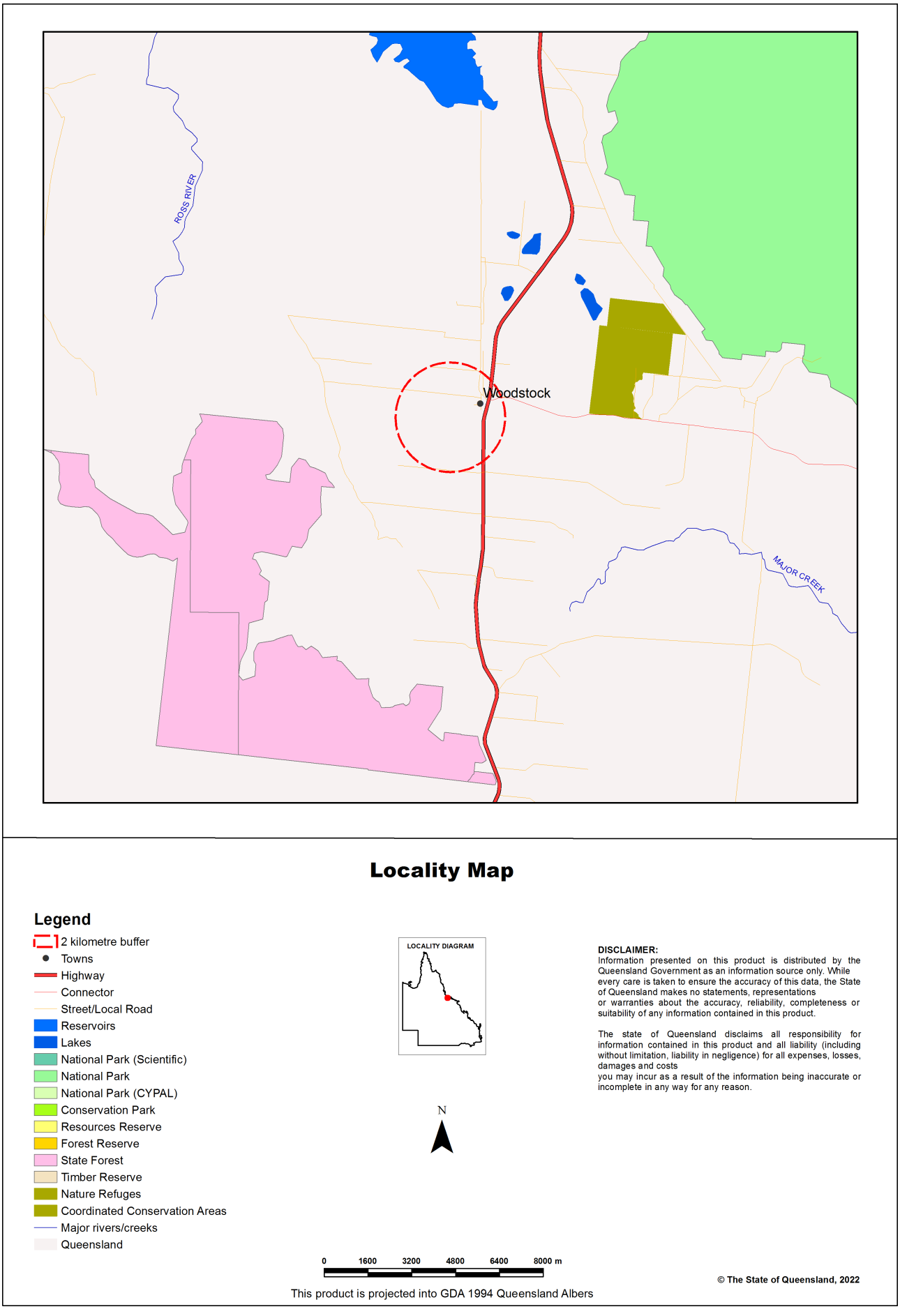
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

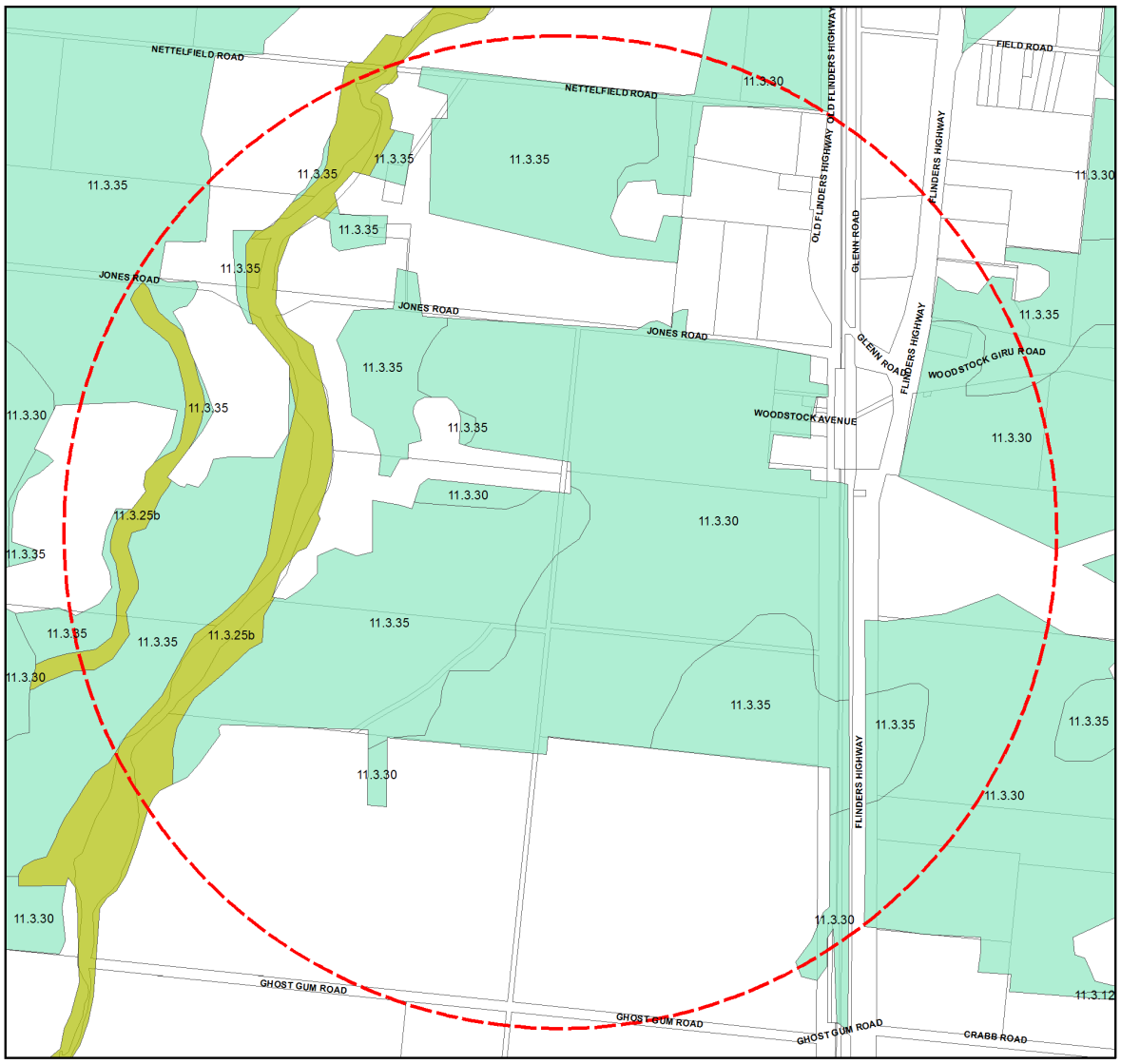
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
11.3.25b	Available	Available
11.3.30	Available	Available
11.3.35	Available	Available
non-remnant	Not currently available	Not currently available

Maps

Map 1 - Location



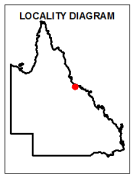
Map 2 - Remnant 2019 regional ecosystems

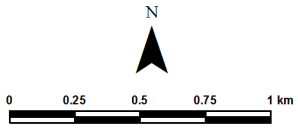


Remnant 2019 Regional Ecosystems

Biodiversity Status

- 2 kilometre buffer
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries

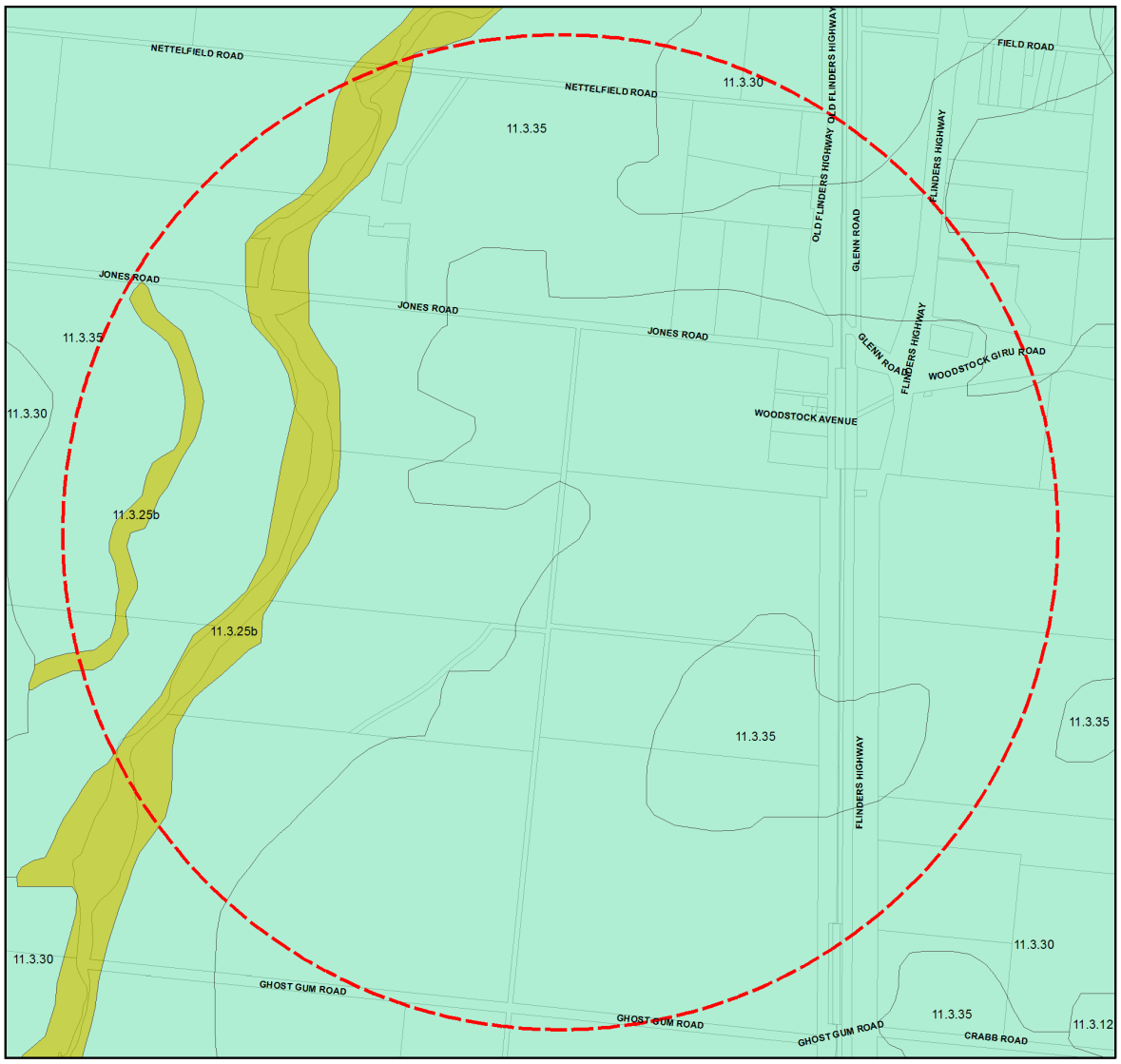




This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- 2 kilometre buffer
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries

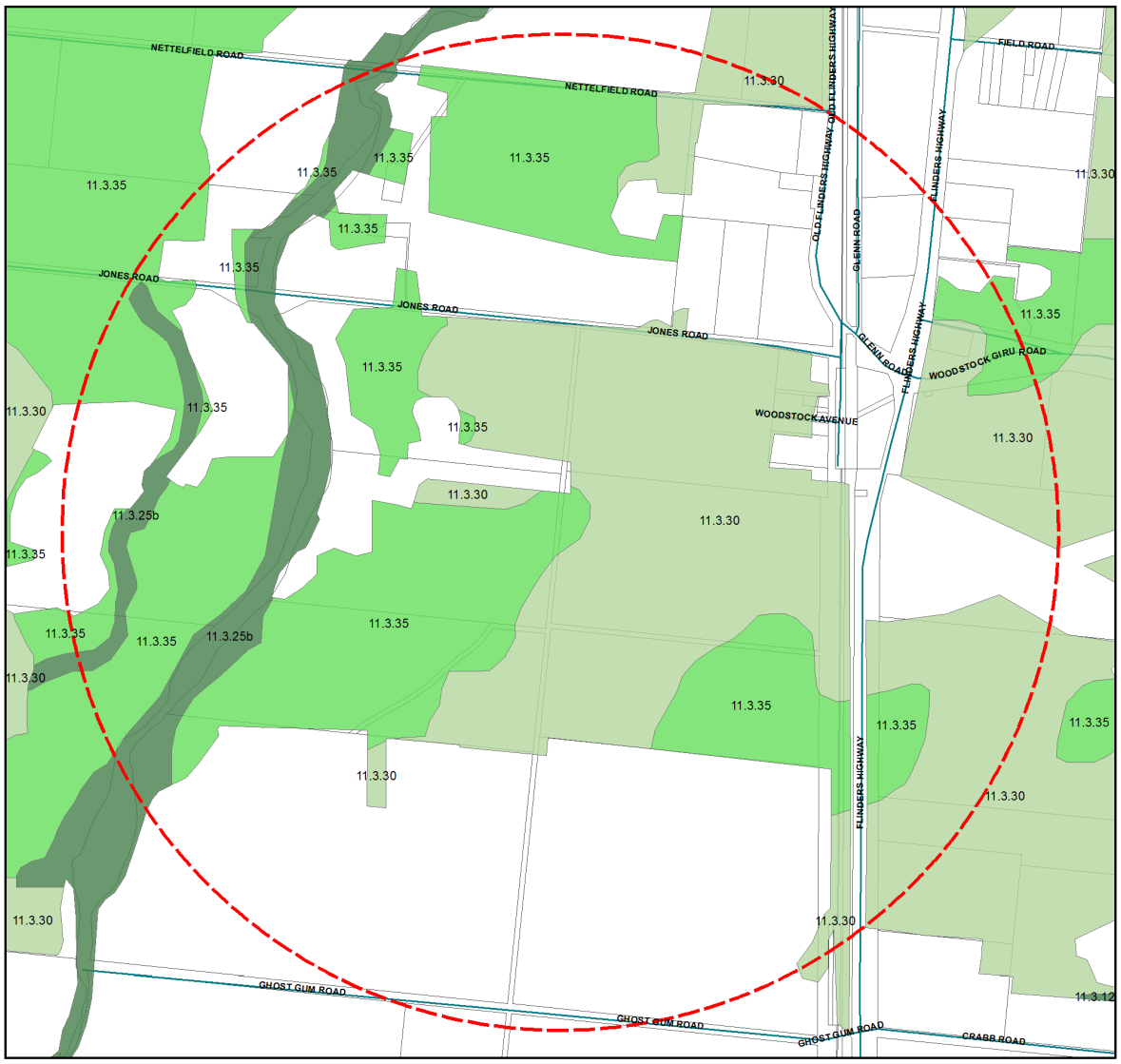
N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Map 4 - Remnant 2019 regional ecosystems by BVG (5M)



Remnant 2019 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- 2 kilometre buffer
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries

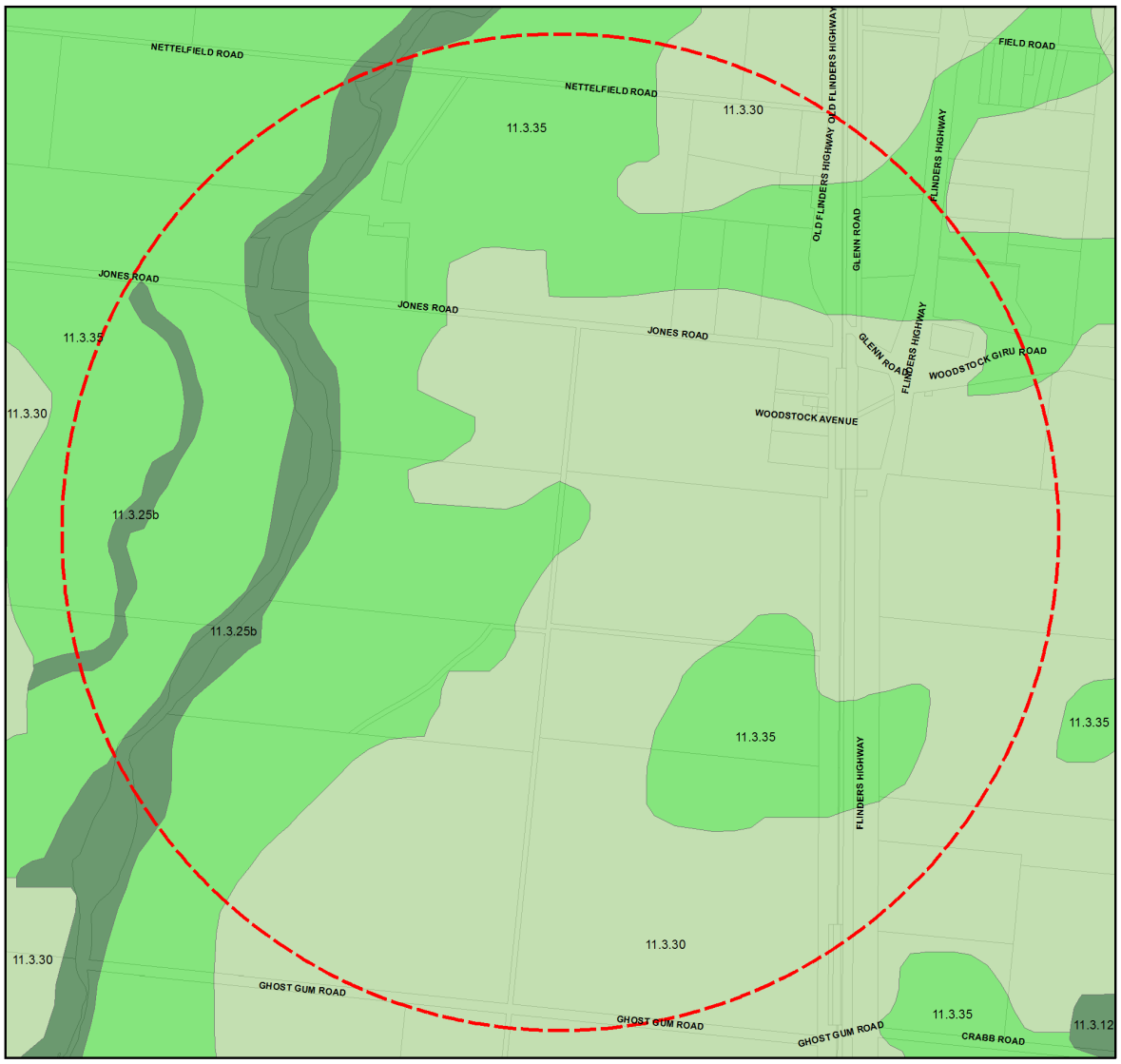
N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- 2 kilometre buffer
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
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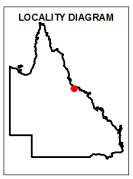
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries



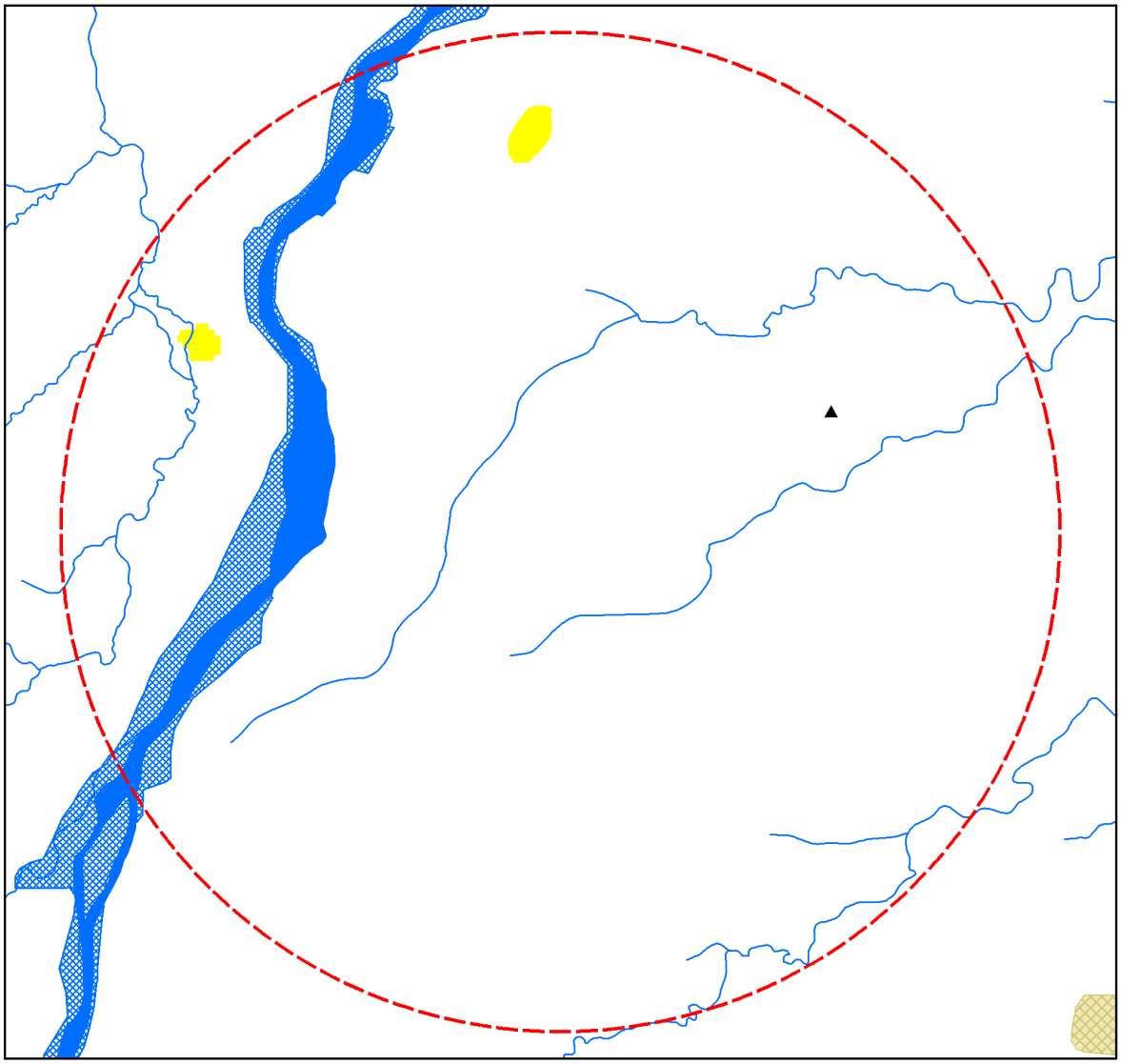
N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Map 6 - Wetlands and waterways



Queensland Wetland Data

Legend

- 2 kilometre buffer
- Towns

Queensland Wetland Data

- Riverine Drainage Lines
- Springs

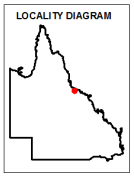
Wetland System - Water Bodies

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies

Wetland System - Regional Ecosystems

- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)

LOCALITY DIAGRAM



N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

Accuracy information: The positional accuracy of wetland data mapped at a scale of 1:100,000 is +/-100m with a minimum polygon size of 5ha or 75m wide for linear features, except for areas along the east coa st which are mapped at the 1:50,000 scale with a positional accuracy of +/-50m, with a minimum polygon size of 1ha or 35m wide for linear features. Wetlands smaller than 1ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpret ing data at a larger scale, e.g. 1:25,000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2013 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Science. The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2013 imagery.

Links and Other Information Sources

The Department of Environment and Science's Website -

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

The methodology for mapping regional ecosystems can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

Technical descriptions for regional ecosystems can be obtained from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

Benchmarks can be obtained from:

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

http://dds.information.qld.gov.au/dds/

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

http://www.dnrm.qld.gov.au/mapping-data/queensland-globe

References

Neldner, V.J., Niehus, R.E., Wilson, B.A., McDonald, W.J.F., Ford, A.J. and Accad, A. (2019). The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 4.0. Queensland Herbarium, Department of Environment and Science.

(https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086)

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F, Addicott, E.P. and Appelman, C.N. (2020). Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 5.1. Updated March 2020. Queensland Herbarium, Queensland Department of Environment and Science, Brisbane.

(https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4)

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

- Regional Ecosystem Description Database

The datasets listed below are available for download from:

http://dds.information.qld.gov.au/dds/

- Biodiversity status of pre-clearing and 2019 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- *Vegetation Management Act 1999*

Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
Longitude: 146.824885 Latitude: -19.600509 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

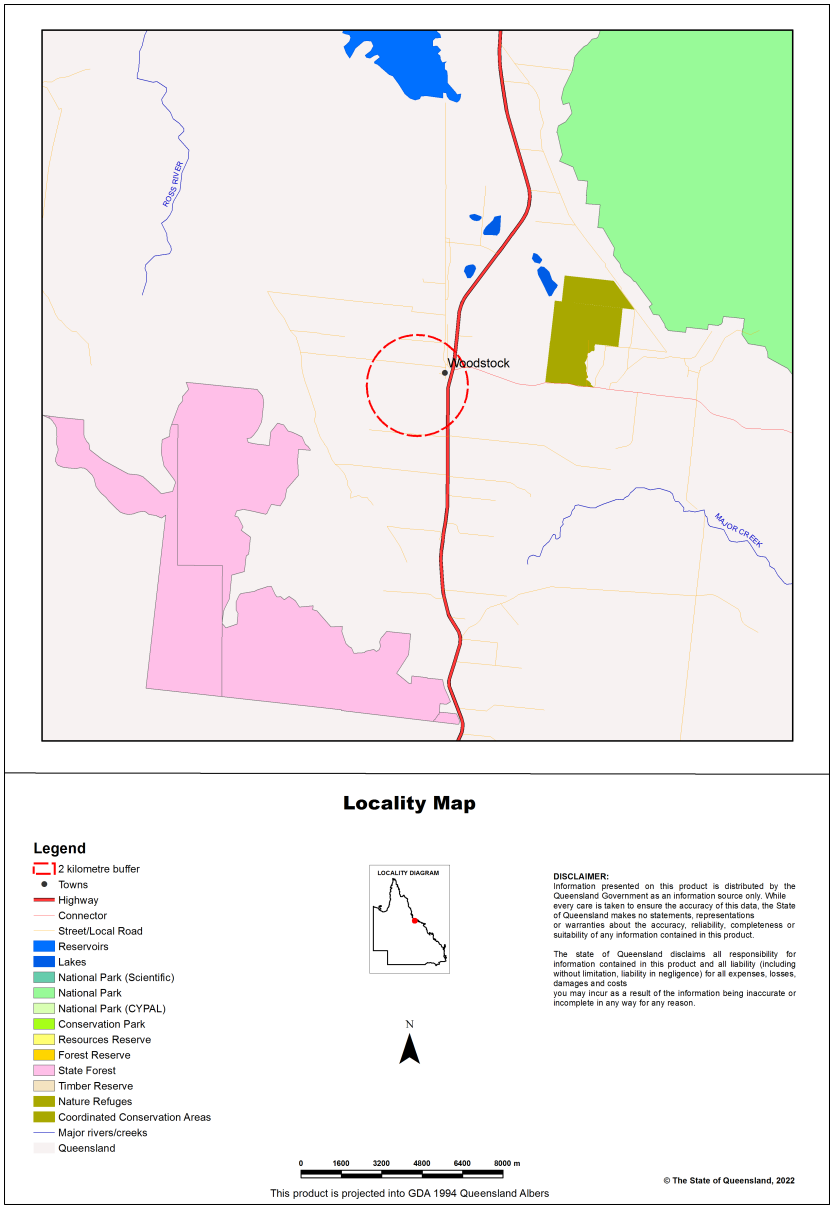
Table of Contents

Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI Longitude: 146.824885 Latitude: -19.600509

Size (ha)	1,256.55
Local Government(s)	Townsville City
Bioregion(s)	Brigalow Belt
Subregion(s)	Townsville Plains
Catchment(s)	Haughton, Ross



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	247.2 ha	19.7%
7b Special least concern animals	0.0 ha	0.0 %
7c i Koala habitat area - core (SEQ)	0.0 ha	0.0 %
7c ii Koala habitat area - locally refined (SEQ)	0.0 ha	0.0 %
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	0.0 ha	0.0 %
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	39.72 ha	3.2%
8d Regulated Vegetation - Essential habitat	249.12 ha	19.8%
8e Regulated Vegetation - intersecting a watercourse **	15.8 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

1c. Protected Areas - special wildlife reserves

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

(no results)

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Not applicable

7c i. Koala habitat area - core (SEQ)

Not applicable

7c ii. Koala habitat area - locally refined (SEQ)

Not applicable

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
Boronia keysii		V	None
Calyptorhynchus lathami	Glossy black cockatoo	V	None
Casuarius casuarius johnsonii	Sthn population cassowary	E	None
Crinia tinnula	Wallum froglet	V	None
Denisonia maculata	Ornamental snake	V	None
Litoria freycineti	Wallum rocketfrog	V	None
Litoria olongburensis	Wallum sedgefrog	V	None
Melaleuca irbyana		E	None
Petaurus gracilis	Mahogany Glider	E	None
Petrogale persephone	Proserpine rock-wallaby	E	None
Phascolarctos cinereus	Koala - outside SEQ*	V	None
Pezoporus wallicus wallicus	Eastern ground parrot	V	None
Taudactylus pleione	Kroombit tinkerfrog	E	None
Xeromys myoides	Water Mouse	V	None

**For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.*

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
Poephila cincta cincta	black-throated finch (white-rumped subspecies)	E	E	
Geophaps scripta scripta	squatter pigeon (southern subspecies)	V	V	

Special least concern animal species records

(no results)

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:

https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/
For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:
https://environment.ehp.qld.gov.au/regional-ecosystems/

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Not applicable

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Regulated vegetation map category	Map number
R	8258

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

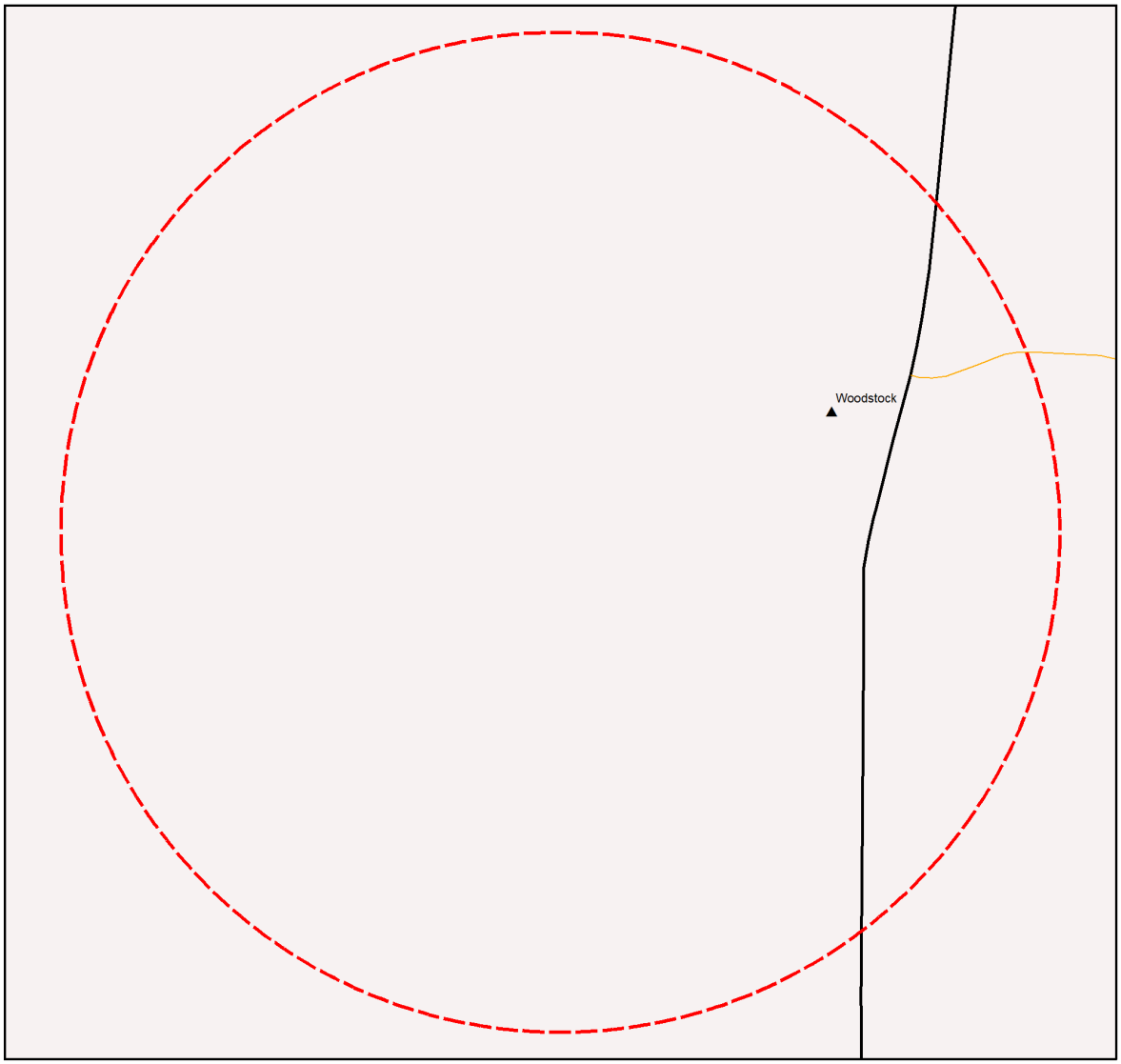
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

Map 1 - MSES - State Conservation Areas

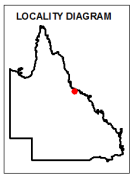


MSES - State Conservation Areas

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates, nature refuges, special wildlife reserves)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)

LOCALITY DIAGRAM

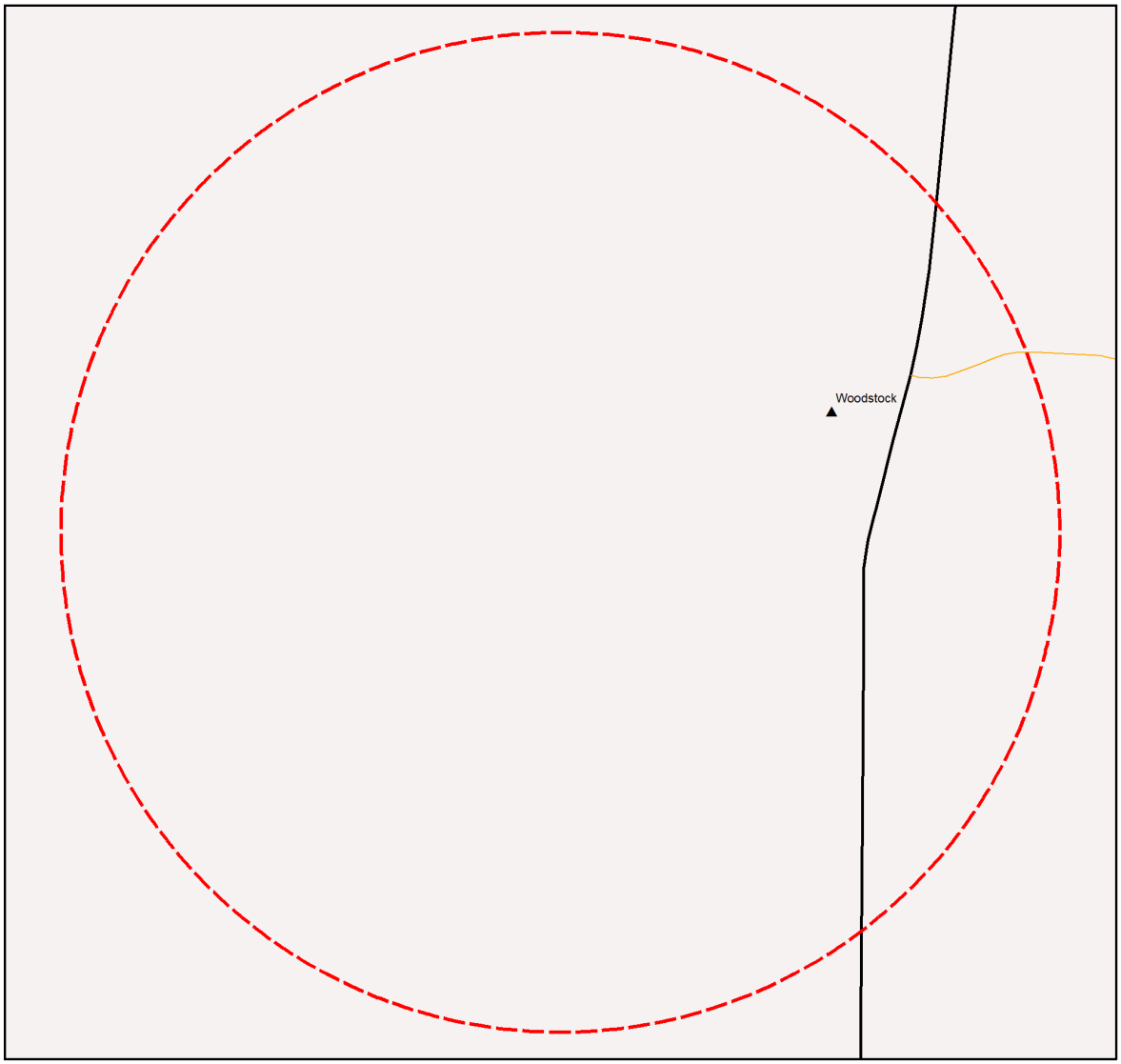


N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

Map 2 - MSES - Wetlands and Waterways

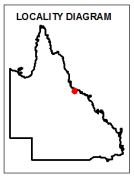


MSES - Wetlands and Waterways

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands

LOCALITY DIAGRAM

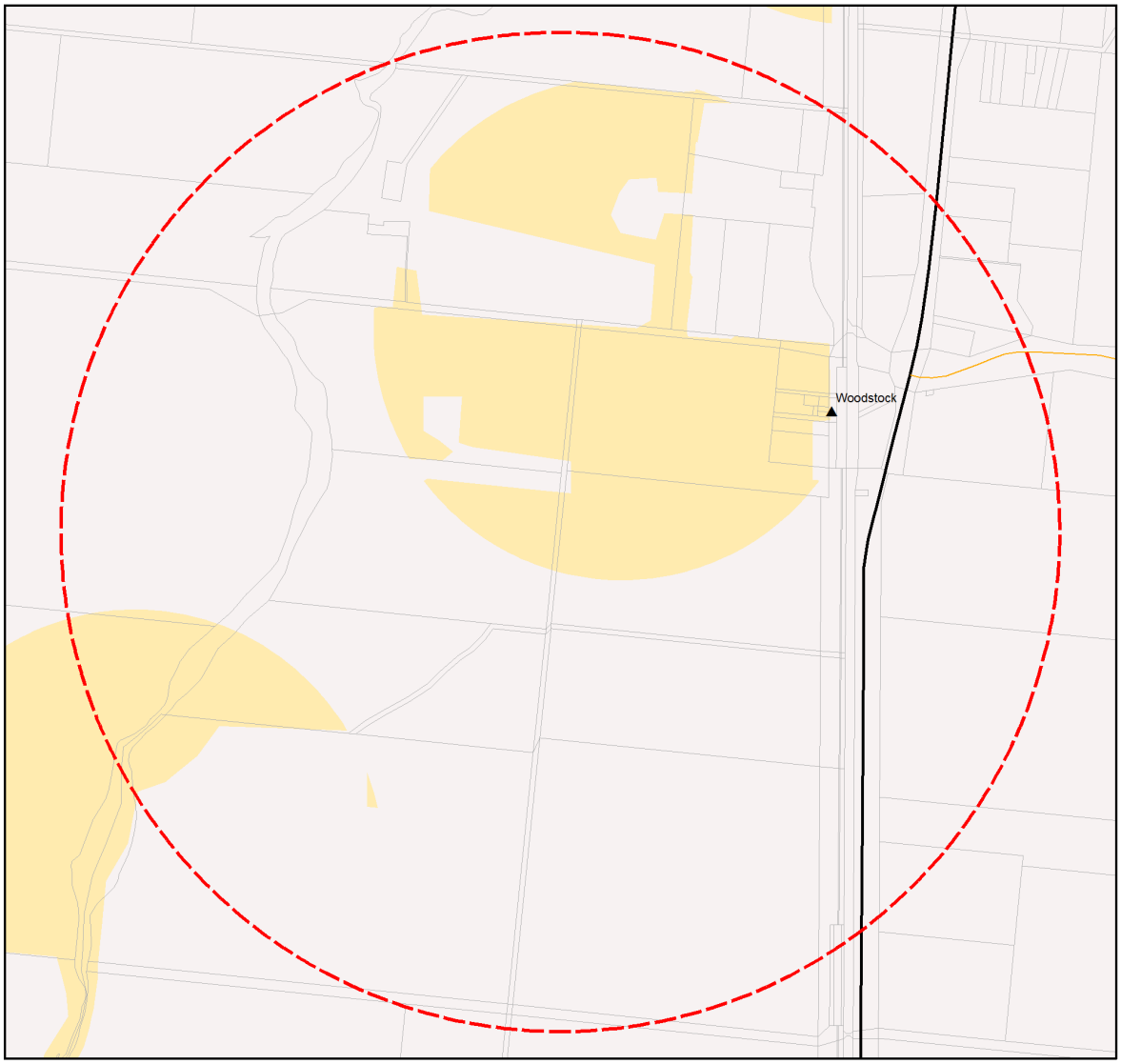


N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals

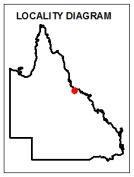


MSES - Species
Threatened (endangered or vulnerable) wildlife and special least concern animals

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Wildlife habitat (special least concern)
- Wildlife habitat (endangered or vulnerable)

LOCALITY DIAGRAM



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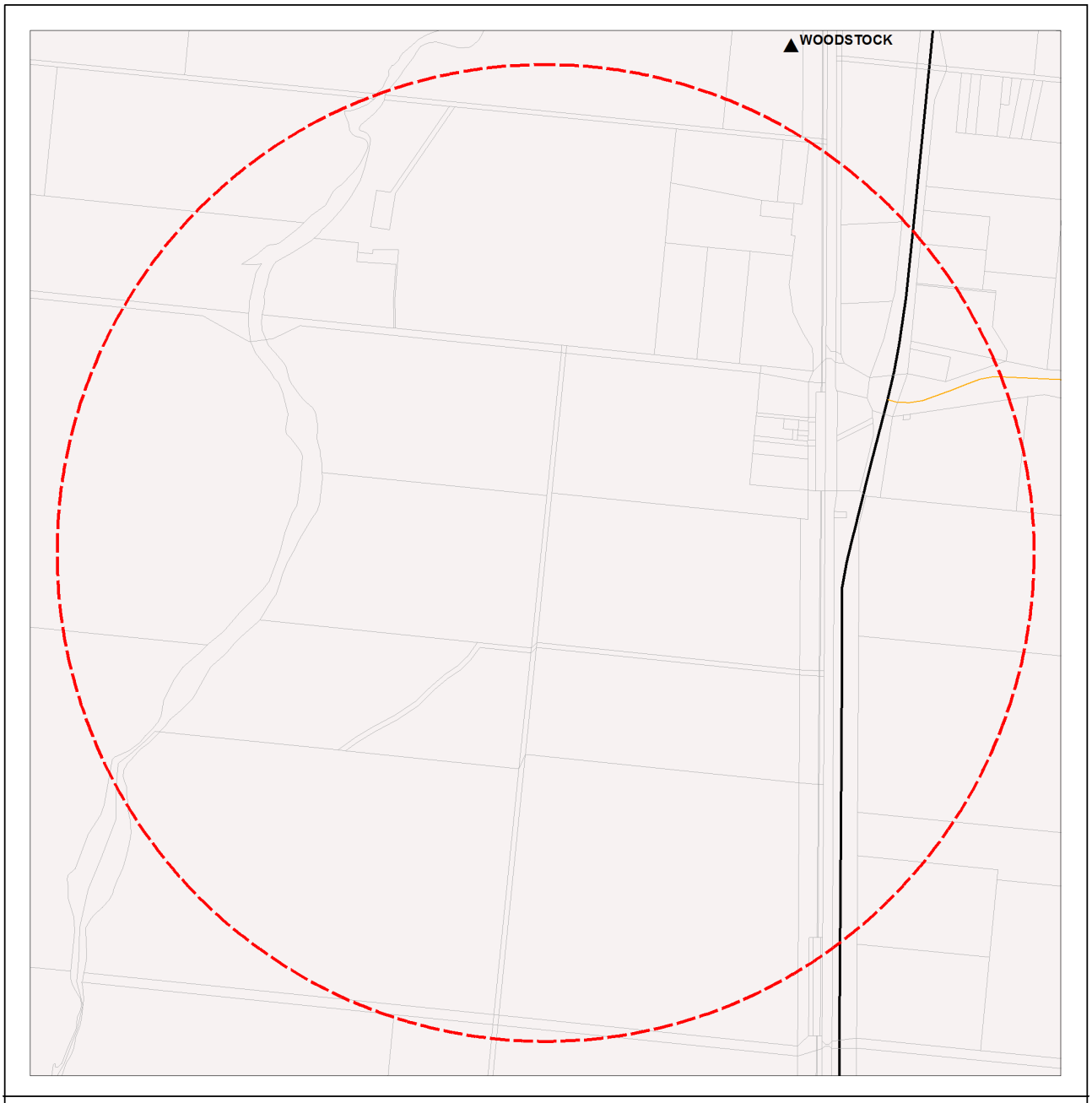
N

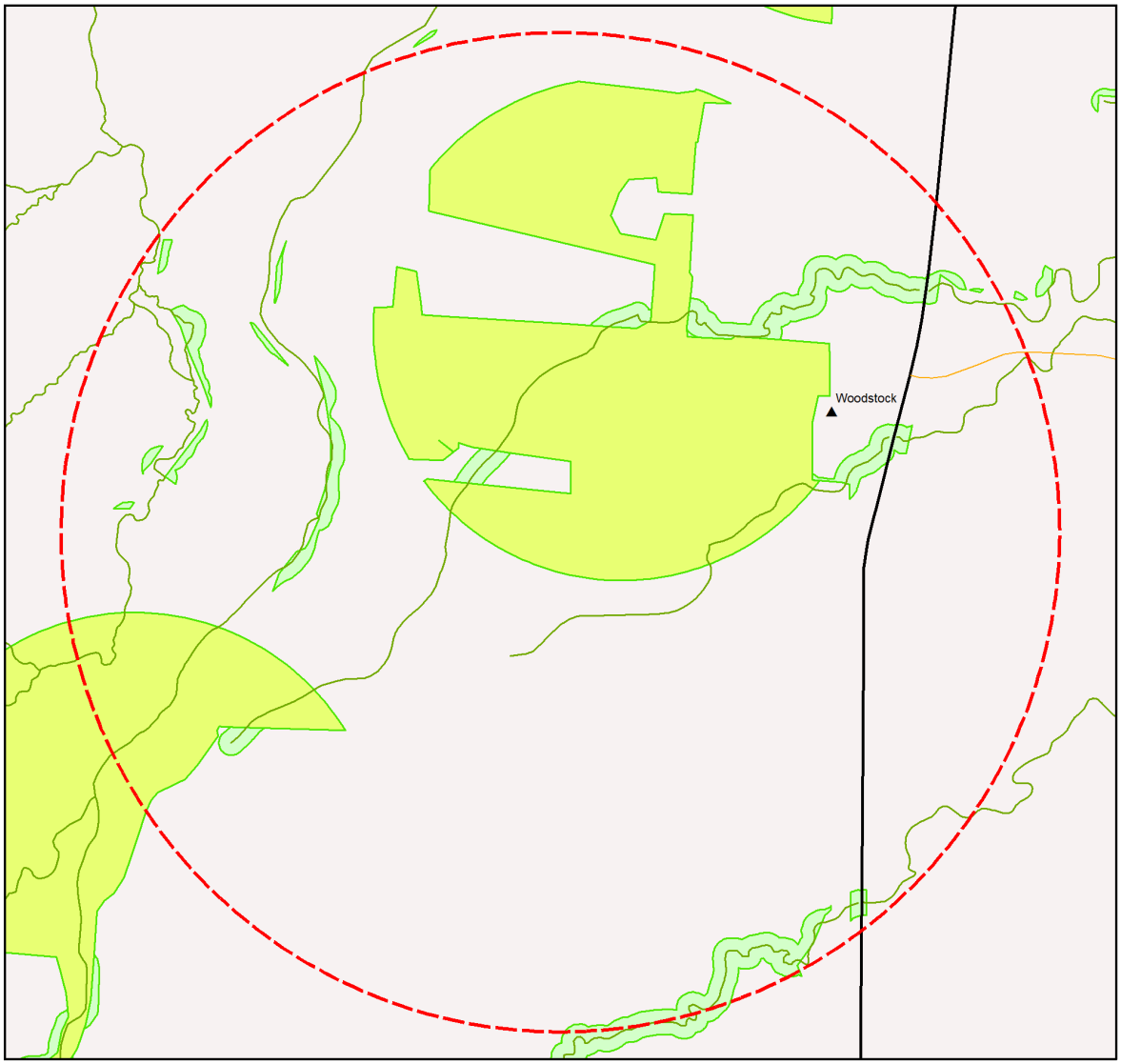
0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

Map 3b - MSES - Species - Koala habitat area (SEQ)

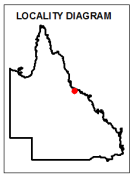


Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest
- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)

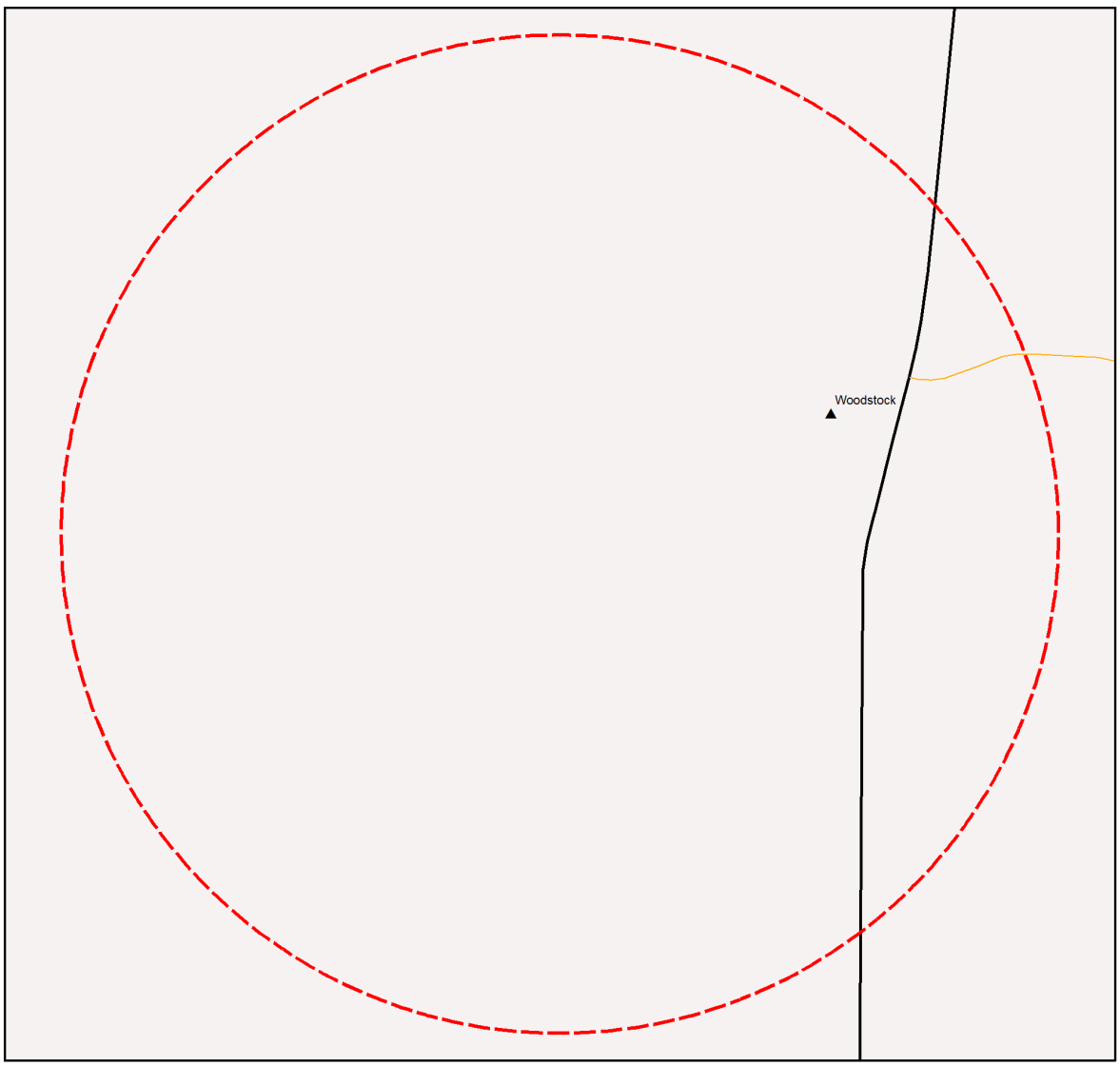


N

0 240 480 720 960 1200 m

This product is projected into GDA 1994 Queensland Albers

Map 5 - MSES - Offset Areas

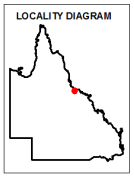


MSES - Offsets

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Legally secured offset area (offset register)
- Legally secured offset area (vegetation offsets)

LOCALITY DIAGRAM



N

0 240 480 720 960 1200 m

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Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- *Environmental Protection Act 1994*
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- *Vegetation Management Act 1999*

Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
Longitude: 146.824885 Latitude: -19.600509 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or Area of Interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "Central co-ordinates" option, the resulting assessment area encompasses an area extending from 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

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Table of Contents

Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: Longitude: 146.824885 Latitude: -19.600509

Size (ha)	1,256.55
Local Government(s)	Townsville City
Bioregion(s)	Brigalow Belt
Subregion(s)	Townsville Plains
Catchment(s)	Haughton, Ross

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Brigalow Belt v2.1
Aquatic Conservation Assessment(s) (riverine)	Great Barrier Reef Catchments v1.1
Aquatic Conservation Assessment(s) (non-riverine)	Great Barrier Reef Catchments v1.3

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	0.0	0.0
Of concern	61.51	4.9
No concern at present	597.7	47.57

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	200.68	15.97
State	435.39	34.65
Regional	0.42	0.03
Local or Other Values	26.43	2.1

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
Number of Palustrine wetlands	0
Number of Lacustrine wetlands	1
Total number of non-riverine wetlands	1

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

(no results)

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	746.51	59.41
High	510.05	40.59
Medium	0.0	0.0
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	1.85	0.15
Low	0.0	0.0
Very Low	0.0	0.0

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	200.68	15.97
State	435.39	34.65
Regional	0.42	0.03
Local or Other Values	26.43	2.1

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains at least 1 Endangered or 2 Vulnerable or Near Threatened species (A)	200.68	15.97
Regional	Remnant contains at least 1 Vulnerable or Near Threatened species (A)	45.42	3.61
Regional	Remnant contains at least one Of Concern RE (B1)	44.66	3.55
Local or Other Values	Refer to diagnostic data for additional information	370.47	29.48

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa	200.68	16.0	45.41	3.6	306.78	24.4	108.34	8.6
B1: Ecosystem Value (Bioregion)			59.92	4.8	601.29	47.9		
B2: Ecosystem Value (Subregion)					661.21	52.6		
C: Tract Size			498.16	39.6			163.05	13.0
D1: Relative RE Size (Bioregion)					101.31	8.1	559.9	44.6
D2: Relative RE Size (Subregion)					101.31	8.1	559.9	44.6
F: Ecosystem Diversity			227.36	18.1	433.85	34.5		
G: Context and Connection	4.59	0.4	258.42	20.6	398.2	31.7		

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant forms part of a bioregional corridor (J)	636.07	50.62

Biodiversity significance	Description	Area (Ha)	% of AOI
Local	Refer to Expert Panel data for additional information	12.13	0.97
Local	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	1.69	0.13

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al*. 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to access overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa					118.02	9.4		
Ia: Centres of Endemism								
Ib: Wildlife Refugia					1.69	0.1		
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								
Ih: Artificial Wetland								
Ii: Hollow Bearing Trees								
Ij: Breeding or Roosting Site								
Ik: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

  • Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;

  • Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;

  • Maintaining large scale seasonal/migratory species processes and movement of fauna;

  • Maximising connectivity between large tracts/patches of remnant vegetation;

  • Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

  • Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);

  • Follow major watershed/catchment and/or coastal boundaries;

  • Incorporate major altitudinal/geological/climatic gradients;

  • Include and maximise connectivity between large tracts/patches of remnant vegetation;

  • Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian

• Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	636.07	50.62
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

Decision Number	Description	Panel Recommended Significance	Criteria Values
brbn_l_17a	None	None	None
brbn_l_18b	None	None	None
brbn_l_93	Locally significant natural palustrine & lacustrine wetlands	Local	Ib (refugia): M

Expert panel decision descriptions:

brbn_l_17a

None

brbn_l_18b

None

brbn_l_93

The panel considered that relatively natural palustrine and lacustrine wetlands and waterbodies within the Brigalow Belt bioregion act as important refugia, especially during periods of drought.

Whilst State significant wetlands are captured under Criterion B1, and regionally significant wetlands under the decision brbn_l_92, the panel agreed that all remaining relatively natural wetland complexes of less than 5ha in size be classed as

being of at least local significance.

Refer to brbn_l_48 for the southern BRB implementation of this decision.

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning prcesses

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at Wetland *Info*:

http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For

flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	746.51	59.41

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	510.05	40.59
Medium	0.0	0.0
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic	1,256.55	100.0						
2. Naturalness catchment	834.22	66.4	422.33	33.6				
3. Diversity and richness	746.51	59.4	422.33	33.6	87.71	7.0		
4. Threatened species and ecosystems			1,256.55	100.0				
5. Priority species and ecosystems	746.51	59.4	510.04	40.6				
6. Special features			746.51	59.4				
7. Connectivity	87.71	7.0			422.33	33.6	746.51	59.4
8. Representative-ness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
ha_r_ec_04	Majors Creek	Haughton	6.2.1 6.3.1 6.4.1	3
ha_r_fl_03	*Melaleuca dealbata* ecosystems on old alluvials (including gilgai landforms and seasonal drainage depressions with or without *livistona decipiens*) -RE 11.3.12	Haughton	5.2.1	4
ha_r_fl_02	Blue Gum on Alluvial Floodplains / Delta land system -RE 11.3.25	Haughton	5.2.1	3
ro_r_fl_02	Blue Gum on Alluvial Floodplains / Delta land system -RE 11.3.25	Ross	5.2.1	3

4 is the highest rating/value

Expert panel decision descriptions:

ha_r_ec_04

Majors Creek is a high-integrity perennial bedrock hosted upper catchment system within national park thereby containing good water quality and natural hydrology. The site has intact riparian vegetation including lowland reaches, but has more surrounding agricultural development than Saint Margaret Creek. It also has a major fish passage barrier downstream on the Haughton River thereby resulting in the loss of catadromous species, such as jungle perch (**Kuhlia rupestris**) from national park reaches.

ha_r_fl_03

Rare (riparian) ecosystem

ha_r_fl_02

Rare (riparian) ecosystem

ro_r_fl_02

Rare (riparian) ecosystem

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	0.0	0.0
Medium	1.85	0.15
Low	0.0	0.0
Very Low	0.0	0.0

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic					1.85	0.1		
2. Naturalness catchment			1.85	0.1				
3. Diversity and richness					1.85	0.1		
4. Threatened species and ecosystems	1.85	0.1						

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
5. Priority species and ecosystems	1.85	0.1						
6. Special features								
7. Connectivity								
8. Representative-ness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
(No Records)				

4 is the highest rating/value

Expert panel decision descriptions:

(No Records)

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, Herbrecs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
Geophaps scripta scripta	squatter pigeon (southern subspecies)	V	V	Medium			FA
Poephila cincta cincta	black-throated finch (white-rumped subspecies)	E	E	High			FA

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

**JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species*.

***I - wetland indicator species; D - wetland dependent species.*.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
Lagorchestes conspicillatus	Spectacled Hare-wallaby	L	FA

Species	Common name	Back on Track rank	Identified flora/fauna
Ninox connivens	Barking Owl	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Haliaeetus leucogaster	White-bellied Sea-Eagle	Low	FA

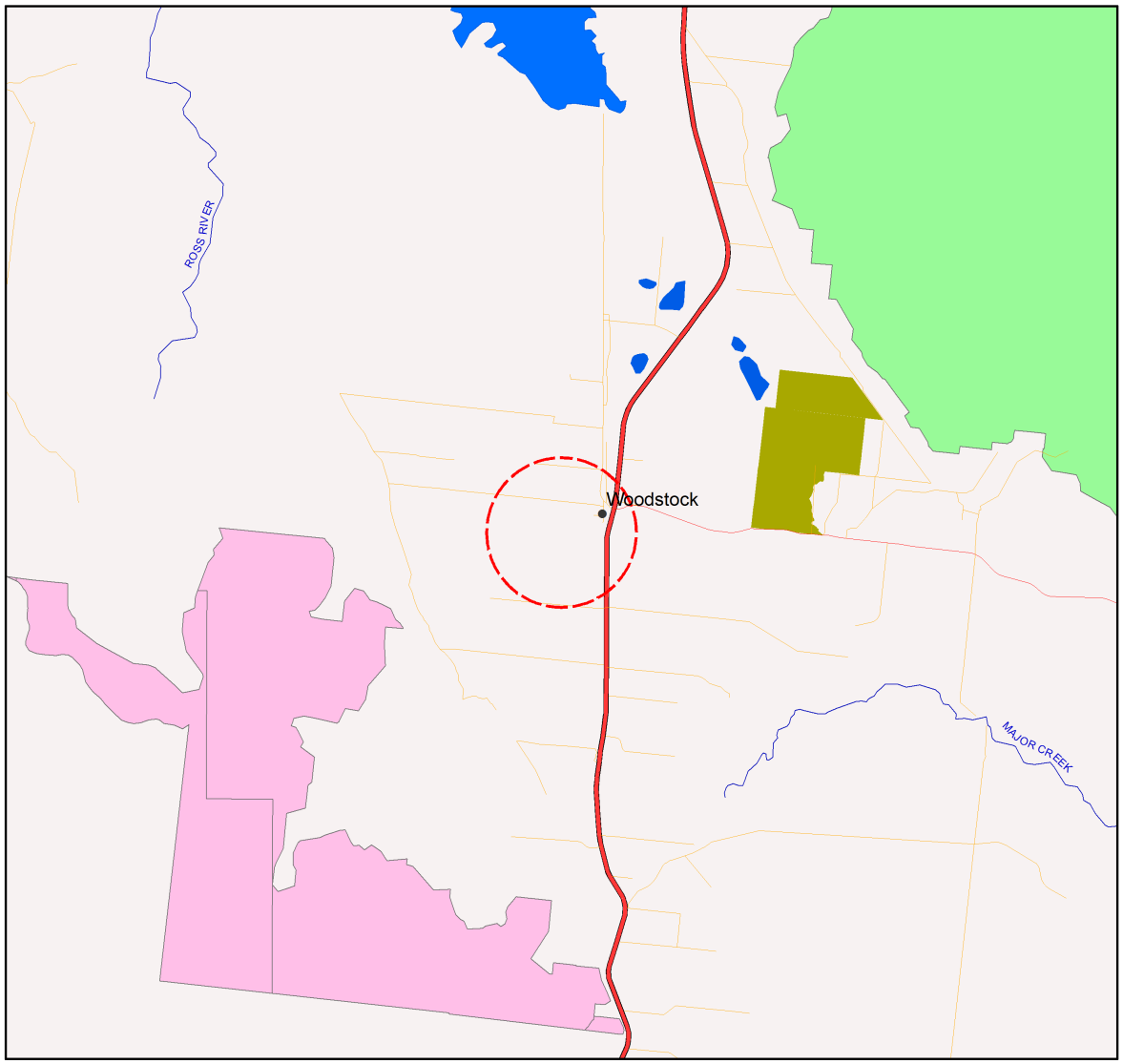
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Bubulcus ibis	Cattle Egret	Low	FA
Haliaeetus leucogaster	White-bellied Sea-Eagle	Low	FA

NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

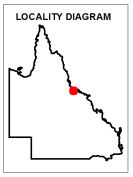
Map 1 - Locality Map



Locality Map

Legend

- 2 kilometre buffer
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



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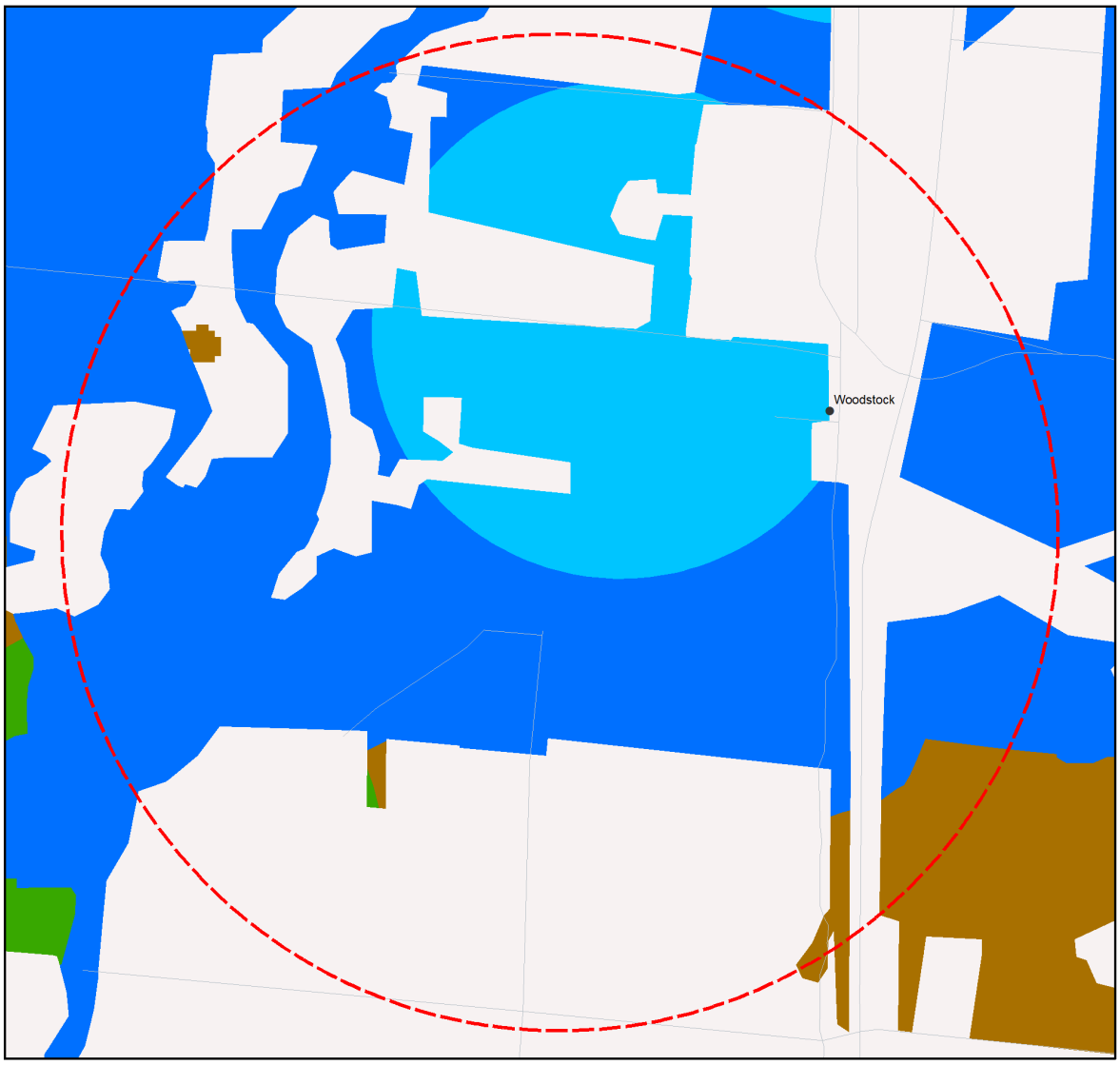
Map 2 - Biodiversity Planning Assessment (BPA)



Biodiversity Planning Assessments

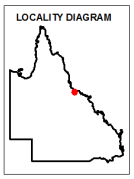
Legend

- 2 kilometre buffer
- Towns
- Roads
- Major rivers/creeks
- Queensland

Biodiversity Planning Assessment

- State Habitat for EVNT taxa
- State
- Regional
- Local or Other Values
- Non Bioregion Ecosystem

LOCALITY DIAGRAM



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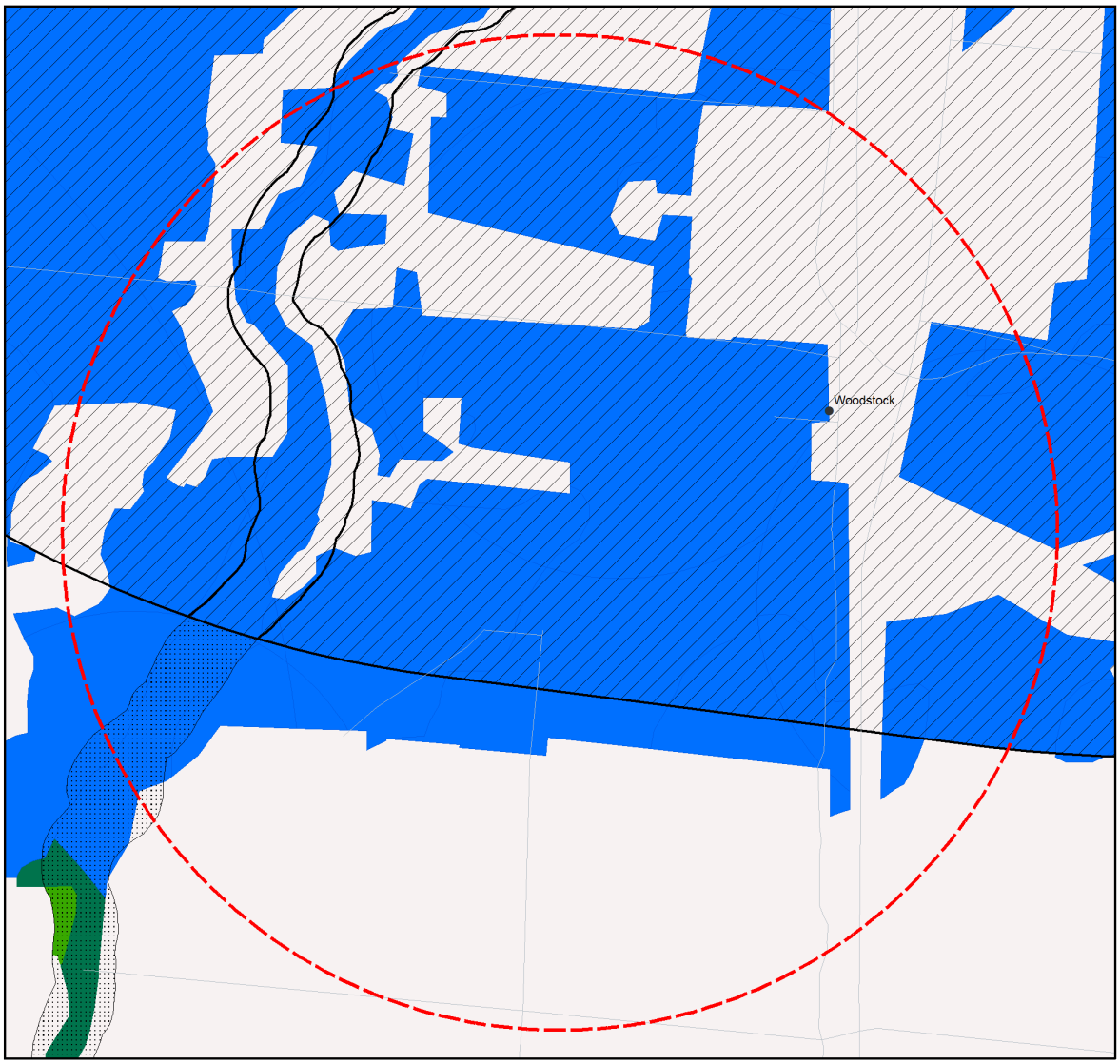
Map 3 - Corridors



Corridors

Legend

- 2 kilometre buffer
- Towns
- Roads
- Major rivers/creeks
- Queensland

Corridors

- State
- Regional

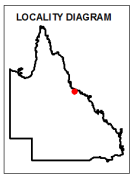
Corridor Triggered Vegetation

- State
- Regional
- Local

Core Area Vegetation

- Brigalow Belt only

LOCALITY DIAGRAM



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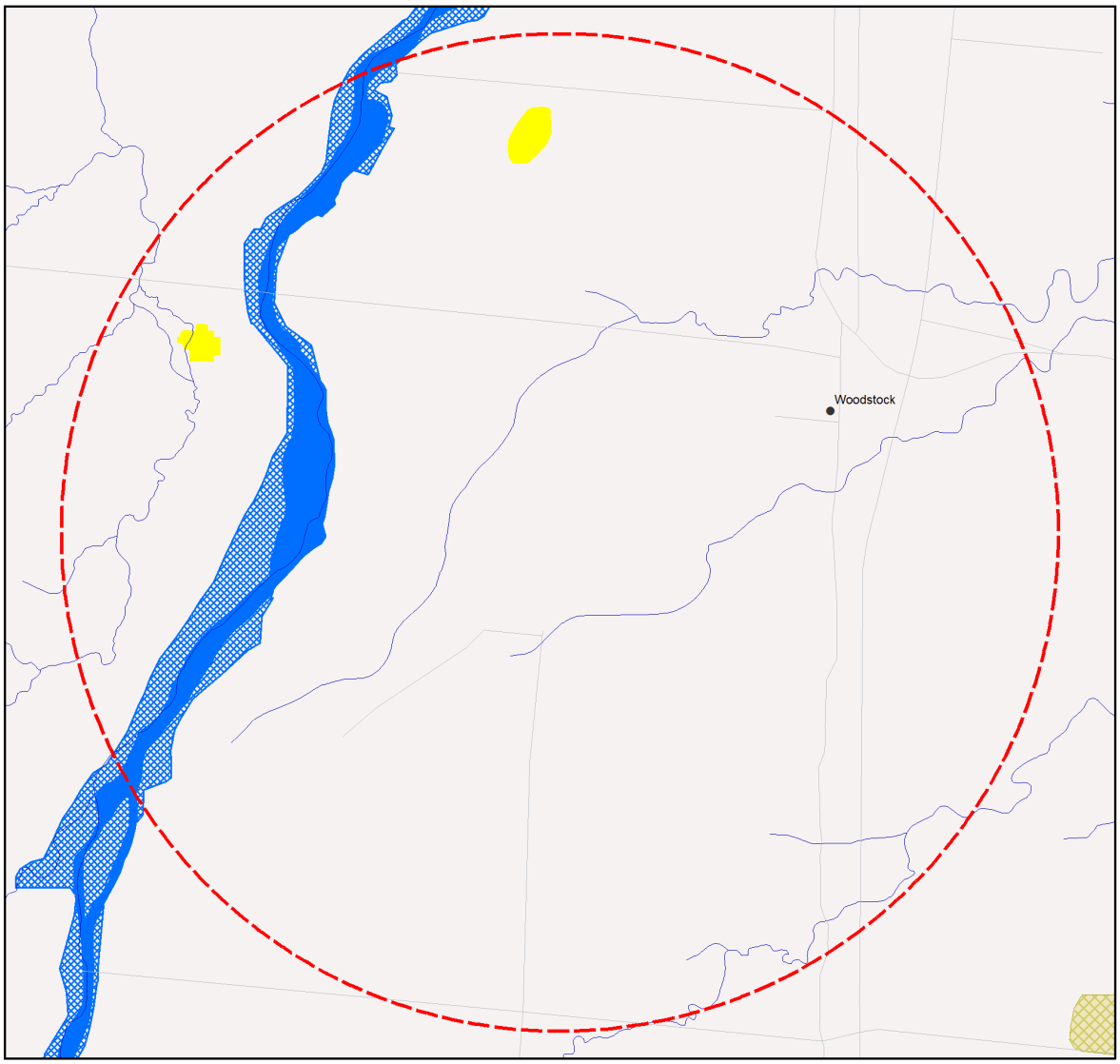
Map 4 - Wetlands and waterways



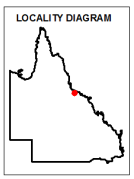
Wetlands and Waterways

Legend

- 2 kilometre buffer
- Towns
- Roads
- Springs
- Rivers/Creeks
- Directory of Important Wetlands
- Ramsar Sites - QLD
- Queensland

Wetland Type

- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies
- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)



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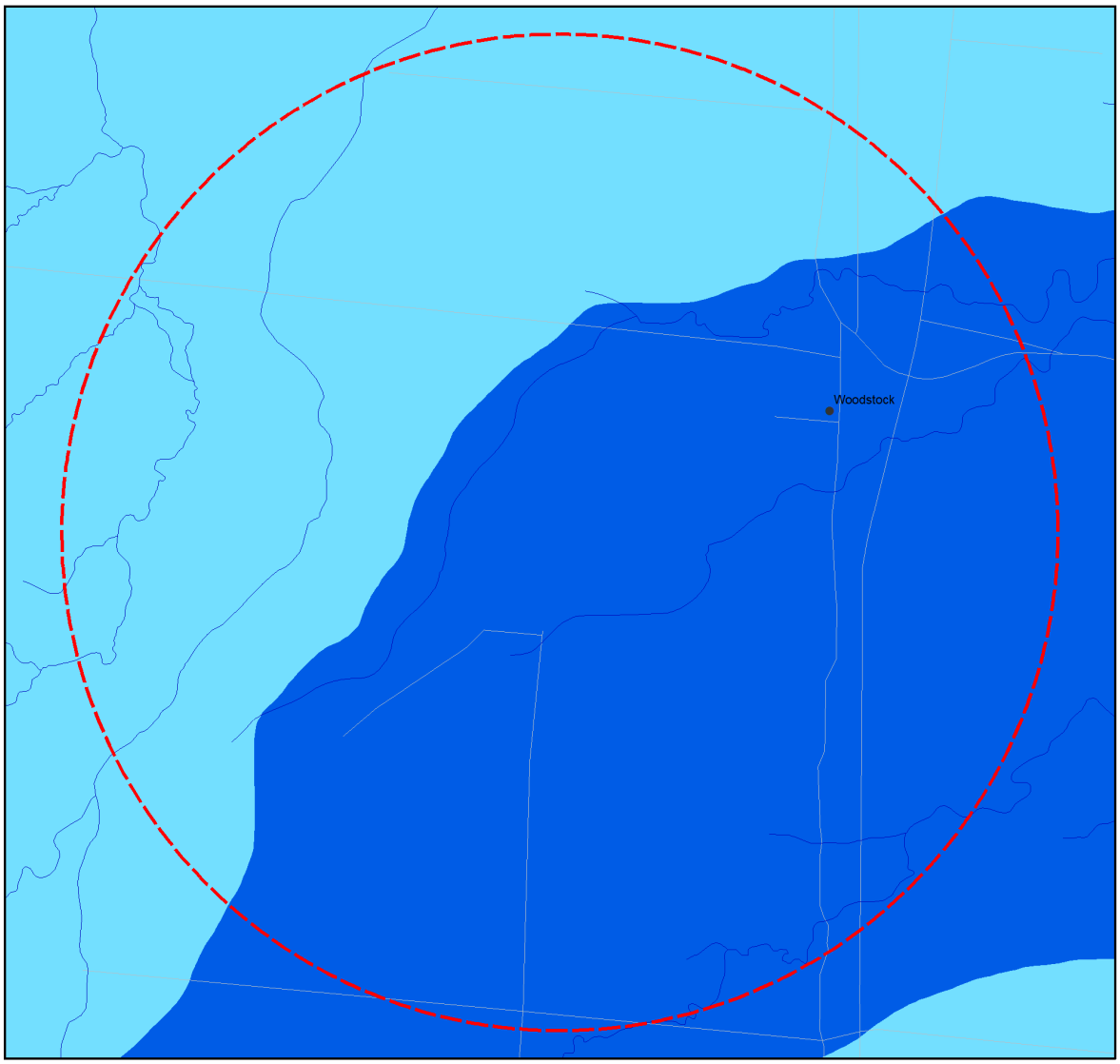
Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Aquatic Conservation Assessment (ACA) - riverine

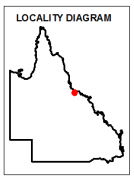
Legend

- 2 kilometre buffer
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Riverine - Subcatchment Significance

- Very High
- High
- Medium
- Low
- Very Low

LOCALITY DIAGRAM



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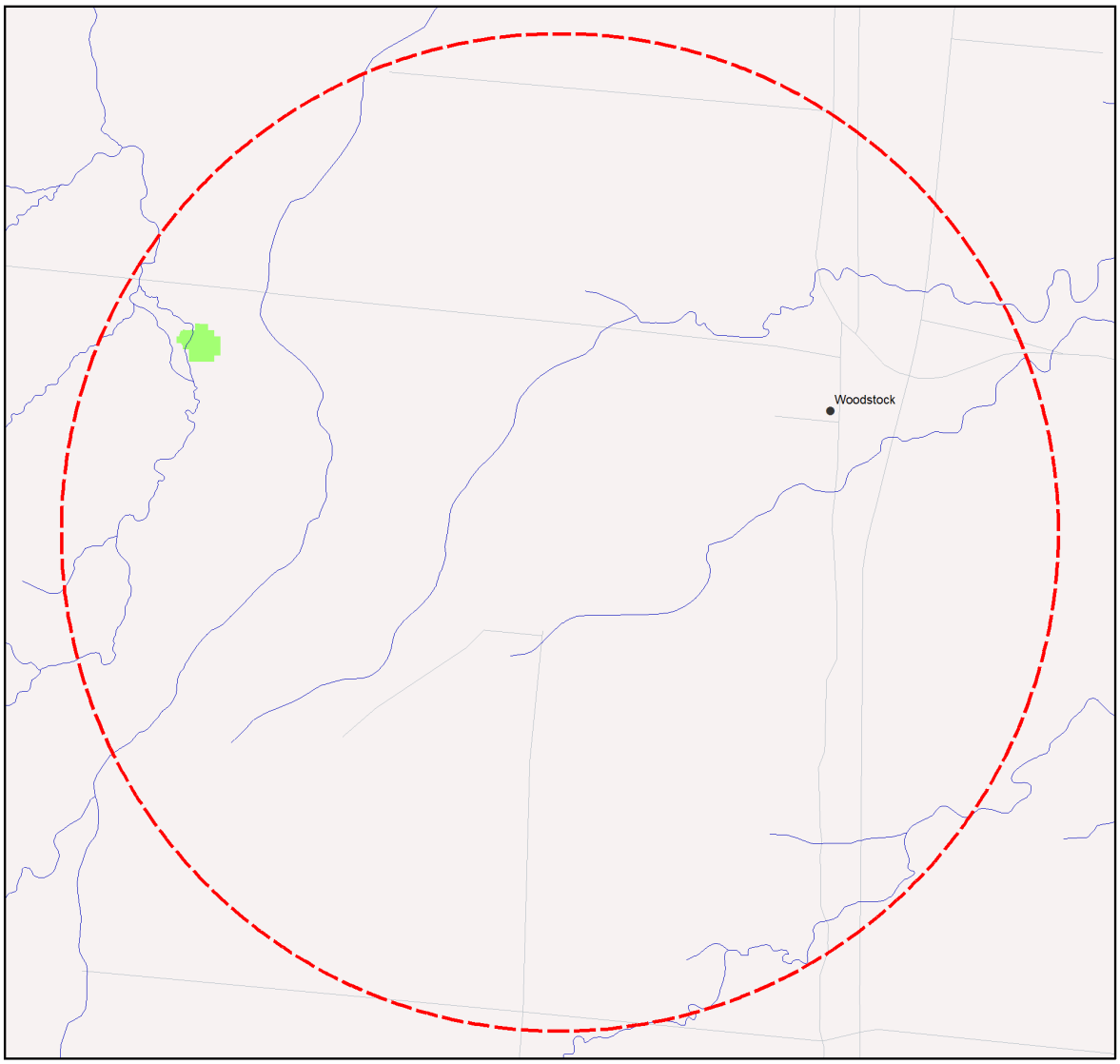
Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



Aquatic Conservation Assessment (ACA) - nonriverine

Legend

- 2 kilometre buffer
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Non-riverine

- Very High
- High
- Medium
- Low
- Very Low

LOCALITY DIAGRAM

N

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This product is projected into GDA 1994 Queensland Albers

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Appendices

Appendix 1 - Source Data

Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDB Non-riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDB Riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.

***These datasets are available at:**

http://dds.information.qld.gov.au/DDS

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- *Environment Protection and Biodiversity Conservation Act 1999*
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement

Appendix B

Curricula vitae

Sandra Walters

Principal Ecologist

Curriculum vitae

Sandra has 22 years' experience in terrestrial ecology, having worked for the past 10 years in environmental consultancy, following ecology roles in state government and private not-for-profit conservation.

She has extensive experience in fauna and flora survey, natural resource management, fire management systems, pest animal management, and Indigenous cultural heritage management.

She has applied her technical skills in Terrestrial Ecology, Environmental Impact Assessment, Fire Management, Mine Rehabilitation and Contaminated Land Assessment across a range of sectors including Defence, Mining and Gas, Energy, Rail, Construction, and State and Local Governments.

Sandra has worked on projects in varied landscapes and legislative jurisdictions, including QLD, NSW, the ACT, Northern Territory and South Australia.

Qualifications

- Bachelor of Environmental Science, Charles Sturt University, 2010
- Certified Environmental Practioner (CEnvP) #1416, Environment Institute of Australia and New Zealand (EIANZ)
- Member, EIANZ, since 30 September 2015
- Rainforest Plant Identification Certificate (JCU/ATH), 2013
- Member, Birdlife Australia, Australasian Bat Society, Queensland Wader Study Group, Native Plants Queensland
- AGSVA Baseline Security Clearance - Australian Government Security Vetting Agency
- QLD Department of Transport and Main Roads SOA E1 Technical Specialist – Ecology and Bushfire
- 'Suitably qualified person' under QLD Protected Plants framework
- Bushfire Attack Level Assessor, FPAA
- Cert 3 in Fire Comm Ops (part)
- Cert 2 Public Safety (Firefighting Ops) (part)

Career

- Lead Ecologist, Aurecon Australasia, 2011 – 2021
- Lead Ecologist, Queensland Parks and Wildlife Service, 2010 - 2011
- Field Ecologist, Bush Heritage Australia, 2005 – 2009
- Field Ecologist, Parks and Wildlife Service of the Northern Territory, 1997 - 2005

Representative experience

Pioneer Valley Mountain Bike Trails (PVMBT) Project | Mackay, QLD | Mackay Regional Council (MRC) | May – October 2021 | Project Manager / Lead Ecologist

Project Manager and Technical Lead for the MRC PVMBT Project, involving the environmental assessment of a network of proposed mountain bike trails within Eungella National Park and Crediton State Forest, as well as freehold land in the Finch Hatton area, west of Mackay.

EMM
creating opportunities

Sandra was technical lead of flora and fauna surveys within elevated sub-tropical rainforest, targeting endemic and threatened species of the region. She was also Project Manager with responsibility for budget, schedule and deliverables management, external stakeholder liaison and internal team leadership. Sandra led stakeholder workshops with MRC and Queensland Parks and Wildlife (QPWS). Approval will be delivered in later stages of the project.

Tully Training Area Upgrade Ecological Assessment | Tully, QLD | Defence | 2019 | Lead Ecologist

Technical lead delivering ecology surveys within Defence's jungle training facility, Tully Training Area, located within the Wet Tropics World Heritage Area (WTWHA). Sandra prepared scientific permits and survey methodology for approval by the Wet Tropics Management Authority (WTMA) and led the field survey and reporting. Field work included targeted surveys for cassowary, four threatened rainforest frogs, red goshawk and numerous threatened flora species.

Sandra provided technical review of the ecology report and EPBC-self assessment, and advice regarding engineering and design elements to mitigate impacts to threatened species that were confirmed within the project area, which included cassowary (Casuarius casuarius johnsonii), common mist frog (Litoria rheocola) and a threatened plant (Cheilocostus potierae).

Kennedy Highway Environmental Assessment | Mareeba, QLD | DTMR | Feb - Aug 2020 | Lead Ecologist

Lead ecologist for detailed environmental assessment of road upgrades along the Kennedy Highway near Mareeba, QLD. A Protected Plants Survey was completed in rainforest vegetation within the Wet Tropics World Heritage Area, along with habitat assessments for threatened fauna. Authored Flora Survey Report and provided technical review of Environmental Scoping Report (ESR), Cultural Heritage Risk Assessment (CHRA), Environmental Assessment Report (EAR), Environmental Design Report (EDR) and contract documents (MRTS16, MRTS51, MRTS52).

Whitsunday Island Ecotourism Feasibility Study| Whitsunday Island, QLD | DTIS | 2018 – October 2021 | Lead Ecologist

Lead ecologist and technical advisor for an ecotourism feasibility study of a proposed new walking trail and premium ecotourism products ('glamping') on Whitsunday Island, north Queensland. Surveys for threatened species (water mouse, Xeromys myoides) were undertaken, along with field verification of mapped Regional Ecosystems. Sandra liaised with QPWS and DTIS regarding survey methodology, approvals pathways and mitigation measures for threatened species, and authored the project technical report.

Wide Centreline Environmental Scoping Report | Innisfail to Ingham, QLD, Australia | DTMR | Jul 2015 – Mar 2016 | Lead Ecologist

Desktop constraints analysis and reporting of relevant environmental factors (e.g. watercourses, essential habitat, threatened species and ecological communities, cultural heritage).

Andrew Jensen

Associate Environmental Scientist

Curriculum vitae

EMM
creating opportunities

Andrew has 15 years' consulting experience across a range of environmental disciplines and industries including mining, renewables, and oil and gas.

Key aspects of his work have included ecological reporting and surveying, preparation of environmental impact statements, preparation of management plans, ecological offset plans, management of subcontractors and health and safety processes, project management and client liaison,

Andrew routinely reviews environmental technical studies and has developed environmental management plans and negotiated environmental approval conditions for clients. Andrew has also been responsible for conducting a number of species impact significance assessments at both Commonwealth and state level and is familiar with the requirements of this process. Andrew has also been responsible for managing, coordinating and undertaking fieldwork campaigns across Queensland.

Qualifications

- Bachelor of Science (Hons), University of St Andrews, 2003

Career

- Associate Ecologist, EMM Consulting, 2019–present
- Senior Environmental Scientist, CDM Smith, 2017–2019
- Senior Environmental Consultant, Coffey, 2010–2017
- Environmental Scientist, Royal Haskoning UK, 2004–2009
- Field Surveyor, British Trust for Ornithology (UK), 2007–2008
- Technician, Royal Haskoning (UK), 2003–2004
- GIS Technician, Essex County Council (UK), 2001–2002

Representative experience

Specimen Hill windfarm, Ecological Surveys and EPBC referral, Biloela (Epuron)

- Designed, coordinated and undertook field ecology surveys for the development. Surveys were consistent with EPBC guidelines for relevant species, and Queensland Vertebrate Fauna Survey Guidelines. Includes design and undertaking of Bird Utilisation Surveys.
- Input into Project design with proponent to ensure ecological aspects included in process, and to minimise issues with DAWE and DES.
- Contributing author to the EPBC referral and ecological technical report for the project.
- Contributing author to EAR and associated documentation (BBMP, FMP, VMP etc)

Boulder Creek windfarm, EPBC referral and ecological surveys, Mount Morgan (Epuron)

- Contributing author to the EPBC referral and ecological technical report for the project.
- Designed and coordinated field ecology surveys for the development. Surveys were consistent with EPBC guidelines for relevant species, and Queensland Vertebrate Fauna Survey Guidelines.
- Input into Project design with proponent to ensure ecological aspects included in process, and to minimise issues with DAWE and DES.
- Contributing author to EAR and associated documentation (BBMP, FMP, VMP etc)
- Contributing author to preliminary documentation for the Project.

Cooloola Great Walk, Review of EPBC referral, Brisbane (Queensland Parks and Wildlife Service)

- Reviewed EPBC referral and supporting documentation for proposed ecotourism development on behalf of QPWS.

Blackwater Tailings Project, Blackwater (BHP)

- Undertook ecological surveys of project area and completed ecological baseline report and habitat mapping.

ARTC Inland Rail Project, Supplementary Fauna Surveys, Brisbane and SEQ (ARTC)

- Assisted in supplementary surveys for MNES and MSES fauna to inform AEIS for the Project.
- Surveys followed relevant State and Federal guidelines.
- Assisted in revisions to species habitat mapping to inform offset calculations.

Olive Downs Coal Mine Project, MNES surveys and monitoring, Moranbah (Pembroke Resources)

- Andrew assisted in pest fauna surveys and MNES surveys for this Project.

Townsville Energy and Chemicals Hub Project, EPBC referral, Townsville (QPM)

- Andrew prepared an ecological technical report to support the EPBC referral for this Project.
- Prepared EPBC referral technical report following Significant Residual Impact Guidelines for MNES.

Queensland Coal Assets, Secondment to BHP, Brisbane (BHP)

- Andrew has been seconded to BHP since October 2019 to assist in their compliance reviews.
- Undertook a review of all conditions of approval, as well as commitments made in compliance documents and plans, and highlighted tasks requiring action.
- Assisted in mapping commitments and conditions against BHP's existing work actions.

ARTC Inland Rail Project, Preclearance surveys for Geotechnical Program, Brisbane and SEQ (ARTC)

- Assisted in pre-clearance surveys for animal breeding places, weeds and protected plants for proposed geotechnical survey locations for the project.

Blackwater Mine Seismic Surveys, MNES Significant Impact Assessments, Brisbane (BHP)

- Undertook a desktop review of ecological constraints in the proposed seismic survey area including previous EMM survey data.
- Prepared significant residual impact assessments for MNES potentially present in the area to determine the need for a project referral.

Mole River Dam, Ecological Constraints Report and Scoping Report, Brisbane (Water NSW)

- Contributing author to ecological constraints report and scoping report for the proposed Mole River dam development in northern NSW.
- Assisted in development of scope for EIS including ecological surveys and reporting.

Carmichael Coal Mine, Secondment to Adani Mining, Brisbane (Adani Mining)

- Andrew was seconded to Adani Mining for five months to assist in their pre-commencement compliance reviews and completing tasks relating to pre-commencement conditions. Adani then requested Andrew return for a further three months following commencement to assist in further compliance reviews and early works tasks.
- Undertook a review of all conditions of approval, as well as commitments made in compliance documents and plans, and highlighted tasks requiring action before Project could commence.
- Assisted in completing outstanding pre-commencement tasks such as updates to the Species Management Plan and the Groundwater Dependent Ecosystems Management Plan.
- Assisted in developing scopes of work for further baseline monitoring and surveys relating to MNES and weeds and pests.

Queensland Oil Refinery, Ecological Surveys, Gladstone (Queensland Oil Refinery)

- Andrew undertook an ecological constraints survey (fauna) of the proposed refinery site including habitat assessments, and scoping for further targeted surveys.

Mount Fox Windfarm, Ecological Constraints Report, Brisbane (Windlab)

- Andrew prepared a desktop ecological review of the project area ecology, including risks to development and recommendations for scoping future field surveys for the proposed windfarm.

Blackwater Mine, Ecological Surveys, Blackwater (BHP)

- Andrew undertook ecological surveys (fauna) of the proposed expansion area including habitat assessments, trapping and active searches in late-wet surveys.
- Surveys were consistent with EPBC guidelines for relevant species, and Queensland Vertebrate Fauna Survey Guidelines.
- Prepared EPBC referral technical report following Significant Residual Impact Guidelines for MNES.

McPhillamys Gold Mine, Ecological Surveys and Biodiversity Assessment Report, Blayney NSW (Regis Resources)

- Andrew undertook ecological surveys of the proposed mine targeting listed fauna species on the site, including habitat assessments, trapping and active searches.
- Contributing author to BAR, including assessment under bilateral agreement of EPBC impacts (and corresponding EPBC referral and impact assessment).

Tipton West Dalby Pipeline, Ecological Surveys, Dalby (APA Group)

- Andrew undertook ecology surveys of the site area (desktop and field survey of ecological constraints) to inform an EA Application for the Project, and prepared an environmental constraints report, including MNES and MSES significance assessment.

Rugby Run Solar Farm, Secondment to Adani Renewables, Brisbane/Moranbah (Adani Renewables)

- Andrew was seconded to Adani Renewables from CDM Smith for six months to work on the Rugby Run Solar Farm Project.
- Developed Construction Environmental Management Plan for the project, and assisted in development of Tier 2 plans and procedures.
- Assisted in Development Approvals, and other Council and State approvals (e.g. protected plant clearing permit, waterway barrier works applications) for the Project.
- Worked in environmental and regulatory team, assisting management of the contractor working on construction. Role included preparing induction materials, review of environmental reporting, site checklists, site compliance reporting and monitoring requirements.

Reedy Creek Wallumbilla Pipeline, Ecological Surveys, Reedy Creek (APA Group)

- Andrew undertook ecology surveys of the alignment targeting animal breeding places (Golden-tailed Gecko, Echidna) to inform a high-risk Species Management Program for the Project.
- Managed weed surveys and mapping along the Project alignment.

Styx Coal Mine, Supplementary Ecological Surveys, Marlborough (Waratah Coal)

- Andrew undertook supplementary ecology surveys of the proposed mine site, including MNES (Red Goshawk, Koala, Painted Snipe, Ornamental Snake).
- Assisted in SEIS update (update of MNES, ecology and offsets chapters) to address DoEE and DES comments.Prepared initial draft of Construction EMP and Species Management

Bauxite Hills Mine, Ecological Surveys, north of Weipa (Metro Mining)

- Undertook survey of proposed haul road corridors targeting potential MNES species on the site.
- Undertook and supervised surveys, including developing method to meet DotEE approval targeting potential key species on site. Surveys included active searches for Red Goshawk nests, and survey for near threatened Cape York subspecies of Rufous Owl, as well as hollow surveys to inform habitat assessment for the Bare-rumped Sheathtail Bat.
- Prepared summary report for submission to DotEE, including analysis of key species present at the site.

Williamtown Airport – expansions, Newcastle (Defence Australia)

- Project managed post approvals ecology issues relating to the EPBC Assessment, following the project being declared a controlled action. Liaison with Department of Defence on site and key consultees over operational impacts and proposed monitoring for migratory shorebirds, Gould's Petrel and bats.

Elk Antelope gas field, Preparation of ESIA, Papua New Guinea (Total E&P PNG Limited)

- Project managed production of ESIA report for an appraisal well in the Elk-Antelope gas field, including preparation of the draft construction management plan.
- Co-ordinated relevant technical desktop studies and collation of report.

Cape River Substation, Vegetation clearing permit, Pentland (Windlab)

- Project manager for vegetation clearing permit for a transmission line easement.
- Prepared supporting information for application including findings of surveys undertaken at the site. Prepared Vegetation Management Plan for the project.

Frieda River Project, Aquatic Ecology Impact Assessment, Papua New Guinea (PanAust)

- Contributing author to aquatic ecology impact assessment for copper-gold mine in Papua New Guinea including assessment of downstream impacts.

Kennedy Energy Park, Ecological assessment and EPBC referral, Hughenden (Windlab)

- Project manager for ecological assessment of renewable energy park.
- Undertook ecological surveys of proposed solar farm and windfarm site and prepared baseline reporting.
- Undertook MNES assessment and EPBC referral for the project, resulting in a 'not a controlled action' decision.

Chifley Road upgrade, Review of Environmental Factors, Chifley NSW (Roads and Maritime)

- Project manager and author of the REF report for a road upgrade in the Blue Mountains. Included preparation of basis for Construction Management Plan.
- Technical report reviewer for heritage, noise and ecology studies.
- Author of submissions report.

Granville Platform Upgrade, Review of Environmental Factors, Granville NSW (Sydney Trains)

- Contributing author of REF report.
- Assessed impacts on threatened species and ecological communities at both a Commonwealth and state level.

Erskineville platform upgrade, Review of Environmental Factors, Erskinville NSW (Sydney Trains)

- Contributing author of REF report.
- Assessed impacts on threatened species and ecological communities at both a Commonwealth and state level.

Menangle Park gas pipeline, Review of Environmental Factors, Menangle Park NSW (Jemena)

- Reviewed and assessed ecological, heritage and water quality impacts for the REF for with the installation of a gas pipeline at Menangle Park, NSW.
- Assessed impacts on threatened species and ecological communities at both a Commonwealth and state level.

Riverwood Bridge upgrade, Review of Environmental Factors, Riverwood NSW (Sydney Trains)

- Contributing author of the REF report
- Assessed impacts on threatened species and communities at Commonwealth and state level.

P'nyang Project appraisal well, Preparation of ESIA, Papua New Guinea (Oil Search)

- Co-ordinated field surveys and production of an ESIA for an appraisal well in Western Province.
- Assisted in development of Environmental and Social Management Plan and stakeholder engagement plan and for the project.

P'nyang Project, Preparation of EIS, Papua New Guinea (Esso PNG P'nyang Ltd)

- Project manager for EIS submission.
- Contributing author of relevant chapters and Construction and Operation Management Plans.

- Undertook and supervised terrestrial biodiversity surveys.
- Technical studies management of biodiversity and ecological studies.
- Assisted in development forum process logistics, and stakeholder engagement.

Former Mary Kathleen uranium mine, Environmental Condition and Rehabilitation Assessment, near Mount Isa (Queensland Government)

- Contributing author of report on existing environment at the site, and risk assessment of the site for rehabilitation prior to release of the site for future land use options.
- Developed scoping section for approvals and impact assessment required for any future activities at the site.

Sarsfield Gold Mine Expansion Project Supplementary Report to the EIS, Ravenswood (Carpentaria Gold)

- Contributing author of chapters for terrestrial ecology and traffic and transport.
- Contributing author of Environmental Management Plan.
- Contributing author of submission responses.
- Developed approach to offsets consistent with State and Federal guidelines.

PNG LNG Pipeline Project, Preconstruction Environmental Surveys, Papua New Guinea (Spiecapag)

- Reviewed and analysed survey reports for pipeline right of way social, environmental and cultural heritage preconstruction surveys. The programme addressed IFC Performance Standards for the project.
- Preconstruction surveys were used to update the project Environmental Management Plan.

PNG LNG Project, Secondment to ExxonMobil, Papua New Guinea (ExxonMobil)

- Seconded to ExxonMobil from Coffey for nine months to work on the upstream elements of the PNG LNG Project.
- Worked in environmental and regulatory team, assisting management of the contractor working on construction of Komo airfield in the Highlands of PNG. Role included assisting in preparation of management plans, induction materials, review of environmental reporting, site checklists, site compliance reporting and monitoring requirements.
- Assisted in the implementation by the contractor of Environmental and Social Management Plans produced by ExxonMobil, and worked with the contractor to produce their own site specific plans.
- Assisted with management and reporting of environmental issues on site (e.g. spills reporting, environmental incidents etc).

Moura Pipeline, Ecological Assessment and EPBC Referral, Moura (Queensland Nitrates)

- Prepared ecological baseline reporting and impact assessment for gas pipeline in central Queensland.
- Prepared MNES assessment and EPBC referral for project.

Hillalong Project, Ecological Surveys for reassignment of vegetation mapping, Glenden (Shandong Energy)

- Carried out ecological surveys of the site, to assist in reassigning incorrectly mapped vegetation at the site, and identifying additional ecological constraints.
- Prepared report for submission to Queensland Government to allow client to continue with exploratory drilling in a buffer zone of a mapped endangered RE.

Surat Gas Project, Supplementary Report to the EIS, Brisbane/Surat Basin (Arrow Energy)

- Contributing author of relevant chapters and Environmental Management Plans.
- Developed processes to address concerns around aquatic and terrestrial ecology.
- Contributing author of submission responses.
- Undertook and supervised terrestrial biodiversity surveys (using standard and targeted trapping methods and flora BioCondition assessment).
- Contributing author of environmental offset strategies and requirements.
- Contributing author of MNES assessment, including liaison with DoE in Canberra.

Arrow LNG Plant, Supplementary Report to the EIS, Brisbane/Gladstone (Arrow Energy)

- Author of relevant chapters and Environmental Management Plans for terrestrial ecology and shorebirds.
- Contributing author of submission responses.
- Author of environmental offset strategies and requirements.
- Contributing author of matters of national environmental significance, liaising with SEWPaC on the development of these documents and application of the EPBC Act guidelines.

Moranbah Gas Project, Threatened Species Management Plan, Brisbane (Arrow Energy)

- Contributing author of Threatened Species Management Plan.

Arrow LNG Plant, Preparation of EIS, Brisbane/Gladstone (Arrow Energy)

- Contributing author of relevant chapters and Environmental Management Plan.
- Contributing author of MNES assessment, liaising with SEWPaC on the development of these documents and application of the EPBC Act.

Pagham Harbour Coastal Defence Scheme, Preparation of EIS, Pagham UK (Environment Agency)

- Produced ornithology section of EIS for the coastal defence scheme at important designated site, involving shingle recharge of areas of the site.
- Assessed existing baseline based on ornithological data and the impacts of the proposed scheme on the ornithology of the site.

QE2 Teesport Berth Development, Preparation of EIS, Teesport UK (PD Teesport)

- Contributing author of relevant section of EIS assessing impacts on ornithological matters in the designated site and proposed management measures.

Round 3 Offshore Windfarms, Review of Ecological Constraints, Edinburgh UK (Airtricity)

- Identified likely constraints with regard to ornithology in potential zones of development based on ecological factors. Identified areas of the zones in which development should be avoided.
- Assisted in developing survey methodologies for boat based surveys of likely offshore windfarm zones in British territorial waters. Survey methodology targeted likely key species within each zone.

Onshore Windfarm bird survey methodology design, Edinburgh UK (Enertrag)

- Identified likely key issues with regard to ornithology around potential sites close to SPAs.
- Assisted in developing survey methodologies for each site based upon these likely issues.

Dover Harbour Terminal 2 Development, Preparation of EIS, Dover UK (Dover Harbour Board)

- Reviewed the existing ornithological data and analysed the surveys undertaken.
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.
- Designed methodology for further wintering shorebird surveys and breeding bird surveys around the site.

Dudgeon Offshore Windfarm, Preparation of EIS, Edinburgh UK (Dudgeon Offshore Wind)

- Reviewed existing ornithological data and analysed surveys undertaken.
- Proposed methodology for further surveys and statistical analysis (offshore boat based bird surveys).
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.

Elgin Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)

- Assisted with production of Controlled Activities Regulations (CAR) licence applications to SEPA for the Elgin Flood Alleviation Scheme.
- Liaised with design team to establish which scheme elements need licensing, and with SEPA to see which licence each scheme element fell under.
- Produced landownership maps for the area and gathered data on sensitive receptors in the downstream area to carry out a flood damage assessment.
- Carried out ecological surveys of the site.

Seaham Harbour Redevelopment, Preparation of EIS, Seaham UK (Durham Council)

- Contributing author to ecology section of EIS for a harbour redevelopment next to Durham Coast SPA.
- Analysed baseline of birds in the designated site.

Titchwell Managed Realignment, Preparation of EIS, Norfolk UK (Royal Society for the Protection of Birds)

- Contributing author to ornithology section of EIS, assessing the impacts on internationally important populations of rare birds at the site.
- Produced a mitigation plan to assist in replacement of lost habitat.

Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys and Preparation of EIS, Elgin UK (Moray Council)

- Assisted with environmental input into design of the scheme throughout its development embedded in client's office.
- Produced an Environmental Opportunities and Constraints Report.
- Assisted in the environmental and sustainability assessment of the options, as part of the scoping process.
- Carried out ecological surveys of the site.
- Contributing author to the EIS for this scheme, in particular terrestrial ecology and introductory chapters and management plans.

Helix Project Phase II, Ecological Surveys, Grangemouth UK (British Waterways)

- Managed environmental input into regeneration of green space area, and prepared ecological opportunities and constraints report.
- Liaised with regulatory authorities on behalf of client.
- Organised and managed protected species surveys undertaken by sub-contractors. Analysed survey information to inform scheme design.
- Undertook Phase 1 habitat survey, including proposal for habitat enhancement measures which could be incorporated into scheme design.

Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)

- Assisted with production of CAR licence applications to SEPA for the Forres (River Findhorn) Flood Alleviation Scheme.
- Carried out ecological surveys of the site.

Proposed Firth of Forth Windfarm, Review of Constraints, Edinburgh UK (Airtricity)

- Identified likely constraints with regard to ornithology in potential zones of development based on ecological factors. Identified areas of the zones in which development should be avoided.
- Assisted in developing survey methodologies for boat based surveys of likely offshore windfarm zones in British territorial waters. Survey methodology targeted likely key species within each zone.

Seahouses seawall upgrade, Ecological Surveys, Seahouses UK (Northumbria Council)

- Developed survey methodology to monitor disturbance of shorebirds to allow construction to continue. Natural England had previously stated that no construction should take place during the winter months due to shorebirds.

Thames Estuary Maintenance Dredging, Review of Ecological Data, London UK (Port of London Authority)

- Analysed Wetland Bird Survey data for sites around the Thames Estuary in London.
- Assessed trends in populations of shorebirds near the proposed dredging sites.

BERR Offshore Energy Strategic Assessment, Review of Survey Method, Edinburgh UK (BERR)

- Assessed the adequacy of the bird aerial survey methodology proposal provided by WWT to survey offshore areas around UK.

Bo'ness Harbour Development, Wintering Bird Management Plan, Bo'ness UK (ING Estate)

- Produced a wintering bird management plan which identified potential impacts on wintering shorebirds on the Firth of Forth, and proposed management measures.

Brent Decommissioning, Sensitivity Assessment and Environmental Risk, Edinburgh UK (Shell)

- Contributed to the provision of biological information on key ornithological receptor groups encountered in the Brent field and wider area.
- Assessed sensitivity relevant to specific hazards and activities likely to result from decommissioning and remediation activities of platforms in the oil field.

Canvey Biodiesel Plant, Preparation of EIS Addendum, Canvey UK (Sure Green Fuels)

- Produced an addendum to the EIS with regard to potential objections from statutory consultees.
- Liaised with consultees to develop mitigation measures and a monitoring programme to assess the possible impact of the development on ornithology.

Barrow Waterfront Harbour Revision Order, Preparation of EIS, Barrow UK (West Lakes Renaissance)

- Contributing author to ecology section of EIS for £100million+ regeneration scheme, next to internationally protected site.

Trow Quarry Remediation Project, Ecological Surveys and Preparation of EIS, Trow UK (South Tyneside Council)

- Analysed baseline populations of birds present near works within designated sites.
- Carried out ecological surveys of the site.
- Contributing author to ornithology section of EIS assessing impacts on ornithological matters in the designated site.

Isle of Grain Windfarm, Review of Ecological Data, Isle of Grain UK (British Petroleum)

- Reviewed additional ecological survey data to that collected as part of the original EIS.
- Assisted in developing a methodology for post-construction monitoring on site

Newhaven Desalination Plant, Preparation of EIS, Newhaven UK (Clarity Ltd)

- Reviewed the existing ornithological data and analysed the surveys undertaken.
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.

Strangford Lough Marine Current Turbine, Preparation of EIS, Strangford UK (SeaGen Ltd)

- Reviewed ornithological data gathered as part of the monitoring work for marine mammals.
- Contributing author to ornithology section of the EIS assessing impacts on ornithological matters in the site and proposed management measures.

Thanet Offshore Windfarm, Preparation of EIS Addendum, Thanet UK (Warwick Energy)

- Produced an addendum to ecology section of the existing EIS based on additional bird survey data for both boat and aerial surveys.

River Carron Forth Gateway Project, Ecological Surveys, Grangemouth UK (British Waterways)

- Managed assessment of environmental opportunities and constraints. Consulted with SEPA/SNH on behalf of client.
- Organised and undertook wintering shorebird surveys.

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Gus Daly

Ecologist

Curriculum vitae

Gus is an ecologist based in EMM's Brisbane office. Gus has experience in flora and fauna identification, particularly avifauna, data collection and analysis, report writing and presentation of results.

Qualifications

- Bachelor of Science (Hons), Southern Cross University, 2017
- Bachelor of Environmental Science majoring in Coastal Management, Southern Cross University, 2015

Career

- EMM Consulting, May 2018–present
- Ecologist (contractor), Australian Broadcasting Corporation, 2018
- Ecologist (contractor), Logan City Council, 2018
- Hydrology Demonstrator/Tutor, Southern Cross University, School of Environmental Science & Engineering2016

Representative experience

- Snowy 2.0, mammal, reptile, avifauna and weed surveys, Kosciuszko National Park NSW (Snowy Hydro Limited)
- Inland Rail, Protected plant and pre-clearance surveys, Gowrie to Kagaru QLD (ARTC)
- Blackwater Mine Expansion, flora and fauna surveys, Blackwater QLD (BMA)
- McPhillamys Gold Project, fauna surveys, Kings Plains NSW (Regis)
- Wagga Wagga Solar Project, fauna surveys, Wagga Wagga NSW (Vena Energy)
- Karreman Quarry Extension, vegetation assessments, Redland Bay QLD (Karreman Quarries)
- Hunter Valley Operations Offset Assessment, flora and fauna surveys, Belford NSW (HVO)
- Cottage Creek Gas Fields, pre-clearance weed surveys, Roma QLD (FYFE)

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Relevant environmental experience

- Conducted mammal and avifauna surveys for biannual monitoring. Project involved field data collection and analysis, Logan, QLD – Logan City Council
- Responsible for fauna identification and data logging of video recordings, Brisbane, QLD – Australian Broadcasting Corporation
- Undertook honours thesis on shorebird foraging ecology and resource partitioning using stable isotope analysis. Project involved field data collection, laboratory analysis and the formation of a scientific manuscript.

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Appendix C

EVNT species likelihood of occurrence

A refined likelihood of occurrence has been prepared for the potential MNES associated with the Project based on EMM's desktop assessment and findings. This assessment was informed by the results of the background research, database searches and field assessments.

Definitions used for the refined likelihood of occurrence are described below:

1. **Known** – records of the species exist in the road reserve.

2. **Likely** – species records exist within the study area and suitable habitat is mapped within 2 km of the Road reserve.

3. **Potential** – species records exist within the study area, suitable habitat for the species exists within study area, but there is insufficient information to categorise the species as likely, or unlikely to occur, in the road reserve.

4. **Unlikely** – a low to very low probability that a species will occur in the road reserve due to the lack of suitable habitat or is outside the species known geographical range.

The refined likelihood of occurrence assessments are provided in Table B.1 below and those ecological communities and species identified as 'known', 'likely' or have 'potential' to occur in the road reserve are summarised in following sections.

C.1 Fauna species

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Calidris ferruginea	Curlew Sandpiper	✓	✓	CE, Mi	E	This migratory shorebird species spends its non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas. When inland, they utilise ephemeral and permanent lakes, lagoons, ponds or dams with bare edges of mud. The species does not breed in Australia (DAWE 2021k).	Unlikely	Preferred habitats of coastal mudflats and shallow wetlands are not known to occur within the study area. The closest record of this species is approximately 20 km from the road reserve adjacent to tidal wetlands. As such, the species is considered unlikely to occur.
Charadrius leschenaultii	Greater Sandplover	✓	×	V, Mi	V	This migratory shorebird species spends its' non-breeding season in coastal parts of Australia. It typically inhabits intertidal mudflats and sandy beaches. The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Cophixalus mcdonaldi	Mount Elliot Nurseryfrog	✓	✓	CE	CR	Found only on Mount Elliot near Townsville at elevations above 900 m ASL around rocky creek margins in rainforest (TSSC 2019b).	Unlikely	The road reserve is outside the known distribution of the species and habitat is unsuitable.
Dasyurus hallucatus	Northern Quoll	✓	✓	E	-	This species utilises a wide range of habitats, showing preference for eucalypt woodlands, riparian vegetation, and vine thickets. They are recorded in higher densities where these areas remain in proximity to suitable denning habitat of steep rocky terrain with crevices and other sheltering microhabitats (TSSC 2005b).	Unlikely	No suitable habitat exists within the study area for this species. Old records (1973 and 2007) occur from within Bowling Green Bay National Park (~12 km from road reserve) consisting of hilly forested habitat. As such, Northern Quoll is considered unlikely to occur within the road reserve.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Denisonia maculata	Ornamental Snake	✓	×	V	V	The Ornamental Snake is a nocturnal species known only from the Brigalow Belt North and the Brigalow Belt South biogeographical regions. Its preferred habitat includes woodlands (Acacia and Eucalypt) and open forests associated with moist areas and cracking clays. It has been recorded from multiple regional ecosystems including RE11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.3.3, 11.5.16, most regularly from those associated with clay soils (Land zone 4). It shelters within deep soil cracks, under coarse woody debris and amongst deep leaf litter. It feeds almost exclusively on frog species and therefore is most active during wet conditions (DAWE 2021l).	Unlikely	Suitable habitat does not occur within the road reserve and no previous records exist. Therefore, this species is considered unlikely to occur.
Egernia rugosa	Yakka Skink	✓	×	V	V	The Yakka Skink occurs in a variety of habitats including eucalypt and acacia woodland, as well as *Callitris* and *Casuarina* dominated communities. Within these communities it requires specific refuge microhabitats including partially buried timber and large rocks, disused animal burrows, and hollow logs (DAWE 2021m).	Unlikely	No records of this species exist within the region and suitable habitat is not mapped within the road reserve. Therefore, the species is considered unlikely to occur.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Erythrotriorchis radiatus	Red Goshawk	✓	×	V	E	The Red Goshawk is a large bird of prey that primarily feeds on other bird species. Its preferred habitat consists of a mosaic of vegetation types including forest and woodland communities with ample prey populations and permanent water. Regular prey species include Corvids, Kingfishers and Parrots. Nesting locations are highly specific and usually restricted to trees taller than 20 m and within 1 km of a permanent watercourse or wetland (DAWE 2021n).	Unlikely	There are multiple regional records of this species with the most recent from 1998. However, no records exist from within the study area and the current disturbed landscape is considered unsuitable for the species. However, this species has undergone a well-documented and severe northerly range retraction in recent decades. Currently, its breeding population is restricted to Cape York peninsula and parts of the Northern Territory (DAWE 2021m). As such, the road reserve is unlikely to support breeding territories and any occurrence of this species would only coincide with post-breeding dispersal of transient young birds. As such, Red Goshawk is considered unlikely to occur.
Eustacus bindal	Spiny Crayfish	✓	✓	CE	CR	This species is endemic to Mount Elliot and occurs in rainforest stream habitat in small areas of gully near the peak (TSSC 2016b).	Unlikely	The road reserve is outside the known distribution of the species and habitat is unsuitable.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Falco hypoleucos	Grey Falcon	✓	×	V	V	The Grey Falcon inhabits woodland, shrubland and grasslands in the arid and semi-arid zones (Menkhorst et al. 2017).	Unlikely	There are no regional records of Grey Falcon and it is mostly restricted to arid habitats. Therefore, the species is considered unlikely to occur.
Geophaps scripta scripta	Squatter Pigeon (southern)	✓	✓	V	V	The Squatter Pigeon is a medium-sized, terrestrial pigeon that occurs from Cape York to southern Queensland (formerly to northern New South Wales). Habitat for the species is generally open-forests to sparse open-woodlands and scrub, dominated by *Eucalyptus, Corymbia, Acacia* or *Callitris* species, within 3 km of surface water. Squatter Pigeons prefer areas in these habitats with low ground cover, typically below 33%. Soils in these areas consist of sandy substrates dissected with low gravely ridges (DAWE 2021a).	Known	Multiple records of this species exist within the study area. Field surveys identified this species as being present in the road reserve and the property to the north and as such the species is considered known to occur.
Hipposideros semoni	Semon's Leaf-nosed Bat	✓	✓	V	E	The species occurs mainly in north-east Queensland between Cape York and Townsville, with an isolated subpopulation at Kroombit Tops National Park (TSSC 2016c). They typically roost in caves and tree hollows (Churchill 2008). It is poorly known and appears to occur at low densities, favouring rainforest habitats and streams adjacent to rainforest.	Unlikely	The road reserve and broader study area provide limited suitable habitat for this species with no nearby records. As such it is considered unlikely to occur.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Hirundapus caudacutus	White-throated Needletail	✓	✓	V	V	A regular summer non-breeding migrant to eastern Australia, the White-throated Needletail is a highly aerial species that forages in the airspace over most habitats. However, the shows some preference for forested hilly areas and coastal ranges. Its roosting habits are poorly known but it has been recorded roosting in woodlands, high amongst the foliage of large Eucalypt species (Pizzey et al. 2012).	Likely	Multiple records of this species are represented within the study area. The species habitat preferences indicate that it could occur in any airspace over the entire road reserve. Therefore, this species is considered likely to occur.
Lerista vittata	Mount Cooper Striped Skink	✓	×	V	V	This species is endemic to Mount Cooper Station near Charters Towers, where it occurs in low closed forest and woodland with vine thickets on sandy soil (TSSC 2008)	Unlikely	The road reserve is outside the known distribution of the species and habitat is unsuitable.
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	✓	✓	V	V	This migratory shorebird species spends its non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas.	Unlikely	Preferred habitats of coastal mudflats and shallow wetlands are not known to occur within the study area. The closest record of this species is approximately 20 km from the road reserve adjacent to tidal wetlands. As such, the species is considered unlikely to occur.
Macroderma gigas	Ghost Bat	✓	×	V	E	This species requires specific breeding habitat throughout its range. Breeding sites are typically large, deep natural caves or abandoned mineshafts, which provide stable environmental conditions. During the non-breeding season, roosting habits are more variable, and the species will utilise rock crevices and overhangs. The species forages in close proximity to roosting sites, in woodland, monsoonal rainforest, and dry vine thickets (Hourigan 2011).	Unlikely	Five records of this species exist within the region. However, most records reside from extensive forested habitats which are not represented within the road reserve. There is no suitable breeding habitat within the survey area. As such the species is considered unlikely to occur.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Neochmia ruficauda ruficauda	Star Finch (Eastern)	✓	×	E	E	This species prefers natural grasslands and grassy woodlands and is often associated with permanent or ephemeral wetlands. Preferred woodlands consist primarily of eucalypts, as well as *Melaleuca* and *Casuarina* species (DAWE 2021o). In recent decades, the distribution of the species has largely contracted to eastern Cape York and the Gulf of Carpentaria (Pizzey et al. 2012).	Unlikely	No records of this species exist within the study area with only two regional records. However, the two available records do not provide dates of the records. This species has recently undergone an extreme range reduction and as such these records are likely to be historical. Therefore, the species is considered unlikely to occur.
Numenius madagascariensis	Eastern Curlew	✓	×	CE	E	The Eastern Curlew is the largest migratory shorebird species and is a non-breeding summer migrant to Australia. It is almost entirely restricted to coastal habitats such as mangrove swamps, bays, inlets and tidal lagoons (DAWE 2021p).	Unlikely	No records or suitable habitat for this species is represented within the road reserve. As such it is considered unlikely to occur.
Petauroides volans volans	Greater Glider	✓	✓	V	E	This folivore prefers eucalypt woodlands with a high diversity of mature myrtaceous tree species and abundant hollows. Populations of this species are sensitive to habitat disturbance and particularly the removal of large mature trees (van der Ree et al. 2004)	Unlikely	Two records of Greater Glider exist within the study area. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The Greater Glider was not identified when undertaking nocturnal spotlighting surveys or through scat observations. It is unlikely the species is present due to the lack of large mature hollow bearing trees and scarcity of large hollows. The road reserve is largely fragmented and has been previously cleared with non-remnant and regrowth vegetation being the dominant vegetation features. This limits large, mature hollow bearing trees for the Greater Glider to feed on or dwell in. Due to unsuitable habitat within the road reserve, absence of records within the study area, lack of mature trees and a scarcity of large hollows it is unlikely this species is present.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Phascolarctos cinereus	Koala	✓	×	E	V	The Koala is an iconic arboreal mammal that inhabits a range of temperate, sub-tropical and tropical and semi-arid habitats throughout eastern Australia. It forages almost exclusively on myrtaceous tree species within the genera of *Eucalyptus, Corymbia, Angophora, Lophostemon* and *Melaleuca*. Preferred species within these genera vary according to range but are predominated by *Eucalyptus* species (DAWE 2021f).	Potential (low)	No records of Koala exist within the study area. However, the alluvial vegetation community (RE11.3.25b) mapped along the western boundary of the road reserve is considered to be suitable habitat for the species, albeit of low quality being dominated by Melaleuca. Therefore, Koala is considered to potentially occur, albeit infrequently. Within the Townsville region, this species is scarce on the mainland – the majority of records are from the introduced population on Magnetic Island. Records on ALA and Wildnet on the mainland are sparse and infrequent.
Poephila cincta cincta	Southern Black-throated Finch	✓	✓	E	E	The Southern Black-throated Finch has undergone an extensive northerly range retraction. Its preferred habitats consist of grassy woodland dominated by eucalypts (savannah communities), but it will also use *Melaleuca* or *Acacia* dominated communities with a diversity of grass species. Riparian habitats can also be utilised within highly fragmented and modified environments (DAWE 2021c).	Likely	Multiple records of this species occur within the study area with the closest record within 2km of the northern road reserve boundary, around Jones Road (Woodstock). As such the species is considered likely to occur. The majority of records in the Townsville area are north of the road reserve in the Woodstock area.
Rhinolophus robertsi	Large-eared Horseshoe Bat	✓	×	V	E	The species occupies a variety of forest habitats from Cape York to Townsville. Its range extends inland to Chillagoe. Preferred foraging habitat includes lowland rainforest, gallery forest along creeklines, riparian woodlands, savannah and *Melaleuca* forest, and the species typically roosts in mineshafts (Churchill 2008).	Unlikely	No records of this species exist within the region, with records south to Townsville. Preferred rainforest or dense riparian habitat is not represented within the road reserve, although the species does occur in melaleuca forest or open eucalypt forest (TSSC 2016d). The species was not recorded on Anabats during ecological surveys. As such the species is considered unlikely to occur.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Saccolaimus saccolaimus nudicluniatus	Bare-rumped Sheathtail Bat	✓	×	V	E	The species occurs in tropical woodland and tall open forests – in Queensland, mainly in Poplar Box or Darwin Stringybark savannah woodland. The species roosts and rears young in tree hollows (Churchill 2008).	Known	There are a number of records from the Townsville region (eg surveys for the Townsville ring road, Majors Creek solar farm). Despite there being few records of the species it is potentially under recorded in the region. It occurs in lowland forest including gallery forest. Numerous calls recorded on Anabat devices in March 2021 while not able to be categorically identified, were assigned to the group *Saccolaimus saccolaimus/Taphozous troughtoni/Ozimops lumsdenae*, and it is highly likely that some of these calls belong to *S.saccolaimus* (Greg Ford, 2021) although other calls were positively assigned to the other species. Subsequent to this in July 2021 further Anabats were deployed to provide further clarity on the status of the species on the road reserve. Calls from this species were confirmed from four sites sampled, with calls from a fifth site being likely from this species.
Rostratula australis	Australian Painted Snipe	✓	×	E	E	The Australian Painted Snipe is a predominately crepuscular and nocturnal shorebird species. Its preferred habitats include shallow ephemeral freshwater wetlands such as swamps, gilgai and streams with ample vegetative cover. It is most common in south-eastern Australia but can exhibit dispersive characteristics and has been known to occur far from its usual range when conditions are suitable, usually following rain events (DAWE 2021s).	Unlikely	Whilst there are records of this species within the study area, the road reserve does not support areas of suitable habitat.

Table C.1 Likelihood of occurrence – Fauna species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Turnix olivii	Buff-breasted Buttonquail	✓	×	E	E	Little contemporary information on habitat is available, but the species is thought to occur in savanna woodlands on the Cape York peninsula.	Unlikely	This species is poorly known, and there are no confirmed records in recent years. Historical sightings are from southern Cape York, Einasleigh Uplands and potentially the Wet Tropics in savanna woodland. The species is unlikely to occur.
Tyto novaehollandiae kimberli	Masked Owl (northern)	✓	×	E	V	Roosting in tree hollows, dense foliage or caves, the northern Masked Owl occupies a wide variety of woodland and forest ecosystems (Menkhorst et al 2017), with some preference for tall open Eucalypt forests with suitable hollows for nesting (DAWE 2021t).	Unlikely	Regional records of this species exist, and although potential habitat may be present within the road reserve (RE11.3.25b), the species is considered unlikely to occur. This is due to the low densities in which this species occurs and the limited area of habitat. It was not recorded during the nocturnal surveys.
Xeromys myoides	Water mouse	✓	×	V	V	Habitat including mangroves and the associated saltmarsh, sedgelands, clay pans, heathlands and freshwater wetlands.	Unlikely	Species considered unlikely to occur. No records of sighting and road reserve is not suitable habitat.

C.2 Flora species

Table C.2 Likelihood of occurrence – Flora species

Scientific name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Bulbophyllum globuliforme	✓	×	V	NT	A tiny epiphytic orchid, the species grows almost exclusively on mature Hoop Pines (*Araucaria cunninghamii*) between the McPherson Range and Townsville (DAWE 2021u).	Unlikely	Occurrence records and suitable habitat for this species do not exist within the road reserve or study area. As such it is considered unlikely to occur.
Dichanthium setosum	✓	×	V	LC	The species occurs in heavy soils (cracking clays and alluvium) in woodland or open woodland from Toowoomba to the Lynd Junction, west-north west of Townsville (DAWE 2021v).	Unlikely	No records exist within the region. No suitable habitat occurs within the road reserve. The species is considered unlikely to occur.
Eucalyptus paedoglauca	✓	✓	V	V	The Mt Stuart Ironbark is restricted to the slopes of Mt Stuart and the surrounding mountain ranges to the south and east of Townsville (EUCLID 2015).	Unlikely	Four records of this species are within the study area including one approximately 7 km west of the road reserve boundary. The species is only known from Mount Stuart and other mountains just south of Townsville, and on ridges or hill slopes (TSSC, 2008). Therefore, the species is considered unlikely to occur as it is outside the known distribution and habitat factors are not present (being alluvial land).
Eucalyptus raveretiana	✓	×	V	LC	The species is found along watercourses, and occasionally on river flats, in scattered populations from Ayr south to Rockhampton (DAWE 2021w).	Unlikely	No records of this species exist within the study area with the closest record being approximately 50 km south-east of the road reserve. Suitable habitat for the species is represented by the alluvial community (RE11.3.25b), however, any record within the study area would be a range extension for the species. As such the species is considered unlikely to occur.

Table C.2 Likelihood of occurrence – Flora species

Scientific name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Marsdenia brevifolia	✓	×	V	V	The species is found in a variety of disjunct locations from west of Paluma in the Wet Tropics to just north of Rockhampton. Each subpopulation is found on different substrates and in different habitat; for instance, the population occurring on Magnetic Island occupies open forest dominated by *Eucalyptus drepanophylla*, while the population west of Paluma occurs on granitic soils in woodland dominated by *E. granitica*, *Corymbia leichardtii* and *E. acmenoides* (DAWE 2021x).	Unlikely	No records of this species occur within the study area and previously recorded habitat does not exist within the road reserve. As such the species is considered unlikely to occur.
Omphalea celata	✓	×	V	V	Endemic to Queensland, the species has been found in semi-evergreen vine thicket and Araucarian microphyll vine forest between Bowen and Mackay (DES 2019d).	Unlikely	The road reserve is well outside the known geographical range of the species and suitable habitats do not exist. Therefore, the species is considered unlikely to occur.
Solanum graniticum	✓	×	E	E	Found on Gloucester Island near Bowen, and the adjacent mainland. It occurs in open eucalypt woodland slopes, on soils derived from granite (DAWE 2022).	Unlikely	The road reserve is well outside the known geographical range of the species and suitable habitats do not exist. Therefore, the species is considered unlikely to occur.
Tephrosia leveillei (T. flagellaris QLD)	✓	×	V	C	This species is poorly known and considered closely related to *Tephrosia flagellaris* with genetic work ongoing. It has been recorded primarily from communities dominated by *Eucalyptus* spp. and *Corymbia* spp (DAWE 2021y).	Unlikely	One regional record of the species approximately 20 km from the road reserve, although the species is known from the area between Chillagoe and Forty Mile Scrub (TSSC, 2008). AS such, the species is considered unlikely to occur.

C.3 Migratory species

Table C.3 Likelihood of occurrence – Migratory species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Migratory terrestrial birds								
Cuculus optatus	Oriental Cuckoo	✓	✓	Mi	SL (Mi)	This species is a summer visitor to Australia. It inhabits a wide range of habitats, including dense to open woodlands and forests, vine thickets monsoonal rainforest and wet sclerophyll forest. It particularly prefers the edges of riparian forests (Menkhorst et al. 2017).	Likely	Multiple records of this species exist within the study area and suitable habitat occurs within the road reserve. This species was identified adjacent to the road reserve during surveys. As such the species is considered likely to occur.
Hirundapus caudacutus	White-throated Needletail	✓	✓	V, Mi	V	This species is almost exclusively aerial in Australia. The species is usually seen in foraging flocks over many habitat types including open forest and rainforest, cleared areas and heathland. They also prefer areas with updrafts (eg hills and coastal cliffs) (Pizzey et al. 2012).	Likely	Multiple records of this species are represented within the study area. Therefore, this species is considered likely to occur.
Monarcha melanopsis	Black-faced Monarch	✓	✓	Mi	SL (Mi)	This species is widespread in eastern Australia. It mainly inhabits rainforest systems, including vine thickets, warm temperate rainforests and dry rainforests. The species can also be found in gullies in open eucalypt forests and coastal foothills (Menkhorst et al. 2017).	Unlikely	One record of this species exists within the study area however no suitable habitat in the road reserve. This species prefers vine thicket and riparian corridors.
Motacilla flava	Yellow Wagtail	✓	✗	Mi	SL (Mi)	This species is an annual migrant to northern Australia and is primarily associated with wetlands, marshlands, exposed mud, and moist grasslands (Menkhorst et al. 2017).	Unlikely	This species has been recorded within the region; however, it is considered an uncommon visitor to northern Australia and only marginal likely occurs within the road reserve. As such, the species is considered unlikely to occur.

Table C.3 Likelihood of occurrence – Migratory species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Myiagra cyanoleuca	Satin Flycatcher	✓	✓	Mi	SL (Mi)	This species is widespread in eastern Australia. It occurs in heavily vegetated gullies in eucalypt dominated forests and woodlands. Specifically, they occur near watercourses or wetlands and occur mostly in the canopy (Menkhorst et al. 2017).	Unlikely	Records of this species occur within the region and likely comprise of transient individuals. However, no records exist within the study area and preferred habitats do not occur. As such the species is considered unlikely to occur.
Rhipidura rufifrons	Rufous Fantail	✓	✓	Mi	SL (Mi)	This species prefers moist habitats such as wet sclerophyll forests, vine thickets and mangroves. It usually occurs in eucalypt dominated gullies with a dense shrubby understorey. It can also occur in drier woodlands along watercourses (Menkhorst et al. 2017).	Unlikely	Multiple records of this species exists within the study area however no suitable habitat in the road reserve. This species prefers vine thicket and riparian corridors.
Symposiachrus trivirgatus	Spectacled Monarch	✓	✓	Mi	SL (Mi)	This species occurs in rainforest, dense waterside vegetation and mangrove ecosystems (Menkhorst et al. 2017).	Unlikely	Multiple records of this species exists within the study area however no suitable habitat in the road reserve. This species prefers vine thicket and riparian corridors.
Migratory wetland birds								
Actitis hypoleucos	Common Sandpiper	✓	✗	Mi	SL (Mi)	This species prefers coastal wetlands and are found around muddy margins or rocky shores. It occurs in some inland wetlands (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Calidris acuminata	Sharp-tailed Sandpiper	✓	✓	Mi	SL (Mi)	This species spends its non-breeding season in Australia along muddy edges of shallow fresh or brackish wetlands. Wetlands they occupy include lagoons, swamps, lakes and dams (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.

Table C.3 Likelihood of occurrence – Migratory species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Calidris ferruginea	Curlew Sandpiper	✓	✓	CE, Mi	CR	This migratory shorebird species spends its' non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas. When inland, they utilise ephemeral and permanent lakes, lagoons, ponds or dams with bare edges of mud. The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Calidris ruficollis	Red-necked Stint	×	✓	Mi	SL (Mi)	This migratory shorebird species spends its' non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas. When inland, they utilise ephemeral and permanent lakes, lagoons, ponds or dams with bare edges of mud. The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Charadrius leschenaultii	Greater Sandplover	✓	×	V, Mi	V	This migratory shorebird species spends its' non-breeding season in coastal parts of Australia. It typically inhabits intertidal mudflats and sandy beaches. The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Charadrius veredus	Oriental Plover	×	✓	Mi	SL (Mi)	This migratory shorebird species spends its' non-breeding season in parts of Australia. The species has been recorded on open plains, often far from water as well as tidal mudflats, claypans and grassy areas (Pizzey et al. 2012). The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.

Table C.3 Likelihood of occurrence – Migratory species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Chlidonias leucoptera	White-winged Black Tern	×	✓	Mi	SL (Mi)	Nonbreeding summer migrant to Australia at times well inland. Occurs over large wetlands, estuaries and coastal waters as well as flooded areas (Pizzey et al 2012).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Calidris melanotos	Pectoral Sandpiper	✓	×	Mi	SL (Mi)	This species mainly occurs in coastal habitats at lagoons, estuaries, swamps and lakes. It can occasionally be found inland. It prefers open fringing mudflats on wetlands (Menkhorst et al. 2017).	Unlikely	This species has not been recorded within the study area and although marginal habitats may occur, the species is considered a scarce migrant and therefore unlikely to occur.
Gallinago hardwickii	Latham's Snipe	✓	✓	Mi	SL (Mi)	This species is a non-breeding visitor to south-eastern Australia. It mainly occurs in permanent and ephemeral freshwater wetlands with low, dense vegetation but can also occur in saline or brackish wetlands that are artificial or modified (Menkhorst et al. 2017).	Unlikely	Latham's Snipe has been recorded within the study area however no suitable habitat in the road reserve.
Gelochilidon nilotica	Gull-billed Tern	×	✓	Mi	SL (Mi)	Widely distributed across Australia in fresh and brackish habitats, including far inland (Pizzey et al 2012).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Hydroprogne caspia	Caspian Tern	×	✓	Mi	SL (Mi)	Occurs in coastal waters as well as larger lakes and rivers inland across most of Australia (Pizzey et al 2012).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Limosa lapponica baueri	Western Alaskan Bar-tailed Godwit	✓	✓	V	V	This migratory shorebird species spends its non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas.	Unlikely	Preferred habitats of coastal mudflats and shallow wetlands are not known to occur within the study area. The closest record of this species is approximately 20 km from the road reserve adjacent to tidal wetlands. As such, the species is considered unlikely to occur.

Table C.3 Likelihood of occurrence – Migratory species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Limosa limosa	Black-tailed Godwit	×	✓	Mi	SL (Mi)	This migratory shorebird species spends its non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas.	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Numenius minutus	Little Curlew	×	✓	Mi	SL (Mi)	This migratory shorebird species spends its' non-breeding season in parts of Australia. The species has been recorded on open plains, often far from water as well as tidal mudflats, claypans and grassy areas (Pizzey et al. 2012). The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Numenius madagascariensis	Eastern Curlew	✓	×	CE, Mi	E	The Eastern Curlew is the largest shorebird species and is a non-breeding summer migrant to Australia. It is almost entirely restricted to coastal habitats such as mangrove swamps, bays, inlets and tidal lagoons (Menkhorst et al. 2017).	Unlikely	This species has not been recorded within the study area and preferred habitats do not occur. Therefore, the Eastern Curlew is considered unlikely to occur.
Pandion cristatus	Eastern Osprey	✓	✓	Mi	SL (Mi)	This species mainly occurs in coastal areas but occasionally occur inland along major river systems. They inhabit wetland habitats such as bays, beaches, mangrove swamps and large lakes. They require brackish or saline water for foraging (Menkhorst et al. 2017).	Unlikely	This species has been recorded within the study area; however, preferred habitat is absent. As such the species is considered unlikely to occur.
Plegadis falcinellus	Glossy Ibis	×	✓	Mi	SL (Mi)	Occurs in well vegetated wetlands, wet pastures, floodplains and occasionally dry grasslands (Pizzey et al 2012).	Unlikely	This species has been recorded within the study area; however habitat is suboptimal and any visit likely to be sporadic. Therefore, the species is unlikely to occur.
Pluvialis fulva	Pacific Golden Plover	×	✓	Mi	SL (Mi)	A non-breeding migrant to Australia, this species can be found in a variety of coastal and freshwater habitats, typically tidal mudflats or grasslands (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.

Table C.3 Likelihood of occurrence – Migratory species

Scientific name	Common Name	PMST search	Wildlife online	EPBC Act status[1]	NC Act status[2]	Habitat and ecology	Likelihood of occurrence	Rationale
Tringa nebularis	Common Greenshank	✓	✓	Mi	SL	A non-breeding migrant to Australia, this species can be found in a variety of coastal and freshwater habitats, typically with mudflats or still, shallow water (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Tringa stagnatilis	Marsh Sandpiper	×	✓	Mi	SL (Mi)	This migratory shorebird species spends its' non-breeding season in coastal parts of Australia. The species has been recorded in various inland regions as it migrates to southern parts of the Australian coastline (Pizzey et al. 2012). Near the coast, it typically inhabits intertidal mudflats in sheltered areas. When inland, they utilise ephemeral and permanent lakes, lagoons, ponds or dams with bare edges of mud. The species does not breed in Australia (Menkhorst et al. 2017).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.
Migratory marine birds								
Apus pacificus	Fork-tailed Swift	✓	✓	Mi	SL (Mi)	This species is almost exclusively aerial and occurs mainly over inland plains. Habitats include riparian woodland, heathland and low scrub areas. They also occur in coastal areas over cliffs and beaches (Menkhorst et al. 2017).	Known	Multiple records of this species are represented within the study area and habitat is present within the road reserve. During surveys this species was identified adjacent to the road reserve; therefore, it is considered as known to occur.
Migratory marine reptiles								
Crocodylus porosus	Estuarine Crocodile	✓	×	Mi	V	This species occurs in coastal rivers and swamps. It can occasionally be found inland along major river systems (DAWE 2021z).	Unlikely	This species occurs within the region; however, no records or preferred habitats occur within the road reserve. As such it is considered unlikely to occur.

Appendix D

Species lists

Class	Scientific name	Common name
Aves	*Accipiter fasciatus*	Brown Goshawk
	Anas superciliosa	Pacific Black Duck
	Anhinga novaehollandiae	Australasian Darter
	Anthus novaeseelandiae	Australasian Pipit
	Aprosmictus erythropterus	Red-winged Parrot
	Aquila audax	Wedge-tailed Eagle
	Ardea alba	Great Egret
	Ardea pacifica	White-necked Heron
	Ardeotis australis	Australian Bustard
	Artamus cinereus	Black-faced Woodswallow
	Artamus leucorynchus	White-breasted Woodswallow
	Aviceda subcristata	Pacific Baza
	Cacatua galerita	Sulphur-crested Cockatoo
	Calyptorhynchus banksii	Red-tailed Black-Cockatoo
	Centropus phasianinus	Pheasant Coucal
	Chenonetta jubata	Maned Duck
	Chrysococcyx basalis	Horsfield's Bronze-cuckoo
	Cisticola exilis	Golden-headed Cisticola
	Colluricincla harmonica	Grey Shrikethrush
	Coracina novaehollandiae	Black-faced Cuckooshrike
	Coracina papuensis	White-bellied Cuckoo-shrike
	Corvus orru	Torresian Crow
	Coturnix ypsilophora	Brown Quail
	Cracticus nigrogularis	Pied Butcherbird
	Cracticus tibicen	Australian Magpie
	Cracticus torquatus	Grey Butcherbird
	Dacelo novaeguineae	Laughing Kookaburra
	Dicaeum hirundinaceum	Mistletoebird
	Dicrurus bracteatus	Spangled Drongo
	Egretta novaehollandiae	White-faced Heron
	Entomyzon cyanotis	Blue-faced Honeyeater
	Falco berigora	Brown Falcon
	Falco cenchroides	Nankeen Kestrel
	Geopelia placida	Peaceful Dove
	Geophaps scripta scripta	Squatter Pigeon (southern)
	Grallina cyanoleuca	Magpie-lark
	Haliastur sphenurus	Whistling Kite
	Lichmera indistincta	Brown Honeyeater
	Lonchura castaneothorax	Chestnut-breasted Mannikin
	Malurus cyaneus	Superb Fairywren

Class	Scientific name	Common name
	Malurus melanocephalus	Red-backed Fairywren
	Manorina flavigula	Yellow-throated Miner
	Melithreptus albogularis	White-throated Honeyeater
	Merops ornatus	Rainbow Bee-eater
	Microcarbo melanoleucos	Little Pied Cormorant
	Microeca fascinans	Jacky Winter
	Milvus migrans	Black Kite
	Myiagra inquieta	Restless Flycatcher
	Ocyphaps lophotes	Crested Pigeon
	Pachycephala rufiventris	Rufous Whistler
	Pardalotus striatus	Striated Pardalote
	Pelecanus conspicillatus	Australian Pelican
	Petrochelidon ariel	Fairy Martin
	Petrochelidon nigricans	Tree Martin
	Phalacrocorax sulcirostris	Little Black Cormorant
	Philemon citreogularis	Little Friarbird
	Platalea flavipes	Yellow-billed Spoonbill
	Platalea regia	Royal Spoonbill
	Platycercus adscitus	Pale-headed Rosella
	Ptilonorhynchus nuchalis	Great Bowerbird
	Rhipidura albiscapa	Grey Fantail
	Rhipidura leucophrys	Willie Wagtail
	Sphecotheres vieilloti	Australasian Figbird
	Synoicus ypsilophorus	Brown Quail
	Taeniopygia bichenovii	Double-barred Finch
	Threskiornis moluccus	Australian White Ibis
	Threskiornis spinicollis	Straw-necked Ibis
	Todiramphus sanctus	Sacred Kingfisher
	Todiramphus pyrrhopygius	Red-backed Kingfisher
	Trichoglossus moluccanus	Rainbow Lorikeet
	Vanellus miles	Masked Lapwing
Non-volant mammals	*Macropus agilis*	Agile Wallaby
	Macropus giganteus	Eastern Grey Kangaroo
Chiroptera	*Rhinolophus megaphyllus*	Eastern Horseshoe Bat
	Chalinolobus gouldii	Gould's Wattled Bat
	Chalinolobus morio	Chocolate Wattled Bat
	Chalinolobus nigrogriseus	Hoary Wattled Bat
	Myotis macropus	Southern Myotis
	Unknown vespertilionid (Vespadelus baverstocki ?)	Inland Forest Bat
	Scoteanax rueppellii	Greater Broad-nosed Bat

Class	Scientific name	Common name
	Scotorepens balstoni	Inland Broad-nosed Bat
	Scotorepens greyii	Little Broad-nosed Bat
	Scotorepens sanborni	Northern Broad-nosed Bat
	Vespadelus troughtoni	Eastern Cave Bat
	Miniopterus australis	Little Bent-wing Bat
	Miniopterus orianae	Southern Bent-wing Bat
	Chaerephon jobensis	Northern Freetail Bat
	Ozimops lumsdenae	Northern Free-tailed Bat
	Ozimops ridei	Eastern Free-tailed Bat
	Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat
	Saccolaimus saccolaimus	Bare-rumped Sheathtail Bat
Reptilia	*Pseudonaja textilis*	Eastern Brown Snake

Note: CEEVNT or migratory species in bold

Note: * = introduced.

Appendix E

Anabat results

Microbat Call Identification Report

Prepared for ("Client"):	EMM Consulting
Survey location/project name:	Woodstock, NE Qld
Survey dates:	26-30 July 2021
Client project reference:	
Job no.:	EMM-2104
Report date:	4 August 2021

Methods

Data received

Balance! Environmental received 20 raw ZCA data files, recorded on four Anabat Express detectors, plus 7391 zero-crossing sequence files (ZC files) recorded with an Anabat Swift detector. The detectors were deployed over five consecutive nights (26th – 30th July 2021) in the Woodstock area, south of Townsville. Seven separate sites were surveyed (see **Figure 1**), with three sites sampled for five nights, two sites for three nights and two sites for 2 nights.

Call analysis and identification

The data were processed in *Anabat Insight* (Version 1.9.7; Titley Scientific, Brisbane). The ZCA data files were converted to bat-call sequence files (ZC files) and then all ZC files were scanned with a generic noise filter to separate files containing only non-bat background noise from those with potentially identifiable bat calls.

All files that passed the noise filter (*i.e.,* contained bat calls) were processed through a Decision Tree analysis to group calls with similar pulse characteristics (*e.g.*, characteristic frequency, slope, duration) and apply tentative species labels. Each "species" group was then reviewed manually to verify and/or correct species labels by comparing call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions (*e.g.,* Reinhold *et al.* 2001; Milne 2002).

The likelihood of species' occurrence in the study area was confirmed by referring to the Australasian Bat Society's *BatMap* application (ABS 2021) and other published distribution information (*e.g.,* Churchill 2008; van Dyck *et al.* 2013).

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).

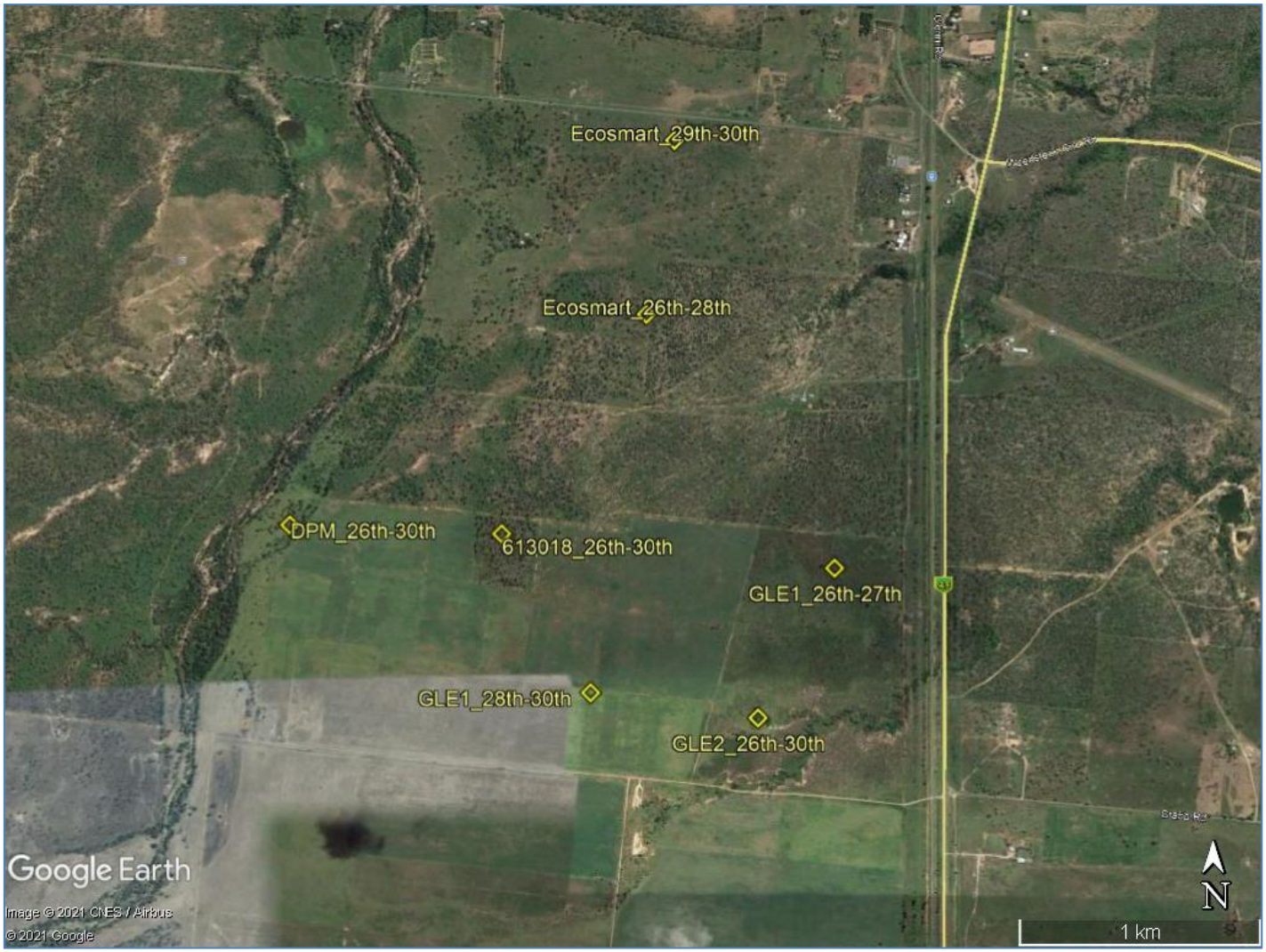

Figure 1 Bat detector locations (Detector name and dates deployed) for the Woodstock survey, 26th – 30th July 2021.

Results

The ZCA conversion and noise filtration process yielded a dataset of 6748 ZC files containing 7387 identifiable bat calls. Fifty-nine percent (4351) of the calls were positively identified, while the other 3036 “unresolved" calls each potentially represented two or more species.

Table 1 provides an overview of the species detected at each site and example spectrograms for each identified species appear in **Appendix 1**. **Appendix 2** gives a full breakdown of the numbers of calls recorded per species per site.

At least 20 and up to 22 species were detected during the Woodstock survey. Eighteen call types were positively attributed to individual species, while one additional type was allocated to the *Nyctophilus* genus. Up to three *Nyctophilus* species potentially occur in the study area, including: *N. bifax; N. geoffroyi*; and *N. gouldi*.

Some 74% (2252) of the unresolved calls were assigned to five undifferentiated species pairs representing species that were otherwise positively identified from more definitive calls (see lower section of table in **Appendix 2**). Where such unresolved calls were identified, but one or more pair members were not also positively identified, those species are shown as “possible” in **Table 1**.

More than 700 distinctive calls appear to represent at least one additional vespertilionid species, the identity of which is unclear. Their steep, short-duration, hooked pulses with characteristic frequency (Fc) at ~44-47 kHz are typically attributable to bats such as *Vespadelus baverstocki* and *Pipistrellus adamsi*; however, neither of those species are known to occur within 100km of the study area (ABS 2021). The nearest known records for these species are ~250 km north (*P. adamsi*) and ~290 km south (*V. baverstocki*) of Woodstock (see **Figure 2**). Given the study area lies within a relatively dry bioclimatic zone (Brigalow Belt North biogeographic region), the more likely source of these calls is *V. baverstocki*, which is adapted to xeric inland regions, whereas *P. adamsi* is generally associated with mesic environments of eastern Cape York Peninsula (Churchill 2008).

An alternative explanation for the “unknown vespertilionid” calls is that they are variant calls from either *Scotorepens sanborni* or *Miniopterus orianae*; however, more typical calls of both species were recorded, and the consistency and high volume of the unknown calls strongly suggests a separate species was responsible.

Threatened species

The **Bare-rumped Sheath-tailed Bat (*Saccolaimus saccolaimus*)** was reliably identified from 12 calls and may have been responsible for a further 35 unresolved calls (which may equally have been made by *Ozimops lumsdenae*). Positively identified calls were detected at six sites and a single unresolved call was detected at the remaining site (detector DPM).

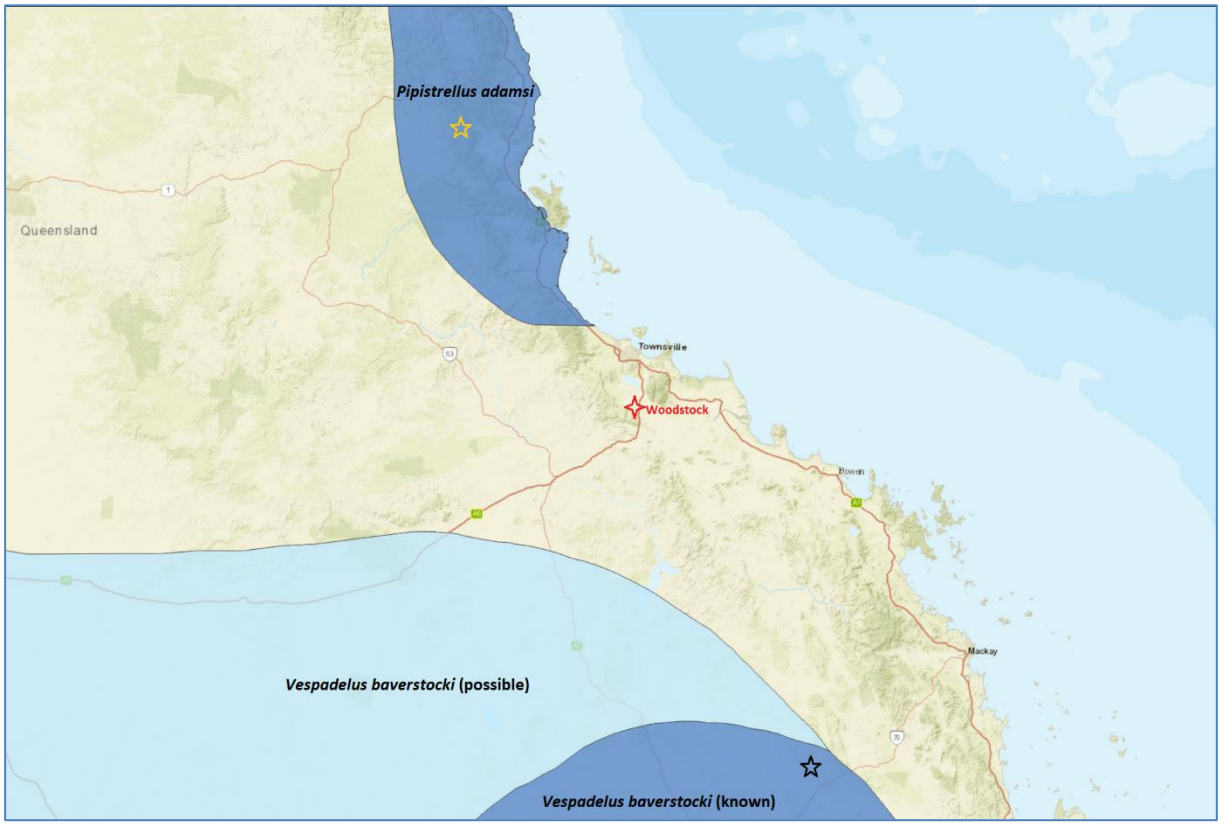

Figure 2 Location of the Woodstock study area in relation to known and possible range boundaries of *Pipistrellus adamsi* and *Vespadelus baverstocki* and nearest confirmed records of those species (stars). Source: base-map and range boundaries from *BatMap* (ABS 2021); species record points from *Atlas of Living Australia* (https://spatial.ala.org.au/; accessed 4/8/2021).

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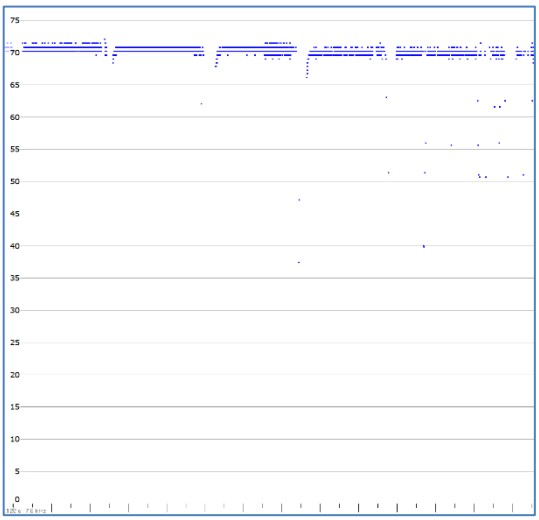
Table 1 Bats recorded during the Woodstock survey, 26-30 July 2021.

♦ = 'definite' - at least one call was attributed unequivocally to the species at the site

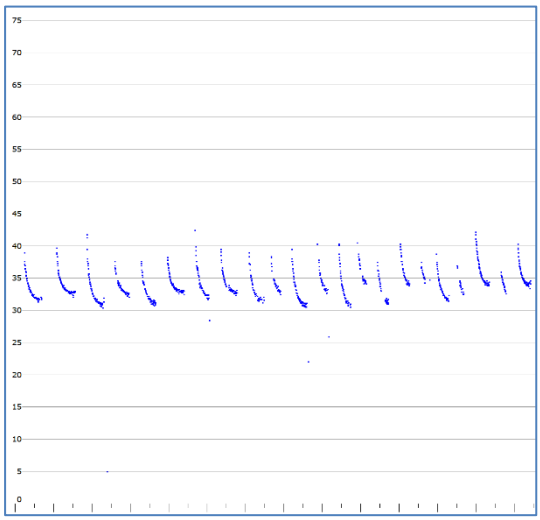
□ = 'possible' - calls like those of the species were recorded, but were not reliably identified

Detector name	613018	DPM	EcoSmart	EcoSmart	GLE-1	GLE-1	GLE-2
Dates	26th-30th July	26th-30th July	26th-28th July	29th-30th July	26th-27th July	28th-30th July	26th-30th July
Rhinolophus megaphyllus		♦	♦		♦		
Chalinolobus gouldii	♦	♦	♦	♦	♦	♦	♦
Chalinolobus morio	♦		□	♦	♦	♦	♦
Chalinolobus nigrogriseus	♦	♦	♦	♦	♦	♦	♦
Myotis macropus		□	♦				♦
Nyctophilus sp.	♦	□			♦	♦	♦
Unknown vespertilionid (*Vespadelus baverstocki* ?)	□	□	□	□	□	□	□
Scoteanax rueppellii	♦	♦		♦			♦
Scotorepens balstoni	♦	♦		♦			♦
Scotorepens greyii	♦	♦	♦	♦	♦	♦	♦
Scotorepens orion	♦				♦		
Scotorepens sanborni	♦	♦	♦	♦	♦	♦	♦
Vespadelus troughtoni	♦		♦	♦	♦	♦	♦
Miniopterus australis	♦	♦	♦	♦	♦	♦	♦
Miniopterus orianae	♦	♦	♦	♦	♦	♦	♦
Chaerephon jobensis	♦	♦	♦	♦	♦	♦	♦
Ozimops lumsdenae	♦	♦	□	♦	□	♦	♦
Ozimops ridei	♦	♦	♦	♦	♦	♦	♦
Saccolaimus flaviventris	♦	♦	♦	♦		♦	♦
Saccolaimus saccolaimus	♦	□	♦	♦	♦	♦	♦

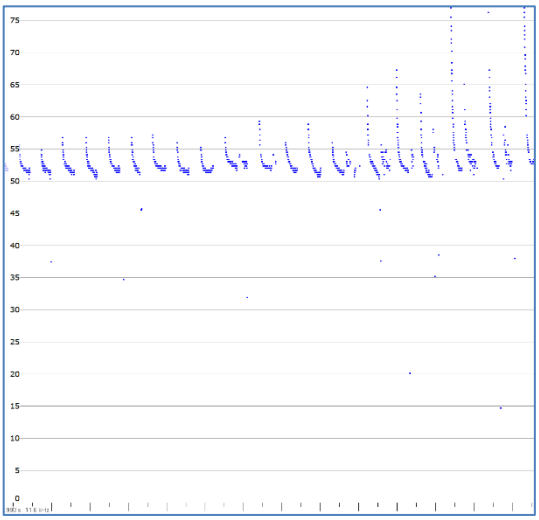
Appendix 1 Representative bat-calls recorded at Woodstock, 26-30 July 2021.
Time between pulses removed; time-scale (*x*-axis) 10ms per tick



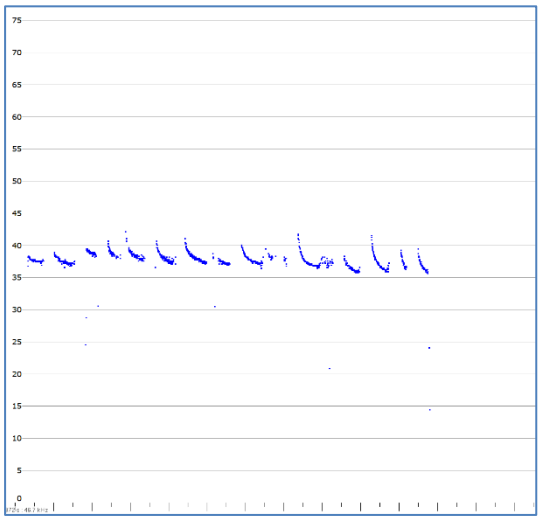
Rhinolophus megaphyllus



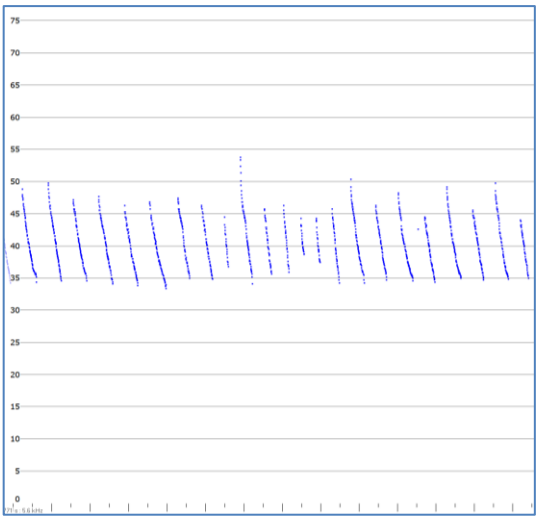
Chalinolobus gouldii



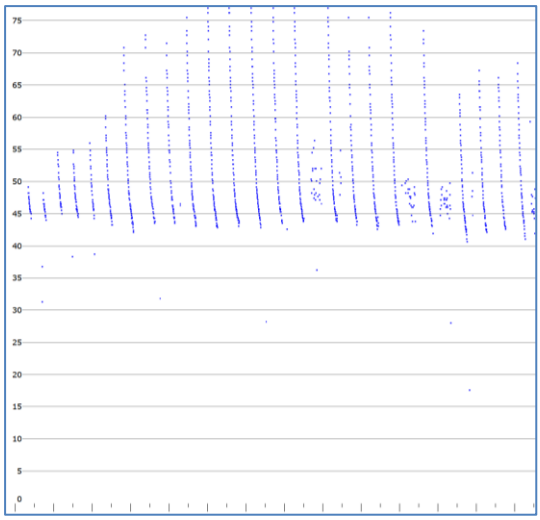
Chalinolobus morio



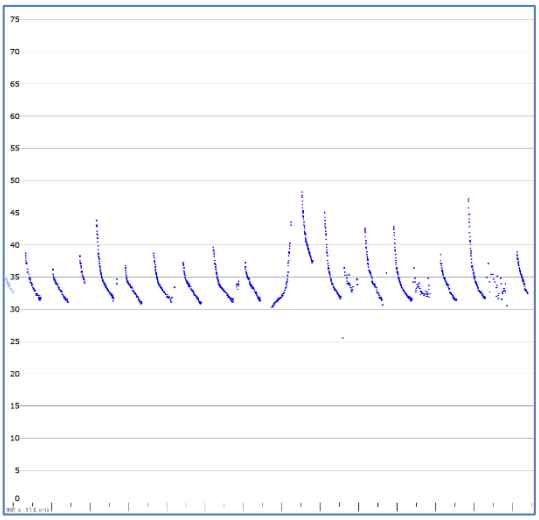
Chalinolobus nigrogriseus



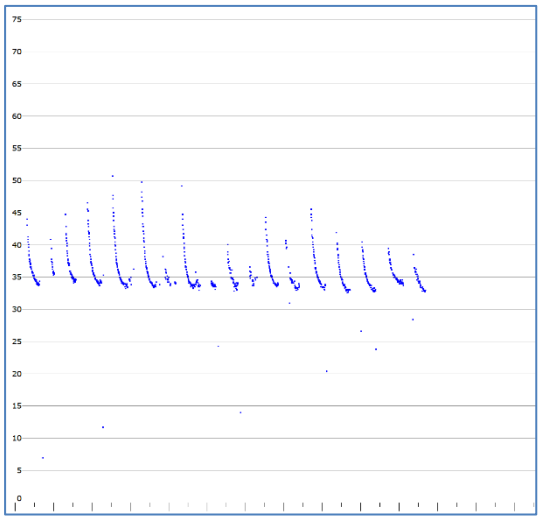
Myotis macropus



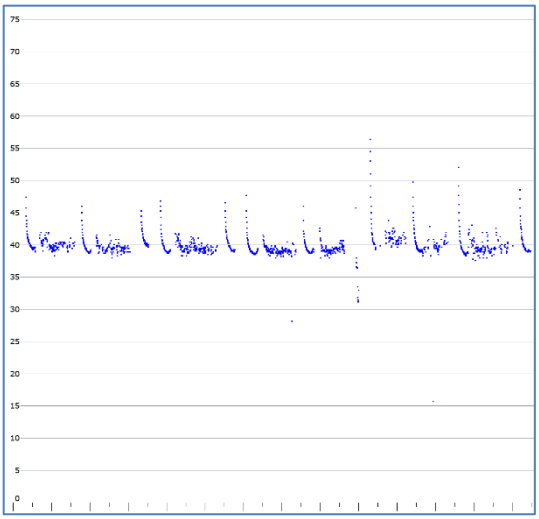
Nyctophilus sp.



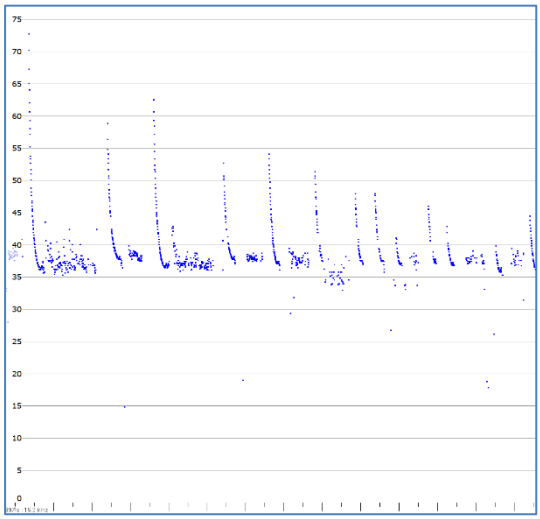
Scoteanax rueppellii



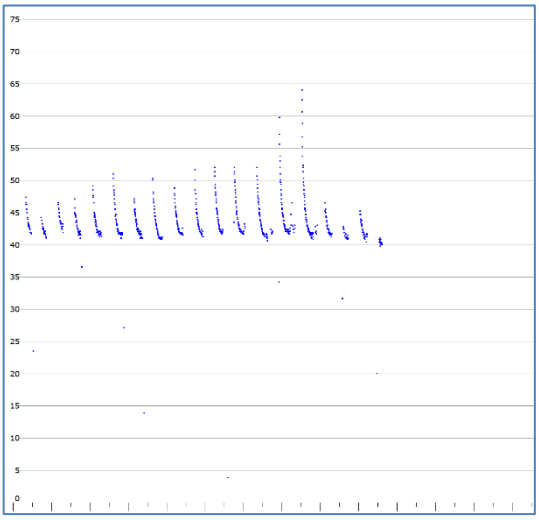
Scotorepens balstoni



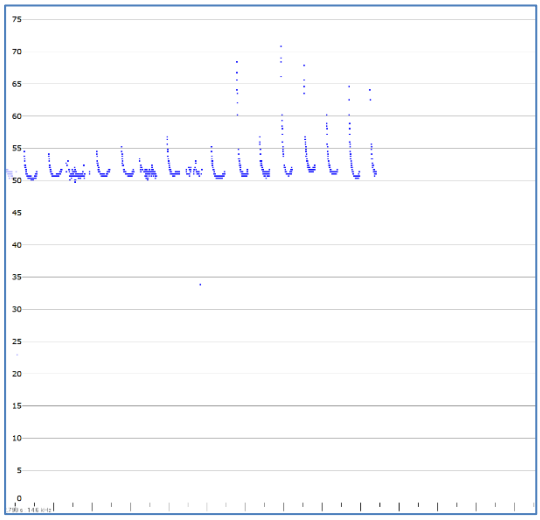
Scotorepens greyii



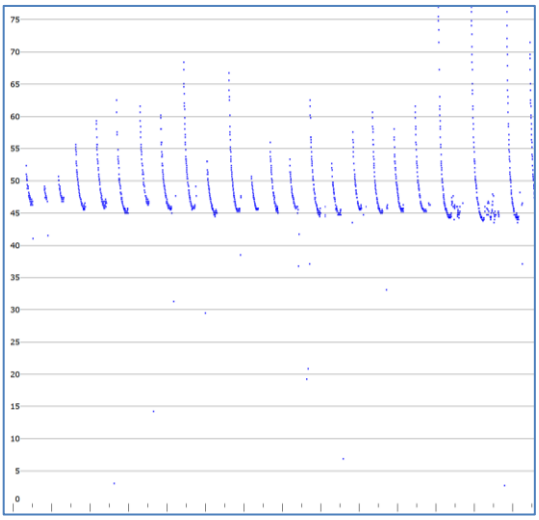
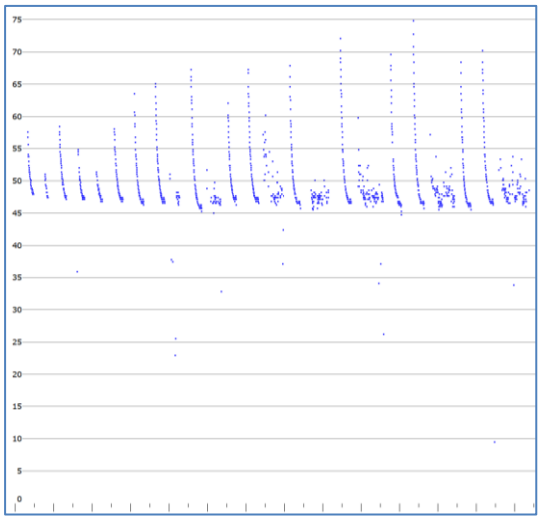
Scotorepens orion



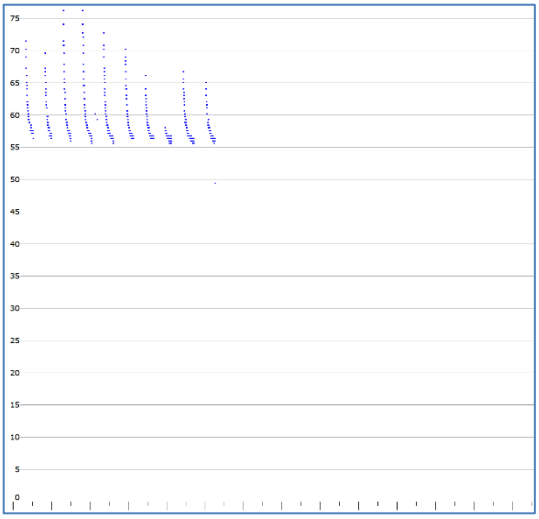
Scotorepens sanborni



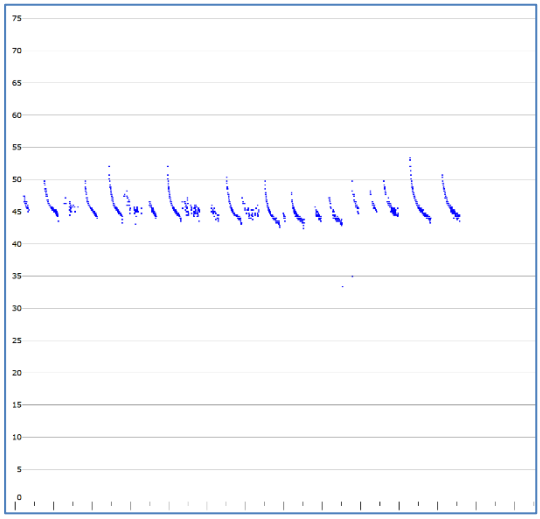
Vespadelus troughtoni

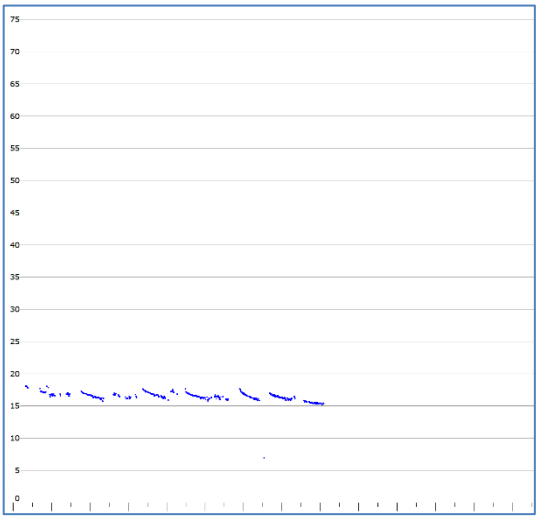
Unknown vespertilionid (*Vespadelus baverstocki*?)



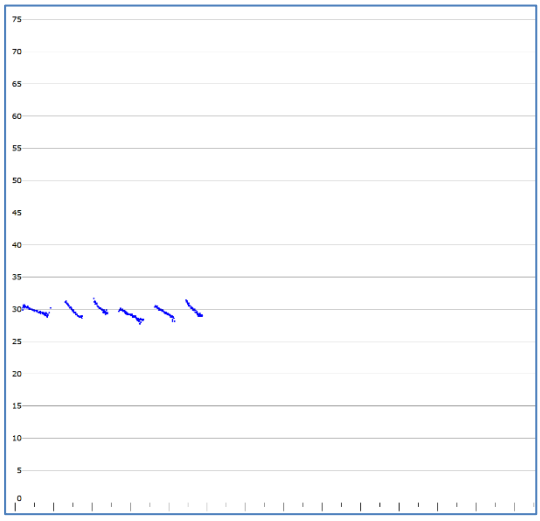
Miniopterus australis



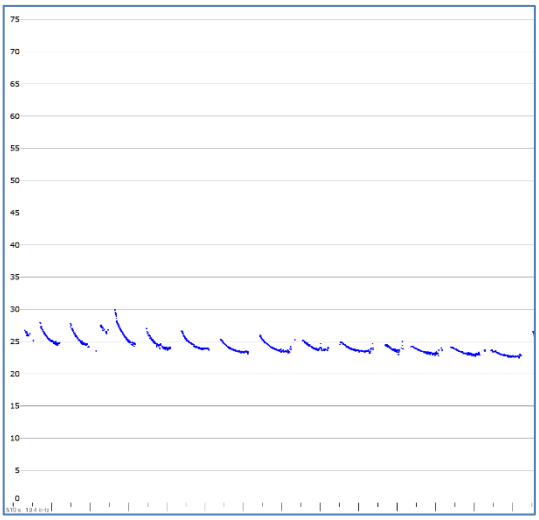
Miniopterus orianae



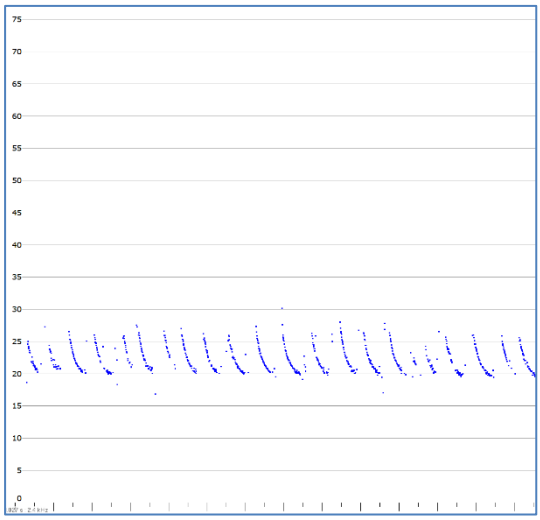
Chaerephon jobensis



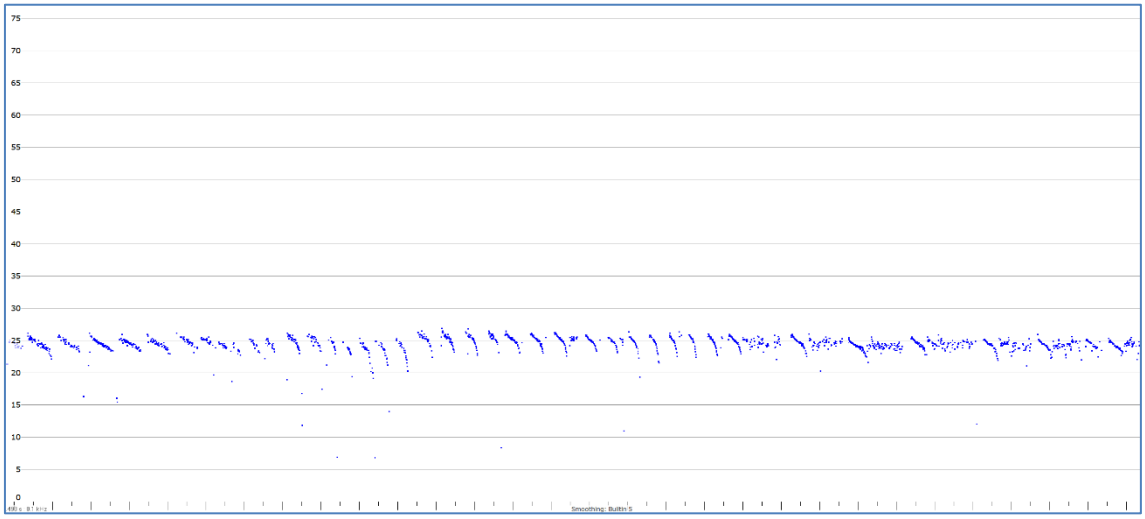
Ozimops ridei



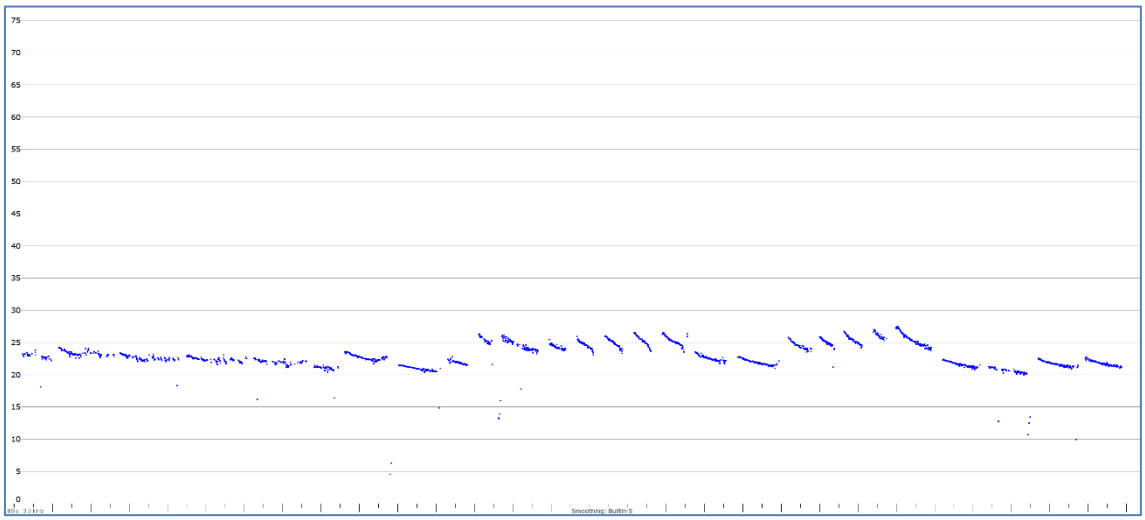
Ozimops lumsdenae



Saccolaimus flaviventris



Saccolaimus saccolaimus



Saccolaimus saccolaimus

Appendix 2 Bats recorded during the Woodstock survey, 26-30 July 2021.
Number of calls attributed per species per detector-night.

Detector name	613018	DPM	EcoSmart	EcoSmart	GLE-1	GLE-1	GLE-2	Species Total
Dates	26-30 July	26-30 July	26-28 July	29-30 July	26-27 July	28-30 July	26-30 July	
Positively identified calls								
Rhinolophus megaphyllus		1	3		1			5
Chalinolobus gouldii	99	10	4	9	7	2	185	316
Chalinolobus morio	1			1	1	29	4	36
Chalinolobus nigrogriseus	15	6	59	13	5	6	629	733
Myotis macropus			1				5	6
Nyctophilus sp.	8				1	1	11	21
Scoteanax rueppellii	124	4		5			214	347
Scotorepens balstoni	19	3		1			5	28
Scotorepens greyii	9	13	6	17	2	2	29	78
Scotorepens orion	3				1			4
Scotorepens sanborni	28	2	14	6	3	2	13	68
Vespadelus troughtoni	2		2	2	12	2	21	41
Miniopterus australis	87	252	203	218	42	186	664	1652
Miniopterus orianae	88	75	19	25	7	1	124	339
Chaerephon jobensis	123	22	33	72	80	129	46	505
Ozimops lumsdenae	12	6		4		1	16	39
Ozimops ridei	28	2	2	12	12	5	28	89
Saccolaimus flaviventris	11	1	1	3		4	12	32
Saccolaimus saccolaimus	5		1	2	1	1	2	12
Unresolved calls								
C. gouldii / O. ridei	837	10	5	25	11	5	392	1285
C. nigrogriseus / S. greyii	392	27	42	36			415	912
M. macropus / Nyctophilus sp.		2						2
S. saccolaimus / O. lumsdenae	17	1	3	6	1	2	5	35
Pipistrellus adamsi / Vespadelus baverstocki	261	3	115	183	9	169	44	784
C. morio / V. troughtoni	1		1	1	3	1	11	18
Site Total	2170	440	514	641	199	548	2875	7387