Prepared for Santos Limited ABN: 80 007 550 923



# Matters of National Environmental Significance - Ecology Assessment

To Support Preliminary Documentation

01-Dec-2021

**Towrie Development Project** 



# Matters of National Environmental Significance - Ecology Assessment

To Support Preliminary Documentation

Client: Santos Limited
ABN: 80 007 550 923

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# **Quality Information**

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# **Executive Summary**

#### Introduction

Santos CSG Pty Ltd (Santos) proposes to produce gas within its existing petroleum tenure (Authority to Prospect (ATP) 2033) subject to Petroleum Lease Application (PLA) 1059) (once PL1059 is granted and all approvals are in place) known as the Towrie Development within the Bowen Basin of central southern Queensland (the Project).

#### **Project description**

The Project will involve progressive development, construction, operation, decommissioning and rehabilitation of up to 116 vertical wells, gas and water gathering networks and supporting infrastructure. The Project will rely on existing centralised gas and water processing infrastructure on adjoining tenures within Arcadia Valley. The total combined footprint of the Project comprising wells, pipelines and tracks will be less than 10% of the subject tenure.

Based on constraints mapping and ongoing field verification, Santos will implement a site-specific constraints protocol to guide siting of surface infrastructure to avoid impacts to Matters of National Environmental Significance (MNES) and minimise (clearing) impacts to maximum disturbance limits. Santos will further minimise direct, indirect and cumulative adverse impacts through mitigation and management measures, remediation and rehabilitation of impacted areas.

#### Assessment methodology

Santos engaged AECOM Australia Pty Ltd (AECOM) to assess potential impacts to ecological MNES for Preliminary Documentation, following the decision of the referral to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). AECOM completed both desktop reviews of online datasets, mapping, literature, aerial imagery and LiDAR, and field assessments to characterise and identify ecological values that may be supported in the Project Area.

Based on species records and the habitat encountered during field surveys and likely to occur within the wider Project Area, a detailed likelihood of occurrence assessment was completed for all species identified in the desktop assessment. A total of 28 MNES were considered known, likely or potentially occurring including 3 threatened ecological communities (TECs), 4 threatened flora species, 15 threatened fauna species and 6 migratory species. Potential MNES habitat within the Project Area generally consists of small fragments that are already disturbed and compromised by historical clearing and thinning, exotic weeds and cattle grazing.

MNES known, likely or having potential to occur within the Project Area, were subject to a two-step assessment process (outlined in Figure ES-1). The initial risk assessment reviewed the potential nature, magnitude and consequence of Project impacts to indicate vulnerability of MNES that warranted further assessment via the significant impact assessment process. MNES with a 'potential' risk rating triggered significant impact assessment while a 'low' risk rating required no further assessment.

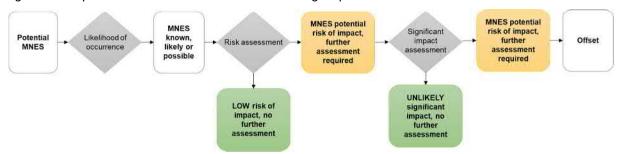


Figure ES-1 Impact assessment process for potential, likely or known MNES

Based on the findings of the risk assessment, significant impact assessments were undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (Department of the Environment, 2013b) for eleven MNES: Brigalow TEC, ooline, Xerothemnella herbacea, koala, painted honeyeater, ornamental snake, yakka skink, southeastern long-eared bat, Australian painted snipe, Latham's snipe and glossy ibis. With the

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implementation of the Protocol (discussed in Section 2.2), species-specific and general mitigation measures (detailed in Section 8.3), the assessments determined that the Project is unlikely to result in a significant impact on any of the known or potential MNES values within the Project Area and as such offsets are not required.

A summary of the MNES assessment results, including likelihood of occurrence, impacts, risk assessment and significant impact assessment is presented in Table ES-1.

Table ES-1 Summary of MNES likelihood of occurrence, risk of impact and significant impact assessment

MNES	Act o	Likelihood	Habitat/Impact (ha)			Risk	Significant
		of occurrence	Habitat utilisation	Impact	% <sup>2</sup>	assessment outcome	impact assessment outcome
Threatened ecolog	gical comn	nunities (TEC)					
Brigalow (Acacia harpophylla dominant and codominant)	E	Known	-	2	<1%	Potential risk, further assessment required	Unlikely
Coolibah – Black box woodlands of the Darling Riverine Plains and the Brigalow Belt south bioregions	E	Unlikely	-	0.0	0%	No further assessment required	NA
Poplar box grassy woodlands on alluvial plains	E	Known	-	0.5	<2%	Low risk, no further assessment required	NA
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions	Е	Known	-	0.0	0%	Low risk, no further assessment required	NA
Weeping myall woodlands	E	Unlikely	-	0.0	0%	No further assessment required	NA
Threatened flora							
Acacia grandifolia	V	Potential	-	0.0	0%	Low risk, no further assessment required	NA
Cadellia pentastylis (Ooline)	V	Known	-	5	<1%	Potential risk, further assessment required	Unlikely
Bertya opponens	V	Potential	-	0.0	0%	Low risk, no further assessment required	NA
Xerothamnella herbacea	E	Likely	-	2	<1%	Potential risk, further assessment required	Unlikely

MNES	EPBC	Likelihood	Habitat/Impact (ha)		Risk	Significant	
	Act status <sup>1</sup>	of occurrence	Habitat utilisation	Impact	% <sup>2</sup>	assessment outcome	impact assessment outcome
Threatened and m	igratory bi	irds	•				
Red goshawk (Erythrotriorchis radiatus)	V	Potential	Foraging/ dispersal	2	<1%	Low risk, no further assessment required	NA
Grey falcon (Falco hypoleucos)	V	Potential	Breeding/ foraging Foraging	0.0	0% <2%	Low risk, no further assessment	NA
Trypoleucos)			libraging	13	<2 /0	required	
Squatter pigeon (southern) (Geophaps scripta scripta)	V	Potential	Dispersal only	13	<1%	Low risk, no further assessment required	NA
Painted honeyeater ( <i>Grantiella picta</i> )	V	Potential	Foraging/di spersal only	12	<3%	Potential risk, further assessment required	Unlikely
White-throated needletail (Hirundapus	V, Mi	Potential	Roosting/ foraging	0	0%	Low risk, no further assessment	NA
caudacutus)			Foraging only	13	1%	required	
Australian painted snipe (Rostratula australis)	E	Potential	Breeding Foraging/ roosting Foraging/ dispersal	5	0% 2.5%	Potential risk, further assessment required	Unlikely
Fork-tailed swift (Apus pacificus)	Mi	Potential	Foraging/ dispersal	13	<1%	Low risk, no further assessment required	NA
Glossy ibis ( <i>Plegadis</i> falcinellus)	Mi	Known	Foraging/ dispersal	1	<1%	Potential risk, further assessment required	Unlikely
Oriental cuckoo (Cuculus optatus)	Mi	Potential	Foraging/ dispersal	13	1%	Low risk, no further assessment required	NA
Satin flycatcher ( <i>Myiagra</i> <i>cyanoleuca</i> )	Mi	Potential	Foraging/ dispersal	13	1%	Low risk, no further assessment required	NA
Rufous fantail (Rhipidura rufifrons)	Mi	Likely	Breeding/ foraging/ dispersal	0.0	0%	Low risk, no further assessment	NA
·			Foraging/ dispersal	13	<1%	required	

MNES	EPBC	Likelihood	Habitat/Impa	act (ha)		Risk	Significant
	Act status <sup>1</sup>	of occurrence	Habitat utilisation	Impact	% <sup>2</sup>	assessment outcome	impact assessment outcome
Latham's snipe (Gallinago hardwickii)	Mi	Potential	Foraging/ dispersal	1	<1%	Potential risk, further assessment required	Unlikely
Threatened mamm	als	1		,	r		
Large-eared pied bat (Chalinolobus dwyeri)	V	Known	Roosting/ foraging Foraging only	0.0	0% <1%	Low risk, no further assessment required	NA
Northern quoll ( <i>Dasyurus</i> hallucatus)	E	Potential	Denning/ foraging Foraging/ dispersal	0.0	0% <2%	Low risk, no further assessment required	NA
South-eastern long-eared bat ( <i>Nyctophilus</i> corbeni)	V	Likely	Roosting/ foraging Foraging only	4	<1%	Potential risk, further assessment required	NA
Greater glider (Petauroides volans)	V	Potential	Breeding/ foraging/ dispersal Foraging/ dispersal	1	<1%	Low risk, no further assessment required	NA
Koala (Phascolarctos cinereus)	V	Potential	Foraging only Dispersal only Refuge/foraging	2	<1%	Potential risk, further assessment required	Unlikely
Threatened reptile	S		,5 5	·I	I.		
Adorned delma (Delma torquata)	V	Potential	Breeding and foraging	1	<1%	Low risk, no further assessment required	NA
Ornamental snake (Denisonia maculata)	V	Potential	Breeding and foraging	2	<1%	Potential risk, further assessment required	Unlikely
Yakka skink ( <i>Egernia rugosa</i> )	V	Potential	Breeding and foraging	2	<1%	Potential risk, further assessment required	Unlikely
Dunmall's snake (Furina dunmalli)	V Acts (E) in	Likely	Breeding and foraging	2	<1%	Low risk, no further assessment required	NA

<sup>1</sup> Status under the EPBC Act: 'E' is Endangered, 'V' is Vulnerable, and 'Mi' is Migratory.

 $<sup>^{2}% \,\</sup>mathrm{The}$  The percentage of potential habitat within the Project Area that will be directly impacted.

1

#### 1.0 Introduction

#### 1.1 Background

Santos CSG Pty Ltd (Santos) proposes to produce gas within its existing petroleum tenure (Authority to Prospect (ATP) 2033) subject to Petroleum Lease Application (PLA) 1059) known as the Towrie Development within the Bowen Basin of central southern Queensland (the Project).

The Project will involve progressive development, construction, operation, decommissioning and rehabilitation of up to 116 vertical wells, gas and water gathering networks and supporting infrastructure. The Project will utilise existing centralised gas and water processing infrastructure on adjoining tenures within Arcadia Valley.

The final configuration and location of infrastructure components will be determined by resource exploration and production success and through implementation of the *Environmental Protocol for Constraints Planning and Field Development* (Attachment B of the PD) throughout the life of the Project. This integrated approach to development reflects best practice gas field management designed to minimise disturbance footprint and impacts on matters of national environmental significance (MNES). The footprint of the Project will not be over the total area but rather will comprise discrete disturbances including production wells, gathering lines and access tracks.

Surface infrastructure will directly impact a fraction (<10%) of the Towrie tenure area (henceforth referred to as the Project Area, detailed below) and not all wells will be drilled at one time. Instead, the Project Area will be developed progressively with construction works occurring in one area at a time, with construction and operation potentially occurring concurrently. Within the Project Area development and production activities will occur to maintain the target gas production rate. The rehabilitation and decommissioning of individual well sites will be undertaken in accordance with regulatory requirements and industry standards.

AECOM has prepared this MNES report to support the Preliminary Documentation (PD) assessment of the Project under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as per the referral decision.

#### 1.2 Project Area

The Towrie Project Area coincides with the Authority to Prospect (ATP) 2033 and Petroleum Lease (PL) 1059 (under application) and covers an area of approximately 8,678 hectares (ha). It is comprised of ten lot and plans in the Arcadia Valley, located 350 kilometres (km) south-west of Gladstone in the Bowen Basin of central southern Queensland (Figure 1).

The Project Area occurs across two local government areas including Central Highlands Regional Council and Maranoa Regional Council local government areas (LGAs). Population centres within the region include Injune (approximately 60 km south), Rolleston (approximately 87 km north) and Bauhinia (approximately 90 km north east) of the Project Area.

The Project Area is predominantly rural land characterised by grasslands and some woodlands, used largely for agricultural development, including cattle grazing and limited cropping. Aerial imagery indicates that vegetation and fauna habitats within the local area are generally disturbed and fragmented as a result of land use practices, with areas of higher quality vegetation generally appearing in elevated areas. Within the Project Area, three main areas of higher quality vegetation occur: the Public Reserve in the north-east, the western ridgeline and the large landform approximately 3 km long (henceforth referred to as 'Middle Hill'). At their highest points, both the western ridgeline and Middle Hill are approximately 600 metres (m) Australian Height Datum (AHD), in contrast to the adjacent undulating plains which are generally between 300 m and 400 m AHD.

Several ephemeral watercourses traverse the Project Area. Arcadia Creek is the highest order watercourse (stream order 5) but occurs only in the north-eastern corner within the Public Reserve. From the centre of the Project Area, six watercourses (stream order 1) traverse north east (all unnamed except Station Creek) towards Arcadia Creek. Within the Project Area a constructed wetland in the north east of the tenure (henceforth the 'wetland') is the confluence of these watercourses including

Station creek (stream order 3). From two sources below the western ridgeline, a single unnamed watercourse (stream order 2) converges in the southern Project Area (lot and plan 2SP200046) and travels directly east before exiting the Project Area and then re-entering in the centre of the eastern boundary and traversing north.

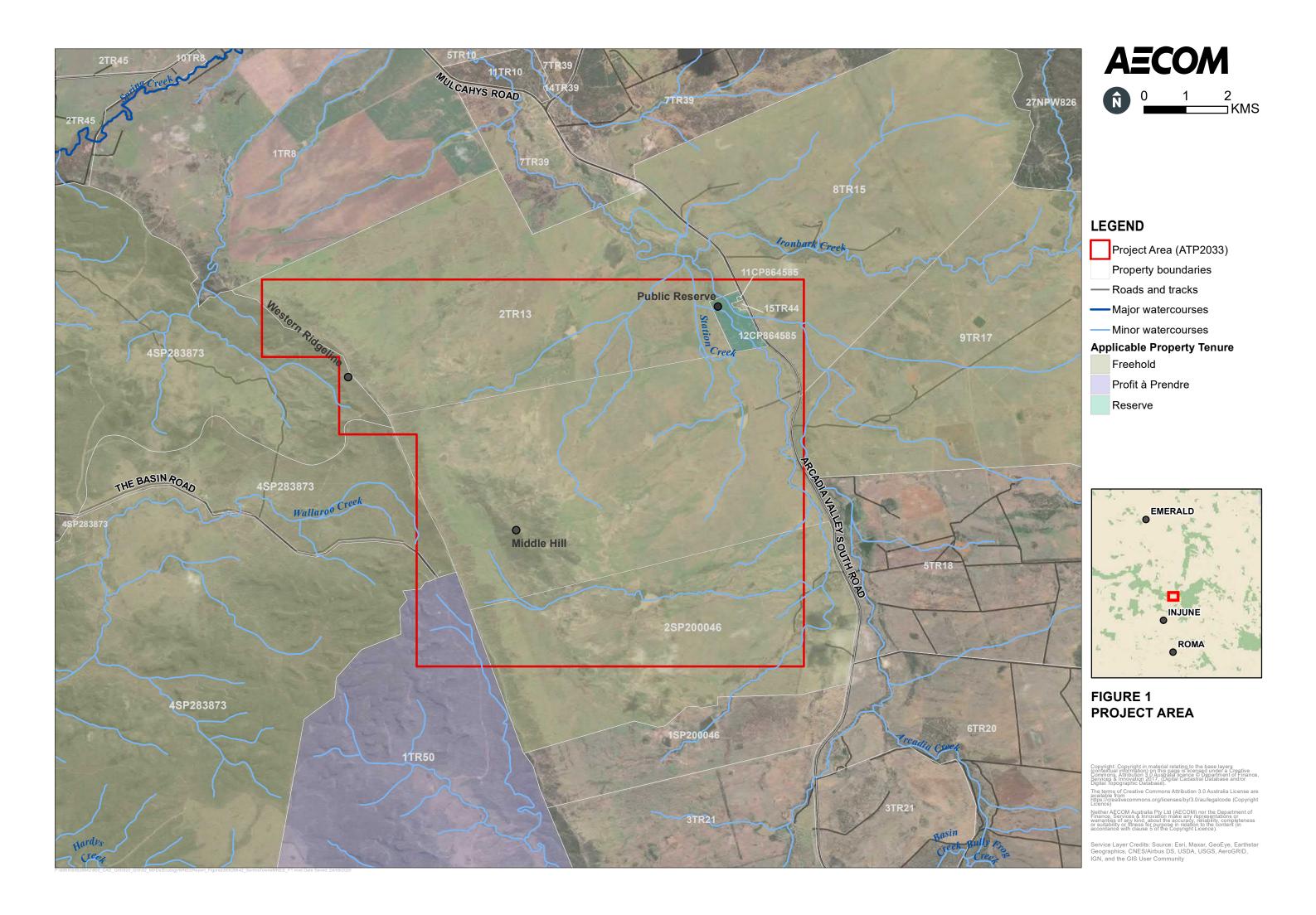
Within the valley, the Project Area is surrounded by agriculture, coal seam gas (CSG) operations and conventional gas operations. In the wider local area, a number of National Parks (NP) and State Forests (SF) occur within 20 km including Expedition (Limited Depth) NP to the east and south-east, Expedition NP to the south, Carnarvon NP to the north east and Boxvale SF to the west (Figure 2).

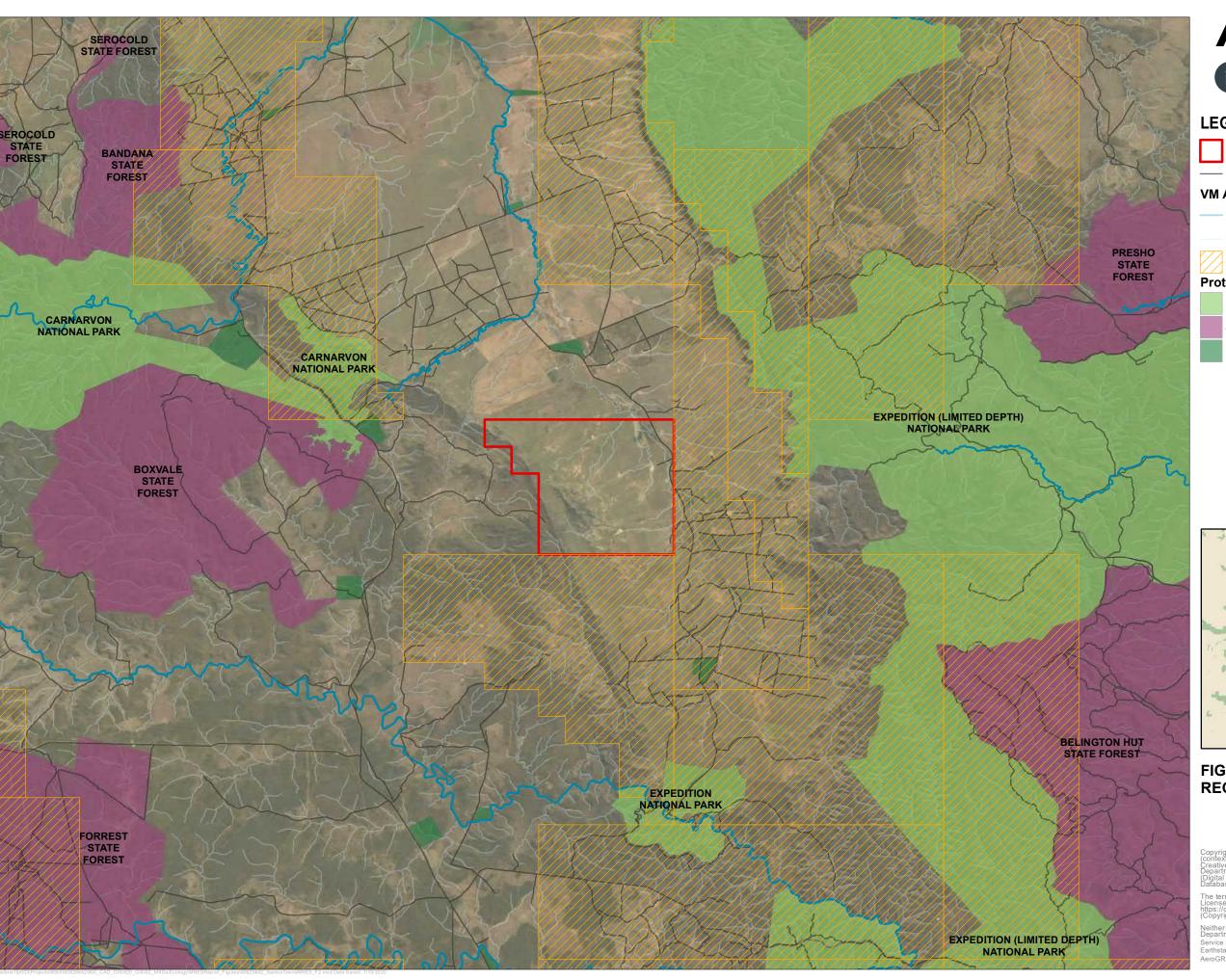
#### 1.3 Scope of work

The purpose of this assessment is to describe the MNES values of the Project Area protected under the EPBC Act, assess the impacts of the Project on these values, and present strategies to avoid, minimise or mitigate potential impacts.

This MNES assessment included the following tasks:

- Conduct a desktop review of available literature and previous studies in the vicinity of the Project Area, and conduct database searches for known or potentially occurring MNES
- Undertake ecological assessment to:
  - document condition, extent and value of vegetation communities, habitat types and other ecological values within the Project Area
  - target potentially occurring threatened ecological communities (TECs), flora and fauna listed under the EPBC Act
  - identify habitat resources for known and potentially occurring threatened flora, fauna and migratory species
- Utilise field-based data in conjunction with aerial imagery and light detection and ranging (LIDAR)
  data to determine the likely extent of vegetation communities, habitat types and associated MNES
  values across the Project Area
- Undertake a likelihood of occurrence assessment to confirm known, likely or potentially present MNES within the Project Area
- Complete an impact assessment for identified or potentially occurring MNES values, inclusive of recommended mitigation and management measures
- Determine the significance of identified impacts in accordance with the Commonwealth Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) and quantify the potential for any significant impacts
- Identify potential offset requirements, if required.





# **AECOM**



0 3.5 7 KMS

## **LEGEND**

- Project Area
- Roads and Tracks

#### **VM Act Watercourses**

- Major
- Minor
- Existing Petroleum Leases

#### **Protected Places**

- National Park
- State Forest
- Reserve



### FIGURE 2 **REGIONAL CONTEXT**

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# 2.0 Project description

The Project includes construction, operation, decommissioning and rehabilitation of up to 116 vertical wells, gas and water gathering networks and supporting infrastructure within the Project Area. A summary of the key components of the construction, operation and decommissioning and rehabilitation phases of the Project is provided in the sections below. The Project activities are further described in the Project's Environmental Management Plan (EMP) (Attachment C of the PD).

Approved exploration and appraisal activities are currently underway within the Project Area to improve understanding of the available gas resources. As understanding of the gas resource increases, investment decisions will be made about the location, scale and timing of the field development. Development timing will also be determined by the proximity to, and synergies with, existing and planned facilities that have been previously approved.

Construction is expected to commence in mid-2022 (pending approval).

#### 2.1 Activities and proposed timing

#### 2.1.1 Construction

#### 2.1.1.1 Well lease for production well or monitoring bore

Up to 116 vertical wells will be drilled into the target coal seam. Well construction will comply with the 'Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland' (DNRME, 2019), which sets minimum standards to achieve long term well integrity.

A well lease will be constructed to accommodate drilling and well completion equipment and support services. The size and layout of the well lease will vary depending on a number of factors such as the number of wells to be drilled (multi-well leases), the size and type of drilling rig, the number of hydraulic stimulation stages, the program for completion of the well(s) and the surrounding environment.

The lease size required to accommodate a typical vertical well is approximately 1 ha. Minimum disturbance leases (consisting of matting placed on the ground to create a hardstand surface) of less than 1 ha would be used where topography and vegetative cover allows. Where additional area is needed to accommodate infrastructure such as a water tank, or native slope requires cut and fill construction, well leases may be up to approximately 1.5 ha in size.

Multi-well leases (up to approximately 2.5 ha) may be used to maximise gas recovery and/or accommodate landholder requirements. Multi-well leases result in a larger footprint per lease area but a reduced footprint per well.

Well construction will involve a drill rig and other equipment including flare, flare sump and storage for fuel, chemicals, drilling fluids, produced water and raw water supply. Hydraulic fracture stimulation will be used to complete the wells. The drilling and hydraulic fracturing processes are discussed in detail in the EMP (Attachment C of the PD). On well completion, a pump will be installed to depressurise the coal seam and facilitate gas production. An operational production well lease will generally include gas and water metering, separation and filtering equipment, electrical and control systems and water and gas pipeline connections.

#### 2.1.1.2 Access roads or tracks

Access tracks are required for construction and operational activities. Construction of a typical access track (8-15 m wide) will accommodate heavy and light vehicles associated with the activities. Wherever practicable, existing access tracks will be upgraded for use and new access tracks will be co-located with gas and water gathering network to reduce the overall construction footprint.

#### 2.1.1.3 Gas and water flowlines and transmission pipelines

A gas and water gathering network including flowlines and pipelines will be constructed to transfer gas and water from each production well to main lines connecting to gas and water management facilities off tenure. A construction right-of-way approximately 10-25 m wide will be required for standard gathering line/pipeline construction including excavation of a trench, pipeline laying, backfilling the trench, and reinstatement of the right-of-way.

#### 2.1.1.4 Supporting infrastructure and activities

Other ancillary infrastructure and incidental petroleum activities required to support the construction and operation activities may include:

- Temporary water storage tanks
- Power and communication lines
- Borrow pits
- Fencing
- Environmental monitoring equipment and management controls
- Geophysical, geotechnical, geological, topographic, cadastral and ecological surveys
- Supporting infrastructure, such as energy supply, water supply and communications.

Landholders store water in existing farm dams for agricultural purposes such as stock watering, irrigation and other domestic purposes and may agree to allow or prefer Santos to use water sourced on site for construction activities. This is particularly true where a landholder holds an organic certification for the property. Water supply will be needed for construction, dust suppression, vehicle wash down, operations and maintenance activities. In accordance with landholder agreements and regulatory approvals, Santos may use water from existing farm dams when supply is abundant and of appropriate quality for construction and dust suppression activities.

#### 2.1.2 Operation

Once completed and connected to gas and water gathering infrastructure, wells will operate continuously on a 24-hour basis. Operating wells will be monitored and controlled remotely. The wells will also have automated shutdown systems in the event of non-routine operating conditions. Ongoing activities at well sites during operations will include routine inspections and maintenance of wellhead infrastructure. Maintenance activities will include repair or replacement of downhole pumps and pump components, clearing of blockages from within the wells that may be limiting production capacity, and other actions as necessary to improve production efficiency.

Well maintenance activities usually require the use of a workover rig (which is smaller than a drilling rig) and are contained within the established lease area for the well.

Gas and water gathering lines and pipelines will also be monitored, inspected and maintained during operation. This will include:

- inspection of low point drains and high point vents as part of routine field maintenance activities
- pigging of high-pressure pipelines to remove build-up from within pipelines
- vegetation slashing within gathering line/pipeline operational right-of-ways.

Operations will occur for approximately 30 years.

#### 2.1.3 Decommissioning and rehabilitation

Decommissioning and rehabilitation will occur post operational life until approximately 2077. All rehabilitation will be carried out in accordance with Queensland State regulations and conditions of the Environmental Authority (EA) issued under the Queensland *Environment Protection Act 1994*. These conditions are expected to be consistent with the Draft Rehabilitation Monitoring Plan included as Appendix A of the Project EMP (Attachment C of the PD).

#### 2.1.3.1 Wells

Wells will be decommissioned in accordance with the mandatory Code of Practice for the construction and abandonment of petroleum wells and associated bores in Queensland (DNRME, 2019). The primary objective of well decommissioning is to isolate hydrocarbon and water bearing formations and eliminate migration pathways (between the reservoir, other formation / aquifers and surface). This is done using cement or bridge plugs. Wells earmarked for decommissioning are subject to individual evaluation to determine the most appropriate decommissioning program.

Consideration of the following is taken into account when plugging and decommissioning the well:

- isolate all formations that have hydrocarbon shows
- isolate formations with different pressure regimes
- set plugs across intermediate casing shoe (if present) to minimise the potential for cross flow between aquifer systems and hydrocarbon bearing intervals
- set plugs across surface casing shoe
- at the surface set a plug in the well prior to cutting off the surface casing bowl.

Final rehabilitation of the well and lease area will include removing the well head, surface infrastructure and fencing; capping the well; filling in pits; respreading topsoil (after preparation) and revegetating the site to match its pre-disturbance vegetation type. Infrastructure that is useful to the landowner (for example an access track or hardstand area) may be handed over to the landowner in accordance with EA conditions.

#### 2.1.3.2 Gas and water flowlines and transmission pipelines

At the cessation of production, gas and water gathering lines and pipelines will be isolated from the wellhead and connection points. Once isolated, gathering lines will be drained, vented and capped in accordance with the *Australian Pipeline and Gas Association (APGA) Code of Environmental Practice (2017)* or applicable code in place at the time of decommissioning. Subsurface components of the gathering network will remain in-situ and the right-of-way rehabilitated.

#### 2.1.3.3 Access tracks and incidental infrastructure

Access tracks and incidental infrastructure will be rehabilitated or handed over to the landowner in accordance with EA conditions, when no longer required. If rehabilitation is required, the site of previous disturbance will generally be ripped and levelled to re-instate natural contours (including watercourses) and revegetated to match the surrounding land-use.

#### 2.2 Constraints-based planning and field development

Santos will adopt the hierarchy of management principles when planning for and implementing new petroleum activities within the Project Area that may result in land disturbance, including:

- 1. Avoidance avoiding direct and indirect adverse environmental impacts where practicable
- 2. Minimise minimise direct and indirect adverse environmental impacts where these cannot be avoided
- 3. Mitigate implement mitigation and management measures to minimise direct, indirect and cumulative adverse impacts
- 4. Remediation and rehabilitation actively remediate and rehabilitate impacted areas to promote and maintain long-term recovery
- 5. Offset (only where required) provide suitable offsets for activities that result in significant residual impacts to MNES even with the implementation of the above principles.

The Environmental Protocol for Constraints Planning and Field Development (the Protocol) is a tool designed by Santos to apply the management hierarchy throughout the life of the Project for each phase of development — infrastructure planning and design, construction, operation, and decommissioning and rehabilitation. Within the Project Area, the Protocol will dictate which activities are permissible and guide infrastructure siting to:

- consider MNES when selecting the location of project activities
- avoid or minimise disturbance to MNES wherever practicable
- ensure that upper disturbance limits for MNES are not exceeded.

The Protocol will be predominantly applied during the Project phases that will result in the most significant land disturbance (i.e. infrastructure planning and design and construction phases). However, all disturbances to land must comply with the Protocol. The key steps of the Protocol are shown in Figure 3 below.

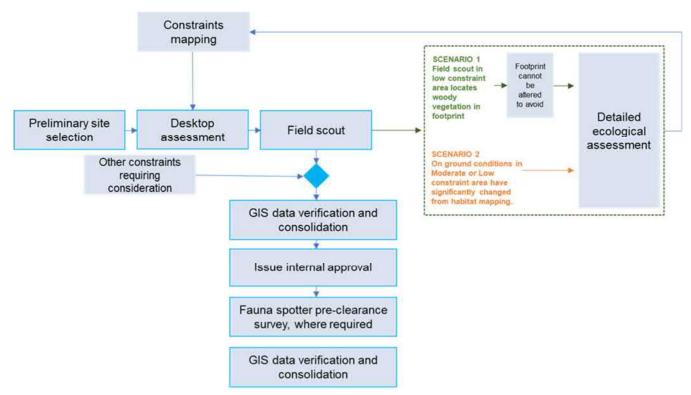


Figure 3 Constraints planning and field development protocol

To complete the preliminary site selection and internal desktop assessment, Santos have employed a geographic information system (GIS) model that assesses the locations of values identified in mapping sourced from government, other open-source datasets and Santos datasets (constraints mapping). The mapping of vegetation communities, habitat types and associated MNES values across the Project Area completed as part of this assessment forms the primary constraints data source for the model (MNES mapping).

To maximise the avoidance and minimisation of impacts on MNES, five hierarchal constraint categories were applied to MNES mapping, including:

- No go areas no petroleum activities permitted
- High constraint areas only low impact petroleum activities and linear infrastructure permitted;
   maximum disturbance limits for MNES must still be adhered to (see Table 17)
- Moderate constraint areas all petroleum activities permitted; maximum disturbance limits for MNES must still be adhered to (see Table 17)
- Low constraint areas all petroleum activities permitted (i.e. no MNES values identified)
- Dams extraction of water for construction purposes where lawful and permitted by the landholder.

Notwithstanding other constraints that may further influence siting, Santos will preferentially locate infrastructure in the low constraint areas, followed by the moderate constraint area.

A field scout will be conducted at all proposed infrastructure sites regardless of the constraint category assigned to that location. At proposed sites within high and moderate constraint areas, draft refinements to the design will be made to avoid habitat features in the following order of priority:

- 1. Hollow-bearing trees and large hollow logs
- 2. Koala food trees
- 3. Mistletoe
- 4. Gilgai
- 5. Termite mounds and raptor nests
- 6. Other features such as decorticating bark and rock piles.

As detailed in the Protocol, if the field scout in a low or moderate constraint area identifies on-ground conditions that are significantly different to what is identified in the mapping, and infrastructure is proposed to be sited in this location, a detailed ecological assessment undertaken by a qualified ecologist will be required to confirm the on-ground conditions. Potential impacts on unmapped MNES values (listed at the time of the approval) will not be permissible as detailed in Table 17.

The attribution of the categories and upper disturbance limits are detailed in Section 7.1.1 and Section 8.0. The Protocol is included as Attachment B of the PD.

# 3.0 Regulatory framework

#### 3.1 Environment Protection and Biodiversity Conservation Act 1999

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

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

#### 3.1.1 EPBC referral and assessment

Under the EPBC Act, a referral to the DAWE is required if the Project has the potential to cause a 'significant impact' on MNES. In relation to listed threatened and migratory species, an action will require approval if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

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

Additionally, an action will require approval if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories:

- · Critically Endangered, or
- Endangered.

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

As identified in Section 1.3, the purpose of this report is to identify the occurrence of MNES within the Project Area and assess the impacts of the Project on these MNES against the *EPBC Act Significant Impact Guideline Policy Statement 1.1* (Department of the Environment, 2013b).

In June 2021, Santos referred the proposed action to DAWE for a decision under section 75 of the EPBC Act on whether the action constituted a Controlled Action, requiring assessment and approval under the EPBC Act. DAWE determined the action was a controlled action on 28 July 2021 due to the following controlling provisions:

- Listed threatened species and communities (section 18 & 18A)
- A water resource, in relation to coal seam gas development and large coal mining development (section 24D and 24E).

This MNES report describes and assesses all relevant potential impacts (direct, indirect, cumulative and facilitated) of the action on listed threatened species and communities and describes avoidance, mitigation and management measures for these impacts. It also assesses potential impacts of the proposed action on migratory species and demonstrates that the action is unlikely to significantly impact these species, consistent with the referral decision.

# 4.0 Assessment methodology

#### 4.1 Desktop assessment

A desktop assessment was undertaken to characterise and identify ecological values that may be supported in the Project Area. The desktop assessment included a review of literature, and searches of publicly available datasets and online mapping. Desktop searches were initially undertaken in August 2019 and were repeated in 2020 as well as April and November 2021. The following information sources were reviewed as part of this assessment:

- DAWE EPBC Act Protected Matters Search Tool (PMST), to identify MNES within a search area extending at least 10 km from the Project Area boundaries (Department of Agriculture Water and the Environment, 2021a) (Appendix A)
- The Queensland Wildlife Online search results for flora and fauna species records within a search area extending 25 km from the centre of the Project Area (Department of Environment and Science, 2021) (Appendix B)
- Atlas of Living Australia (ALA) for threatened flora and fauna species records (Australian Government, 2020)
- The Queensland Department of Natural Resources, Mines and Energy (DNRME) Regulated Vegetation mapping
- The Queensland Department of Environment and Science (DES) Regional Ecosystem (RE) mapping version 11 to determine the nature and extent of vegetation within and surrounding the Project Area
- DNRME Vegetation Management Act 1999 (VM Act) watercourse mapping
- DES VM Act wetland mapping (Department of Environment and Science, 2020)
- DES map of Queensland wetland environmental values to identify wetlands of high ecological significance (HES) and general ecological significance (GES) (DES, 2020b)
- Queensland wetland classification mapping (DES, 2020c)
- DES Protected Plants Flora Survey Trigger Map to identify the high risk areas for protected plants (DES, 2020b)
- DES Essential Habitat mapping to identify vegetation in which a threatened species has been known to occur.
- Historical aerial imagery (Q Imagery, 2021).

Reviews of the above data sources were conducted based on the coordinates presented below in Table 1.

Table 1 Data source search parameters

Data source	Search coordinates	Search buffers
EPBC Act Protected Matters Search Tool	-25.25089 148.71226, -25.24436 148.82453, -25.33656 148.83071, -25.34059 148.75655, -25.28255 148.75071, -25.28349 148.7332, -25.2689 148.73217, -25.26983 148.71466	10 km
Wildlife Online	-25.2913, 148.7868	25 km
All other mapping	Restricted to the bounds of the Project Area	0 km

#### 4.2 Other ecological assessments

Four ecological studies have been undertaken within or in proximity to the Project Area that are of relevance to this assessment. These studies were reviewed to gain an understanding of the ecological values across the area as well as the methods utilised to determine possible presence of the MNES values. The methods adopted by each study are summarised below.

#### Terrestria Pty Ltd 2021 - Gilga Briefing Note

Terrestria Pty Ltd (Terrestria) conducted a site walk over within the eastern extent of the Project Area (Lot and Plan 3TR12) on behalf of Santos in March 2021. The purpose of this walk over was to assess the condition of areas of gilgai mapped by AECOM (2020) via LiDAR and determine the presence of microhabitat features required by the threatened ornamental snake (*Denisonia maculata*). The area was found to provide very low habitat values for any threatened fauna species known to occur within the locality. Due to recent blade ploughing, the area contained little to no soil cracks, fallen woody material, rocks or native trees, shrubs, forbs or grasses.

This briefing note is provided in Appendix H.

#### Terrestria Pty Ltd 2021 – Bottle Tree Area Ecological Monitoring and Assessment: Summer 2021

Terrestria have completed ecological assessments and monitoring at the Santos Bottle Tree property in 2021 that follow from the 2019 baseline surveys. Santos has identified the Bottle Tree property as containing suitable environmental values to acquit offset obligations incurred by the Santos GLNG Project. Offset areas within the Bottle Tree property were assessed by Terrestria in 2021 using the following methods:

- BioCondition
- Targeted threatened flora surveys and habitat assessments
- Targeted fauna surveys including;
  - Camera traps: 10 units used over at least 14 consecutive nights targeting northern quoll and possibly yakka skink
  - Elliot B or Cage traps: four per site over four consecutive nights targeting northern quoll
  - Funnel traps: six units at five trap sites over four consecutive nights
  - Anabats: three units for four consecutive nights targeting large-eared pied bat
  - Spotlighting: targeting koala, Dunmall's snake, ornamental snake, northern quoll and adorned delma
  - Harp traps: two units for four consecutive nights targeted south-eastern long-eared bat and large-eared pied bat
  - Active searches for signs and scats.

The Bottle Tree property is located less than 5 km to the north east of the Project Area.

#### Terrestria Pty Ltd 2018 - PLSS 666 3TR12 Regional Ecosystem Survey (Draft)

Terrestria conducted an ecological survey at select areas within Lot and Plan 3TR12 on behalf of Santos in March 2019 to inform the locating of proposed gas infrastructure. The assessment comprised a desktop review of publicly available data, followed by a field survey which included the following methods relevant to this assessment:

 Vegetation characterisation and TEC assessments at 'Middle Hill' (the large vegetated hill in the west of Lot and Plan 3TR12).

#### Boobook Ecological Consulting 2017 - Broad-scale Ecological Assessment Report

In 2017, Boobook Ecological Consulting completed a terrestrial ecology assessment on behalf of Santos to identify ecological values within the several properties in the Arcadia Valley. Specifically, the areas assessed consisted of parts of Lot and Plans 6TR11, 7TR39, 8TR15, 9TR17, 7TR22, 8TR23 and the Lonesome holding (807PH1979), within tenements PL234, PL420, PL421 and PL440. Some of

these properties (7TR39, 8TR15 and 9TR17), occur directly east of the Project Area. The remaining properties assessed also occur east of the Arcadia Valley Road but to the north and south.

The assessment was completed in two parts, comprising a desktop review of publicly available data and previous surveys followed by site investigations in late October and early November 2017. Field investigations occurred at a number of sites across the aforementioned properties and included the following methods relevant to this assessment:

- Vegetation characterisation including Secondary, Tertiary and Quaternary assessments as per Neldner et al. (2019)
- TEC assessments
- Regional ecosystem assessment
- Microhabitat assessments
- Targeted threatened flora surveys
- Opportunistic observations.

#### 4.3 Field surveys

Two field surveys were completed across the Project Area in 2020. The first survey was conducted at select areas on Lot and plan 2TR13 and Lot and plan 3TR12 by two AECOM ecologists from 19 to 26 June 2020 (five days). Steve Wilson, an Australian reptile specialist, conducted surveying during three of the five days.

The second survey was conducted over six days between 14 December and 21 December 2020, by three AECOM ecologists and Steve Wilson across Lot and plan 2TR13 and Lot and plan 1TR50.

The areas surveyed are henceforth referred to collectively as the Survey Area (Figure 4).

#### 4.3.1 Flora

#### 4.3.1.1 Vegetation community assessment

The extent, classification and condition of ground-truthed vegetation communities within the Survey Area was validated in accordance with the Methodology for Surveying and Mapping Regional Ecosystem and Vegetation Communities in Queensland (Neldner, et al., 2019). This included traversing the Survey Area undertaking tertiary and quaternary level assessments.

As per the Queensland Herbarium methodology (Neldner, et al., 2019), tertiary level site assessments were undertaken within a 10 by 50 m quadrat, collecting the following information:

- vegetation structure, species composition and percentage cover for each structural layer
- aspect and slope
- soil type
- landform
- disturbance type and severity
- RE and remnant status.

Quaternary-level sites were utilised to verify vegetation units and confirm dominant characteristic species. Structural analysis included recording the height class and life form of the dominant species within the mid and canopy strata as per (Neldner, et al., 2019). Several time-encoded digital photographs were taken at each tertiary and quaternary site assessment as a reference.

RE classification was determined based on the vegetation, soil and landform characteristics identified in the field, geological mapping for the region and the Regional Ecosystem Description Database (REDD). Condition status for woody vegetation was evaluated utilising the definitions of remnant vegetation under the VM Act. For the purposes of this assessment, vegetation was mapped into three categories:

- Remnant: woody vegetation that has not been cleared or vegetation that has been cleared but
  where the dominant canopy has greater than 70% of the height and greater than 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.
- High-value regrowth (HVR): areas previously cleared or disturbed (e.g. by wildfire) over 15 years
  ago and containing woody vegetation floristically and structurally consistent with the RE but
  typically less than 70% of the height and less than 50% density of the RE.
- Regrowth or non-remnant: areas previously cleared or otherwise significantly disturbed.

During the first survey, a total of 34 sites including 19 tertiary transects and 15 quaternary sites were undertaken. An additional 24 tertiary and 42 quaternary sites were undertaken within the Survey Area during the second survey (Figure 4).

#### 4.3.1.2 Functionality assessment

Vegetation communities assessed to comprise remnant or HVR vegetation and analogous to an RE with an endangered biodiversity status (under the Queensland *Environmental Protection Act 1994*), were also assessed for functionality. Four condition attributes as per Table 2 below were assessed to determine if the patch was considered functional.

Table 2 Minimum ecosystem attributes for functional non-grassland ecosystems

Attribute	Cut-off
Patch size	>0.5 ha
Total non-native perennial vegetative cover	<50%
Recruitment to EDL	Yes
Minimum median canopy height	>1/3 of the median benchmark

#### 4.3.1.3 TEC assessments

TEC assessments were undertaken across the Survey Area to confirm the presence of TECs identified during the desktop assessment, namely:

- Brigalow (Acacia harpophylla dominated and co-dominated) TEC (Brigalow TEC)
- Poplar Box Grassy Woodland on Alluvial Plains (Poplar box TEC),
- semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (SEVT TEC)
- Coolibah Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions (Coolibah TEC)
- Weeping Myall Woodlands (Weeping myall TEC)

TEC assessments were undertaken in the field to identify vegetation communities meeting the key diagnostic and condition threshold criteria as described for each specific TEC in the relevant Commonwealth Approved Conservation Advice or Species Profile and Threat Database (SPRAT).

For Coolibah TEC and Weeping myall TEC, no vegetation was identified to be analogous to the TEC and therefore further assessment against the condition thresholds was not required. For the remaining three TECs, full assessments could be completed in the field due to the presence of suitable analogous vegetation.

The assessment for Brigalow TEC during the field survey consisted of collecting the following data at various sites within Brigalow vegetation:

- Dominance or co-dominance of Brigalow
- Brigalow listed RE
- Exotic perennial cover

- Age of community
- Patch size.

The assessment for Poplar box TEC during the field survey consisted of collecting the following data at sites within vegetation dominated by *Eucalyptus populnea* (poplar box):

- Dominance of poplar box
- Soil type and or land zone
- Exotic perennial cover
- Patch size
- Evidence of recruitment.

The assessment for SEVT TEC during the field survey consisted of collecting data to determine RE classification at various sites identified to comprise of semi-evergreen vine thicket species. REs that are identified to form the TEC are listed in Table 3.

Table 3 SEVT TEC listed REs

RE	Short description
11.2.3	Microphyll vine forest ("beach scrub") on sandy beach ridges
11.3.11	Semi-evergreen vine thicket on alluvial plains
11.4.1	Semi-evergreen vine thicket ± Casuarina cristata on Cainozoic clay plains
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains/remnant surface
11.7.1x	Semi-evergreen vine thicket on the slopes and scarps of rocky residual ranges with Cainozoic lateritic duricrust
11.8.3	Semi-evergreen vine thicket on Cainozoic igneous rocks
11.8.6	Macropteranthes leichhardtii thicket on Cainozoic igneous rocks
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks
11.9.4	Semi-evergreen vine thicket on Cainozoic fine-grained sedimentary rocks
11.9.8	Macropteranthes leichhardtii thicket on Cainozoic fine-grained sedimentary rocks
11.11.18	Semi-evergreen vine thicket on old sedimentary rocks with varying degrees of metamorphism and folding

#### 4.3.1.4 Targeted flora searches

Targeted searches for threatened flora species identified in the desktop assessment were undertaken in areas of potentially suitable habitat confirmed during vegetation community assessments across the Survey Area.

#### 4.3.1.5 Specimen ID

Where plant species could not be identified in the field, fruiting and/or flowering specimens were taken to assist with identification. For those species not field identified during the surveys, samples were pressed and dried, and positive identifications of plant specimens were subsequently made under laboratory conditions.

#### 4.3.1.6 Nomenclature

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

#### 4.3.2 Terrestrial fauna

The baseline sampling of vertebrate fauna species was undertaken using standard methodologies for the systematic survey of terrestrial fauna in eastern Australia (Eyre et al., 2018). Methods employed during the first field assessment included:

- Fauna habitat assessments
- Active searches
- Scat and sign searches
- · Visual and auditory identification surveys of birds
- Incidental observations.

In December 2020, the field survey included the above fauna methods as well as:

- Pitfall and funnel trapping
- Spotlighting and call playback
- Camera traps and hair tubes
- Anabat call detectors.

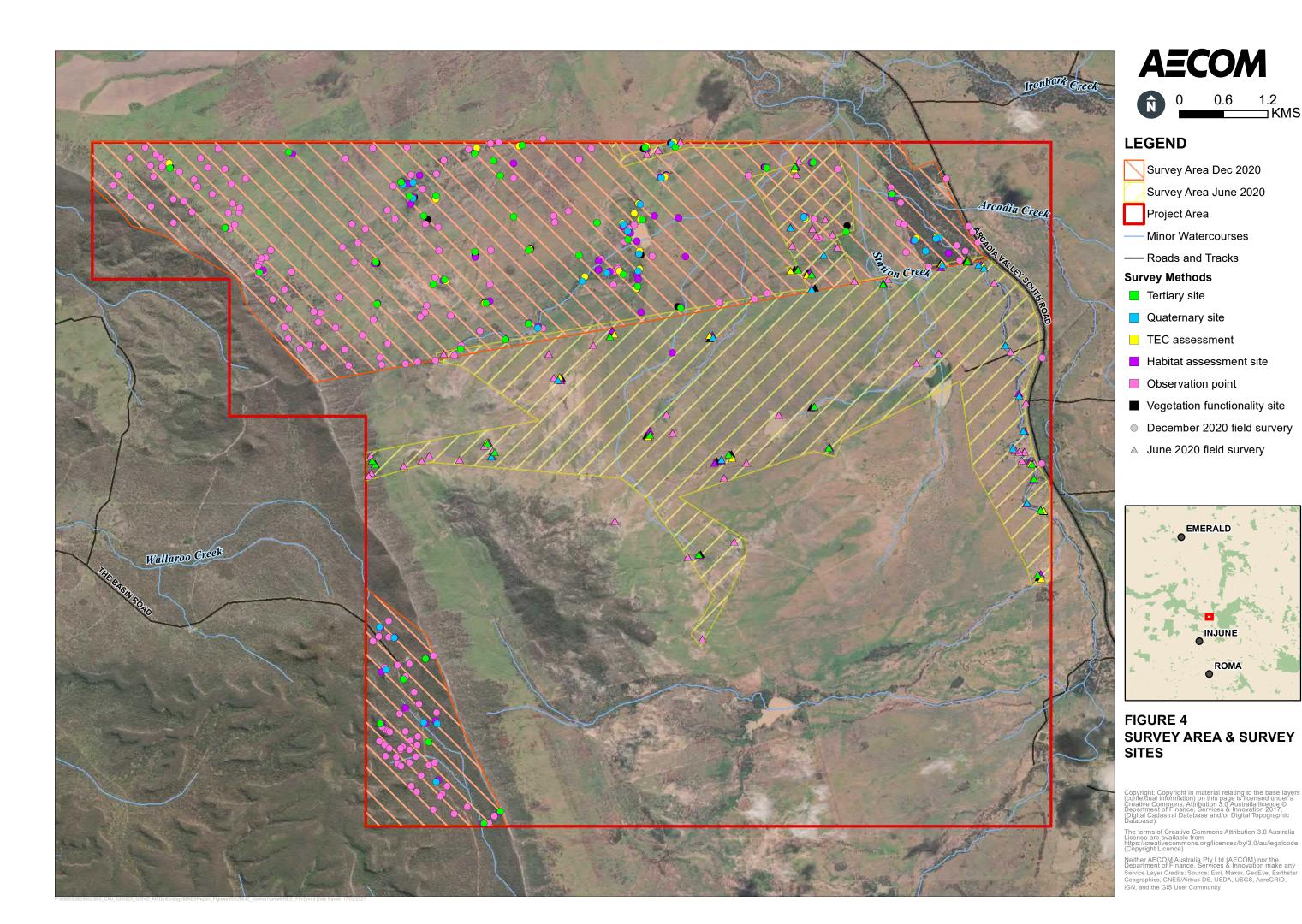
Further information regarding each of these methods and survey effort is detailed in Table 4 below. Fauna habitat assessment sites are displayed on Figure 4. At every fauna habitat assessment site, active searches, scat and sign searches and bird censusing was conducted.

Fauna survey methods Table 4

Method	Target fauna	Description	Survey effort (June 2020)	Survey effort (December 2020)
Habitat assessment	Reptiles, mammals, amphibians	Habitat assessments have been completed across the Survey Area during both surveys. Each habitat assessment site was one hectare (100 m x 100 m, or 200 m x 50 m). Habitat attributes recorded during the assessment included:	26 fauna habitat sites	60 fauna habitat sites
	and birds	<ul> <li>Vegetation structure and dominant species, including a description of canopy, shrub and ground layer structure and composition.</li> <li>Soil composition and landform</li> <li>Presence and abundance of tree hollows and stags.</li> <li>Presence and abundance of woody debris such as habitat logs and ground timber.</li> <li>Rocky habitat such as surface rocks, boulders, crevices, overhangs and caves.</li> <li>Proximity to water (both permanent and ephemeral).</li> <li>Disturbance from invasive weeds/pests.</li> <li>Other disturbances such as grazing pressure, clearing, thinning or fire.</li> <li>Any other significant habitat features, or values present, such as leaf litter, gilgai, decorticating bark, dense grass/shrub shelter, seeding grass cover, fruiting plants,</li> </ul>		
Active search	Reptiles, mammals, amphibians and birds	nectar and pollen producing plants (i.e. mistletoe), and koala food trees.  Searches included scanning the trees and ground, searching beneath microhabitat such as rocks, fallen timber and peeling bark, digging through leaf litter and soil at tree bases and flushing birds from areas with a dense or grassy ground cover. Physical disturbance to habitat features and reptiles was kept to a minimum. Active searching was completed at habitat assessment sites across the Survey Area.		
Scat and sign search	Reptiles, mammals, amphibians and birds	Searches included looking for signs of animal activity, including tracks, scats, scratches, bones, fur, feathers, nests, foraging holes and diggings. Scat and sign searches were completed at habitat assessment sites across the Survey Area.		
Diurnal bird survey	Birds	Roaming/meandering bird surveys using both visual and auditory identification. Surveys commenced at dawn and continued throughout the day and were completed during both surveys. In December 2020, active birding was also completed at wetland / farm dam sites.	Approximately 72- person hours	Approximately 110-person hours

Method	Target fauna	Description	Survey effort (June 2020)	Survey effort (December 2020)
Incidental observations	Reptiles, mammals, amphibians and birds	All fauna observed incidentally within or in close proximity to the Survey Area were recorded, including those seen while travelling along roads and tracks.		
Spotlighting and call playback	Nocturnal birds and mammals, arboreal mammals, reptiles and amphibians	At select locations in Lot and plan 2TR13 in December 2020, roaming / meandering nocturnal searches were completed in suitable habitat using headtorches and hand-held spotlights. Where habitat was suitable for koala, an audio recording of a koala mating call was also played using a portable speaker. After playing the recording, field staff listened for any return calls or movement and then spotlighted surrounding trees.  Spotlighting from the passenger window of a slow-moving vehicle was also undertaken along farm tracks, targeting larger ground and arboreal mammals and nocturnal birds.	-	24 person-hours
Pitfall trapping Funnel trapping	Amphibians, reptiles, small terrestrial mammals	Where the substrate permitted, 20 L buckets were installed in the ground at 7.5 m intervals. A metal mesh fence was erected in a small trench on top of the buckets. Funnel traps were also installed at regular intervals along the fence, and where the substrate was too hard for buckets to be installed. Pitfall and funnel trapping occurred at three sites within Lot and Plan 2TR13 in December 2020. Sites were located within potential ornamental snake habitat.	-	3 sites
Camera trapping & hair tubes	Reptiles, medium - large terrestrial mammals  Analysis of still photos captured on cameras was undertaken by qualified ecologists. Captured images of fauna were identified to species level where possible.  Cameras were deployed along potential northern quoll movement corridors (i.e. rock screes or narrow drainage lines where movement would be unhindered) along the western ridgeline in Lot and plan 2TR13 in December 2020. Cameras were aimed at hair tubes that had been baited with oats, honey, peanut butter and sardines. A maximum of 11 cameras were utilised over four nights.  Analysis of still photos captured on cameras was undertaken by qualified ecologists. Captured images of fauna were identified to species level where		-	40 camera trap nights
Passive echolocation call detection	Microbats	Three detectors were used across 9 sites within Lot and plan 2TR13 in December 2020. Unattended bat recorders (Anabat Swifts) were placed in the vicinity of foraging sites such as vegetation corridors, flyways, over watercourses and adjacent to artificial waterbodies (dams) in representative potential, likely and known habitat.	-	16 detector nights

Method	Target fauna	Description	Survey effort (June 2020)	Survey effort (December 2020)
		Data recorded on the bat recorders were analysed by a qualified specialist, Greg Ford of Balance! Environmental. The format and content of the analysis summary reports comply with nationally accepted standards for the interpretation and reporting of Anabat data (Reardon, 2003).		



#### 4.3.3 Survey effort

The desktop assessment identified a number of threatened and migratory fauna species as either being 'likely' or having 'potential' to occur within the Project Area (Section 6.0). These species were the subject of targeted survey effort and are identified in Table 5, along with the relevant guideline survey effort and actual survey effort employed for each species. Species not targeted during the field survey are species that either have no suitable habitat within the Project Area or are not considered to have a distribution that overlays the Project Area. These species included:

- Fitzroy River turtle and white-throated snapping turtle due to the lack of suitable flowing creeks or rivers within the Survey Area
- Star finch due to the lack of records within a 100 km radius of the Survey Area
- Osprey due to the lack of records within a 100 km radius of the Survey Area
- Migratory and threatened sandpiper species due to the inland location and lack of suitable mudflat foraging habitat

Whilst these species were not targeted, other survey techniques employed for the target species would have been suitable at detecting presence, particularly for the migratory or threatened bird species.

The fauna surveys were undertaken in accordance with:

- Survey guidelines for Australia's threatened reptiles (Department of Sustainability, Environment, Water, 2011b)
- Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010b)
- Survey guidelines for Australia's threatened mammals (Department of Sustainability, Environment, Water, Population and Communities, 2011)
- Survey guidelines for Australia's threatened bats (Department of the Environment Water Heritage and the Arts, 2010a)
- Draft referral guidelines for the nationally listed Brigalow Belt reptiles (Department of Sustainability Environment Water Population and Communities, 2011a)
- Referral guideline for 14 birds listed as migratory species under the EPBC Act (Department of the Environment, 2015b)
- Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment and Energy, 2017)
- Queensland Government's Terrestrial Fauna Survey Guidelines for Queensland (Eyre et al., 2018)
- Species-specific survey guidelines, such as the survey guidelines for the koala (Department of the Environment, 2014c), painted honeyeater (Rowland, 2012b) and yakka skink (Ferguson & Mathieson, 2014).

Guidelines listed above provide a recommended standardised method of collecting ecological data, generally across smaller sized project sites (i.e. < 50 ha). They are broad guidelines and do not factor in quality of habitat and other site-specific information that may influence presence and the suitable level of survey effort that is practical to implement. For example, undertaking four separate surveys across the migratory period of Latham's snipe (*Gallinago hardwickii*) for a highly disturbed inland environment that is likely to support occasional individual visitors of the species.

A review of aerial imagery prior to surveying highlighted that the Project Area and wider study area include large sections of agricultural land, which given the historical disturbance is likely to have reduced ecological value. Where practical, the survey guidelines above have been met as detailed below in Table 5. Where survey guidelines have only partially been met due to their impracticality at this scale, effort is still considered sufficient due to the nature of the Project Area and the adoption of other techniques such as habitat assessments where presence of suitable habitat resources has been used as a surrogate for presence.

Table 5 Survey guideline requirements and survey effort undertaken per MNES

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?		
Birds	Birds					
Squatter pigeon (southern) (Geophaps scripta scripta)	Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010b).	<ul> <li>Survey techniques</li> <li>The survey guidelines for Australia's threatened birds recommends the following survey methods and effort for the squatter pigeon (southern):</li> <li>Road driving during day (driving transects).</li> <li>Active searches: 15 hours over 3 days in areas &lt;50 ha.</li> <li>Flushing surveys: 10 hours over 3 days in areas &lt;50 ha.</li> <li>Waterhole searches: Survey effort not specified.</li> <li>Seasonal considerations</li> <li>No evidence of long-distance seasonal movements or seasonal considerations required.</li> </ul>	driving transects and flushing surveys were conducted concurrently: total of 162 person hours over 10 days.  • Waterholes and dams were visually surveyed throughout the surveys.  • Targeted habitat assessments were conducted for the species throughout	Requirements met  Survey effort undertaken exceeds the minimum survey requirements for the species.  The survey consisted of all recommended survey techniques (active searches, flushing surveys, road driving and waterhole searches). Targeted habitat assessments were conducted in both June and December 2020 across a range of suitable habitat types to supplement the search effort.  No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.		
Red goshawk ( <i>Erythrotriorchis</i> <i>radiatus</i> )	Survey guidelines for Australia's threatened birds (Department of the Environment Water Heritage and the Arts, 2010b).	<ul> <li>Survey techniques</li> <li>The survey guidelines for Australia's threatened birds recommends the following survey method and effort for the red goshawk:</li> <li>Area searches: 80 hours over 10 days.</li> <li>Search in groups of tall trees and in trees along riverbanks for nests.</li> <li>Red goshawks are very secretive, so scanning for nests is the most effective way to detect the species presence.</li> <li>Seasonal considerations</li> </ul>	<ul> <li>162 person hours over 10 days.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> </ul>	Requirements met Survey effort undertaken exceeds the minimum survey requirements for the species. Potential nests for the species were searched throughout the surveys. Audio and visual surveys for birds were conducted throughout the field surveys, including those seen while travelling along roads and tracks.		

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
		No evidence of long-distance seasonal movements or seasonal considerations required.		Targeted habitat assessments were conducted in both June and December 2020 across a range of suitable habitat types to supplement the search effort. No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.
Painted honeyeater (Grantiella picta)	Targeted species survey guidelines – painted honeyeater (Rowland, 2012b).	<ul> <li>Survey techniques         The survey guidelines for the painted honeyeater recommend:         <ul> <li>Area searches (during breeding season) involving systematically searching for birds and signs of their presence (e.g. nesting habitat), as well as listening for their calls.</li> <li>Surveys should be undertaken during daylight hours and preferably in the early morning (&lt;2 hours after sunrise) and late afternoon (&lt;2 hours before sunset) and avoid inclement weather (i.e. rain and wind).</li> </ul> </li> <li>At least 1 hour of surveying per day for a minimum of 4 days.</li> <li>Seasonal considerations         <ul> <li>This species exhibits seasonal north-south movements following mistletoe fruiting in which its breeding season (October to March) is closely matched.</li> </ul> </li> </ul>	<ul> <li>20 hours of active bird surveys over 10 days during December.</li> <li>90 person hours of incidental bird surveys over 10 days during December.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> </ul>	Requirements met  The survey effort exceeds the recommended survey effort for the species.  Targeted habitat assessments were conducted in both June and December 2020 across a range of suitable habitat types to supplement the search effort.  No surveying has been undertaken within the southern Project Area (2SP200046). A field survey would be required to determine the presence and abundance of mistletoe. However, a precautionary approach has been adopted in the habitat mapping and the presence of mistletoe has been assumed in areas of potentially suitable habitat.
Australian painted snipe (Rostratula australis)	Survey guidelines for Australia's threatened birds (Department of the Environment Water	Survey techniques The survey guidelines for Australia's threatened birds recommends the following survey method and effort for the Australian painted snipe:	Waterholes and dams were visually surveyed	Requirements met  Area search effort exceeds the recommended survey effort for the species.

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	Heritage and the Arts, 2010b).	<ul> <li>Area searches or transects through suitable wetlands (for sites of less than 50 ha when wetland holds water but is not flooded): 10 hours over 3 days.</li> <li>Targeted stationary observations at dawn and dusk within suitable wetlands: 10 hours over 5 days.</li> <li>Spotlight shortly after dusk: Survey effort not specified.</li> <li>Difficult to detect even when present.</li> <li>Seasonal considerations</li> <li>The movements of the Australian painted snipe are poorly known, and it may be a migratory species. There are no seasonal considerations for targeted surveys for this species.</li> </ul>	throughout surveying.  162 person hours over 10 days during June and December 2020.  Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.	Stationary observations were undertaken at areas of best habitat during both surveys however this was not completed at dawn or dusk. Spotlighting was conducted at one wetland location during December 2020.  Targeted habitat assessments were conducted at all areas of potentially suitable habitat in June and December 2020 to supplement the search effort.  No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.
Grey falcon (Falco hypoleucos)	No species-specific guideline available.  In absence of guideline, Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre, T.J., et. al. 2014) for diurnal birds applies.	Survey techniques  Per survey period, at least 6 x 5-10 minute area searches within 100 x 100m survey site.  Seasonal considerations  Nil.	<ul> <li>162 person hours over 10 days during June and December 2020.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> </ul>	Requirements met Significant survey effort undertaken for the species. No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.
White-throated needletail (Hirundapus caudacutus)	Referral guideline for 14 birds listed as migratory species under the EPBC Act	Survey techniques  Observations should be made as late as possible in the evening of birds coming into roost in tall trees along ridge tops. Survey effort not specified.	162 person hours over 10 days during June and December 2020.	Requirements met Significant survey effort undertaken for the species and this species is predominantly aerial.

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	(Department of the Environment, 2015b).	Seasonal considerations Surveys should be conducted October to March.	Targeted habitat assessments (potential roost sites) were conducted for the species throughout the duration of the field surveys.	No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.
Migratory Birds				
Latham's snipe (Gallinago hardwickii)	Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species: Latham's snipe (Department of the Environment and Energy, 2017).	Survey techniques  The survey guidelines recommend the following methods and survey effort for the Latham's snipe:  Bird surveys in suitable habitat:  1 x survey in December  2 x surveys in January  1 x survey in February  Surveys should be conducted during the day and consist of area searches or line transects in suitable habitat (i.e. wetland or other waterbodies and their surrounding vegetation (Department of Agriculture Water and the Environment, 2021b).  Seasonal considerations  Surveys should be conducted for Latham's snipe between October and February when the species arrive and depart in Australia.	<ul> <li>Waterholes and dams were visually surveyed throughout surveying in June and December 2020.</li> <li>20 hours of active birding and 90 hours of incidental birding over 5 days during December 2020.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> </ul>	Bird surveying has only been completed during the correct seasonal timeframe once. However, targeted habitat assessments were conducted in both June and December 2020 across all areas of potentially suitable habitat to supplement the search effort.  No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted. The Project Area does not contain core habitat for this species given its inland location and therefore full survey effort is not required.
Oriental cuckoo and five migrant flycatchers during	Referral guideline for 14 birds listed as migratory species under the	Survey techniques  The referral guideline for 14 birds listed as migratory species under the EPBC Act prescribes the following survey methods:	162 person hours over 10 days during June and December 2020.	Requirements met The survey effort exceeds the recommended survey effort for the species'.

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
breeding season and migration	EPBC Act (Department of the Environment, 2015b).	Bird surveys:  2 ha survey in 20 minutes over sufficient survey plots to estimate a density, and hence the population size across the proposed development area.  Standardised timed periods.  Seasonal considerations  Surveys should be conducted during the appropriate survey period:  Oriental cuckoo: September to May.  Satin flycatcher: spring or autumn.  Rufous fantail: spring or autumn.	Targeted habitat assessments (potential roost sites) were conducted for the species throughout the duration of the field surveys.	Surveys were conducted in June (winter) and December (summer), indicating timing may have only been appropriate for the oriental cuckoo. However, targeted habitat assessments were conducted in June and December 2020 across a range of suitable habitat types to supplement the search effort.  No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted. Core habitat for the species' is limited to the western ridgeline and Middle Hill. No direct impacts as a result of the Project will occur in these areas and as such recommended survey effort is not required.
Mammals	I			
Large-eared pied bat (Chalinolobus dwyeri)	Survey guidelines for Australia's threatened bats (Department of the Environment Water Heritage and the Arts, 2010a).	Survey techniques The survey guidelines for Australia's threatened bats prescribes the following survey methods and effort for the large-eared pied bat:  Unattended bat recorder:  A minimum of 16 detector nights over 4 nights in areas <50 ha.  Unattended bat recorders should be left overnight at multiple locations.  The use of electronic bat detectors is the best means of non-invasive survey.	<ul> <li>Unattended bat recorder: 16 detector nights during December 2020.</li> <li>Roost searches: undertaken whilst conducting habitat assessments. No roosts or caves were identified.</li> <li>Targeted habitat assessments were</li> </ul>	Requirements partially met Survey effort undertaken meets the minimum survey requirements for two of the recommended methods (unattended bat recorder and roost searches). Unattended bat recorders were utilised during the December 2020 survey, which is the suitable season for detection. Bat call analysis completed by Balance! Environmental confirmed this species at sites in the western extent of lot and plan 2TR13.

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
		<ul> <li>Attended bat recorders:         <ul> <li>A total of 6 detector hours over a minimum of 3 nights.</li> <li>Walking or driving transects using hand-held detectors should begin at dusk.</li> </ul> </li> <li>Roost searches:         <ul> <li>For large project areas in gorge country, ground-based searching could be expected to take several days.</li> <li>Ground-based searches should focus on identifying sandstone caves and crevices where the species roosts.</li> </ul> </li> <li>Harp traps and/or mist nets:         <ul> <li>A minimum of 16 trap or net nights over 4 nights.</li> <li>Effort can be increased depending on suitable flyways or caves.</li> </ul> </li> <li>Seasonal considerations</li> <li>Surveys are best conducted from October through to March.</li> </ul>	conducted for the species throughout the duration of the field surveys.	Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement survey effort. No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted. A precautionary approach has been adopted in the habitat mapping and the presence of foraging habitat resources has been assumed in areas of potentially suitable habitat.
South eastern long-eared bat (Nyctophilus corbeni)	Survey guidelines for Australia's threatened bats (Department of the Environment Water Heritage and the Arts, 2010a).	Survey techniques  The survey guidelines for Australia's threatened bats prescribes the following survey methods and effort for the south eastern long-eared bat:  • Unattended bat recorder:  - Calls are not distinguishable reliably from other Nyctophilus species using bat recorders.  However, bat detectors can be used to identify areas used by long-eared bats. Acoustic	Unattended bat recorder: 16 detector nights during December 2020. Roost searches: undertaken whilst conducting habitat assessments. No roosts or caves were identified.	Requirements partially met Survey effort undertaken meets the minimum survey requirements for one of the recommended methods (unattended bat recorder). Unattended bat recorders were utilised during the December 2020 survey which is the suitable season for detection. Bat call analysis completed by Balance! Environmental confirmed Nyctophilus sp., however this species

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
		detection can then be followed up with an appropriate level of trapping.  Harp traps and/or mist nets:  20 trap nights over a minimum of 5 nights. Harp traps and/or mist nets should be placed both within open fly-ways and within cluttered vegetation such as woodland, mallee or forest as the species forages below the tree canopy, often at ground level. Significant effort should also be conducted over water (artificial or naturally occurring).  Seasonal considerations  Surveys are best conducted on warm nights from October through to April.	Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.	cannot be identified to a species level by call.  Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement survey effort. No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted. A precautionary approach has been adopted in the habitat mapping and the presence of roosting and foraging habitat resources has been assumed in areas of potentially suitable habitat.
Greater glider ( <i>Petauroides</i> volans)	Species-specific guidelines for survey for the greater glider are not currently available. However, the species is readily detectable by spotlighting (Lindenmayer et al., 2001). Terrestrial Vertebrate Fauna Survey Guidelines for Queensland	Survey techniques In the absence of species-specific survey guidelines, Eyre et al. (2018) was used to determine suitable survey techniques. Survey methods include:  • Spotlighting transects (100 m x 100 m) per 30-person minutes. Survey effort not specified.  Seasonal considerations The greater glider is known to have high site fidelity with relatively small home ranges. There are no seasonal considerations for this species.	<ul> <li>24 hours of spotlighting over 4 nights during December 2020.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> </ul>	Requirements met  Spotlighting survey effort was concentrated in eucalypt woodlands along or adjacent to watercourses with a high abundance of hollow-bearing trees.  The survey effort for greater glider is not specified, however effort conducted is considered suitable for detecting the species.  Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement search effort. No surveying has been undertaken within the southern Project Area (2SP200046); however

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	(Eyre et al., 2018) were utilised in the absence of species-specific guidelines.			findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.
Koala (Phascolarctos cinereus)	Survey guidelines for Australia's threatened mammals (Department of Sustainability, Environment, Water, Population and Communities, 2011).  EPBC Act referral guidelines for the vulnerable koala (Department of the Environment, 2014c).	Survey techniques  The EPBC Act referral guidelines for the vulnerable koala do not prescribe specific survey effort requirements due to the high level of variation of this species across its distribution. Although both this document and the survey guidelines for Australia's threatened mammals recommend the following key survey techniques:  Spotlighting with call playback: Survey effort determined on a case-by-case basis.  Remote camera: Survey effort determined on a case-by-case basis.  SATs (Phillips & Callaghan, 2011): Sampling of a minimum of 30 koala food trees within suitable habitat. Survey effort determined on a case-by-case basis.  Seasonal considerations  Optimal time period for direct observation surveys is between August and January, as this is when koala activity is generally at its peak and resident breeding females with back-young are most easily observed. Direct observation surveys conducted outside of this period must take into account the potential for lower koala activity (reduced detectability) and other relevant seasonal considerations.	<ul> <li>24 hours of spotlighting over 4 nights during December 2020.</li> <li>Call playback was conducted concurrently with spotlighting.</li> <li>Remote cameras: 40 camera trap nights over 4 nights during December 2020.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.</li> </ul>	Requirements met  A combination of key survey techniques, as recommended by the survey guidelines were utilised to determine utilisation and areas of potential habitat for koala. Spotlighting with call playback and remote cameras were conducted in suitable habitat (i.e. Eucalypt dominated woodlands, riparian corridors and brigalow open woodland with poplar box), as determined by targeted habitat assessments, to adequately sample differing habitats.  Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement search effort. No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted.
		Presence/absence surveys in the inland context, conducted during dry periods, should be centred on		

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
		riparian areas, upper/mid-slope areas and other dry- period refugia in order to maximise detectability.		
Northern quoll (Dasyurus hallucatus)	Survey guidelines for Australia's threatened mammals (Department of Sustainability, Environment, Water, Population and Communities, 2011).  EPBC Act referral guideline for the endangered northern quoll Dasyurus hallucatus (Department of the Environment, 2016).	Survey techniques  The survey guidelines for Australia's threatened mammals recommends a range of survey methods to detect the northern quoll. The EPBC Act referral guidelines for the endangered northern quoll do not prescribe specific survey effort requirements due to the variation of this species' ecology and population sizes across it's distribution. However, this guideline does make survey recommendations for Queensland which include:  • Camera trapping (as opposed to cage trapping) targeted to habitat critical to the survival of the species. Transects of 10 camera traps spaced at least 100 m intervals for four nights is recommended.  • Supplementary techniques including:  - Latrine searches  - Detection dogs  - Hair tubes in conjunction with camera traps.  Seasonal considerations  Camera traps can be used at any time of the year, however preferably when individuals are likely to be active and more detectable.	Camera traps with hair tubes were deployed at spaced intervals along the rocky ridgeline slope (habitat critical to the survival of the species) within the northern Project Area across four nights during December 2020 (total effort of 40 camera trap nights).  Targeted habitat assessments were conducted for the species throughout the duration of the field surveys in June and December 2020.	Requirements met  A combination of survey techniques including the key technique for Queensland, as recommended by the survey guidelines, were utilised to determine utilisation in areas of potential 'habitat critical to the survival of the species'. Targeted surveying was conducted in December, which should coincide with good activity levels due to warm temperatures and an abundance of prey following spring.  No surveying has been undertaken within the southern Project Area (2SP200046); however findings of the field surveys and habitat modelling indicate areas of higher quality habitat for this species were targeted. A precautionary approach has been adopted in the habitat mapping and the presence of denning and foraging habitat resources has been assumed in areas of potentially suitable habitat.
Reptiles  Adorned delma (Delma torquata)	Draft referral guidelines for nationally listed Brigalow Belt reptiles	Survey techniques The EPBC Act draft referral guidelines for nationally listed Brigalow Belt reptiles (Brigalow Belt reptiles referral guideline) prescribes one-off diurnal searches as the most effective method for detecting this species. This	38 hours over six days of diurnal active searches in December 2020.	Requirement met The species is diurnal, therefore active searches were conducted during the day. Hand searches / active searches were

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	(Department of Sustainability Environment Water Population and Communities, 2011a). Survey guidelines for Australia's threatened reptiles (Department of Sustainability, Environment, Water, 2011b).	<ul> <li>includes active searches of microhabitat for 1.5 hours in each hectare of suitable habitat. A minimum of 3 days with 1 repeat (6 days).</li> <li>The survey guidelines for Australia's threatened reptiles state that pitfall trapping proved to be less effective than rock turning. However, recommends:         <ul> <li>One-off hand searches (including raking through leaf litter) in suitable habitat.</li> <li>Pitfall trapping (during late spring to summer) and funnel trapping, using six 20 litre (L) buckets and funnel traps along a 15m drift fence.</li> </ul> </li> <li>Seasonal considerations         <ul> <li>Previous studies suggest the optimal period for survey is between October and February (warmer conditions), particularly after rain when soil moisture is increased.</li> </ul> </li> <li>Additionally, referral guidelines recommend surveys to be undertaken late September to late March.</li> </ul>	Targeted habitat assessments were conducted for the species throughout the duration of both the June and December 2020 field surveys.	conducted in suitable habitat during December 2020.  Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement search effort.  Following the field surveys and results of the habitat modelling, a total of 920.37 ha of potential adorned delma habitat is estimated to occur within the wider Project Area. All potential habitat is restricted to the western ridgeline. No direct impacts as a result of the Project will occur to the habitat of the western ridgeline and as such recommended survey effort is not required.
Ornamental snake ( <i>Denisonia</i> maculata)	Draft referral guidelines for nationally listed Brigalow Belt reptiles (Department of Sustainability Environment Water Population and Communities, 2011a). Survey guidelines for Australia's threatened reptiles (Department of	Survey techniques  The EPBC Act draft referral guidelines for nationally listed Brigalow Belt reptiles prescribes the following survey methods and effort for the ornamental snake:  One-off diurnal search:  Active searches of microhabitat for 1.5 hours in each hectare of suitable habitat.  A minimum of 3 days with 1 repeat (6 days).  Spotlighting:  1.5 hours in each hectare of suitable habitat.  A minimum of 3 nights.  Pitfall and funnel trapping:  6 x 20L buckets along a 30m drift fence.	<ul> <li>Pitfall and funnel trapping during December 2020 at three sites.</li> <li>24 hours of spotlighting over four nights in December 2020.</li> <li>38 hours over six days of diurnal active searches in December 2020.</li> <li>Targeted habitat assessments were</li> </ul>	Requirements partially met  Targeted surveying was conducted in December 2020, which is likely to be the peak activity season. However, conditions were unseasonably dry and no water was observed in any of the gilgais.  Pitfall and funnel trapping was completed at three sites. At two of the three survey sites, three pitfall buckets were used rather than the recommended six. To supplement the pitfall traps, six funnel traps were installed at each site. At the third trap site, only funnels were used (a total of 12) due to the very hard substrate. The species is likely to be active between

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	Sustainability, Environment, Water, 2011b).	<ul> <li>2 replicates per habitat type, morning and evening checks over 4 days.</li> <li>Opportunistic surveys of roads.</li> <li>The Brigalow Belt reptiles referral guideline states that if the targeted species is not detected using all of the recommended survey techniques, at least one replicate survey should be conducted.</li> <li>Seasonal considerations</li> <li>The ornamental snake is most likely to be encountered by searching in and around suitable gilgai habitats during the evening when frogs are most active, approximately 1–3 days following heavy rainfall (greater than 5 mm), especially thunderstorms (Department of Agriculture Water and the Environment, 2021b).</li> <li>Additionally, referral guidelines recommended surveys to be undertaken late September to late March.</li> </ul>	conducted for the species throughout the duration of both the June and December 2020 field surveys.	sheltering sites at night. As such, spotlighting focused on detecting the presence of the species during this time. Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement search effort.
Yakka skink ( <i>Egernia rugosa</i> )	Draft referral guidelines for nationally listed Brigalow Belt reptiles (Department of Sustainability Environment Water Population and Communities, 2011a).  Targeted species survey guidelines – yakka skink (Ferguson & Mathieson, 2014).	Survey techniques  The EPBC Act draft referral guidelines for nationally listed Brigalow Belt reptiles prescribes the following survey methods and effort for the yakka skink:  One-off diurnal search:  Active searches of microhabitat for 1.5 hours in each hectare of suitable habitat.  A minimum of 3 days with 1 repeat (6 days).  Transects:  Survey effort not specified.  Visual searches using binoculars:  Survey effort not specified.  Elliot traps:	<ul> <li>38 hours over six days of diurnal active searches in December 2020.</li> <li>Colony search transects completed during December 2020 in areas of best habitat.</li> <li>Targeted habitat assessments were conducted for the species throughout the duration of both the June and</li> </ul>	Requirements met  Targeted surveying was conducted in December 2020, which is likely to be the peak activity season. However, conditions were unseasonably dry.  Hand searches / active searches were conducted in suitable habitat. Colony transect searches were also completed during December 2020 in areas identified to provide high quality habitat (the Public Reserve).  The species is diurnal, therefore active searches were conducted during the day. Targeted habitat assessments were conducted across a range of suitable

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	Survey guidelines for Australia's threatened reptiles (Department of Sustainability, Environment, Water, 2011b).	<ul> <li>Used for confirmation only around burrows or colony sites.</li> <li>Cat food used as bait.</li> <li>Camera traps (only around colonies):         <ul> <li>12 camera trap nights per colony over 4 nights.</li> </ul> </li> <li>Funnel traps (only around colonies):         <ul> <li>60 trap nights per colony over 4 nights.</li> </ul> </li> <li>The Brigalow Belt reptiles referral guideline states that if the targeted species is not detected using all of the recommended survey techniques, at least one replicate survey should be conducted.</li> <li>Seasonal considerations</li> <li>Seasonal activity patterns are not well known, however previous surveys/observations of the species suggest that peak activity times are late spring and summer.</li> <li>Additionally, referral guidelines recommended surveys to be undertaken late September to late March.</li> </ul>	December 2020 field surveys.	habitat types during both survey periods (June and December 2020) to supplement search effort.  Following the field surveys and results of the habitat modelling, a total of 1106.53 ha of potential yakka skink habitat is estimated to occur within the wider Project Area, and includes areas within the southern Project Area (2SP200046). No surveying has been undertaken within the southern Project Area. A precautionary approach has been adopted in the habitat mapping and the presence of microhabitat features has been assumed in areas of potentially suitable habitat.
Dunmall's snake (Furina dunmalli)	Draft referral guidelines for nationally listed Brigalow Belt reptiles (Department of Sustainability Environment Water Population and Communities, 2011a) Survey guidelines for Australia's	Survey techniques  The Brigalow Belt reptiles referral guideline prescribes the following survey methods and effort for the Dunmall's snake:  One-off diurnal search: Active searches of microhabitat for 1.5 hours in each hectare of suitable habitat. A minimum of 3 days with 1 repeat (6 days).  Transects: Survey effort not specified. Spotlighting:	<ul> <li>Pitfall and funnel trapping during December 2020 at three sites.</li> <li>24 hours of spotlighting over four nights in December 2020.</li> <li>38 hours over six days of diurnal active searches in December 2020.</li> </ul>	Requirements partially met  Targeted surveying was conducted in December 2020, which is likely to be the peak activity season. However, conditions were unseasonably dry. Hand searches / active searches were conducted in suitable habitat. Although very little is known about the species peak activity and habitat preferences, consequently active day and night searches were conducted across a wide range of habitat types.

Species	Relevant guidelines	Survey guideline requirements	Effort undertaken	Requirements met?
	threatened reptiles (Department of Sustainability, Environment, Water, 2011b)	<ul> <li>1.5 hours in each hectare of suitable habitat.</li> <li>A minimum of 3 nights.</li> <li>Pitfall and funnel trapping:         <ul> <li>6 x 20L buckets along a 30m drift fence.</li> <li>2 replicates per habitat type, morning and evening checks over 4 days.</li> </ul> </li> <li>Opportunistic surveys of roads.</li> <li>The survey guidelines for Australia's threatened reptiles state that all survey methods are likely to yield low returns as reliable survey methods for the species are not known; however, the guidelines recommend:         <ul> <li>Active searching of sheltering sites</li> <li>Pitfall trapping</li> <li>Road driving at night (particularly after wet weather).</li> <li>The Brigalow Belt reptiles referral guideline states that if the targeted species is not detected using all of the recommended survey techniques, at least one replicate survey should be conducted.</li> </ul> </li> <li>Seasonal considerations</li> <li>Seasonal activity patterns are not well known; however, the species appears to be more active from late spring to early autumn and is more likely to be observed moving between sheltering sites on warm nights.</li> <li>Additionally, referral guidelines recommended surveys to</li> </ul>	Targeted habitat assessments were conducted for the species throughout the duration of both the June and December 2020 field surveys.	Pitfall and funnel trapping occurred at three sites. At two survey sites three pitfall buckets were used rather than the recommended six. At each of these sites, six funnel traps were used to supplement the pitfall traps. At the third trap site, only funnels were used (a total of 12) due to the very hard substrate.  Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement search effort.  Following the field surveys and results of the habitat modelling, a total of 1219.55 ha of potential Dunmall's snake habitat is estimated to occur within the wider Project Area, and includes areas within the southern Project Area (2SP200046). No surveying has been undertaken within the southern Project Area. A precautionary approach has been adopted in the habitat mapping and the presence of microhabitat features has been assumed in areas of potentially suitable habitat.
				been assumed in areas of potentially

# 4.4 Aerial imagery and LIDAR assessment

Santos provided AECOM aerial imagery and LIDAR data (ground and non-ground) of the Project Area collected in 2020 to inform initial vegetation and habitat mapping.

Two digital elevation models (DEM) were generated. The first DEM was generated in ESRI GIS software ArcGIS Pro utilising both ground and non-ground LIDAR returns with a 2 m horizontal resolution. The DEM was displayed as point clouds and overlain with the aerial imagery, creating a coloured three-dimensional view of the landscape. Tree density and average vegetation height was able to be determined using this data. Both these attributes allowed for the condition status of woody vegetation to be inferred based on the definitions of remnant vegetation under the VM Act. Historical aerial imagery was also used to assist this determination, particularly when differentiating between HVR and regrowth. HVR was identified from regrowth areas based on the persistence of the vegetation in imagery over the last 15-year period.

To identify and map habitat that is associated with terrain features (i.e. gilgai, creek lines, etc), a second DEM with a 60 centimetre (cm) resolution was generated in Global Mapper from ground-returns only. A hillshade effect (alteration of lighting and shadows based on the location of the sun) was applied to the DEM to enhance the appearance of depth and dimension.

During the December 2020 field survey, vegetation and habitat mapping developed prior was ground-truthed. Following this survey, the characteristics of ground-truthed vegetation communities observable on aerial imagery (shape, colour, landform associations) were applied to identify and map other potential areas of the same vegetation community within the areas of the Project Area that could not be accessed.

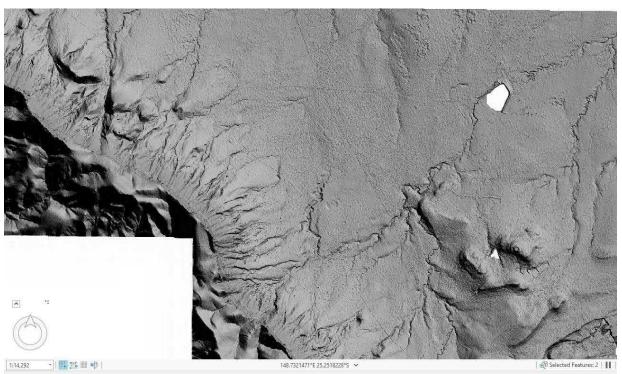


Plate 1 Hillshade effect image - north western extent of lot and plan 2TR13

### 4.5 Likelihood of occurrence

A likelihood of occurrence assessment for MNES communities and species identified during the desktop review was undertaken. Where possible, targeted assessments were undertaken in the field for species identified as either being likely to occur, or having potential to occur, within the Project Area, based on the desktop sources. The methodology was applied again after field surveys and LIDAR assessment to determine the likelihood of occurrence once site-based information became available.

Each species was assessed against the categories defined below.

- Known: Species was positively identified and recorded in the Project Area during the field surveys; or previous, reliable records occur within the Project Area
- **Likely**: Species was not recorded during the field surveys or previously, however there are known records within the nearby surrounding area and suitable habitat exists in the Project Area
- **Potential**: Species was not recorded during the field surveys or previously, however known records occur in the surrounding area and habitat in the Project Area is marginal or degraded
- Unlikely: Habitat in the Project Area might be marginally suitable; however, species was not recorded during the field surveys, and no known records of the species exist within the surrounding area
- No: This is usually applied to marine species or seabirds for terrestrial sites.

# 4.6 MNES mapping

Following the completion of the field survey, the likelihood of occurrence assessment and the aerial imagery and LIDAR assessment, mapping for the MNES values known or having the potential to occur within the Project Area was undertaken.

Where available, information from publicly available databases were used as a basis to develop the 'modelling rules', including relevant species recovery plans (where available), referral guidelines, approved conservation advice, the Species Profile and Threats database (SPRAT), management plans and peer-reviewed journal articles. Habitat assessments collected during the field surveys, species records (previous and survey records), and Project vegetation mapping was used to map the potential habitat according to the modelling rules. These mapping rules, assumptions and GIS approach are detailed in Table 24 of Appendix D.

### 4.7 Impact assessment

MNES known, likely or having potential to occur within the Project Area were subject to a two-step process to assess the potential for significant impacts as outlined in Figure 5 below. The purpose of the two-step approach was to focus in on the key MNES values relevant to potential Project impacts and determine significant impacts. This is particularly relevant for the Project as large areas containing potential MNES within the Project Area will be avoided as per the Protocol (see Section 2.2), which will negate the risk of potential impact.

The first step was a risk assessment, which involved reviewing the nature and magnitude, as well as the worst-case scenario consequences of potential Project impacts. This process considered all Project phases (construction, operation and rehabilitation) as well as the extent, duration and frequency of proposed works.

The findings of the risk assessment indicated the MNES' vulnerability to potential impacts, and whether further assessment via the significant impact assessment process was necessary to determine potential significant impacts.

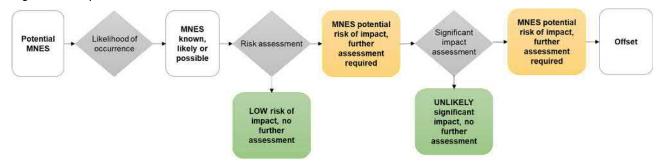


Figure 5 Impact assessment process for potential, likely or known MNES

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#### 4.7.1 Risk assessment

A risk assessment framework was implemented to understand which MNES values may be at risk of potential significant impacts as a result of the Project. Potential direct and indirect Project impacts on MNES within the Project Area were assessed by determining the worst-case scenario consequences and the likelihood of such anticipated consequences actually occurring. The combination of these factors were evaluated via a risk matrix to identify the associated level of Project risk to the MNES.

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

MNES that are evaluated via the risk matrix with a 'potential' risk rating triggered further assessment whilst MNES with a 'low' risk rating required no further assessment. The risk assessment framework, including likelihood and consequence criteria for specific MNES is outlined in Appendix E.

### 4.7.2 Significant impact assessment

For all MNES evaluated with a 'potential' risk rating as a result of the assessment process described in Section 4.7.1, significant impact assessments were undertaken in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance* (Department of the Environment, 2013b). The approach and specific significant impact criteria utilised is outline in Appendix F.

#### 4.8 Limitations

#### 4.8.1 Approach and land access

This assessment has been completed using a combination of field-validated data, desktop information and extrapolated field survey results. As such the results are subject to the level of accuracy and detail associated with this information. Interpretation of LIDAR and aerial imagery was completed visually, and as a result some degree of subjectivity occurs in the mapping completed via this method.

Due to land access restrictions, the southern allotment of the Project Area (lot and plan 2SP200046) was unable to be surveyed. Based on aerial imagery, the allotment contains a high percentage of non-remnant grazing land and vegetation patches in similar condition observed in the northern Project Area. However due to the lack of field validation of this allotment it is possible not all vegetation communities potentially present have been identified. Furthermore, different land management practices are known to occur across the Project Area, which may create variations in the condition of vegetation communities and habitat types that have not been identified for the southern allotment.

To address these limitations, a precautionary approach has been applied. Where potential suitable habitat for MNES, or REs (remnant or HVR condition) analogous to a potential TEC has been identified, presence has been assumed and therefore included in the impact assessment.

#### 4.8.2 Detectability

The general limitations to this ecology assessment conducted in the Project Area include the following:

- Species with large home ranges may not be present in the Project Area-part of their home range during the survey period.
- The difficulty in detecting certain species during the survey period (e.g. cryptic species and species present in the Project Area in low densities).
- Biological factors such as sex, age-class, and breeding biology which may influence species' habitat use and detectability during different times of year.

For those species not detected and with records nearby, habitat assessments were undertaken to determine the value of the Project Area to support such species. The absence of a species was not assumed because it was not detected.

A flora assessment has inherent limitations associated with the variability of vegetation communities across a survey location, and changes to the detectability and presence of species over time. The seasonal condition during which the first survey was undertaken (winter) was not conducive to a high degree of detectable floral diversity. The second survey was conducted in summer, however prolonged dry periods in the months prior to the survey may have limited regeneration, flowering and growth. Furthermore, it is recognised that field studies undertaken over just one season cannot always account for 100% of potential floral diversity present across a survey location.

Field survey data collection to inform mapping was conducted using a hand-held iPad unit with aerial imagery. The accuracy of the iPad is generally <5 m and considered appropriate for the purpose of this assessment.

# 5.0 Ecological values

### 5.1 Regional context

#### 5.1.1 Bioregion and subregion

The Project Area is primarily located within the Central Highlands Regional Council LGA, with small sections of the western ridgeline falling within the Maranoa Regional Council LGA. It is approximately 60 km north east of Injune and within the southern section of the Brigalow Belt Bioregion (BRB). The landscape of this bioregion is mixed, including hilly areas with low ridges and undulating plains within the lower flats and alluvial areas.

Except for some small areas in the south western corner considered part of the Carnarvon Ranges, the Project Area is situated within the Arcadia subregion of the BRB. The eastern, southern and western Arcadia subregion terrain is characterised as rugged on coarse sandstones with *Eucalyptus* spp. and *Corymbia* spp. woodland communities. The central area of the subregion is largely contained within a broad valley of undulating plains. Where clay soils occur, vegetation is dominated by *Acacia harpophylla* (brigalow) and some softwood scrub, and by *Eucalyptus populnea* (poplar box) where soils are alluvial (Sattler & Williams, 1999).

#### 5.1.2 Surface geology and landzones

The DNRME Surat Basin regional surface geological mapping (1974) identified the Project Area to contain five different geology units (Department of Natural Resources Mines and Energy, 2020). Geology units are described in Table 6 below.

Table 6 Major surface geology units mapped within the Project Area

Unit Name	Map Symbology	Age	Lithology Summary	General location within Project Area
Alluvium Q-NSB	Q	Quaternary	Alluvium of older flood plains, sand, gravel, soil	East
Rewan Group	Rr	Early Triassic  – Middle  Triassic	Lithic sandstone, pebbly lithic sandstone, green to redish brown mudstone and minor volcanilithic pebble conglomerate (at base)	Centre
Clematis Group	Re	Middle Triassic	Medium to coarse-grained quartzose to sublabile, micaceous sandstone, mudstone and granule to pebble conglomerate	Western ridgeline (slope)
Moolayember Formation	Rm	Middle Triassic	Micaceous lithic sandstone, micaceous siltstone	Western ridgeline (upper plateau)
Precipice Sandstone	Jp	Early Jurassic	White to brown, poorly sorted, thick-bedded, cross-bedded, fine to very coarse-grained, pebbly quartzose sandstone; minor white to yellowish brown, laminated siltstone (in upper part), carbonaceous shale, lithic sublabile sandstone, granule conglomerate	Western ridgeline (upper plateau)

Land zones are categories that describe the major geologies, the associated landforms and geomorphic processes in Queensland, and are a critical component of the RE classification scheme. Land zones have been delineated across the Project Area based on the available surface geology mapping. Three land zones (Table 7) have been identified and are broadly consistent with the surface geology mapping. Definitions are consistent with (P. R. Wilson & Taylor, 2012).

Table 7 Land zones and associated surface geologies present within the project site.

Land Zone	Description	Associated Geological Unit
3	Recent Quaternary alluvial systems, including closed depressions, paleoestuarine deposits currently under freshwater influence, inland lakes and associated wave built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.	Q, Rm
9	Fine grained sedimentary rocks, generally with little or no deformation and usually forming undulating landscapes. Siltstones, mudstones, shales, calcareous sediments, and labile sandstones are typical rock types although minor interbedded volcanics may occur. Includes a diverse range of fine textured soils of moderate to high fertility, predominantly Vertosols, Sodosols, and Chromosols.	Rr, Re
10	Medium to coarse grained sedimentary rocks, with little or no deformation, forming plateaus, benches and scarps. Includes siliceous (quartzose) sandstones, conglomerates and minor interbedded volcanics, and springs associated with these rocks. Excludes overlying Cainozoic sand deposits (Land Zone 5). Soils are predominantly shallow Rudosols and Tenosols of low fertility, but include sandy surfaced Kandosols, Kurosols, Sodosols and Chromosols.	Rr, Re, Rm, Jp

#### 5.1.3 Climate

The climate of the region is sub-tropical, characterised by warm wet summers and mild dry winters. The nearest Bureau of Meteorology (BOM) station to the Project Area is located south in the township of Injune (station number 043015). Recorded mean maximum daily temperatures are highest from November through to February, ranging from 31.6°C to 33.8°C (BOM, 2020). In winter (June to August) mean minimum daily temperatures are at their lowest, and range from 3.3°C to 4.5°C.

The annual mean rainfall is 631.6 mm, with the wettest period occurring during the months of late spring and summer when, on average, 55% of the annual rainfall occurs.

#### 5.2 Vegetation communities

DES RE mapping (Version 11.0) was reviewed as part of the initial desktop assessment to determine the extent of REs across the Project Area. The Project Area was shown to primarily comprise disturbed non-remnant vegetation, as well as some homogenous and heterogenous polygons within the western ridgeline, Middle Hill and the Public Reserve, analogous to a total of nine REs (Table 8 below). Based on biodiversity status under the *Environmental Protection Act 1994* (EP Act), of the mapped REs two are listed as Endangered (RE 11.9.4a, 11.9.5/11.9.5a), two as Of Concern (RE 11.3.2 and 11.3.25) and the remaining are No Concern at Present. Desktop RE mapping is shown on Figure 6.

Results of the field survey confirmed the dominance of non-remnant grassland generally dominated by *Cenchrus ciliaris* (buffel grass) across the centre of the Survey Area, with occasional small patches of woody vegetation comprising six of the nine mapped REs as well as two additional REs (RE 11.3.1 and 11.10.11) not previously mapped (Table 8 and Table 9). As indicated by the State RE mapping, large areas of remnant vegetation were confirmed to only occur within the western ridgeline, Middle Hill and the Public Reserve.

Findings of the aerial imagery and LiDAR assessment determined the likely occurrence of the aforementioned field-validated REs in remnant, HVR and regrowth forms within the broader Project Area (i.e. outside of the Survey Area). Both RE 11.9.4 and 11.10.1 are known to occur at Middle Hill based on the findings of Terrestria's 2017 assessment however the spatial extent of these communities was delineated using aerial imagery and LiDAR.

The extent, condition, dominant species and conservation significance of each vegetation community field validated and assessed via LiDAR is described below in Table 10, with representative site images (where available). Non-remnant communities recorded during the field surveys are also described. The mapped extent of each vegetation community within the Project Area is shown in Figure 7.

Table 8 Desktop REs within the Project Area confirmed or unconfirmed via field or LiDAR validation

RE ID	Short Description	VM Act Status <sup>1</sup>	Biodiversity status <sup>2</sup>	Field- validated	LiDAR validated
11.3.2	Eucalyptus populnea woodland on alluvial plains	Of Concern	Of Concern	Yes	Yes
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Least Concern	Of Concern	Yes	Yes
11.3.39	Eucalyptus melanophloia +/- E. chloroclada open woodland on undulating plains and valleys with sandy soils	Least Concern	No concern at present	No	No
11.9.4a	Semi-evergreen vine thicket (SEVT)	Of Concern	Endangered	Yes	Yes
11.9.5	Acacia harpophylla and/or Casuarina cristata open forest on fine-grained sedimentary rocks	Endangered	Endangered	Yes	Yes
11.9.5a	Open forest of Acacia harpophylla +/- Eucalyptus populnea, Casuarina cristata, Cadellia pentastylis and Brachychiton spp. on sedimentary rocks	Endangered	Endangered	Yes	No
11.10.1	Corymbia citriodora woodland on coarse-grained sedimentary rocks	Least Concern	No concern at present	No	Based on previous ecological assessment (Terrestria, 2017)
11.10.13 a	Eucalyptus cloeziana +/- E. melanoleuca +/- Corymbia bunites +/- E. sphaerocarpa woodland to open forest	Least Concern	No concern at present	No	No
11.10.4	Eucalyptus decorticans, Lysicarpus angustifolius +/- Eucalyptus spp., Corymbia spp., Acacia spp. woodland on coarse-grained sedimentary rocks	Least Concern	No concern at present	Yes	Yes
Non remnant	Non remnant vegetation	-	-	Yes	Yes

<sup>1</sup> Conservation status of the RE under the VM Act.

Table 9 Additional RE verified within the Survey Area not previously mapped

RE ID	Short Description	VM Act Status <sup>1</sup>	Biodiversity status <sup>2</sup>	Field- validated	LiDAR validated
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	Endangered	Yes	Yes

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

RE ID	Short Description	VM Act Status <sup>1</sup>	Biodiversity status <sup>2</sup>	Field- validated	LiDAR validated
11.10.11	Eucalyptus populnea, E. melanophloia +/- Callitris glaucophylla woodland on coarse-grained sedimentary rocks.	Least Concern	No concern at present	Yes	No

<sup>1</sup> Conservation status of the RE under the VM Act.

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

Table 10 Vegetation communities within the Project Area

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Brigalow low open forest on alluvial plains	HVR 11.3.1	This vegetation community occurs on undulating plains, along shallow and narrow drainage lines within the Survey Area. In the wider Project Area it is also mapped in the northern central area of 2TR13 and eastern extent of 2SP200046.  It comprises a low canopy layer ranging from 7 to 13 m dominated by <i>Acacia harpophylla</i> (brigalow), with <i>Eucalyptus populnea</i> (poplar box) or <i>Eucalyptus melanophloia</i> (silver-leaved ironbark) emergents (height ranging 13 to 17 m). The canopy often also contains <i>Lysiphyllum carronii</i> (red bauhinia). Canopy cover is generally mid-dense, averaging approximately 40 %. The sub-canopy is sparse (average cover 16 %) and also dominated by young brigalow, with <i>Geijera parviflora</i> (wilga) and red bauhinia often co-dominant. A low, often very sparse shrub layer of wilga, <i>Carissa ovata</i> (currant bush) and <i>Alectryon diversifolius</i> (scrub boonaree) is also present. The ground layer coverage is highly variable, ranging from 20 to 60 %. Areas of high cover were due to exotic grasses <i>Cenchrus ciliaris</i> * (buffel grass) and <i>Urochloa mosambicensis</i> * (sabi grass), although native grasses such as <i>Enteropogon ramosus</i> (curly windmill grass) and <i>Aristida sp.</i> were also sometimes present. In addition to the presence of exotic weed species, other disturbances include heavy stock grazing and historical clearing.	E/E	57.41 Ground-truthed: 25.71 Desktop only: 31.70	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Brigalow open forest on alluvial plains	11.3.1	This vegetation community was field-validated to occur in the Public Reserve and in patch along the unnamed tributary of Station Creek (eastern extent of Project Area). In the wider Project Area, scattered patches are considered to occur within 2TR13 while large connected tracts occur within 2SP200046, generally in association with mapped VM Act watercourses.  Vegetation is dominated by brigalow with an average canopy height of 15 m and 35 % cover. Occasional poplar box forms an emergent canopy up to 16 m. A lower sub canopy to 9 m is often present and is composed of younger brigalow with the addition of Atalaya hemiglauca (whitewood) and wilga. A low, variable shrub layer also occurs, generally dominated by native species such as Apophyllum anomalum (broom bush) or Maireana microphylla (cotton bush), with occasional recruited wilga, brigalow, scrub boonaree and Citrus glauca (desert lime). Shrub cover is very sparse at or below 5 %.  The coverage and composition of the ground layer is highly variable. Where this vegetation community occurs in the Public Reserve, cover is low (20 %) and largely comprised of native grasses and forbs including Aristida sp., Eragrostis sp., Enteropogon ramosus (curly windmill grass), Dianella sp. and Lomandra longifolia. In contrast, where it occurs along the unnamed creek, cover is 60 % and dominated by the exotic buffel grass. Disturbances for this vegetation community are limited in some areas, but include historical clearing, weed infestation and grazing.	E/E	157.96 Ground-truthed: 43.90 Desktop only: 114.06	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Eucalyptus populnea +/- Eucalyptus melanophloi a open forest on alluvial plains	11.3.2	This vegetation community was confirmed along a shallow drainage line on low undulating plains at one location within the Survey Area. Within the wider Project Area, it is considered to also occur in two large patches on the eastern boundary and in six patches along a mapped watercourse in 2SP200046.  The canopy is sparse (20 %) and dominated by poplar box with an average height of 16 m. The sub-canopy is dominated by poplar box and brigalow up to 10 m, as well as wilga and red bauhinia up to 6 m. A very sparse (<10%) low shrub layer comprised of the exotic species <i>Maireana microphylla</i> (cotton bush) is also present. The ground layer coverage is mid-dense (35 %) and dominated by the exotic grasses buffel grass and sabi grass. Disturbance due to grazing was found to be severe.	OC/ OC	48.87 Ground-truthed: 24.14 Desktop only: 24.73	
Eucalyptus camaldulensi s riparian woodland	11.3.25	This vegetation community occurs along the unnamed tributary of Station Creek that traverses the Project Area in the east. It is also considered to occur along Arcadia Creek, in the north east of the Project Area.  The canopy is dominated by <i>Eucalyptus camaldulensis</i> (river red gum) with an average height of 22 m. Other species also recorded in the canopy were <i>Corymbia tessellaris</i> (Moreton Bay ash) poplar box and <i>Eucalyptus melanophloia</i> (silver-leaved ironbark). Canopy cover averaged 30%. A sparse (15%) subcanopy layer is present and generally dominated by brigalowup to 10 m. Poplar box, Moreton Bay ash, <i>Acacia salicina</i> (Sally wattle), wilga and red bauhinia were also occasionally recorded	OC / LC	41.97 Ground-truthed: 39.18 Desktop only: 2.79	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
		in the sub-canopy. A very sparse shrub layer (>10%) is present and largely comprises young wilga, red bauhinia, <i>Acacia excelsa</i> (ironwood) up to 2 m, with occasional <i>Maireana microphylla</i> (cotton bush). The ground layer is generally variable with sparse cover (25%) due to cattle grazing. Although native grasses such as <i>Aristida sp.</i> and <i>Bothriochloa bladhii</i> are present, the exotic grasses buffel grass) and sabi grass frequently dominate. The main source of disturbance in this community is historical thinning and cattle grazing, with soil compaction leading to areas of severe stream bank erosion.			
SEVT with brigalow understorey	11.9.4a	Within the Survey Area this vegetation community was confirmed on a steep low hill just north of Middle Hill. In the wider Project Area.  On the low hill, the canopy layer coverage is sparse (15%) and dominated by <i>Acacia harpophylla</i> (brigalow) followed by <i>Geijera parviflora</i> (wilga) with an average height of 5 m. A very sparse (5% cover) emergent canopy is present, dominated by <i>Lysiphyllum carronii</i> (red bauhinia) with occasional <i>Atalaya hemiglauca</i> (whitewood) up to 15 m. The sub-canopy is also very sparse, primarily comprised of wilga with some <i>Brachychiton rupestris</i> (narrow-leaved bottle tree) and <i>Casuarina cristata</i> (belah). The shrub layer is the ecologically dominant layer (EDL) with a cover of 20% recorded. It is dominated by <i>Eremophila mitchellii</i> (false sandalwood) with <i>Croton insularis</i> (silver croton) also frequently occurring. Other species present in the shrub layer include <i>Alectryon diversifolia</i> (scrub boonaree), <i>Carissa ovata</i> (currant bush) and <i>Diospyros humilis</i> (Queensland ebony). The ground layer coverage is sparse (10%) and dominated by the exotic grass <i>Cenchrus ciliaris*</i> (buffel grass). Other ground layer species include <i>Abrus precatorius</i> (crab eye	E/OC	0.71 Ground-truthed: 0.71 Desktop only: 0.0	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
		creeper), Cheilanthes sieberi and Pandorea jasminoides. Exotic weed species, heavy stock grazing and historical clearing are the primary disturbances in this community.			
SEVT	11.9.4	This community was confirmed within the western ridgeline and adjacent to a farm dam in the western extent of Lot 2 plan TR13 during the field survey. This community was also confirmed within Middle hill by Terrestria (2017). This community had a variable mid-dense canopy dominated by either Eucalyptus orgadophila, belah or Brachychiton rupestris. On the lower slopes, this community may be dominated by brigalow in the canopy. Within the western ridgeline, cover provided by the understorey and shrub was mid-dense to dense, and greater than recorded in areas of RE 11.9.4.a likely due to the lack of disturbance in this location (only evidence of fire and some historical thinning).  Due to limited access and topography, understorey species could not be confirmed but are considered likely to include Flindersia collina, Backhousia angustifolia, brigalow, Excoecaria dallachyana and Brachychiton rupestris, with shrub species including Gossia bidwillii, Glossocarya hemiderma, Acalypha eremorum, Croton insularis, Pittosporum spinescens and currant bush. The ground layer is likely dominated by currant bush or Einadia nutans. Although some exotic grasses may occur, their cover will be low.	E/OC	493.96 Ground-truthed: 6.28 Desktop only: 487.68	
SEVT regrowth	HVR 11.9.4	This community occurs on the exterior and lower slopes of the western ridgeline and Middle Hill. Outside of these areas, an additional four small patches are mapped to the north in 2TR13. A review of historical aerial imagery indicates that historical clearing has occurred in these areas, and as such the vegetation is likely to be in HVR condition.	E/OC	42.64 Ground-truthed: 2.12	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
		Areas of this vegetation community are likely to contain canopy vegetation as described above (remnant RE 11.9.4), however cover is likely to be considerably lower. The sub-canopy and shrub layer is likely to be variable although predominately sparse to very sparse, and only contain a fraction of usually occurring species. Exotic grasses such as buffel grass may dominate the ground layer.		Desktop only: 40.52	
Brigalow low open forest on sedimentary rock	HVR 11.9.5	This vegetation community was confirmed to occur in scattered patches on low rises within the Survey Area. In the wider Project Area, scattered patches are also mapped to occur in the western extent, especially within the 2SP200046 property south of Middle Hill.  It has a low canopy dominated by brigalow and occasionally wilga with an average height of 6.5 m. Other species recorded in the canopy include of whitewood, poplar box, <i>Eremophila mitchellii</i> (false sandalwood), red bauhinia and <i>Owenia acidula</i> (emu apple). Canopy cover is generally mid-dense, averaging approximately 37.5 %. An emergent canopy is sometimes present, comprised of poplar box, silver-leaved ironbark or red bauhinia up to 16.5 m. The sub-canopy is sparse (average cover 10 %) and highly variable, dominated by brigalow, wilga, false sandalwood or red bauhinia with heights ranging from 3 to 6 m. A shrub layer is usually absent, although where present is very sparse (>5%) and comprised of currant bush, young brigalow or <i>Clerodendrum floribundum</i> (lolly bush). The ground layer is dominated by the exotic buffel grass and generally sparse (average of 30 %). The native forb <i>Abutilon oxycarpum</i> and other exotic grasses such as <i>Echinochloa colona</i> (barnyard grass) and <i>Megathyrsus maximus</i> (guinea grass) were also present. In addition to the presence of exotic weed species,	E/E	Ground-truthed: 30.02  Desktop only: 36.50	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
		other disturbances include heavy stock grazing and historical clearing.			
Brigalow low open forest with SEVT understorey	HVR 11.9.5a	A single patch of this community was confirmed within the northern Survey Area. Based on the findings of the aerial imagery and LIDAR assessment a single very small additional patch is also mapped in the area.  Brigalow and <i>Cadellia pentastylis</i> (ooline) up to 10 m tall form a sparse canopy. The shrub layer is low and sparse; some areas are taller and generally dominated by wilga with occasional patches of currant bush. The ground layer is sparse to very sparse, and dominated by exotic buffel grass.	E/E	0.48 Ground-truthed: 0.28 Desktop only: 0.20	-
Brigalow open forest on sedimentary rock	11.9.5	This community occurs as scattered patches primarily in the northern Survey Area. Based on the findings of the aerial imagery and LIDAR assessment, it also occurs across the wider Project Area, primarily in the western extent of 2SP200046.  Open forest dominated by brigalow (10-12 m) with an average recorded cover of 60%. A prominent also sparse low tree layer is present and also dominated by brigalow up to 7 m. Occasional ooline, <i>Eucalyptus orgadophila</i> and poplar box occur and form a sparse emergent layer. The shrub layer is sparse and dominated by species such as wilga and <i>Apophyllum anomalum</i> up to 2 m. A lower shrub layer to 0.5 m also occurs in some areas, containing <i>Capparis spp.</i> , <i>Maireana microphylla</i> , currant bush, regrowth brigalow and <i>Apophyllum anomalum</i> . The ground layer is generally very sparse and dominated by the exotic buffel grass with occasional <i>Sclerolaena birchii</i> . Grazing impacts were generally high.	E/E	40.62 Ground-truthed: 2.49 Desktop only: 38.13	

Vegetation Community	RE	Description	BD¹/ VM Act² Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Brigalow open forest on sedimentary rock with SEVT understorey	11.9.5a	This community was confirmed as scattered patches on the undulating plains and low rises of the northern Survey Area. Two small discrete patches are also mapped in the north-western Project Area, based on the findings of the aerial imagery and LIDAR assessment.  Brigalow predominates and forms a fairly continuous mid-dense canopy (average height of 12 m). Brigalow also formed a very sparse lower canopy layer. Other tree species such as poplar box, <i>Cadellia pentastylis</i> (ooline) and <i>Brachychiton rupestris</i> were also recorded in some areas forming part of the canopy or	E/E	11.99 Ground-truthed: 5.42 Desktop only: 6.57	-
		emerging above it. The shrub layer is variable but generally sparse; some areas are taller and dominated by <i>Alectryon diversifolius</i> , while other areas are very low and dominated by currant bush or <i>Citrus glauca</i> . The ground layer is sparse, most frequently dominated by exotic buffel grass but also containing <i>Enteropogon acicularis</i> and <i>Paspalidium caespitosum</i> . Grazing impacts were generally high.			
Corymbia citriodora woodland on coarse- grained	11.10.1	however is expected to occur within Middle Hill based on the	NCAP / LC	2.52 Ground-truthed: 0.00	-
sedimentary rocks		Corymbia citriodora (spotted gum) predominates and forms a distinct but discontinuous woodland (to open forest) canopy (20-30m high). On rocky slopes, Eucalyptus crebra (narrow-leaved ironbark) and C. hendersonii (Henderson's bloodwood) may be scattered throughout the canopy or locally abundant. On flats and footslopes, scattered narrow-leaved ironbark, C. clarksoniana (Clarkson's bloodwood) and Moreton Bay ash may		Desktop only: 2.52	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
		occur. Corymbia trachyphloia (brown bloodwood) and E. cloeziana often occur on crests and plateaus while E. apothalassica and E. longirostrata sometimes occur in moister microhabitats. Scattered tall to low shrubs, such as Acacia leiocalyx, Acacia spp., Bursaria spinosa subsp. spinosa, Persoonia falcata, Alphitonia excelsa, Petalostigma pubescens and Xanthorrhoea johnsonii are usually present and sometimes form a conspicuous layer. The ground layer varies from sparse to moderately dense (depending on the rockiness) and is dominated by perennial grasses.			
Eucalyptus decorticans open forest on sedimentary rock	11.10.4	This vegetation community occurs within the Project Area on fine-grained sedimentary rocks along the steep hill slopes and upper plateaus of the western ridgeline.  The canopy is dominated by <i>Eucalyptus decorticans</i> (gum-top ironbark) with an average height of 22 m. The canopy coverage is mid-dense with 40% recorded. Gum-top ironbark up to 14 m also dominates the sub-canopy. The shrub layer is variable, with very sparse (<10%) areas dominated by <i>Acacia leiocalyx</i> and <i>Pittosporum spinescens</i> up to 2.5 m and mid-dense areas of tall <i>Acacia bancroftiorum</i> primarily where the substrate comprises large rock slabs. Other species present in the shrub layer include currant bush, whitewood and desert lime. The ground layer is dominated by the native grass <i>Arundinella nepalensis</i> with a generally mid-dense cover (30 to 70% recorded). Also common are the native grasses <i>Aristida sp.</i> and <i>Paspalidium sp.</i> , while <i>Enneapogon sp.</i> and <i>Lomandra multiflora</i> occur occasionally. Evidence of disturbance in this community was low, restricted to fire (at least 5 years ago) and limited historical thinning near access tracks and fence lines.	NCAP / LC	840.02 Ground-truthed: 469.38 Desktop only: 370.64	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Eucalyptus moluccana +/- Eucalyptus chloroclada open forest on sedimentary rock	11.10.1	This vegetation community was field-validated within the Project Area on the fine-grained sedimentary rocks of the upper plateaus of the western ridgeline.  The canopy is dominated by <i>Eucalyptus moluccana</i> up to 23 m tall with some areas co-dominated by <i>Eucalyptus chloroclada</i> or <i>Eucalyptus virens</i> . The canopy is mid-dense, with recorded cover ranging from 35 to 55%. Other species occasionally present within the canopy include <i>Eucalyptus crebra</i> , <i>Eucalyptus melanophloia</i> , <i>Corymbia clarksoniana</i> and <i>Corymbia trachyphloia</i> . A sparse sub-canopy of the dominant canopy species up to 12 m is also sometimes present. <i>Allocasuarina luehmannii</i> and occasionally <i>E. molluncana</i> form a sparse lower tree layer (T3); however, this layer is also variable and absent in some areas. The shrub layer is sparse (cover ranging from 10 – 15%) and dominated by <i>Acacia leiocalyx</i> with occurrences of <i>Psydrax sp.</i> . The ground layer is dominated by native perennial grasses however cover was generally very sparse; recent fire activity was evident and likely to have reduced cover significantly. Recorded dominant ground layer species include <i>Aristida sp.</i> and <i>Enteropogon sp.</i> , Other than fire, disturbance within this community was low and restricted to edge effects associated with the few existing tracks adjacent.	NCAP/ LC	81.82 Ground-truthed: 81.82 Desktop only: 0.0	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Ooline stand		This community is restricted to the undulating plains and low hillslopes of the western lot and plan 2TR13, where it occurs as very scattered patches surrounded by cleared pasture. The canopy is sparse to very sparse and contains only <i>Cadellia pentastylis</i> (ooline) up to 14 m tall. Regrowth ooline was also commonly recorded in the lower tree layer, and in some areas was dominant. Patches of this community are generally very small (<0.5 ha) and due to their isolated nature vegetation heath is average to poor as a result of edge effect disturbances.	NA/NR	1.45 Ground-truthed: 1.45 Desktop only: 0.0	
Brigalow and softwood scrub regrowth	-	Patches of largely monotypic regrowth vegetation were observed across the Survey Area, largely beside tracks and along drainage lines. Vegetation was usually dominated by brigalow up to 6 m or <i>Alstonia constricta</i> (bitter bark) up to 7 m which formed a low sparse canopy. Where bitter bark dominated, other softwood scrub species occasionally occurred in the canopy including <i>Acacia fasciculifera</i> , <i>Flindersia collina</i> (leopard ash), <i>Cassia tomentella</i> (velvet cassia) and <i>Petalostigma pubescens</i> (quinine tree). Both brigalow and softwood scrub regrowth had a low and sparse shrub layer of currant bush. The ground layer is dominated by buffel grass although variable in cover, with areas of bare ground common.	NA/NR	204.81 Ground-truthed: 48.20 Desktop only: 156.61	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Farm dams and the Wetland		Semi-permanent waterbodies comprising farm dams occurred in scattered locations across the Survey Area, many of which were associated with mapped watercourses. Waterbodies generally had raised banks on one or two sides, with scattered occurrences of the shrub <i>Maireana microphylla</i> (cotton bush) higher up on the top of the bank the only woody vegetation. Canopy tree species were absent. Ground cover is sparse and is dominated by <i>Cenchrus ciliaris*</i> (buffel grass), but chenopod species, notably <i>Salsola australis</i> (Roly-poly) were also observed on the upper banks. In the low lying areas close to the water's edge, <i>Juncus usitatus</i> (common rush) sometimes formed a small area of uniform ground cover up to 0.5 m. Interspersed with the common rush were scattered <i>Leptochloa digitata</i> (umbrella cane grass). Exotic weeds such as <i>Xanthium pungens</i> (Noogoora burr) and <i>Cirsium vulgare</i> (spear thistle) were also noted in low lying areas forming extensive dense stands. Aquatic flora species are largely absent with <i>Spirodela punctata</i> (thin duckweed) the only species recorded. An unknown green alga was the only other organisms noted within the water. Cattle pugging at the water's edge was a common disturbance in these areas.  The large constructed wetland (the Wetland) adjacent to the Public Reserve is the only waterbody within the Survey Area recorded in moderate condition. The Public Reserve which flanks the eastern side of the wetland restricts cattle access. Areas of low fringing vegetation are largest at this location and generally comprise species recorded at the farm dams. When fully inundated, canopy vegetation within the Public Reserve would also shade low lying areas along the eastern extent of the Wetland. Significant modification has occurred at the far north eastern extent of the Wetland including the installation of embankments.	NA/NR	Ground-truthed: 129.80  Desktop only: 37.83	

Vegetation Community	RE	Description	BD <sup>1</sup> / VM Act <sup>2</sup> Status	Area (ha) (Ground- truthed / Desktop- only)	Image
Other non- remnant vegetation (including cleared pasture)		Large portions of the Survey Area comprise historically cleared and managed cattle pasture dominated by exotic buffel grass. Cover in many areas was very dense due to the restricted access to cattle. Within the northern Project Area (lot and plan 2TR13), occasional stands of planted <i>Leucaena leucocephala</i> formed a very sparse shrub layer. Stands of three to four mature trees (generally poplar box or red bauhinia) also occur sporadically near homesteads and cattle stock yards. Trees were highly isolated and in poor health with canopy dieback and potentially stunted growth. Areas of very low and sparse regrowth brigalow (0.5 – 2 m) also occur largely beside tracks. Although mature trees and regrowth vegetation occurs in this community, vegetation was determined to lack any demonstrable ecological function due to the high level of historical modification and ongoing disturbance.	NA/NR	6,097.4	

<sup>1</sup> Biodiversity (BD) status of the RE based on an assessment of the condition of remnant vegetation in addition to the pre-clearing and remnant extent of a regional ecosystem. NCAP=No Concern at Present; OC=Of Concern; E=Endangered

<sup>2</sup> Conservation status of the RE under the VM Act; NR=Non-remnant; LC=Least Concern; OC=Of Concern; E=Endangered.

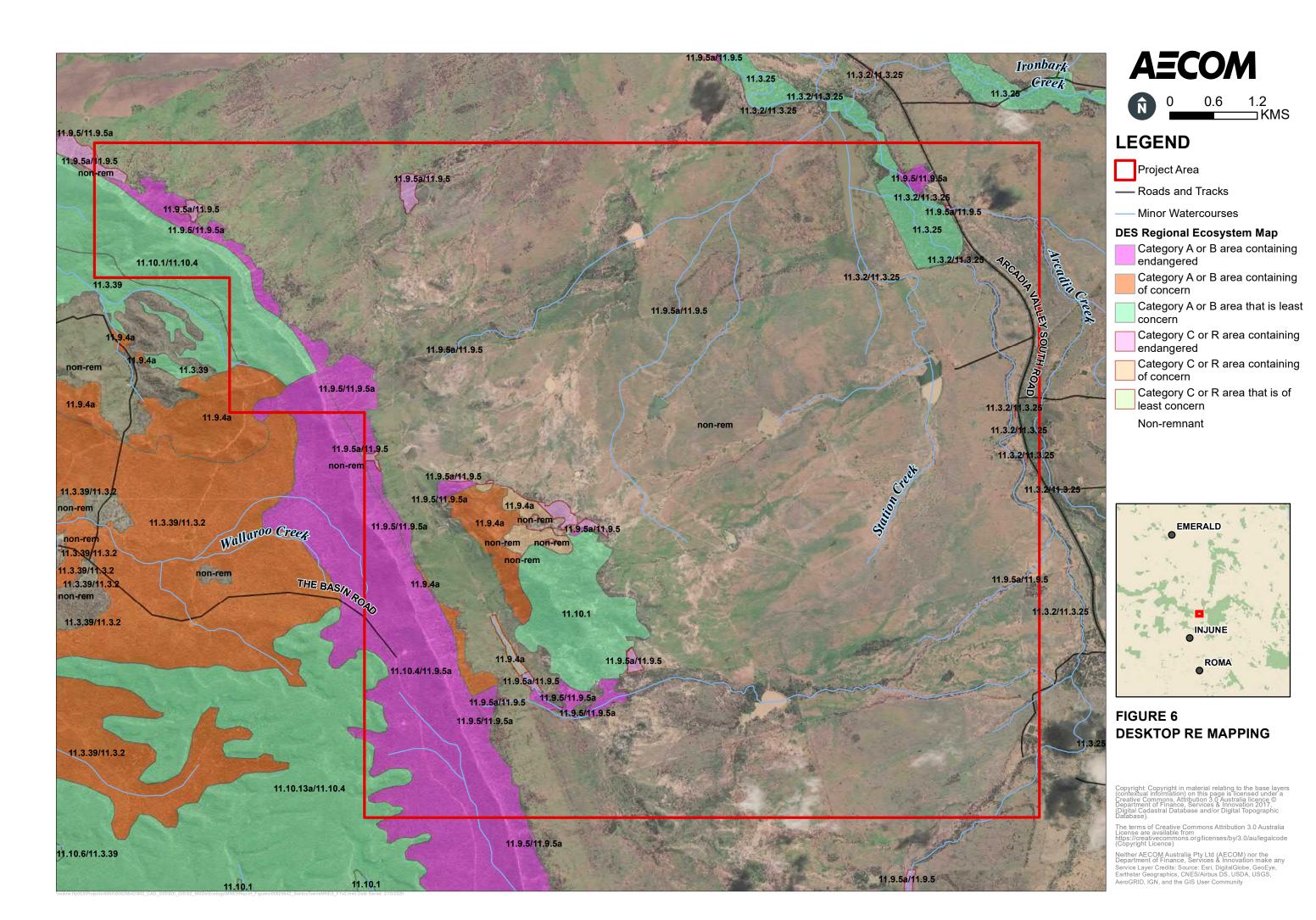
# 5.3 Flora diversity

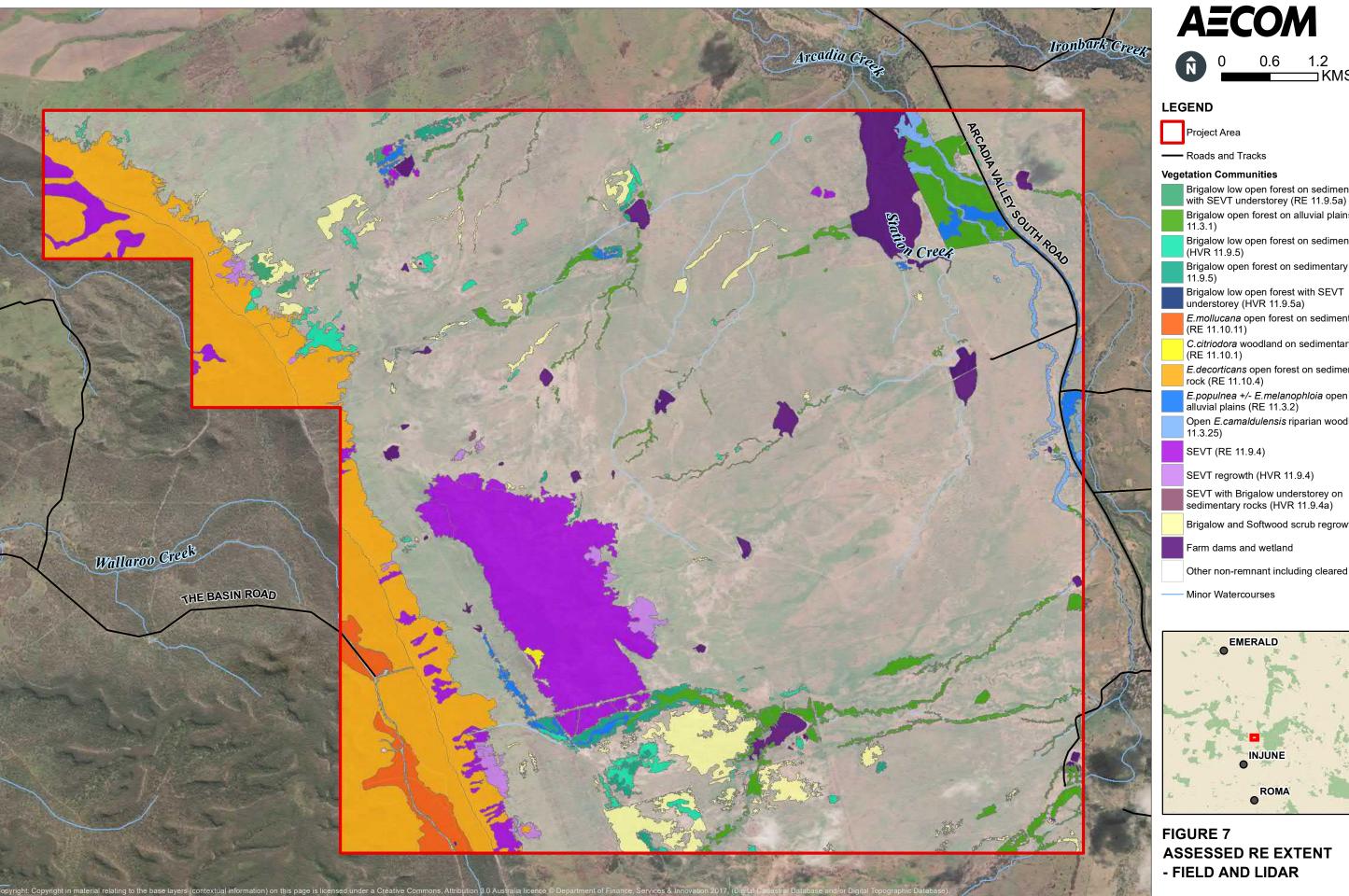
The field survey identified the presence of 93 taxa representing 35 families and 73 genera. Families represented by three or more genera comprised Poaceae (17), Myrtaceae (13), Mimosaceae (9). Genera represented by three or more species comprised *Acacia* (7 species) and *Eucalyptus* (9).

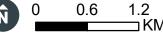
No threatened flora species were identified in the June 2020 survey, however during the December 2020 survey ooline (*Cadellia pentastylis*) was recorded at scattered locations in the northern Project Area (lot and plan 2TR13). The full flora species list is provided in Table 50 of Appendix G.

## 5.4 Introduced flora species

A total of 11 exotic species were recorded from the Project Area during the field survey, including one species which is considered to be a 'Restricted Matters' under the *Biosecurity Act 2014* and a Weed of National Significance (WoNS): *Opuntia tomentosa\** (prickly pear).







- Brigalow low open forest on sedimentary rock with SEVT understorey (RE 11.9.5a)
- Brigalow open forest on alluvial plains (RE 11.3.1)
- Brigalow low open forest on sedimentary rock
- Brigalow open forest on sedimentary rock (RE
- E.mollucana open forest on sedimentary rock
- C.citriodora woodland on sedimentary rock
- E.decorticans open forest on sedimentary
- E.populnea +/- E.melanophloia open forest on alluvial plains (RE 11.3.2)
- Open E.camaldulensis riparian woodland (RE
- - Brigalow and Softwood scrub regrowth
  - Other non-remnant including cleared pasture



# **ASSESSED RE EXTENT**

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# 5.5 Fauna habitat types

The landscape assessed during the survey was generally found to have been significantly altered from its original state due to broad-scale land clearing and cattle grazing. The exception to this being the Public Reserve, Middle Hill, and the western ridgeline, which are all considered to comprise large contiguous tracts of remnant vegetation.

Notwithstanding the aforementioned areas, fauna habitat within the Survey Area was found to occur in disjunct patches of vegetation in regrowth or advanced regrowth form, with remnant areas generally limited and associated with farm dams or mapped watercourses and drainage lines. Fauna habitat that does persist has been subject to disturbance from cattle grazing, selective clearing, weeds and pests. This has led to a general lack of native understorey growth, microhabitat features such as fallen woody debris and reduced structural complexity across the habitats. Despite signs of habitat degradation, several fauna habitat values still exist.

At least nine fauna habitat types are considered to occur within the Project Area based on both field validated data and the LiDAR assessment (Table 11, Figure 8). A description of these communities and the key fauna habitat opportunities is provided below.

Table 11 Fauna habitat types

Habitat No.	Habitat Type	Analogous REs	Area (ha)
1	Brigalow low open forest on alluvial plains and sedimentary rock	HVR 11.3.1, HVR 11.9.5 & HVR 11.9.5a	124.41
2	Eucalypt open woodland on alluvial plains	11.3.2 11.3.25	90.83
3	SEVT	11.9.4 HVR 11.9.4 11.9.4a	536.60
4	Brigalow open forest on alluvial plains and sedimentary rock	11.3.1, 11.9.5 & 11.9.5a	210.57
5	Eucalypt open forest on coarse-grained sedimentary rock	11.10.1, 11.10.4 & 11.10.11	924.36
6	Farm dams and the Wetland	Non-remnant	167.63
7	Gilgai	Non-remnant	132.30
8	Brigalow and soft wood scrub regrowth	Non-remnant	204.81
9	Cleared exotic pasture and other non-remnant	Non-remnant	6,288.56

#### Brigalow low open forest on alluvial plains and sedimentary rock

Within the Survey Area, this habitat commonly occurs as small scattered patches on the undulating plains. Due to a high level of disturbance from ongoing cattle grazing, weeds, thinning and historical clearing, habitat was generally considered low quality.

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No reptiles were recorded in this habitat during the field survey. However, occasional microhabitat features such as stones and rocks, woody debris or small fallen logs and thin leaf-litter cover do occur. Gilgai was not recorded, however outside of the Survey Area gilgai may occur within intact patches that have limited disturbance.

Foraging opportunities for foliage-gleaning and nectar-feeding bird species occur largely as a result of brigalow trees containing flowering and fruiting mistletoe. Mistletoe was common and two different species occurred; one of which was grey mistletoe (Amyema quandang), a known foraging resource of the threatened painted honeyeater (Grantiella picta). Bird species recorded in this habitat were the olive-backed oriole (Oriolus sagittatus), ground cuckoo-shrike (Coracina maxima), apostlebird (Struthidea cinerea) and the bar-shouldered dove (Geopelia humeralis).

Hollow-bearing trees and stags were rare however, indicating nesting opportunities for hollowdependent species are limited.

No mammals were recorded within this habitat type during the field surveys. Small patches of grass in the understory are likely to provide some foraging opportunities for macropods such as the eastern grey kangaroo (Macropus giganteus), however due to the general openness of the understorey minimal sheltering habitat for small ground-dwelling mammals is present.

No amphibians were recorded in this habitat and opportunities for this fauna group are considered limited due to the lack of available water.

#### Brigalow open forest on alluvial plains and sedimentary rock

This habitat occurs in small to moderately sized patches in the northern and southern extents of the Project Area (Plate 2). The largest patch occurs in the Public Reserve where quality is considered high due to the overall lack of historical disturbance, fragmentation, and close proximity to water when the Wetland is inundated. Where this habitat occurs in the southern extent of the Project Area, habitat quality is also likely to be moderate to high quality due to its connected nature.

Microhabitat features such as stones and rocks, woody debris and thin leaf-litter cover are occasional to commonly present and provide some opportunities for reptiles. In the higher quality areas of this habitat (the Public Reserve) where disturbance is limited, these features are more prevalent and other features also occur including decorticating bark suitable for the velvet gecko (Oedura sp.) which was recorded, and medium to large fallen logs potentially suitable for the threatened yakka skink (Egernia rugosa). Soil cracks are rare and no gilgai was recorded, however in other intact areas of this habitat outside of the Survey Area these features may occur.

During the field survey, flowering brigalow trees were frequently observed containing flowering and fruiting mistletoe. Mistletoe was common and two species were recorded, one of which was grey mistletoe, a known foraging resource of the threatened painted honeyeater. These features also provide foraging opportunities for foliage-gleaning bird species such as striated pardalote (Pardalotus striatus) and rufous whistler (Pachycephala rufiventris), and nectar-feeders including the pale-headed rosella (Platycercus adscitus) and spiny-cheeked honeyeater (Acanthagenys rufogularis) which were recorded.

The koala food tree Eucalyptus populnea (poplar box) occasionally occurs within this habitat and may help facilitate koala movement to larger, more suitable patches of habitat (Plate 2). Stags and mature poplar box trees commonly bore small to medium sized hollows, which provide nesting opportunities for hollow-dependent microbats and birds such as parrots and nocturnal species such as owls and nightjars. However, hollow-bearing trees were less common in areas of low open forest comprised of advanced regrowth vegetation.

Small patches of grass in the understory are likely to provide some foraging opportunities for macropods such as the eastern grey kangaroo which was frequently observed. As grass tussocks were generally uncommon, minimal sheltering habitat for small ground-dwelling mammals is present.

Habitat opportunities for amphibians are restricted to the overflow areas of adjacent waterbodies and associated watercourses. The only amphibian recorded during the field survey, the spotted marsh frog (*Limnodynastes tasmaniensis*), was recorded within this habitat.



Plate 2 Brigalow open forest on alluvial plains and sedimentary rock habitat

## Eucalypt open woodland on alluvial plains

This habitat occurs largely as linear patches along or within proximity to watercourses (Plate 3). Although disturbance from weeds, cattle grazing and some stream bank erosion is present, habitat is likely to provide an important corridor for fauna movement across the landscape.

Watercourses associated with this habitat were commonly found to have ponding or slow flowing water, suggesting that water availability is moderate and likely to be greater during the wet season. Such conditions create suitable habitat for a range of common amphibian species. Banks were generally steep however, indicating that habitat is unlikely to be suitable for reptile species such as turtles. Other opportunities for reptiles in this habitat are limited to the occasional woody debris, small to medium fallen logs and small areas of thin leaf litter. No reptiles were recorded in this habitat during the field survey.

Tall, koala food trees dominate the canopy and occasionally had birds such as the black-shouldered kites (*Elanus axillaris*) nesting within. Given the proximity to water, koalas may utilise habitat as refuge when water availability in the landscape is low. Mistletoe was only rarely recorded, nonetheless suitable foraging conditions for a range of nectar-feeding and foliage-gleaning birds occurs. Bird species recorded include the weebill (*Smicrornis brevirostris*), thornbills (*Acanthiza sp.*), brown honeyeater (*Lichmera indistincta*), white-plumed honeyeater (*Lichenostomus penicillatus*) and noisy friarbird (*Philemon corniculatus*). A group of double-barred finches (*Taeniopygia bichenovii*) were also observed drinking from a pool of water.

Hollow-bearing tress (usually *Eucalyptus camaldulensis*) and stags were common. Hollows were generally medium in size and therefore potentially suitable for the threatened greater glider. Despite the relatively open understorey, microbat species such as the threatened south-eastern long eared bat (*Nyctophilus corbeni*) may utilise the flyway created by the creek line and roost in the tree hollows. The areas of grassy ground layer provide dispersal opportunities for small ground-dwelling mammals and foraging opportunities for large mammals such as macropods.



Plate 3 Eucalypt open woodland on alluvial plains

# Semi-evergreen vine thickets

This habitat occurs as scattered patches within the gullies and steep slopes of the western ridgeline and Middle Hill, as well as the low hills in the western extent of the Project Area (Plate 4). Within the western ridgeline, habitat is high quality due to the overall lack of historical disturbance.

Although no birds were recorded during the field survey, a variety of species are likely to utilise the structurally complex vegetation of this habitat for refuge, and forage on the high diversity of flowering and fruiting plants.

Microhabitat features such as woody debris, stones, fallen logs and areas of leaf litter are abundant on the lower slopes and suitable for a range of reptile species including the eastern mulch-slider (*Lerista fragilis*) and the eastern striped skink (*Ctenotus robustus*) which were recorded. Areas of thick leaf litter and rock piles are expected to be common especially in the lower gullies. In the upper slope areas, larger stones and boulders occur and potentially provide denning opportunities for the threatened northern guoll (*Dasyurus hallucatus*).

The ground layer also contained a mid-dense cover of native grasses, which in addition to the shrubby understorey provides refuge and dispersal opportunities for small ground-dwelling mammals such as the exotic house mouse (*Mus musculus*\*) which was recorded under a large stone on the lower slopes.

Larger mammals such as macropods may forage on the native grasses. Opportunities for arboreal mammals however are limited; koala habitat trees and hollow-bearing trees are largely absent.

A number of threatened flora, fauna and migratory species are known to occur in SEVT communities, including ooline, *Bertya opponens*, rufous fantail (*Rhipidura rufifrons*) and northern quoll.



Plate 4 Semi-evergreen vine thickets

### Eucalypt open forest on coarse-grained sedimentary rock

This habitat occurs within the western ridgeline and Middle Hill, largely connected to patches of SEVT habitat. Where assessed, this habitat was found to be of high quality due to the overall lack of disturbance, with only evidence of fire, some weeds and historical thinning observed. Within the western ridgeline especially, this habitat is highly connected to contiguous likely remnant vegetation to the west and north west.

Within the western ridgeline, this habitat provides a variety of shelter / cover opportunities for reptiles and small ground-dwelling fauna including sandstone escarpments, common native grass tussocks, an abundance of medium stones and large boulders, shallow leaf litter and occasional to common fallen logs and decorticating bark (Plate 5). Reptiles recorded within this community include the thick-tailed gecko (*Underwoodisaurus milii*), Bynoe's gecko (*Heteronotia binoei*), fence skink (*Cryptoblepharus virgatus*) and fire-tailed skink (*Morethia taeniopleura*). Given the complexity of the ground layer, this habitat is suitable for multiple threatened brigalow belt reptiles including the yakka skink, adorned delma (*Delma torquata*) and Dunmall's snake. Habitat opportunities for amphibians are limited due to the lack of water resources.

One mammal was recorded within this habitat: the short-beaked echidna (*Tachyglossus aculeatus*) which is listed Special Least Concern under the NC Act. However, given the occurrence of large

boulders and fallen logs, suitable denning and foraging opportunities for the threatened northern quoll also occur. The sandstone escarpments throughout this habitat also provide overhangs and rock crevices suitable for roosting microbat. A cave entrance with roosting microbats was observed in this habitat type during field surveys. As *Eucalyptus sp.* dominates the canopy, this habitat type is also likely suitable for koala. However, large hollow-bearing trees were rare so habitat is not considered suitable for denning for greater glider.

Opportunities for birds within this habitat type include foraging habitat for canopy gleaners and nectar-feeders. As both the western ridgeline and Middle Hill comprise a mosaic of at least two remnant vegetation communities (Eucalypt open forest and SEVT), suitable foraging habitat for the red goshawk (*Erythrotriorchis radiatus*) is present. Small and medium hollows were also recorded in canopy trees and stags, suitable for hollow dependent birds and flying mammals such as the threatened south-eastern long eared bat. Birds recorded in this habitat include the striated pardalote, Lewin's honeyeater (*Meliphaga lewinii*), white-eared honeyeater (*Lichenostomus leucotis*) and rufous whistler.

Within Middle Hill, habitat comprises open forest of spotted gum and narrow-leaved ironbark. Vegetation is likely to have a moderate level of structural complexity with a developed canopy and sparse shrubby understorey. Given the lack of historical disturbance, canopy trees and stags are likely large and hollow-bearing, and the ground layer is likely to contain an abundance of microhabitat features including deep leaf litter, boulders, rock piles and logs. These habitat features indicate suitability for a range of threatened and migratory fauna species, including but not limited to koala, greater glider, red goshawk, south-eastern long-eared bat and adorned delma.



Plate 5 Eucalypt open forest on coarse-grained sedimentary rocks

#### Brigalow and softwood scrub regrowth

Within the Survey Area, scattered patches of young brigalow regrowth of up to 6 m and softwood scrub regrowth (generally dominated by bitter bark) up to 7 m occur. Within the Survey Area (specifically lot and plan 2TR13), large areas of brigalow regrowth occur primarily on lower rises in the western extent with smaller patches generally associated with shallow drainage lines and tracks.

Habitat opportunities for fauna was found to be generally limited (Plate 6). Refuge for reptiles and small ground-dwelling mammals is provided by the grassed ground layer with occasional small stones. As clay-based soils occur across the Survey Area, intact brigalow regrowth areas that have limited disturbance may also contain gilgai microrelief habitat suitable for the threatened ornamental snake. Areas of gilgai microrelief that were field validated within this habitat type were found to be heavily disturbed by cattle. Abundance of soil cracks and fallen woody debris was lower and a greater incursion of exotic grasses was noted within the gilgai. Gilgai depth varied with only a few areas supporting deeper gilgai that would retain water for longer periods of time.

The structurally short and dense brigalow and softwood scrub regrowth vegetation may also provide suitable refuge and dispersal for some small birds such as fairy-wrens, and the threatened squatter pigeon (southern) (*Geophaps scripta scripta*).



Plate 6 Regrowth habitat

## Gilgai

Following review of the pre-clear RE mapping, aerial imagery and LiDAR DEM, areas of gilgai habitat were mapped within the Project Area. In the eastern extent of the 3TR12 property, two areas of gilgai occur within approximately 200 m of each-other, covering a combined area of approximately 103.06 ha. This area was assessed by Terrestria in March 2021 and was found to be in a highly degraded state due to exotic grass incursion (buffel grass) and ongoing cattle grazing within and surrounding. In addition, recent blade ploughing was also observed across the area, which had caused significant ground disturbance to the gilgai landforms (Appendix H). Anecdotal evidence indicates that this particular lot is frequently managed using this method. As a result, any habitat features that may have occurred in this area, such as soil cracks and other microhabitat that are important habitat features for ornamental snake, are no longer present. Based on this and the lack of connectivity to other areas of potential habitat in the Project Area, the area of ploughed gilgai is not considered potential ornamental snake habitat. Blade ploughing is a common land management practice in areas previously dominated by Brigalow vegetation communities and it is often undertaken routinely.

Another six patches of gilgai habitat occur to the north within lot and plan 2TR13 and one to the south within lot and plan 2SP200046. These areas of habitat are considerably smaller and associated with young regrowth brigalow. Within lot and plan 2TR13, these areas were also found to be highly disturbed due to historical clearing and exotic grass incursion. Abundance of soil cracks and fallen woody debris was also generally found to be low.

The onset of early wet season rains is generally expected to trigger the breeding of burrowing frogs and other species within the gilgai. The available water, tadpoles and frogs are expected to attract a diversity of predators including birds, reptiles and ground-dwelling mammals. However due to the level of disturbance and ongoing pasture management practices (i.e. blade ploughing), all areas of gilgai habitat within the Project Area are considered marginally suitable for the Australian painted snipe (Rostratula australis), listed endangered under the EPBC Act.

#### Farm dams and the constructed wetland

A total of 36 artificial lacustrine waterbodies (as defined by the Queensland DES wetland area mapping) in the form of farm dams occur in scattered locations within the Project Area. Within the Survey Area, some farm dams were very small in size and generally had minimal fauna habitat value due to the steep man-made banks, extensive cattle pugging at the water's edge and little to no aquatic or canopy vegetation. Common ducks such as the grey teal (Anas gracilis) and Pacific black duck (Anas superciliosa) were frequently recorded at these locations.

Elsewhere, the farm dams were larger and associated with watercourses and drainage lines (Plate 8). These dams usually had raised banks on one or two sides and were also regularly accessed by cattle. However, small areas of wetland vegetation were commonly present on the low-lying fringes and riparian zones of the associated drainage line, providing refuge and foraging opportunities for species such as the white-necked heron (Ardea pacifica), black swan (Cygnus atratus), black-fronted dotterel (Elseyornis melanops), Australasian grebe (Tachybaptus novaehollandiae) and masked lapwing (Vanellus miles), all of which were recorded in low numbers. Cattle disturbance is still present at these farm dams, including pugging at the water's edge as well as sedimentation and reduced water quality.

The constructed wetland located adjacent to the Public Reserve (the Wetland) in the north east of the Project Area, provides higher quality wetland habitat for a variety of fauna species. This constructed wetland is expansive during the wet season, and one of largest in the local valley area indicating that it is likely to be an important resource throughout the year. Undisturbed brigalow open forest vegetation flanks a large portion of the wetland's eastern boundary, providing dispersal and refuge for grounddwelling mammals and reptiles that access the wetland to drink. Tall trees provide perching opportunities for raptors foraging over the water.

Despite its relatively good condition, the Wetland is regularly accessed by the landholder of lot and plan 2TR13 as an agricultural water source. This combined with natural fluctuation in water levels during the dry season results in high variations in the wetland extent (Plate 7).





Plate 7 Constructed wetland extent fluctuations (left 2020, right 2021)

Considerable modification of the Wetland has also occurred historically. The entire western length was previously cleared and extensive damming works including the construction of an embankment has occurred at the north eastern extent. Outside of the embankment, the banks of the wetland are gentle slopes and large areas of shallow water with aquatic fringing vegetation occur especially in the south. Constructed embankments within the constructed wetland also provide narrow, low-lying vegetated islands when the wetland is fully inundated. These areas specifically are likely to provide ideal foraging conditions for wetland birds including the EPBC Act listed endangered Australian painted snipe and migratory Latham's snipe. Exposed muddy margins are minimal at the wetland and the area is not considered to support mudflat areas that could be used by wader bird species.

A diversity of bird species, some of which in moderate numbers, were recorded at the Wetland including: the Australasian darter (*Anhinga novaehollandiae*), eastern great egret (*Ardea alba modesta*), emu (*Dromaius novaehollandiae*), white-bellied sea eagle (*Haliaeetus leucogaster*), black-winged stilt (*Himantopus himantopus*), Australian pelican (*Pelecanus conspicillatus*), red-necked avocet (*Recurvirostra novaehollandiae*), pink-eared duck (*Malacorhynchus membranaceus*), unidentified tern, black swan, white-necked heron and masked lapwing. During the December 2020 field survey, a total of six migratory glossy ibis (*Plegadis falcinellus*) were also recorded.



Plate 8 Large farm dam

## Other non-remnant vegetation (cleared pasture and cropping)

Other non-remnant vegetation (cleared pasture and cropping) as a result of historical clearing, cattle grazing and fodder cropping (*Leucaena leucocephala*) covers large areas in the centre, as well as smaller areas in the north and south Project Area.

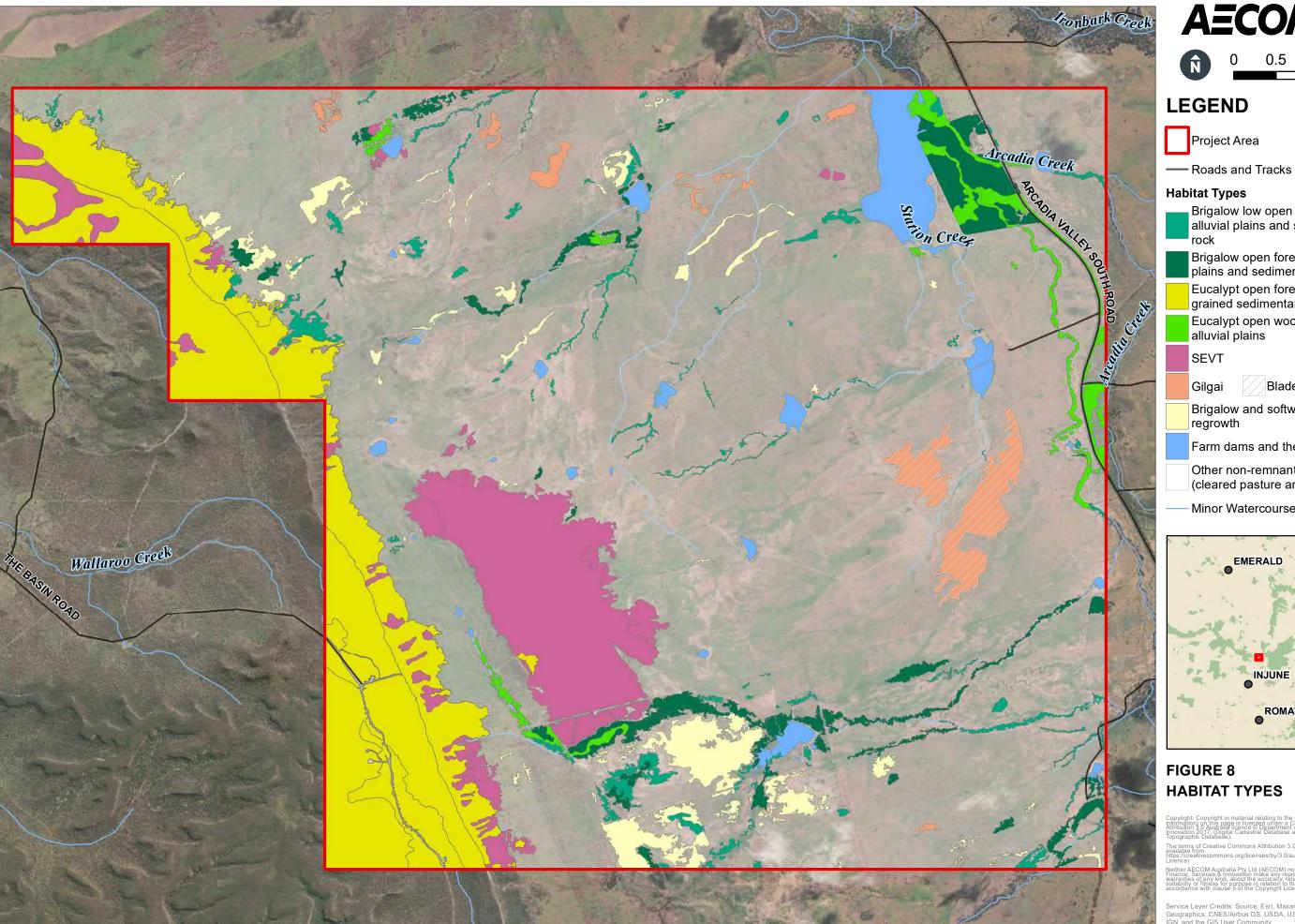
Habitat values in this community were limited but included rare small stands of mature trees, some sparse shrubby *Leucaena* and an abundance of exotic grass in the ground layer where grazing had been restricted (Plate 9). Microhabitat features in the ground layer were largely absent, and limited to

occasional medium stones on the low hills. Mature trees in this habitat type were in poor health, had varying degrees of canopy dieback and lacked habitat features such as hollows. Due to this, and the lack of shade that these trees would provide, no trees are considered shelter trees suitable for koala.

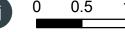
Cleared pasture and cropping may provide some dispersal opportunities for commonly occurring small mammals and reptiles. Small birds such as fairy-wrens may use the *Leucaena* for refuge. Raptors, granivorous birds and larger mammal species such as the eastern grey kangaroo were also observed foraging in this habitat. Habitat values provided are not sufficient to support any MNES fauna values due to the high levels of ongoing disturbance, agricultural practices such as blade-ploughing and cattle grazing and dominance of exotic flora.



Plate 9 Exotic pasture



# **AECOM**



- Brigalow low open forest on alluvial plains and sedimentary
- Brigalow open forest on alluvial plains and sedimentary rock
- Eucalypt open forest on coarse-grained sedimentary rocks
- Eucalypt open woodland on alluvial plains

Blade plouged gilgai

Brigalow and softwood scrub

Farm dams and the Wetland

Other non-remnant vegetation (cleared pasture and cropping)

Minor Watercourses



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# 5.6 Fauna diversity

The field survey recorded a total of 147 fauna species including 99 birds, 25 mammals, 17 reptiles and 6 amphibians. Two recorded species are considered conservation significant due to their listing under the EPBC Act:

- Glossy ibis; Migratory under the EPBC Act
- Large-eared pied bat; Vulnerable under the EPBC Act.

#### 5.6.1 Birds

Birds were the primary fauna group observed throughout the survey. A total of 99 bird species were recorded.

A variety of nectar-feeding birds (honeyeaters and parrots) were recorded in the Eucalypt woodland and brigalow open forest habitats of the Survey Area, with the high level of activity likely the result of flowering Acacia trees and generally abundant and flowering mistletoe. Honeyeaters were especially common, with ten species recorded including the spiny-cheeked honeyeater, blue-faced honeyeater (*Entomyzon cyanotis*), brown honeyeater, white-eared honeyeater (*Lichenostomus leucotis*), white-plumed honeyeater, singing honeyeater (*Lichenostomus virescens*), yellow-throated miner (*Manorina flavigula*), Lewin's honeyeater, little friarbird (*Philemon citreogularis*) and noisy friarbird. Parrot species were generally less abundant and included the pale-headed rosella, rainbow lorikeet (*Trichoglossus haematodus*), Australian king parrot (*Alisterus scapularis*) and red-winged parrot (*Aprosmictus erythropterus*).

Small woodland birds, including weebills, striated pardalotes and thornbills (*Acanthiza sp.*) were restricted but relatively common within the Eucalypt woodland habitat on alluvial plains. Other small birds, including finches (*Taeniopygia* spp.) and fairy-wrens (*Malurus* spp.) occurred in the regrowth brigalow, brigalow woodlands, Eucalypt-dominated woodland and in disturbed fringes however their occurrence was generally low.

Other more disturbance tolerant bird species were recorded across the Survey Area, including the apostlebird, pied butcherbird (*Cracticus nigrogularis*), magpie lark (*Grallina cyanoleuca*) and crested pigeon (*Ocyphaps lophotes*).

Raptors were also relatively abundant within the Survey Area and surrounds, primarily observed perching in canopy trees or foraging in the cleared pasture areas and along Arcadia Valley Road directly adjacent to the Project Area. Ten species were recorded including the wedge-tailed eagle (*Aquila audax*), spotted harrier (*Circus assimilis*), black-shoulder kite, brown falcon (*Falco berigora*), nankeen kestrel (*Falco cenchroides*), Australian hobby (*Falco longipennis*), peregrine falcon (*Falco peregrinus*), white-bellied sea eagle, whistling kite (*Haliastur sphenurus*) and black kite (*Milvus migrans*).

A range of waterbird species are supported by the presence of multiple farm dams and the Wetland. Species such as the pacific black duck, masked lapwing, grey teal and Australian wood duck (*Chenonetta jubata*) were frequently recorded across all the different water sources, while others such as the pink eared duck, eastern great egret, great crested grebe (*Podiceps cristatus*), black-winged stilt, red-kneed dotterel (*Erythrogonys cinctus*), black-fronted dotterel were rare occurrences and located only at the higher quality waterbodies or the Wetland. In particular, approximately six glossy ibis individuals, which are listed as migratory under the EPBC Act were observed foraging within the southern shallow areas of the Wetland (lot and plan 2TR13).

#### 5.6.2 Mammals

Excluding introduced species, a total of twenty-five mammal species were recorded during the field surveys. Microbat species, which were recorded only during the December 2020 survey using unattended call detectors within the northern Project Area (lot and plan 2TR13), comprise almost 70% of total mammal diversity. Seventeen microbat species were positively identified via call analysis by Greg Ford, including the threatened large-eared pied bat and *Nyctophilus sp.* (whose calls cannot be differentiated further). The large-eared pied bat was recorded on three separate nights during the December 2020 field survey within the following habitat types:

Eucalypt open forest on coarse-grained sedimentary rocks (lower western ridgeline)

• Brigalow open forest on alluvial plains and sedimentary rock (lower slopes of the western ridgeline and north of the western farm dam).

Calls from the *Nyctophilus* genus that may potentially include the threatened south-eastern long-eared bat were recorded on all four nights during the December 2020 field survey within four habitat types including:

- Eucalypt open forest on coarse-grained sedimentary rocks (lower western ridgeline)
- Eucalypt open woodland on alluvial plains (Public Reserve)
- Brigalow open forest on alluvial plains and sedimentary rock (lower slopes of the western
- SEVT (adjacent to the western farm dam).

Three additional common microbat species may also occur, however these could not be confirmed due to variations in the recorded call signature.

Despite the 24 person-hours of spotlighting, macropods were the most commonly observed mammal, generally seen foraging in the tall grass of the other non-remnant vegetation within the Survey Area and along Arcadia Valley Rd directly adjacent. Five macropod species were recorded including the rufous bettong (*Aepyprymnus rufescens*), eastern grey kangaroo, whiptail wallaby (*Macropus parryi*), common wallaroo (*Macropus robustus*) and the red-necked wallaby (*Macropus rufogriseus*). The only arboreal mammal recorded was the common brushtail possum (*Trichosurus vulpecula*), observed in the Eucalyptus open woodland on alluvial plains of the Public Reserve during spotlighting. It was also determined to occur within the connecting brigalow open woodland on alluvial plains habitat based on indirect evidence (a skull).

One mammal recorded, the short-beaked echidna (*Tachyglossus aculeatus*) is listed Special Least Concern under the NC Act however not listed under the EPBC Act.

### 5.6.3 Reptiles and amphibians

Eight reptile species and one amphibian species were recorded during the field survey. The single amphibian recorded was the spotted marsh frog, which was heard along a grassy drainage line connecting to a farm dam.

Of the eight reptiles recorded five were skinks and three were geckos. The chain-backed dtella (*Gehyra catenata*) and Arcadia velvet geckos were located on the furrowed bark of brigalow trees within the brigalow open woodland habitat while the Bynoe's gecko was located under a rock in the Eucalyptus open forest habitat of the western ridgeline. Recorded skinks also occurred within these habitats, and include the elegant snake-eyed skink (*Cryptoblepharus pulcher*), fence skink, eastern striped skink (*Plate 10*), eastern mulch-slider and fire-tailed skink.



Plate 10 Eastern striped skink (Ctenotus robustus)

# 5.7 Introduced fauna species

A total of seven introduced fauna species were recorded during the field surveys, four of which are listed as restricted matters under the Biosecurity Act:

- European rabbit (Oryctolagus cuniculus\*) Listed as a category 3, 4, 5, 6 restricted matter
- Dingo/dog (Canis lupus\*) Listed as a category 3, 4, 5, 6 restricted matter
- Feral cat (Felis catus\*) Listed as a category 3, 4, 6 restricted matter
- House mouse (Mus musculus\*)
- Cane toad (Rhinella marina\*)
- Common myna (*Sturnus tristis*\*)
- Pig (Sus scrofa\*) Listed as a category 3, 4, 6 restricted matter.

Other introduced fauna species restricted under the Biodiversity Act are likely to occur within the Project Area including the European fox (*Vulpes vulpes\**) and black rat (*Rattus rattus\**).

# 5.8 Wetlands and watercourses

Wetland mapping reviewed as part of the desktop assessment included the DES Queensland Wetland mapping, MSES High Ecological Significance (HES) wetland mapping and Vegetation management wetland mapping. VM Act watercourse mapping was also reviewed.

The Project Area contains several watercourse features recognised under the VM Act, with stream orders ranging from one to five. Arcadia Creek is the highest order watercourse (stream order 5) within

the Project Area, but traverses only a small section of the Public Reserve in the north-eastern corner before exiting to the north. From the centre of the Project Area, six watercourses (stream order 1) traverse north east (all unnamed except Station Creek) towards Arcadia Creek. These watercourses are associated with five of the larger wetlands within the Project Area. The largest wetland in the north east of the Project Area (the Wetland) is the confluence of these watercourses including Station creek (stream order 3).

From two sources below the western ridgeline, a single unnamed watercourse (stream order 2) converges in the southern Project Area (2SP200046) and travels directly east before exiting the Project Area. This watercourse then re-enters the Project Area from the centre of the eastern boundary and flows north through the Public Reserve and into the Wetland.

The Wetland, located on lot and plan 2TR13, is approximately 1.5 km long and 1 km wide and at least double the size of other farm dams within the Project Area. It is flanked by remnant brigalow open forest along large portions of the eastern length and contains narrow linear vegetative islands as well as muddy margins with low fringing vegetation on the southern boundary. Further information regarding the habitat values associated with this constructed wetland are discussed in Section 5.5. The Wetland as well as nine other farm dams (generally the largest waterbodies within the Project Area) are considered lacustrine artificial wetlands as per the Queensland Wetland mapping (waterbody data). Mapped vegetation associated with the Public Reserve, the unnamed watercourse along the eastern boundary and areas east of Arcadia Valley Road are considered riverine wetland systems.

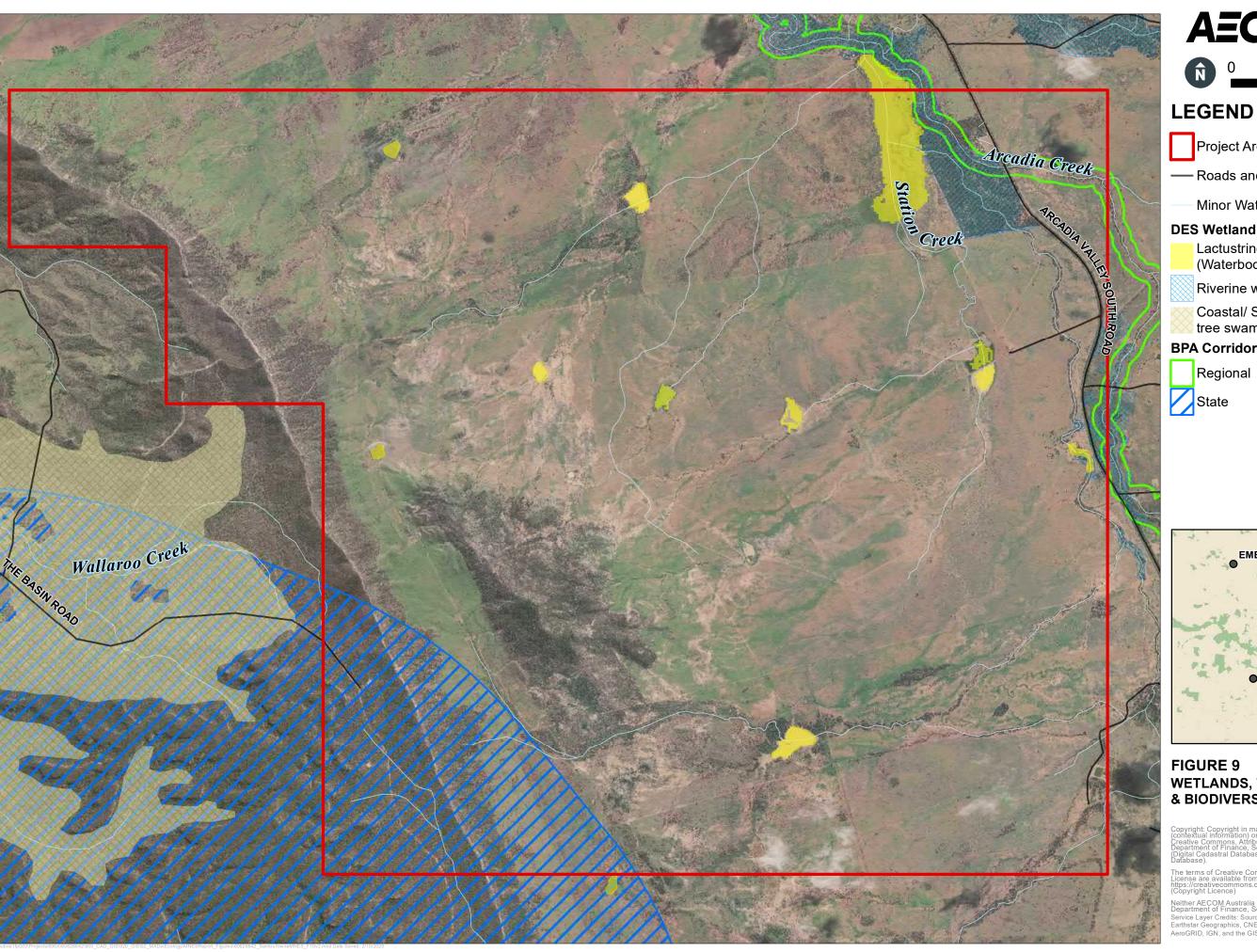
No waterbodies within the Project Area are mapped VM Act wetlands or HES wetlands. Based on aerial imagery a number of smaller, farm dams also occur within the Project Area although not identified in wetland mapping. Wetlands and watercourses within the Project Area are shown on Figure 9.

# 5.9 Landscape connectivity

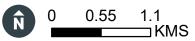
A review of DES BPA corridor mapping identified Regional and State and local-level biodiversity areas occur within the Project Area (see Figure 9). In the south-eastern extent of the Project Area, a state significant corridor occurs in association with the western ridgeline and adjacent Carnarvon Ranges. A regionally significant corridor is mapped along Arcadia Creek, although only a small portion of this falls within the north east Project Area.

Fauna movement in the centre of the Project Area is largely restricted due to the lack of woody vegetation as a result of broad-scale land clearing. Although not identified in the DES BPA mapping, narrow riparian vegetation associated with the mapped watercourses (especially the unnamed tributary of Station Creek) provide the only movement opportunities for fauna across the landscape and are therefore highly important. Although disturbed, vegetation associated with these watercourses provides connection to areas of higher quality habitat including the Wetland and Public Reserve in the north east, as well as Middle Hill in the south west of the Project Area. Connectivity between Middle Hill and the western ridgeline is limited, restricted to small fragmented patches of vegetation that would provide only 'stepping stone' movement opportunities.

Due to their high level of connectivity, linear vegetation patches east and west of Arcadia Valley Road are also considered important for the movement of fauna within the valley due to the overall high level of broadscale clearing in adjacent areas.



# **AECOM**



Project Area

— Roads and Tracks

Minor Watercourses

# **DES Wetland Mapping**

Lactustrine wetland (Waterbody based)

Riverine wetland (RE based)

Coastal/ Sub-coastal floodplain tree swamps (RE based)

# **BPA Corridors**

Regional



# FIGURE 9 WETLANDS, WATERCOURSES & BIODIVERSITY CORRIDORS

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Finance, Services & Innovation make any Service Layer Credits: Source: Esri, DigitalGiobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# 6.0 MNES likelihood of occurrence

# 6.1 World heritage properties

The PMST report generated for the Project determined there are no world heritage properties within proximity to the Project Area.

# 6.2 National heritage places

The PMST report generated for the Project determined there are no national heritage places within proximity to the Project Area.

# 6.3 Wetlands of international importance (RAMSAR)

The PMST report generated for the Project determined there are no wetlands of international importance within proximity to the Project Area.

#### 6.4 Great Barrier Reef Marine Park

The Great Barrier Reef marine park is not located within proximity to the Project Area.

#### 6.5 Commonwealth marine area

The Project Area is sufficiently distant from any commonwealth marine areas.

# 6.6 Listed threatened ecological communities

A review of the PMST report generated for the Project determined that five EPBC Act listed TECs potentially occur within the Project Area. Of these five communities, REs associated with four are considered present within the Project Area and are discussed further in the sections below (Table 12).

The 'Coolibah – Black box woodlands of the Darling Riverine Plains and the Brigalow Belt south bioregions' TEC is considered unlikely to occur within the Project Area based on results of the field surveys during which *Eucalyptus coolabah* or any of the listed analogous REs were not recorded *Acacia pendula* was not recorded during the field survey and no publicly available records occur within 50 km of the Project Area. As such, the 'Weeping myall woodlands' TEC is also considered unlikely to occur within the Project Area.

Table 12 EPBC listed TECs and associated REs

EPBC Act TEC	EPBC Act status	Analogous REs in BRB	Analogous REs mapped within Project Area?
Brigalow (Acacia harpophylla dominant and co-dominant) (Brigalow)	Endangered	11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21.	Yes: 11.3.1, 11.9.5 & 11.9.5a
Coolibah – Black box woodlands of the Darling Riverine Plains and the Brigalow Belt south bioregions	Endangered	11.3.3, 11.3.15, 11.3.16, 11.3.28, 11.3.37	No
Poplar box grassy woodlands on alluvial plains (Poplar box)	Endangered	11.3.2, 11.3.17, 11.4.7, 11.4.12.	Yes: 11.3.2
Semi-evergreen vine thickets of the Brigalow Belt (north and south) and Nandewar bioregions (SEVT)	Endangered	11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.13, 11.8.3, 11.8.6, 11.9.4, 11.9.8, 11.11.18,	Yes: 11.9.4 & 11.9.4a

EPBC Act TEC	EPBC Act status	Analogous REs in BRB	Analogous REs mapped within Project Area?
Weeping myall woodlands	Endangered	11.3.2, 11.3.28.	Yes: 11.3.2*

<sup>\*</sup> RE 11.3.2 is an analogous where weeping myall (*Acacia pendula*) trees are present. Weeping myall was not recorded during the field survey including within adjacent road reserves.

# 6.6.1 Brigalow TEC

Within the Survey Area, the assessment of brigalow patches was completed in accordance with the Conservation Advice (Department of the Environment, 2013a) and determination of each patch was assessed against key diagnostic criteria and condition thresholds as described below in Table 13. A total of 107.81 ha of RE 11.3.1, 11.9.5 and 11.9.5a (HVR or remnant) was ground-truthed during the field survey, and of this total area only 38.77 ha was determined to be Brigalow TEC. While all assessed patches met the key diagnostic criteria, the majority did not meet at least one condition threshold (generally found to have greater than 50% cover of exotic perennial weeds (namely buffel grass) in the ground layer).

Within the wider Project Area, the findings of the LiDAR assessment indicated the occurrence of additional areas of RE 11.3.1, 11.9.5 and 11.9.5a in both HVR and remnant condition. Given no field validated data for these areas is available, all patches greater than 0.5 ha that were considered intact and functional (i.e. not an isolated patch or very narrow patch) were conservatively assumed to meet key diagnostic criteria and condition thresholds (an additional 214.88 ha). Patches that occur on the boundary of the Project Area that may actually be larger due to connecting areas adjacent were also assessed, however none that were not already considered potential TEC were located. A breakdown of the vegetation considered to comprise brigalow TEC is provided below in Table 13.

Expansive areas of brigalow regrowth were also identified within the Project Area, however due to the young age of these communities and dominance of buffel grass in the surrounding vegetation, these were considered unlikely to meet the Brigalow TEC condition thresholds.

Table 13 Key diagnostic characteristics and condition thresholds for the brigalow TEC

Criteria	Criteria met	Criteria not met	
Key Diagnostic Criteria			
The presence of Acacia harpophylla as one of the most abundant tree species in the patch. A. harpophylla is either dominant in the tree layer, or co-dominant with other species (notably Casuarina cristata, other species of Acacia, or species of Eucalyptus.)	334.98 ha (210.57 ha of remnant and 124.41 ha of HVR)	0.0 ha	
In Queensland, the patch is in one of the following Queensland bioregions (including outliers) and it meets the description of one of 16 Queensland REs prescribed:  Brigalow Belt Bioregion: REs 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21.  Southeast Queensland Bioregion: REs 12.8.23, 12.9-10.6, 12.12.26.  Mulga Lands Bioregion: RE 6.4.2.			
Condition Thresholds			
The patch is 0.5 ha or more in size.	253.65 ha (189.69 ha	81.33 ha	
Exotic perennial plants comprise less than 50 % of the total vegetation cover of the patch, as assessed over a minimum sample area of 0.5 ha (100 m by 50 m), that is representative of the patch.	of remnant and 63.97 ha of HVR)		

# 6.6.2 Poplar box TEC

Within the Survey Area, the assessment of poplar box patches was completed in accordance with the Conservation Advice (Department of the Environment and Energy, 2019a) and determination of each patch was assessed against key diagnostic criteria and condition thresholds as described below in Table 14.

A total of 25.78 ha of RE 11.3.2 was ground-truthed during the field survey (remnant). Of this total area, 7.94 ha was determined to not meet Poplar box TEC condition criteria due to the dominance of exotic buffel grass in the ground layer. Ground-truthed areas of Poplar box TEC were restricted to the Public Reserve and areas east of Arcadia Valley Road.

Within the wider Project Area, the findings of the LiDAR assessment indicated the occurrence of additional areas of RE 11.3.2 in remnant condition along a shallow drainage line west of Middle Hill and east of Arcadia Valley Road. Given no field validated data for this location is available, all patches greater than 1 ha were conservatively assumed to meet key diagnostic criteria and condition thresholds (an additional area of 23.20 ha). Patches that occur on the boundary of the Project Area that may actually be larger due to connecting areas adjacent were also assessed, however none that were not already considered potential TEC were located.

Table 14 Key diagnostic criteria and condition thresholds for the poplar box TEC

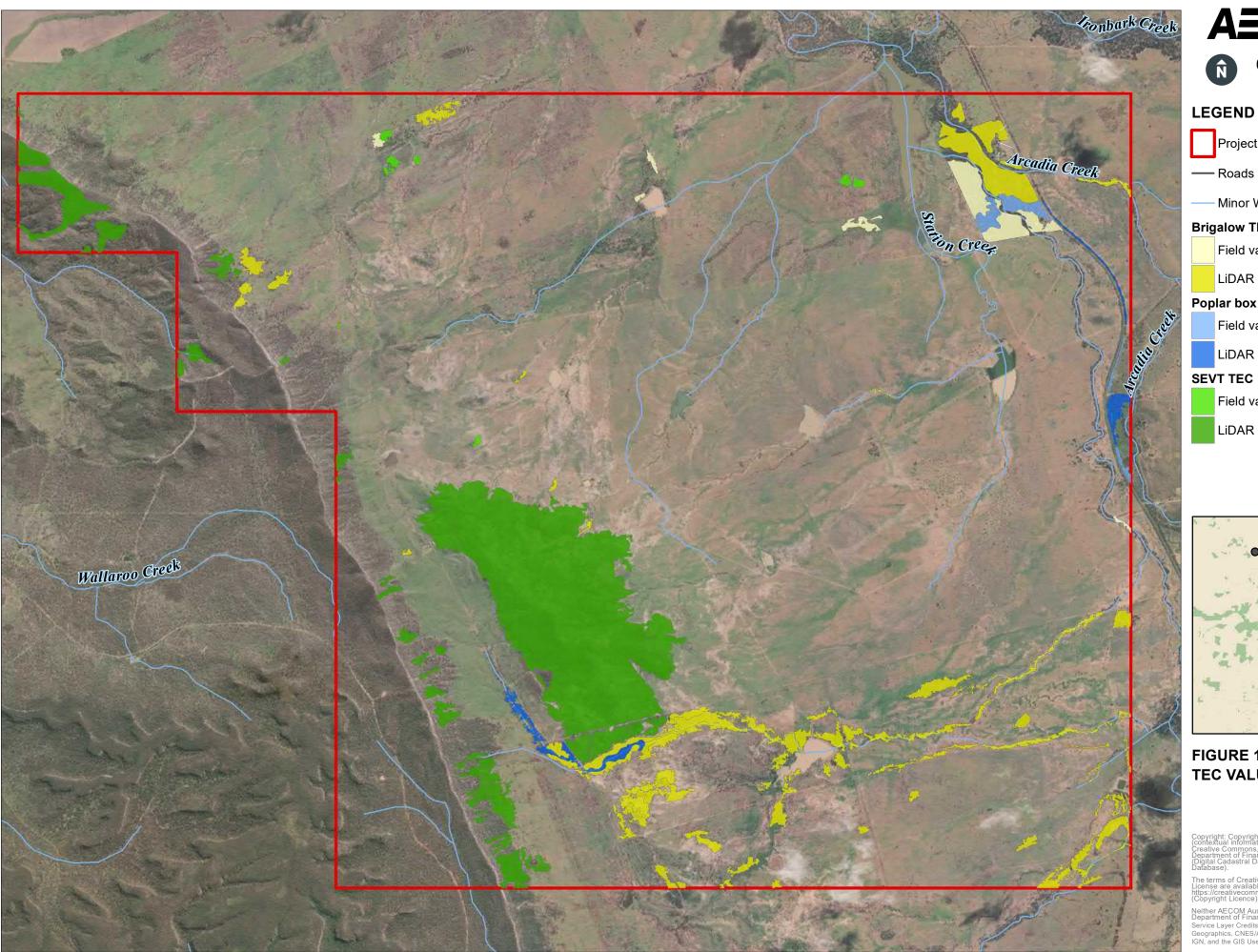
Criteria		Criteria met	Criteria not met
Key Diagnost	ic Criteria		
grassy open w	ocommunity structure is described as a grassy woodland to coodland with a tree crown cover of 10% or more at patch scale.  Om) crown cover of shrubs to small trees is low, about 30% or	48.87 ha	0.0 ha
presence of E	be species are capable of reaching 10 m or more in height. The acalyptus populnea (or a poplar box hybrid with other Eucalyptus nopy and as the dominant tree species.		
Brigalow Belt N	one of the following Queensland bioregions (including outliers): North, Brigalow Belt South, Southeast Queensland. And the patch associated with ancient and recent depositional alluvial plains.		
Condition The	resholds		
Category A1 (High quality)	The patch is 1 ha or more in size, the crown cover of canopy trees in the patch is >10% and >90% of perennial vegetation cover in the ground later is native and >30 native plant species per patch in the ground layer.	39.41 ha	9.46 ha*
Category C (minimum for patch to be subject to the referral)	The patch is 5 ha or more in size, the crown cover of canopy trees in the patch is >10% and <50% of perennial vegetation cover in the ground later is native and >20 native plant species per patch in the ground layer and >10 mature trees per ha with DBHs of 30 cm or more and smaller trees, saplings or seedlings suggestive of recruitment.		

<sup>\*</sup> inclusive of areas that were determined to not be TEC during field assessments as well as patches of RE11.3.2 mapped via LiDAR that are less than 1 ha in size.

#### 6.6.3 **SEVT TEC**

As described in Section 4.3.1.3, the assessment for the SEVT TEC consisted of collecting data to determine RE classification at various sites identified to comprise of semi-evergreen vine thicket species. The SEVT REs 11.9.4 and 11.9.4a were confirmed within the western ridgeline, the low hills and undulating plains of west Lot 2 Plan TR13 during the field survey. The presence of RE 11.9.4 has previously been confirmed within Middle Hill by Terrestria. Based on the findings of the LiDAR assessment, additional patches of RE 11.9.4 and 11.9.4a were mapped within the wider Project Area

along the lower and upper western ridgeline as well as directly south of Middle Hill. Overall, the total potential area of SEVT TEC within the Project Area is 534.49 ha.



# **AECOM**



— Roads and Tracks

Minor Watercourses

# **Brigalow TEC**

Field validated

# Poplar box TEC

Field validated

Field validated

LiDAR only



# FIGURE 10 **TEC VALUES**

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# 6.7 Listed threatened species

The PMST report identified 28 threatened species as potentially occurring within the Project Area and surrounds. Of the 28 threatened species, two were confirmed during the field survey. A single EPBC Act listed flora species was recorded during the December 2020 field survey: ooline, which was recorded at scattered locations in the northern Project Area (lot and plan 2TR13) (Figure 11). The large-eared pied bat which is listed Vulnerable under the EPBC Act was also recorded during the December 2020 survey using call detection (anabat). This species was recorded on three separate nights across the Eucalypt open forest on coarse-grained sedimentary rocks (lower western ridgeline) and the Brigalow open forest on alluvial plains and sedimentary rock (lower slopes of the western ridgeline and north of the western farm dam) habitat types within the Project Area (Figure 18).

A likelihood assessment was conducted for the remaining species identified in the desktop assessment to determine which are possible or unlikely to occur within the Project Area. This evaluation was based on an understanding of the preferred habitats of the species, knowledge of the type and condition of habitats present within the Project Area as well as field records and the proximity of publicly available records.

The assessment determined three (3) threatened flora and 14 threatened fauna species as 'potential' or 'likely' to occur within the Project Area. A total of nine threatened species were found to be unlikely occurrences. These species and the reason for this determination is as follows:

- Arthraxon hispidus (hairy-joint grass): no records occur within the vicinity of the Project Area.
   Whilst the Project Area contains potentially suitable habitat in the form of Eucalypt woodland on alluvium, this habitat is considered highly marginal due to the level of cattle disturbance and exotic grass incursion that was observed in this habitat type. Hairy-joint grass is particularly susceptible to these impacts.
- *Dichanthium setosum* (bluegrass): whilst a historical record occurs approximately 60 km to the north west in Boxvale State Forest, the Project Area does not contain the basaltic soil substrate that is needed to support the presence of the species.
- Thesium austral (Austral toadflax): no records occur within the area surrounding the Project Area. The Project Area also does not contain the required habitat to support the presence of the species, namely natural grasslands and native grassy woodlands with periodic wet conditions.
- Tylophora linearis: no records occur within the area surrounding the Project Area. The Project Area also does not contain the required habitat to support the presence of the species, namely woodland communities with the compositional mix of flora species (including but not limited to Melaleuca uncinata, Eucalyptus fibrosa, E. sideroxylon, E. albens, Acacia hakeoides, A. lineata, and Myoporum spp.) that are known to be associated with the species.
- Curlew sandpiper (Calidris ferruginea) and greater sand plover (Charadrius leschenaultii): no
  records occur within the area surrounding the Project Area. This species is typically found along
  the Queensland coastline and the Project Area is greater than 250 km from the coast. The Project
  Area also does not contain the required habitat to support the presence of the species, namely
  exposed mudflat surrounding lagoons, wetlands or estuarine/marine habitats.
- Star finch (eastern) (*Neochmia ruficauda ruficauda*): no records occur within the area surrounding the Project Area. As detailed on SPRAT, this species is now thought to be extinct from southern Queensland areas where the Project Area is situated. This is largely based on the findings of Holmes (1996, 1998), who determined records of the species occur only from scattered sites in central Queensland (i.e. between 21°S and 25°S, and 141°E and 150°E).
- Southern snapping turtle (*Elseya albagula*) and Fitzroy River turtle (*Rheodytes leukops*): no records occur within the area surrounding the Project Area. Watercourses within the Project Area are highly ephemeral and suitable riffles and pools do not occur. Banks are highly disturbed by cattle and do not have the soil type suitable for either species to nest.

The detailed likelihood of occurrence assessment is detailed in Table 15 below. Potential habitat for known, likely or potential species as well as confirmed records of the two threatened species identified during the field survey within the Project Area are shown on Figure 11 to Figure 26.

Table 15 Likelihood of occurrence assessment – threatened species

	Potential habitat utilisation in Project Area Status				ject Area	Records	
Species	(EPBC Act, NC Act)	Distribution and habitat requirements	bution and habitat requirements  Breeding / Foraging habitat  nesting/ nosting habitat  roosting habitat		Dispersal habitat		Likelihood of occurrence
Plants							
Acacia grandifolia	Vulnerable; -	This species is endemic to south-east Queensland (QLD) and restricted to the Mundubbera area in the Burnett district (Department of the Environment, 2014a). It has a range of approximately 100 km and an occurrence extent of approximately 4200 km². It occurs in ironbark gum and spotted gum forests and woodlands, growing on hilly terrain of varying aspects and slope. The most frequently recorded associated tree species are Eucalyptus crebra, Corymbia citriodora, Corymbia trachyphloia and Eucalyptus exserta. It is reported to respond well to disturbance, growing well on roadsides and after fire.	open forests and v Survey Area. The these areas also o	Field surveys confirmed the presence of Eucalypt open forests and woodlands on hilly terrain within the Survey Area. The LiDAR assessment indicated that these areas also occur in the wider Project Area in association with the western ridgeline and Middle Hill		Yes Two records from 2002 are located west at Boxvale State Forest, within 30 km of the Project Area (from a centre coordinate). Species was not detected in targeted searches during the field survey.	Potential
Arthraxon hispidus Hairy-joint grass	Vulnerable; Vulnerable	Arthraxon hispidus has been recorded throughout QLD and on the northern tablelands and north coast of New South Wales. In QLD, records have identified species as far north as Port Douglas and as far south as Carnarvon National Park, however, most occurrences are south of Noosa.  In QLD, Arthraxon hispidus can be found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps, as well as woodland (Department of Agriculture Water and the	No Suitable habitat in woodland on alluvi however due to the incursion and cattl marginal.	um occurs within high level of but	the Project Area; fel grass	No This species is not known to the Arcadia Valley, and no ALA records occur within 100 km of the Project Area	Unlikely

	Potential habitat utilisation in Project Area					Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		Environment, 2021b). As per the DES Species Profile, the main identified threats to hairy-joint grass include trampling and over-grazing by stock and competition from introduced grasses.					
Cadellia pentastylis Ooline	Vulnerable; Vulnerable	This species is found in a range of vegetation communities including dry rainforest, semi-evergreen vine thickets, brigalow-belah, poplar box and bendee communities. <i>Cadellia pentastylis</i> often occurs on the edge of sandstone or basalt escarpments and prefers moderately fertile soils favoured by agriculture (Department of Environment and Science, 2020c).	Yes Field surveys confin the northern Pro (Figure 11). Suita Survey Area in the dominated open for indicated that thes Project Area. Area Project Area that he conservatively conspecies.	oject Area (lot an ible habitat occur form of SEVT a prests. The LiDA e areas also occus of regrowth venave not been greated.	d plan 2TR13) rs within the and brigalow- R assessment cur in the wider getation in the ound-truthed are	Yes This species was confirmed in the northern Project Area (Figure 11). At least 13 ALA records occur within 25 km of the Project Area (from a centre coordinate), some as recent as 2014.	Known
Bertya opponens	Vulnerable; -	This species occurs in QLD and New South Wales. In QLD, its distribution ranges from Emerald in the north and Charleville in the west, with an outlier near Charters Towers. It has been recorded in a variety of communities including mixed shrubland, lancewood woodland, mallee woodland, Eucalyptus/Acacia open forest with shrubby understorey, Eucalypt/Callitris open woodland and semi-evergreen vinethicket (SEVT) on shallow and rocky or much deeper and well-drained soils (Department of Agriculture Water and the Environment, 2021b).	Yes Field surveys and presence of suitable the western portion of SEVT, Eucalypin 11).	le habitat for this n of the Project <i>A</i>	s species within Area in the areas	No No records occur within the area surrounding the Project Area. However, ALA records occur at four locations south of the Project Area within and near Lonesome National Park (within 50 km from a centre coordinate). Two post-1980's records occur within 25 km of	Potential

	Charles		Potential habitat utilisation in Project Area			Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
						the Project Area as detailed on the Wildlife Online report. Species was not detected in targeted searches during the field survey.	
Dichanthium setosum Bluegrass	Vulnerable; -	An upright bluegrass less than 1 m tall. Associated with heavy basaltic black soils and found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. (WetlandInfo, 2019).	No Soils within the Pr such no suitable h	•	ot basaltic and as	Yes A single record from the centre of the Project Area occurs approximately 60 km to the north west in Boxvale State Forest.	Unlikely
Thesium australe Austral toadflax	Vulnerable; Vulnerable	Austral toadflax occurs in New South Wales, the Australian Capital Territory, QLD and Victoria. The species' distribution is large although sporadic, occurring between the Bunya Mountains in south-east Queensland to north-east Victoria and as far inland as the Toowoomba region (Department of Agriculture Water and the Environment, 2021b). There is an outlier in Carnarvon National Park on the Consuelo Tableland of the southern Brigalow Belt. This species is semi-parasitic on roots of grasses (notably kangaroo grass ( <i>Themeda triandra</i> )), and occurs in subtropical, temperate and subalpine climates over a range of altitudes. It occurs in shrubland, grassland or woodland, often on damp sites.	•	ere largely only only only only only only only on	dominant in the dry ests of the western prohibited and curred. The ed as coarse- te terrain does not tion communities	No The population at Carnarvon National Park is considered an outlier. No ALA records occur within 50 km of the Project Area (from a centre coordinate).	Unlikely

	Charles			utilisation in P	Records		
Species	Status (EPBC Act, NC Act)		Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		Vegetation types include open grassy heath dominated by swamp myrtle (Leptospermum myrtifolium), small-fruit Hakea (Hakea microcarpa), alpine bottlebrush (Callistemon sieberi), woolly grevillea (Grevillea lanigera), coral heath (Epacris microphylla) and Poa spp.; kangaroo grass grassland surrounded by Eucalyptus woodland; and grassland dominated by Barbed-wire Grass (Cymbopogon refractus).					
Tylophora linearis	Endangered; Endangered	This species has rarely been collected and is known from eight localities in the Dubbo area and Mount Crow near Barraba in New South Wales, and "Myall Park" near Glenmorgan in QLD. This species grows in dry scrub, open forest and woodlands associated with Melaleuca uncinata, Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla, Allocasuarina luehmannii, Acacia hakeoides, Acacia lineata, Myoporum spp., and Casuarina spp.	No The Project Area of proximity to one of localities. The Project Area of localities are not provided in the project Area of localities are not provided in the project Area of localities.	f the species' kn ject Area also do nities with the co	own eight oes not contain ompositional mix of	No No ALA records occur within 75 km of the Project Area (from a central coordinate).	Unlikely
Xerothamnella herbacea	Endangered; Endangered	This species is a sparse sprawling herb, known from two sites north east of Chinchilla; a single record near Theodore and a record near Yelarbon east of Goondiwindi, Queensland. It occurs in brigalow dominated communities in shade situations, often growing in leaf litter and associated with gilgai on heavy clay soils (Department of the Environment Water Heritage and the Arts, 2008b). Three of	Yes Field surveys confidominated vegeta the Survey Area. that these areas a (namely brigalow of plains of the valley dominated vegeta validated were fout that is likely to imp	tion and gilgai or The LiDAR asse Iso occur in the communities) on toor. Majority or tion communities and to have a dis	ommunities within ssment indicated wider Project Area in the undulating of Brigalow-s that were field sturbed understory	Yes Multiple records occur within 30 km of the Project Area (Wildlife Online and ALA). ALA records are located to the east in Presho State Forest (a single 1998 record) and within	Likely

	Chatra		Potential habitat	Potential habitat utilisation in Project Area			
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		the four known populations occur in cleared areas of non-remnant vegetation.	present for this spe Brigalow (i.e. remr vegetation) on allu habitat for this spe	nant and high valu vium is considere	ie regrowth d potential	Lonesome National Park to the south (multiple from 2012 and 2014). This species was also recorded within the Arcadia Valley during surveying by Boobook in 2017. Species was not detected in targeted searches during the field survey.	
Birds			1				
Curlew sandpiper ( <i>Calidris</i> ferruginea)	Critically Endangered	Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They occur in both fresh and brackish waters.  In Australia, curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers (Department of Agriculture Water and the Environment, 2021b).	No Species does not breed in Australia.	No The Project Area does not contain large exposed mudflat areas surrounding wetland areas. Farm dams are highly degraded and not suitable. It is also an inland environment with no saline influence.	No Species generally inhabit coastal environments and therefore disperse along the eastern coastline whilst migrating.	No The nearest ALA record occurs 200 km north of the Project Area (centre coordinate).	Unlikely

	Chatria		Potential habitat	utilisation in Pro	ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
Greater sand plover ( <i>Charadrius leschenaultii</i> )	Vulnerable; Vulnerable	The greater sand plover is a non-breeding migrant to Australia. While in Australia, the greater sand plover occurs in in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west. There are five sites in Australia that are considered internationally important, one of which occurs in Queensland: south-eastern corner of Gulf of Carpentaria. The species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons and inshore reefs, rock platforms, small rocky islands or sand cays on coral reefs. They seldom occur at shallow freshwater wetlands (Department of Agriculture Water and the Environment, 2021b).	No Species does not breed in Australia.	No The Project Area is greater than 250 km from the coast and does not occur within the species mapped distribution as per SPRAT. Given the small size and modified nature of the waterbodies within the Project Area, habitat is not considered suitable.		No ALA records within 100 km of the Project Area (centre coordinate). This species is almost exclusively coastal.	Unlikely
Red goshawk ( <i>Erythrotriorchi</i> <i>s radiatus</i> )	Vulnerable; Endangered	The red goshawk occurs mostly in extensive areas of coastal and subcoastal open forest and woodland that support a mosaic of vegetation types. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins. Permanent water (watercourses and wetlands) is usually present in close proximity, with tall	No Whilst permanent water occurs within the Project Area as well as woodland communities, no areas support emergent trees of a sufficient	Yes There is the potential for red goshawk to be inhabiting the surrounding ranges (Carnarvon and	Yes There is the potential for red goshawk to be inhabiting the surrounding ranges (Carnarvon and Expedition). The large tracts	No No ALA records within 50 km of the Project Area (centre coordinate). A single undated record with a high degree of spatial uncertainty occurs approximately	Potential

	Status		Potential habitat	utilisation in Pro	ject Area	Records	
Species	(EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		emergent trees used for nesting. The red goshawk is thought to have a very large home range covering between 50 and 220 square kilometres.  Sparsely distributed across coastal and sub-coastal Australia, from the western Kimberly to northern New South Wales. Appears to have been a contraction in range in recent years. Occasionally recorded from gorge country in central Australia and western Queensland (Department of Agriculture Water and the Environment, 2021b).	size that are utilised for red goshawk nesting	Expedition). The large tracts of vegetation at Middle Hill and the western ridgeline may provide suitable foraging habitat (Figure 12).	of vegetation at Middle Hill and the western ridgeline may provide suitable dispersal habitat (Figure 12).	80 km north of the Project Area. Numerous raptor species were identified during the field survey; however red goshawk was not detected.	
Squatter pigeon (southern) (Geophaps scripta scripta)	Vulnerable; Vulnerable	The squatter pigeon occurs in dry grassy woodland and open forest, mostly in sandy and gravel areas (land zone 5 and 7) close to water. Breeding and foraging habitat is centralised around water resources such as dams and creeks (1-3 km). This sub-species is ground-dwelling that inhabits the grassy understorey of open eucalypt woodland, as well as sown grasslands with scattered remnant trees, disturbed areas (such as roads, railways, settlements and stockyards), scrubland, and <i>Acacia</i> regrowth.  This sub-species is now largely (if not wholly) restricted to Queensland, from the New South Wales border, north to the Burdekin River, west to Charleville and Longreach, and east to the coast to	No Whilst permanent water occurs within the Project Area as well as woodland communities, these occur on clay soils. Sandy or gravel soils that the species requires for breeding habitat that is associated with land zone 5 and 7 do not occur within 1km of	No Whilst permanent water occurs within the Project Area as well as woodland communities, these occur on clay soils. Sandy or gravel soils that the species requires for foraging habitat that is	Yes The species can utilise a range of habitat types whilst dispersing between breeding and foraging habitat. Connected regrowth, high value regrowth and remnant communities within the Project Area provide suitable	Yes Six records dating from 1978 to 2014 occur within 25 km of the Project Area (from a centre coordinate). Five of the records occur within Expedition National Park east of the Project Area, while the sixth occurs west of the Project Area in Boxvale State Forest. Species was not detected in targeted	Potential

Status			Potential habitat utilisation in Project Area			Records	
Species	(EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		Townsville and Proserpine (Department of Agriculture Water and the Environment, 2021b).	these water sources or across the Project Area.	associated with land zone 5 and 7 do not occur within 1km of these water sources or the Project Area.	dispersal habitat for the species (Figure 14).	surveys during the field survey.	
Grey falcon (Falco hypoleucos)	Vulnerable; Vulnerable	The grey falcon occurs in timbered lowland plains, particularly <i>Acacia</i> shrublands that are crossed by tree-lined water courses. It has also been observed foraging in treeless areas, tussock grassland and open woodland (Threatened Species Scientific Committee, 2020). At night, roosting may occur on areas of bare ground (Schoenjahn, 2018). When breeding this species utilises the disused nests of other raptors or corvids. Nests that occur in the tallest trees along watercourses, particularly <i>Eucalyptus camaldulensis</i> and <i>E. coolabah</i> , are preferred. However, like other falcons this species may also nest in telecommunication towers.  The grey falcon is endemic to mainland Australia, occurring in arid and semi-arid regions including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia. The species occurs at low densities across its range and is	Yes The Project Area contains woodlands dominated by Eucalyptus camaldulensis along Arcadia Creek, which also occur adjacent to Brigalow dominated regrowth to woodland communities. This riparian habitat could provide suitable breeding habitat (Figure 13).	Yes The Project Area contains riparian areas adjacent to regrowth shrubby areas as well as open cleared pasture. These adjacent regrowth, high value regrowth and remnant habitat could provide suitable foraging habitat (Figure 13).	Yes The Project Area contains riparian areas adjacent to regrowth shrubby areas as well as open cleared pasture. These adjacent regrowth, high value regrowth and remnant habitat could provide suitable dispersal habitat (Figure 13).	No No ALA records occur within 50 km (from a centre coordinate), however this species is known to be rare and occur at low densities throughout its distribution. The nearest ALA record is located 125 km to the east near Glenmoral (undated and high spatial uncertainty). Two undated records also occur approximately 150 km to the north east at Springsure.	Potential

Species		Ctatus		Potential habitat utilisation in Project Area			Records	
	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence	
		reported to be absent from the Cape York Peninsula, as well as areas east of the Great Dividing Range in Queensland and New South Wales (Threatened Species Scientific Committee, 2020).						
Painted honeyeater ( <i>Grantiella picta</i> )	Vulnerable; Vulnerable	The painted honeyeater occurs in dry forests and woodlands, where its primary food is mistletoes in the genus <i>Amyema</i> , though it will also take some nectar and insects. It is also known to occur in riparian woodland communities dominated by eucalypt species such as <i>Eucalyptus camaldulensis</i> , although its breeding distribution is dictated by the presence of mistletoes which are largely restricted to older trees.  The species is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of 26° S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Department of Agriculture Water and the Environment, 2021b).	No The Project Area occurs north of the known breeding habitat for the species.	Yes Although the majority of the Project Area comprises non-remnant grazing land, regrowth and remnant Brigalow woodland areas as well as riparian areas dominated by Eucalyptus camaldulensis generally had an abundance of mistletoe (at least two species recorded) (Figure 15).	Yes Although the majority of the Project Area comprises non-remnant grazing land, regrowth and remnant Brigalow woodland areas generally as well as riparian areas dominated by Eucalyptus camaldulensis had an abundance of mistletoe (at least two species recorded) (Figure 15).	No ALA records within 50 km of the Project Area (centre coordinate).	Potential	
White-throated needletail	Vulnerable / Migratory;	The white-throated needletail is found across a range of habitats, more often	Yes	Yes	Yes	No	Potential	

	Chatria		Potential habitat	utilisation in Pro	ject Area	Records	Likelihood of occurrence
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		
(Hirundapus caudacutus)	Special Least Concern	over wooded areas, where it is almost exclusively aerial, though does roost in tree hollows and the foliage canopy. It forages for insects on the wing; flying anywhere between "cloud level" and "ground level" and readily forms mixed feeding flocks with other aerial insectivores.  This species is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and New South Wales, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (Department of Agriculture Water and the Environment, 2021b).	White-throated needletail roost in trees that are on elevated landforms that allow the species to drop into flight. Woodland communities on the western ridgeline may provide suitable roosting habitat (Figure 16).	Species is an aerial forager and therefore could be foraging above the Project Area.	Species is predominantly aerial and therefore could be dispersing above the Project Area.	No records occur within the area surrounding the Project Area. However, four ALA records occur within 50 km of the Project Area (centre coordinate) however two are unlikely to be reliable (undated and or has a high degree of spatial uncertainty). The other two records both occur within the Expedition National Park and are dated 2003 and 2014.	
Star finch (eastern) ( <i>Neochmia</i> ruficauda ruficauda)	Endangered; Endangered	The star finch (eastern) occurs mainly in grasslands and grassy woodlands that are located close to bodies of fresh water. It also occurs in cleared or suburban areas such as along roadsides and in towns. Studies at nine former sites of the star finch (eastern) found that the habitat consisted mainly of woodland. These habitats are dominated by trees that are typically associated with permanent water or areas that are regularly inundated; the most common species are <i>Eucalyptus coolabah</i> , <i>Eucalyptus tereticornis</i> ,	No Species is now likely to be extinct in the southern extent of its range.	No Species is now likely to be extinct in the southern extent of its range.	No Species is now likely to be extinct in the southern extent of its range.	No The species has not previously been known to occur within the Arcadia Valley and no ALA records (including undated or spatially unreliable) occur within 100 km of the Project Area (centre coordinate).	Unlikely

	Chatus		Potential habitat	utilisation in Pro	ject Area	Records		
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence	
		Eucalyptus tessellaris, Melaleuca leucadendra, Eucalyptus camaldulensis and Casuarina cunninghamii.  Based on the small number of accepted records, the distribution of this species formerly extended from Bowen in central Queensland, south to the Namoi River in northern New South Wales, and west to the Blackall Range. Recent records have been obtained only from scattered sites in central Queensland (i.e. between 21°S and 25°S, and 141°E and 150°E) and, consequently, the star finch (eastern) now appears to be extinct in both southeastern Queensland and northern New South Wales (Department of Agriculture Water and the Environment, 2021b).						
Australian painted snipe (Rostratula australis)	Endangered; Vulnerable	Preferred habitat includes shallow inland wetlands, brackish or freshwater, that are permanently or temporarily inundated. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree ( <i>Melaleuca</i> ). Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby.	Yes When inundated, the wetland on Lot 2 on TR13 contains exposed islands made from constructed embankments. As these are not natural island features, the presence of native aquatic	Yes The wetland and some farm dams provide fringing aquatic vegetation suitable in providing coverage whilst the species forages. The	Yes The wetland and some farm dams provide fringing aquatic vegetation suitable in providing coverage for dispersal (Figure 17).	No This species was not recorded during the field surveys. No records occur within the area surrounding the Project Area. However, one ALA record occurs 72 km north of the Project Area.	Potential	

	Otatus		Potential habitat	utilisation in Pro	ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		This species has been recorded from wetlands in all Australian states, however is most common in eastern Australia, especially the Murray-Darling Basin. Individuals are nomadic, and there is some evidence of partial migration from south-eastern wetlands to coastal central and northern Queensland in autumn and winter (Department of Agriculture Water and the Environment, 2021b).	vegetation is limited. However, these areas may provide nesting habitat for the species (Figure 17).	gilgai areas may also provide temporary foraging resources when inundated from large rainfall events (Figure 17).			
Mammals							
Large-eared pied bat (Chalinolobus dwyeri)	Vulnerable; Vulnerable	Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the large-eared pied bat. Records from southeast Queensland suggest that rainforest and moist eucalypt forest habitats on other geological substrates at high elevation are of similar importance to the species. No maternity roost sites are known in Queensland. As per the species' SPRAT, foraging occurs at night around roost sites for a distance of up to several kilometres.  The species' current distribution is also poorly known. Records exist from Shoalwater Bay, north of Rockhampton, Queensland, through to the vicinity of Ulladulla, New South Wales in the south. Despite the large range, it has been	Yes Sandstone escarpments that provide overhangs and caves were confirmed within the Eucalypt open forest habitat that occurs on the upper plateaus of the western ridgeline. Overhangs and caves are suitable for the roosting of this	Yes Woodland valley habitat occurs across the Project Area and is considered fertile especially where alluvial soils dominate. Areas of connected remnant and high value regrowth within the Project Area	Yes This species is highly mobile and may disperse across the entire Project Area between roosting and foraging habitat. Areas of connected remnant and high value regrowth within the Project Area are considered to provide the	Yes This species was confirmed to occur within the Eucalypt open forest on coarse grained sedimentary rocks and the Brigalow open forest on alluvial plains and sedimentary rock habitats within the Project Area via bat call analysis completed by Balance! Environmental. Nine records occur within 50 km of the	Known

	Status		Potential habitat	utilisation in Pro	ject Area	Records		
Species	(EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence	
		suggested that the species is far more restricted within the species' range than previously understood (Department of Agriculture Water and the Environment, 2021b).	species (Figure 18).	are considered to be of a condition to support foraging resources for the species (Figure 18).	coverage suitable for the dispersal of the species (Figure 18).	Project Area (from a centre coordinate) dating from 1979 (4 records), 2001 (3 records), 2002 and 2003 (1 record each). Records occur north east to south east of the Project Area within or close to the Expedition National Park.		
Northern quoll  Dasyurus hallucatus	Endangered;	The northern quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern quoll are also known to occupy non rocky lowland habitats such as beachscrub communities in central Queensland. Northern quoll habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal.  In Queensland, the northern quoll is known to occur as far south as Gracemere and Mount Morgan, south of Rockhampton, as far north as Weipa in Queensland and extends as far west into central Queensland to the vicinity of	Yes A variety of denning opportunities occur within the Eucalypt open forest on coarse grained sedimentary rocks habitat including sandstone escarpments that provide overhangs and caves (upper western ridgeline) as well as rocky outcrops and	Yes The Project Area contains scattered patches of woodland vegetation that are within 1 km of suitable denning habitat. Patches that provide connectivity between denning habitat and water sources are considered suitable for the foraging and dispersal of this species (Figure 19).		No Targeted surveying completed in December 2020 (camera traps and hair tubes) did not detect this species. Although no ALA records occur within 50 km, the species is known to occur within Carnarvon National Park which is largely connected to Boxvale State Forest located directly west of the Project Area.	Potential	

	Oleder		Potential habitat	utilisation in Pro	ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		Carnarvon Range National Park (Department of Agriculture Water and the Environment, 2021b).	screes (lower western ridgeline) (Figure 19).				
South-eastern long-eared bat (Nyctophilus corbeni)	Vulnerable; Vulnerable	The south-eastern long-eared bat is found in a wide range of inland woodland vegetation types. These include box/ironbark/cypress pine woodlands, Allocasuarina luehmannii woodlands, Acacia harpophylla woodland, Casuarina cristata woodland, Angophora costata woodland, Eucalyptus camaldulensis forest, Eucalyptus largiflorens woodland, and various types of tree mallee. This species is more abundant in extensive stands of vegetation in comparison to smaller woodland patches. Roosting occurs in tree hollows, crevices, and under loose bark.  The south-eastern long-eared bat is found in southern central Queensland, central western New South Wales, north-western Victoria and eastern South Australia, where it is patchily distributed, with most of its range in the Murray Darling Basin. Most records are from inland of the Great Dividing Range (Department of Agriculture Water and the Environment, 2021b).	Yes Hollow-bearing trees and / or trees with loose bark were occasionally recorded during the field survey and as such habitat is considered suitable for roosting. Habitat within the Project Area that supports these habitat features include the remnant Brigalow and Eucalypt habitat types (Figure 20).	Yes The Project Area contains woodlands dominated by Acacia harpophylla and Eucalyptus sp. in both remnant and high value condition; these habitat types provide the more complex understorey that is suitable for foraging (Figure 20).	Yes This species is highly mobile and may disperse across the Project Area through foraging habitat (Figure 20).	Yes Nyctophilus sp. was recorded within the Survey Area based on the bat call analysis; however calls from this genus cannot be differentiated. Two ALA records (dated 2002 and 2014) occur within 50 km of the Project Area in the Expedition National Park (from a centre coordinate).	Likely
Greater glider	Vulnerable; Vulnerable	During the day, this species spends most of its time denning in hollowed trees, with	Yes	Yes	Yes	Yes	Potential

	Chatria		Potential habitat	utilisation in Pro	ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
(Petauroides Volans)		each animal inhabiting up to twenty different dens within its home range. It is primarily folivorous, with a diet mostly comprising the leaves and flowers of Myrtaceae (e.g. eucalypt) trees. The greater glider is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows.  The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria, with an elevational range from sea level to 1200 m above sea level. An isolated inland subpopulation occurs in the Gregory Range west of Townsville, and another in the Einasleigh (Department of Agriculture Water and the Environment, 2021b).	Trees bearing medium or large hollows were recorded during the field surveys, primarily in the Eucalypt riparian woodlands. Abundance of hollow-bearing trees was generally low and therefore is considered more marginal habitat (Figure 21).	The Project Area contains woodlands and forests dominated by Eucalyptus sp. in both remnant and HVR condition; these vegetation communities are suitable for foraging (Figure 21).	Although vegetation within the Project Area is largely patchy and disturbed, some tracts of connected Eucalypt woodland occur along the drainage lines and adjacent to Arcadia Valley Road. This habitat is also present within the western ridgeline as a large contiguous patch (Figure 21).	Targeted surveying completed in December 2020 (spotlighting) did not detect this species. Three ALA records occur within 25 km of the Project Area, and many more within 50 km (from a centre coordinate).	
Koala ( <i>Phascolarctos</i> <i>cinereus</i> )	Vulnerable; Vulnerable	Koalas inhabit a range of temperate, subtropical and tropical forest, woodland and semi-arid communities dominated by species from the genus <i>Eucalyptus</i> . Koalas eat a variety of eucalypt leaves and a few other related tree species, including <i>Lophostemon</i> , <i>Melaleuca</i> and <i>Corymbia</i> species. Koalas are found in higher densities where food trees are	NA This species is not known to have specific habitat requirements for breeding.	Yes The Project Area contains woodlands and forests dominated by Eucalyptus sp. in both remnant and	Yes Field surveys confirmed the presence of Eucalyptus populnea as an occasional canopy tree or emergent in	No Targeted surveying completed in December 2020 (spotlighting and call playback) did not detect this species. No records occur within the area	Potential

	Chatus		Potential habitat	utilisation in Pro	ject Area	Records		
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence	
		growing on more fertile soils and along watercourses. They do, however, remain in areas where their habitat has been partially cleared and in urban areas. In Queensland, the koala's distribution extends inland from the east coast: from the Wet Tropics interim biogeographic regionalisation of Australia bioregion, into the Einasleigh Uplands bioregion; from the Central Mackay Coast bioregion, through the Brigalow Belt North bioregion to the Desert Uplands and Mitchell Grass Downs bioregions, and from the Southeast Queensland bioregion, through the Brigalow Belt to the Mulga Lands and Channel Country bioregions in the southwest of the state (Department of Agriculture Water and the Environment, 2021b).		high value condition; these vegetation communities are suitable for foraging. (Figure 22).	Brigalow woodlands on alluvial substrates. Although not dominated by Eucalypts, patches of this community may be used to forage while dispersing to areas of higher quality habitat (Figure 22).	surrounding the Project Area. Two historical ALA records (1987 and 1988) occur within 25 km of the Project Area (centre coordinate), and an additional three records occur within 50 km (dated 1996 and 2001).		
Reptiles								
Adorned delma ( <i>Delma</i> torquata)	Vulnerable; Vulnerable	The adorned delma normally inhabits Eucalypt-dominated woodlands and open-forests in Queensland RE Land Zones 3, 9, and 10. This species has been recorded from rocky areas associated with dry open forests and has been found in open Eucalypt and Acacia woodland with an understorey of native grasses and loose rocks. The adorned delma has also been recorded from eucalypt woodland adjacent to semi-	Yes The Project Area contains Eucalypt woodlands and forests on Land Zones 3 and 10 as well as Acacia woodlands on Land Zone 9 (HVR and remnant condition). Microhabitat features and native grass tussocks however were only abundant in the larger contiguous patches		NA	No Targeted surveying completed in December 2020 (active searching) did not detect this species. No records occur within the area surrounding the Project Area. However, two ALA	Potential	

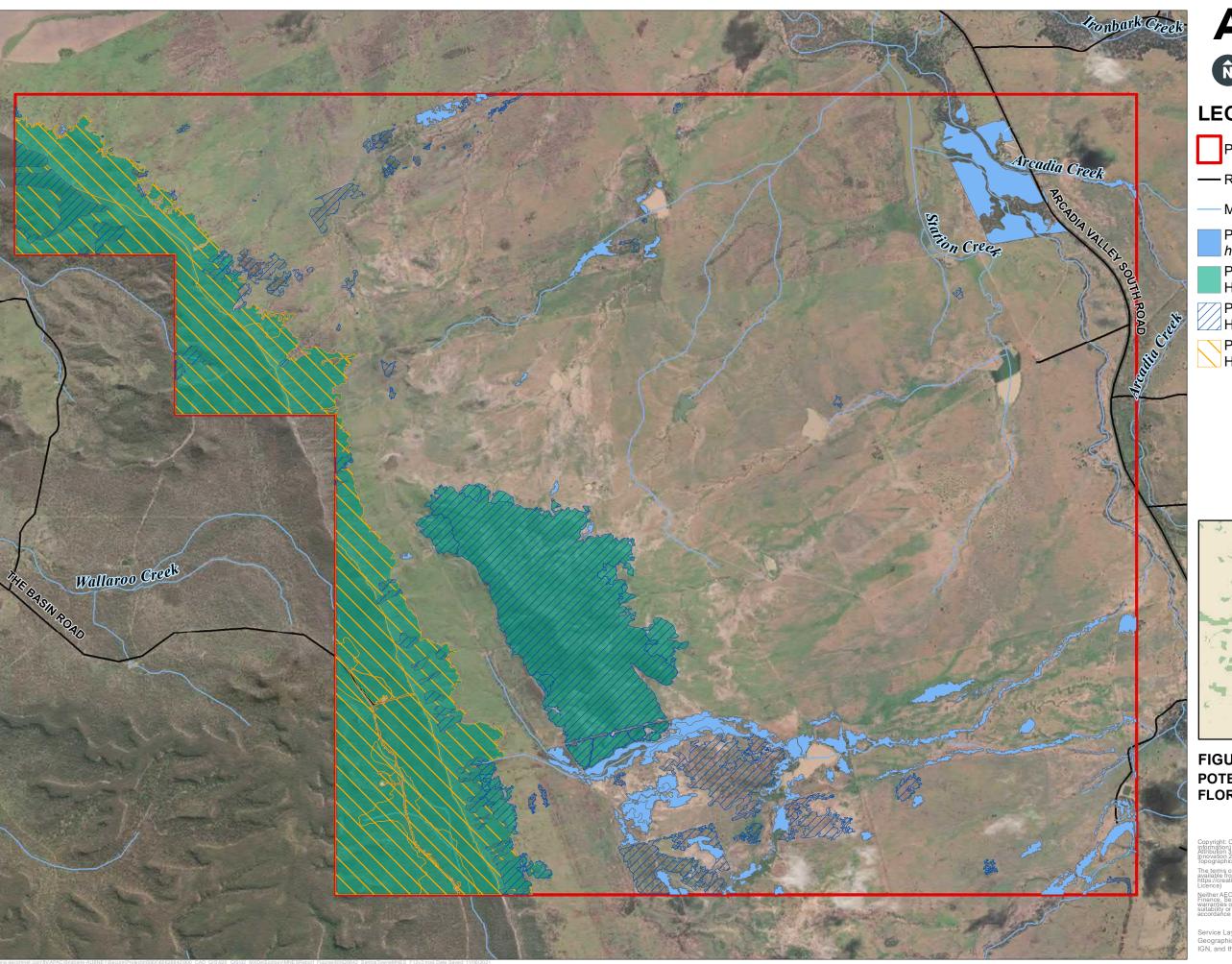
	Chatus		Potential habitat	utilisation in Pro	ject Area	Records		
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence	
		evergreen vine thicket. The presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30 to 100 mm thick) appears to be an essential characteristic of the adorned delma microhabitat and is always present where the species occurs.  This species has been recorded at the following sites: the Bunya Mountains, Blackdown Tablelands National Park, Expedition National Park, Western Creek, and the Toowoomba Range (Department of Agriculture Water and the Environment,	(western ridgeline and Public Reserve) (Figure 23). This species is not known to have specific habitat requirements for breeding and as such is considered to breed in the same habitat suitable for foraging.			records from 2001 occur at Presho Forest Reserve, west of the Project Area within 50 km.		
Ornamental snake ( <i>Denisonia</i> maculate)	Vulnerable; Vulnerable	This species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions in Queensland RE Land Zone 4, but also lake margins and wetlands. This species' habitat is likely to be found in <i>Acacia harpophylla</i> , <i>Acacia cambagei</i> , <i>Acacia argyrodendron</i> or <i>Eucalyptus coolabah</i> -dominated vegetation communities, or pure grassland associated with gilgais. These are commonly mapped as Queensland REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred (Department of Sustainability	Yes Although highly degraded from cattle grazing, exotic grass incursion and in some locations historical blade ploughing, gilgai habitat is present within the Project Area and may be suitable for this species. Shallow gilgai were also rarely recorded in areas of Acacia harpophylla woodland on coarse-grained sedimentary rocks (Figure 24).		NA	No Targeted surveying completed in December 2020 (spotlighting, pitfall and funnel traps) did not detect this species. No records occur within the area surrounding the Project Area. However, a single record from 1998 occurs north of the Project Area within 50 km.	Potential	

	Charles		Potential habitat utilisation in Proje		ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		Environment Water Population and Communities, 2011a).  This species is known only from the Brigalow Belt North and parts of the Brigalow Belt South biogeographical regions. The core of the species' distribution occurs within the drainage system of the Fitzroy and Dawson Rivers (Department of Agriculture Water and the Environment, 2021b); of the combined Basin area, approximately 6% is Project Area.					
Yakka skink (Egernia rugosa)	Vulnerable; Vulnerable	Habitat requirements are poorly known; however, this species is known from rocky outcrops, sand plain areas and dense ground vegetation, in association with open dry sclerophyll forest (ironbark) or woodland, brigalow forest and open shrubland. In the Brigalow Belt bioregion, core habitat includes: poplar box (Eucalyptus populnea) woodland, mulga (Acacia aneura) woodland, white cypress pine (Callitris glaucophylla); usually in association with eucalypt species such as E. populnea, E. melanophloia or Corymbia tessellaris, ironbark (typically E. melanophloia) woodland, and disturbed, treated and cleared areas of suitable habitat, grazed or ungrazed, where suitable microhabitat features still remain (Ferguson & Mathieson, 2014). Colonies	Yes This species is known to occur in a range of habitat types. Suitable woodland habitat dominated by core habitat canopy species as per the species' SPRAT is present within the Project Area. However, most patches were found to have a high level of disturbance from exotic grass, grazing and edge effects. Microhabitat features needed to support colonies were only abundant in the larger contiguous patches of habitat (western ridgeline and Public Reserve) as such these areas are considered to provide potential habitat (Figure 25).		NA	No Targeted surveying completed in December 2020 (active searching and colony seaches) did not detect this species. No records occur within the area surrounding the Project Area. However, three ALA records occur within 50 km of the Project Area (centre point), however these are likely unreliable (pre-1980's, a high degree of spatial	Potential

	Chatana		Potential habitat	utilisation in Pro	ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		have been found in large hollow logs, cavities or burrows under large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes (Department of Sustainability Environment Water Population and Communities, 2011a).  The known distribution of the yakka skink				uncertainty or missing information).	
		extends from the coast to the hinterland of sub-humid to semi-arid eastern Queensland. This vast area covers portions of the Brigalow Belt, Mulga Lands, South-east Queensland, Einasleigh Uplands, Wet Tropics and Cape York Peninsula Biogeographical Regions (Department of Agriculture Water and the Environment, 2021b).					
White-throated snapping turtle ( <i>Elseya</i> <i>albagula</i> )	Critically Endangered; Endangered	The white-throated snapping turtle prefers clear, flowing, well-oxygenated water associated with their ability to extract oxygen from the water via cloacal respiration. The preferred habitat for this species is the permanent flowing reaches of the rivers that are characterised by steep sides, a sand-gravel substrate and an abundance of underwater refuge (e.g. rocks, logs and undercut banks) (Hamann et al. 2007). Populations occur at much lower densities where flow is reduced	No Creeks and drainage lines within the Project Area do not have soil types suitable for the nesting of this species. Banks are moderately to highly	No During the field survey creeks were observed to hold only small occasional ponds of water. Levels of coarse woody debris	No All watercourses within the Project Area are a low stream order and are considered non-perennial.	No No ALA records occur within 50 km of the Project Area (centre coordinate).	Unlikely

	Chatus		Potential habitat	utilisation in Pro	ject Area	Records	
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		Likelihood of occurrence
		(upstream of dams, weirs etc.). Nesting in is primarily restricted to sand and loam alluvial deposits.  This species occurs only in three catchments (Burnett, Mary and Fitzroy) and is considered a habitat specialist (Department of Agriculture Water and the Environment, 2021b).	disturbed from cattle grazing.	and rocks in the creekbed were low. Creeks are generally very narrow and highly disturbed from cattle grazing.			
Dunmall's snake ( <i>Furina</i> dunmalli)	Vulnerable; Vulnerable	This species has been found in a broad range of habitats, including: forests and woodlands on black alluvial cracking clay and clay loams dominated by <i>Acacia harpophylla</i> , <i>Acacia burrowii</i> , <i>Acacia deanei</i> , <i>Acacia leiocalyx</i> , <i>Callitris</i> spp. or <i>Allocasuarina luehmannii</i> ; and various <i>Corymbia citriodora</i> , <i>Eucalyptus crebra</i> and <i>Eucalyptus melanophloia</i> , <i>Callitris glaucophylla</i> and <i>Allocasuarina luehmannii</i> open forest and woodland associations on sandstone derived soils. Little is known about the ecological requirements of Dunmall's snake, however, the species has been found sheltering under fallen timber and ground litter.  The Dunmall's snake occurs primarily in the Brigalow Belt region in the southeastern interior of Queensland. Records indicate sites at elevations between 200–500 m above sea level (Department of			NA	Yes Targeted surveying completed in December 2020 (active searching) did not detect this species. However, Terrestria (2021) did record this species on the Santos Bottle Tree property which is located less than 5 km to the north east of the Project Area (see Section 4.2). No ALA records occur within the area surrounding the Project Area. However, a single historical record (1977) occurs within 50 km of the Project	Likely

	01-1	Distribution and habitat requirements	Potential habitat	utilisation in Pro	ject Area	Records	Likelihood of occurrence
Species	Status (EPBC Act, NC Act)		Breeding / nesting/ roosting habitat	Foraging habitat	Dispersal habitat		
		Agriculture Water and the Environment, 2021b).				Area at Presho State Forest to the east.	
Fitzroy River turtle (Rheodytes leukops)	Vulnerable; Vulnerable	Fitzroy River turtles are generally attributed to fast-flowing clear freshwater rivers and rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles, commonly in association with <i>Eucalyptus tereticornis, Casuarina cunninghamiana, Callistemon viminalis, Melaleuca linariifolia</i> and <i>Vallisneria</i> sp Foraging in these habitats is generally associated with in-stream debris such as fallen logs. Alluvial sand/loam banks with a relatively steep slope, low density of ground/understorey vegetation and partial shade cover appear to be preferred for nesting. Due to the species' ability to respire aerially and aquatically, this species can also inhabit fastflowing riffle zones where primarily airbreathing species such as the white-throated snapping turtle may be excluded. The bulk of records for this species are associated with the large primary streams of the Fitzroy River system: the Nogoa, Comet, MacKenzie, Connors, Isaac, Dawson and Fitzroy Rivers (Department of Agriculture Water and the Environment, 2021b).	No Creeks and drainage lines within the Project Area do not have soil types suitable for the nesting of this species. Banks are moderately to highly disturbed from cattle grazing.	No During the field survey creeks were observed to hold only small occasional ponds of water. Levels of coarse woody debris and rocks in the creekbed were low. Creeks are generally very narrow and highly disturbed from cattle grazing.	No All watercourses within the Project Area are a low stream order and are considered non-perennial.	No ALA records occur within 50 km of the Project Area (centre coordinate).	Unlikely





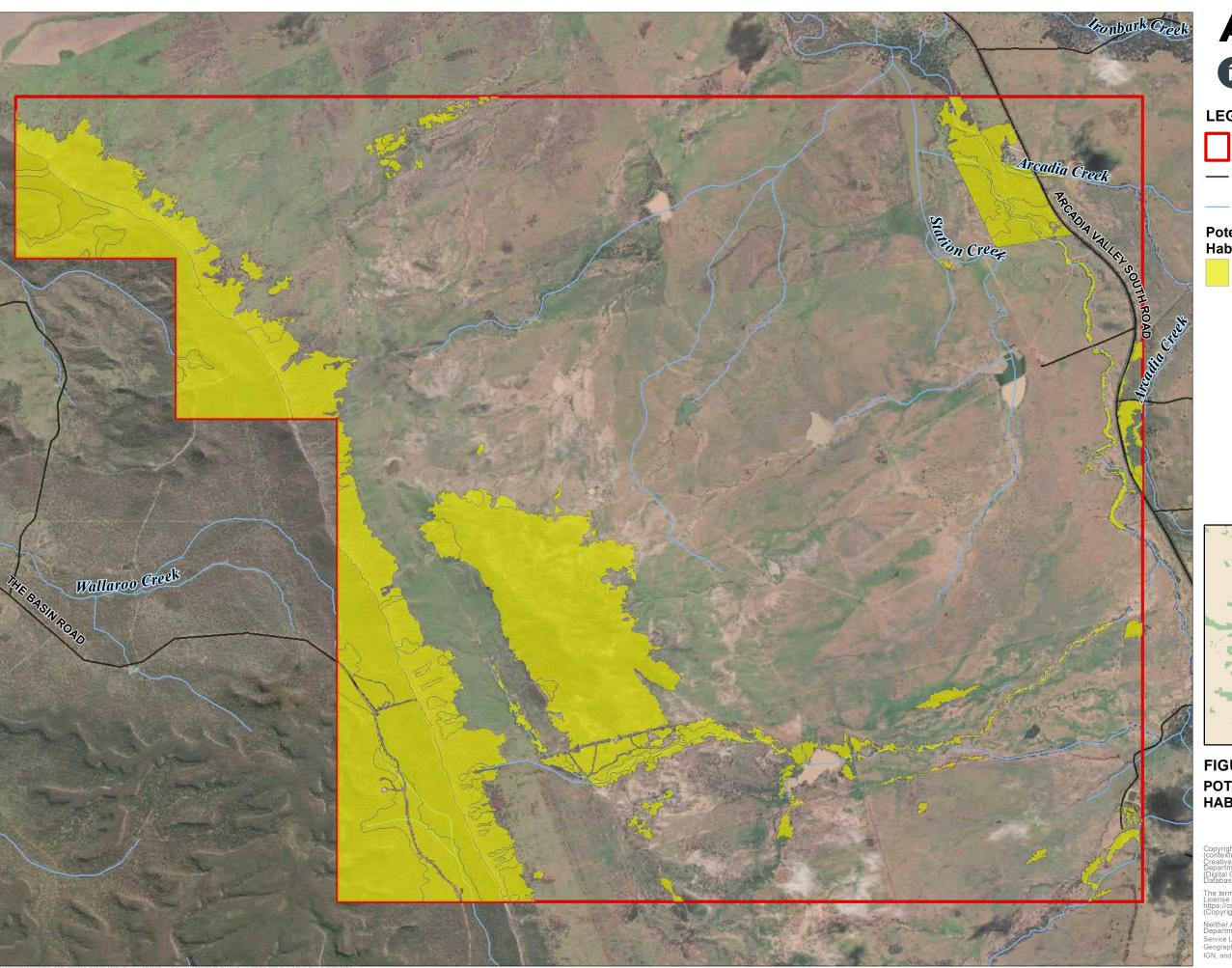
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#### **LEGEND**

- Project Area
- Roads and Tracks
- Minor Watercourses
- Potential Xerothamnella *herbacea* Habitat
- Potential Bertya opponens Habitat
- Potential and / or known ooline /// Habitat
- Potential Acacia grandifolia Habitat



#### FIGURE 11 POTENTIAL THREATENED **FLORA HABITAT**





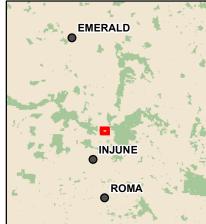
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#### **LEGEND**

- Project Area
- Roads and Tracks
- Minor Watercourses

#### **Potential Red Goshawk** Habitat

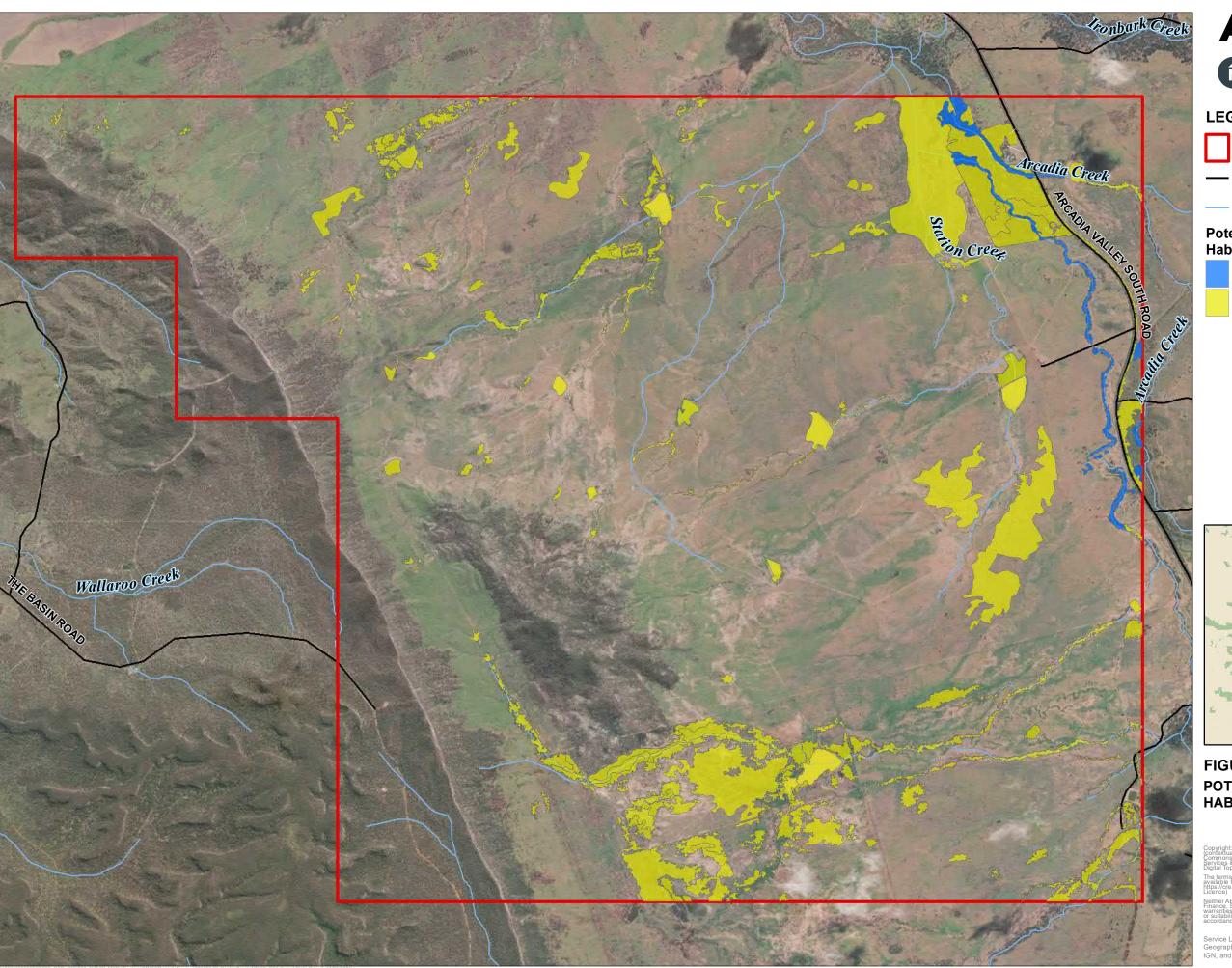
Foraging only



#### FIGURE 12 POTENTIAL RED GOSHAWK HABITAT

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#### **LEGEND**

- Project Area
- Roads and Tracks
- Minor Watercourses

#### Potential Grey Falcon Habitat

Breeding / foraging

Foraging

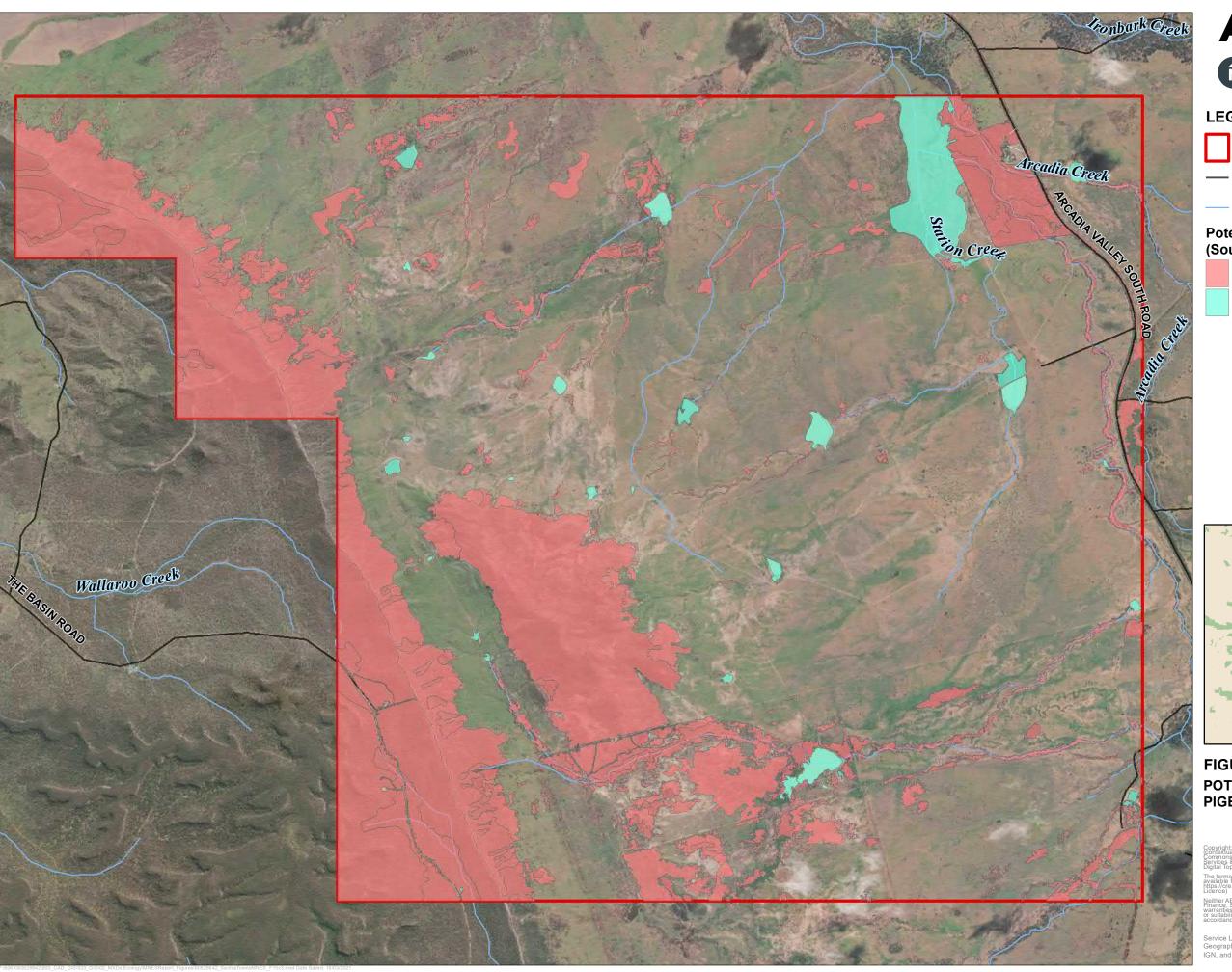


# FIGURE 13 POTENTIAL GREY FALCON HABITAT

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#### **LEGEND**

Project Area

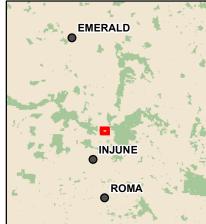
— Roads and Tracks

- Minor Watercourses

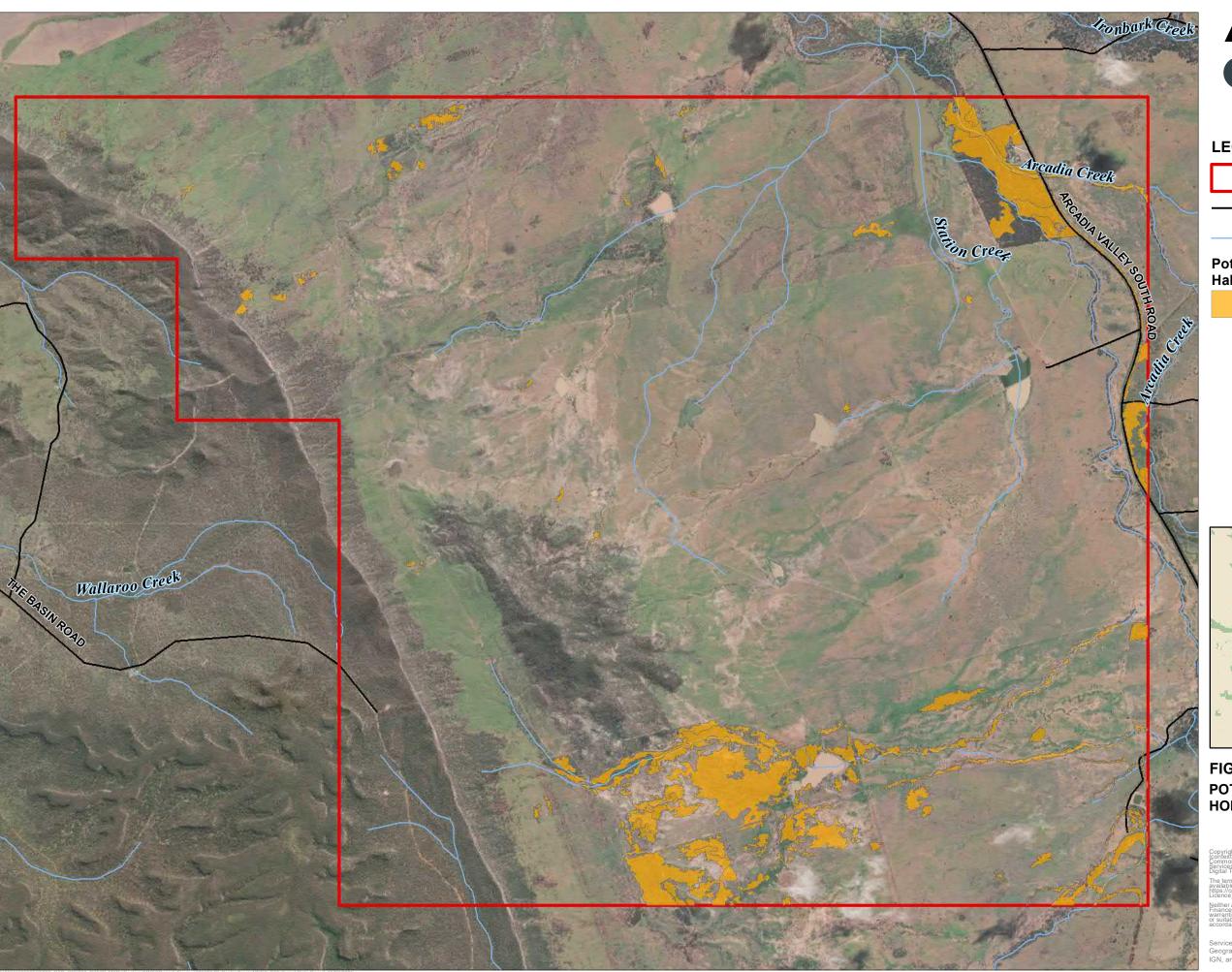
#### **Potential Squatter Pigeon** (Southern) Habitat

Dispersal

Water source



#### FIGURE 14 POTENTIAL SQUATTER **PIGEON (SOUTHERN) HABITAT**







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#### **LEGEND**

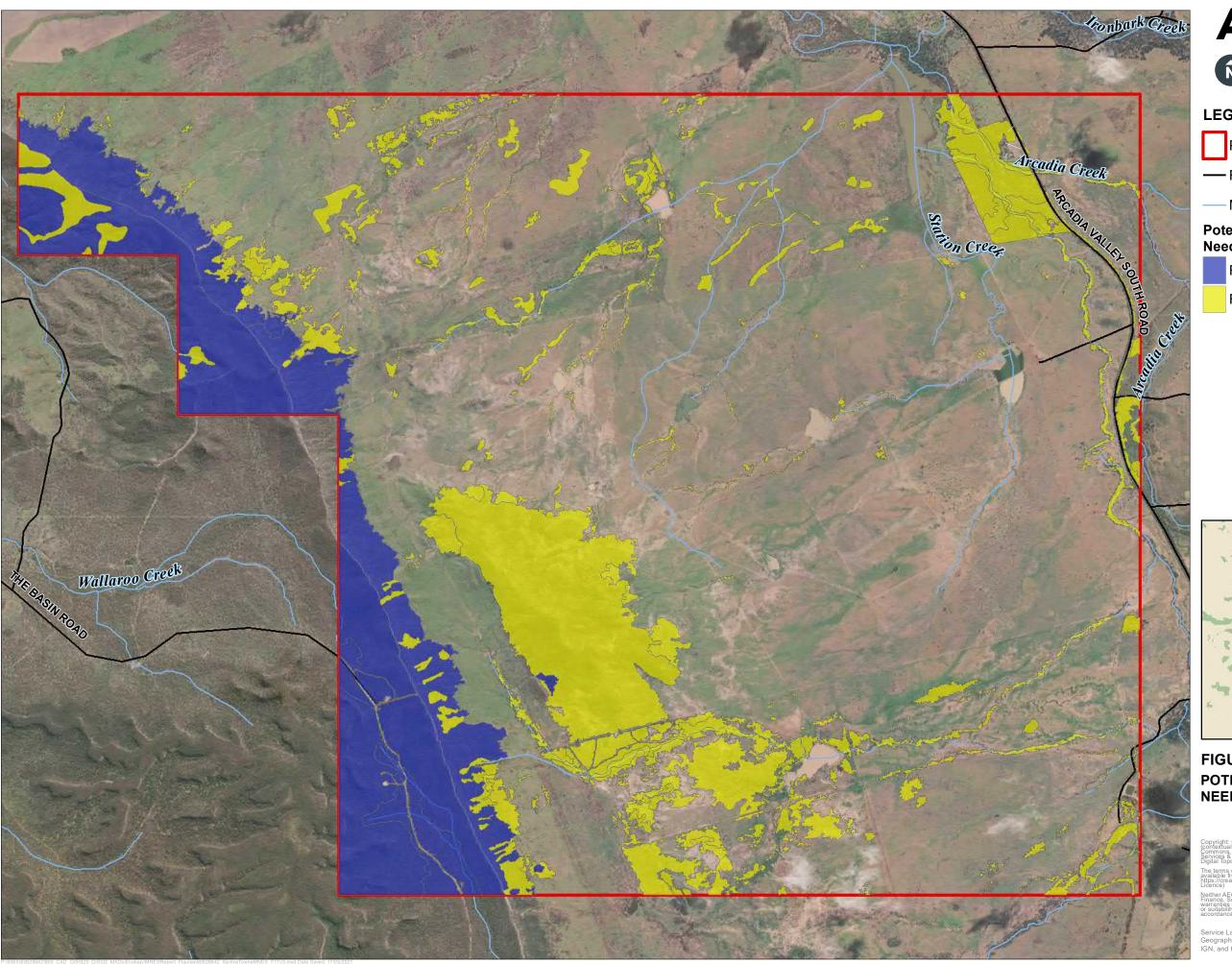
- Project Area
- Roads and Tracks
- Minor Watercourses

#### **Potential Painted Honeyeater** Habitat

Foraging & dispersal



#### FIGURE 15 POTENTIAL PAINTED **HONEYEATER HABITAT**





0 0.55 1.1 KMS

#### **LEGEND**

- Project Area
- Roads and Tracks
- Minor Watercourses

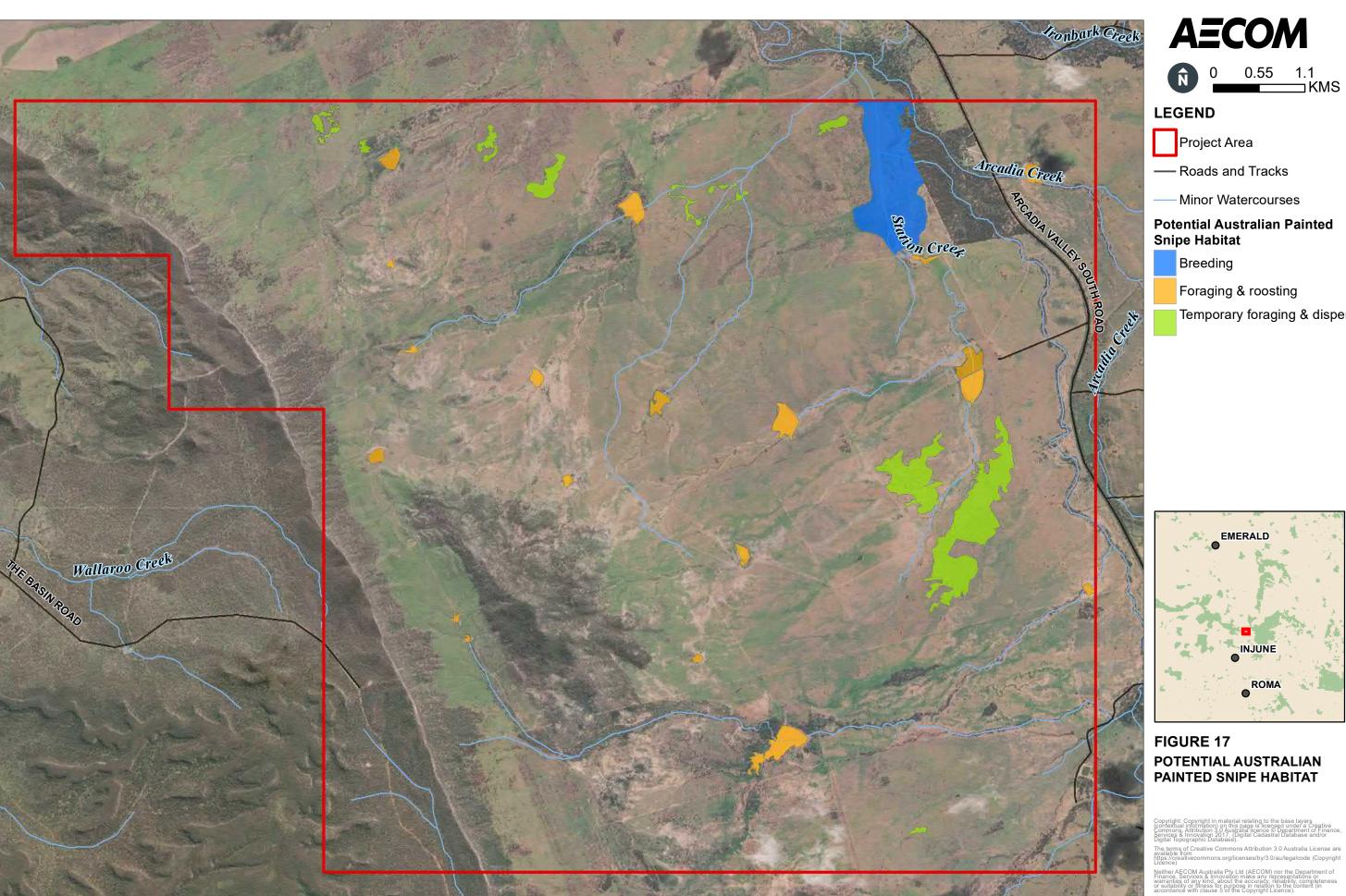
#### **Potential White-throated Needletail Habitat**

Roosting & foraging

Foraging only



#### FIGURE 16 POTENTIAL WHITE-THROATED **NEEDLETAIL HABITAT**



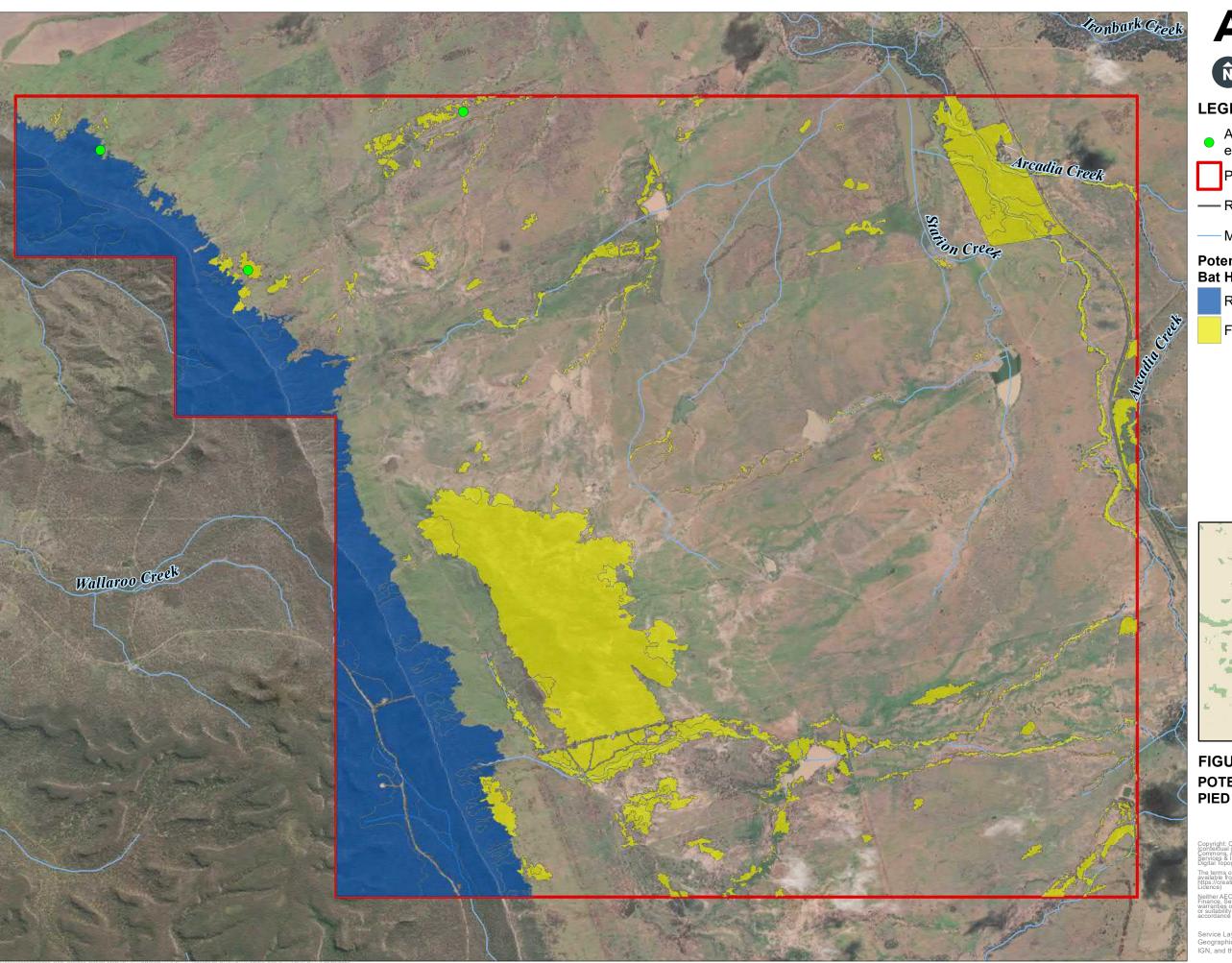
### **Potential Australian Painted**

Foraging & roosting

Temporary foraging & dispersal



### **POTENTIAL AUSTRALIAN** PAINTED SNIPE HABITAT





#### **LEGEND**

- AECOM 2020 recorded Large-eared Pied Bat calls
- Project Area
- Roads and Tracks
- Minor Watercourses

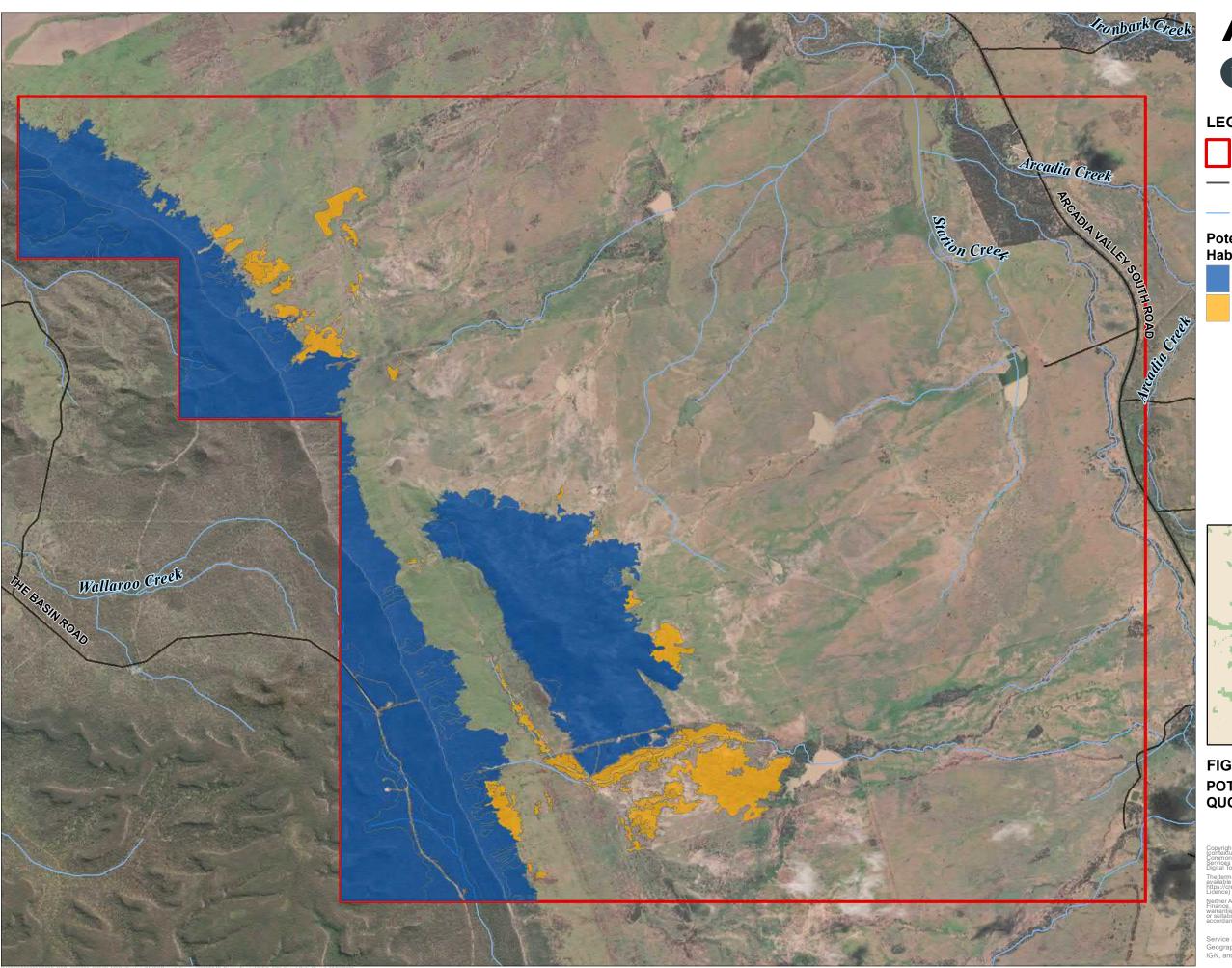
#### **Potential Large-eared Pied Bat Habitat**



Foraging



#### FIGURE 18 POTENTIAL LARGE-EARED **PIED BAT HABITAT**





0 0.55 1.1 KMS

#### **LEGEND**

- Project Area
- Roads and Tracks
- Minor Watercourses

#### **Potential Northern Quoll** Habitat



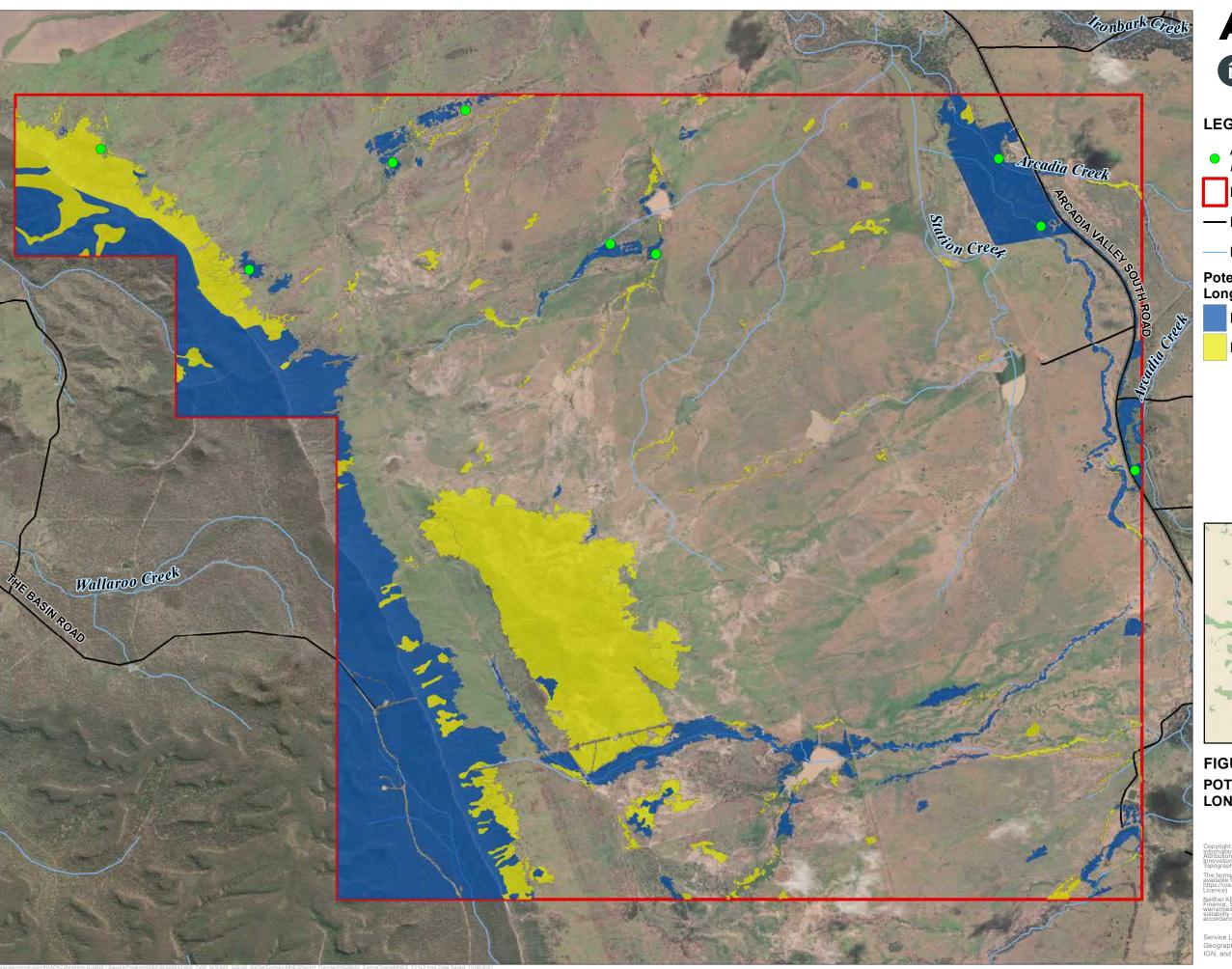
Denning & foraging



Foraging & dispersal



#### FIGURE 19 POTENTIAL NORTHERN **QUOLL HABITAT**





#### **LEGEND**

- AECOM 2020 recorded Nyctophilus sp. calls
- Project Area
- Roads and Tracks
- Minor Watercourses

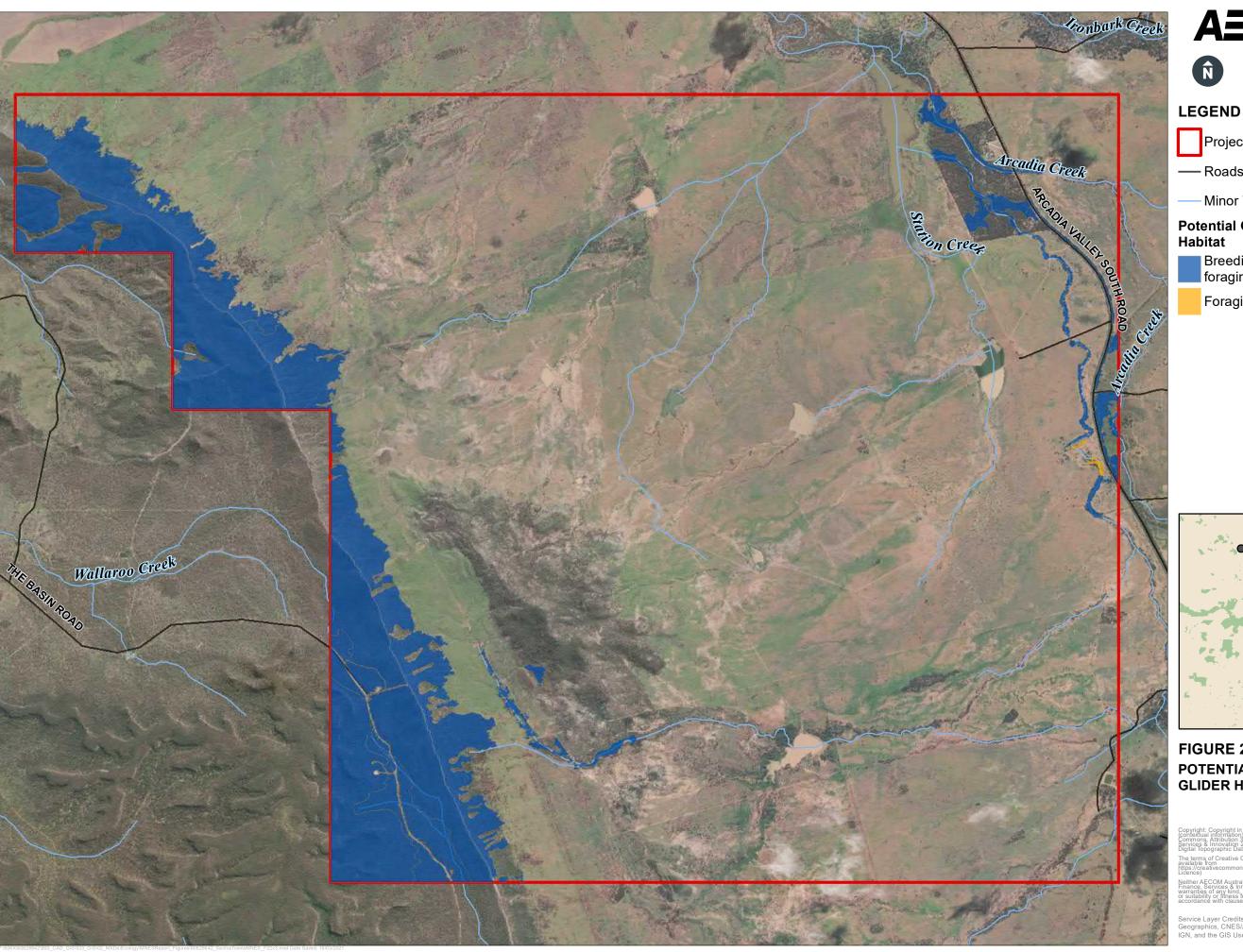
#### **Potential South-eastern** Long-eared Bat Habitat

Roosting & foraging

Foraging only



#### FIGURE 20 POTENTIAL SOUTH-EASTERN LONG-EARED BAT HABITAT





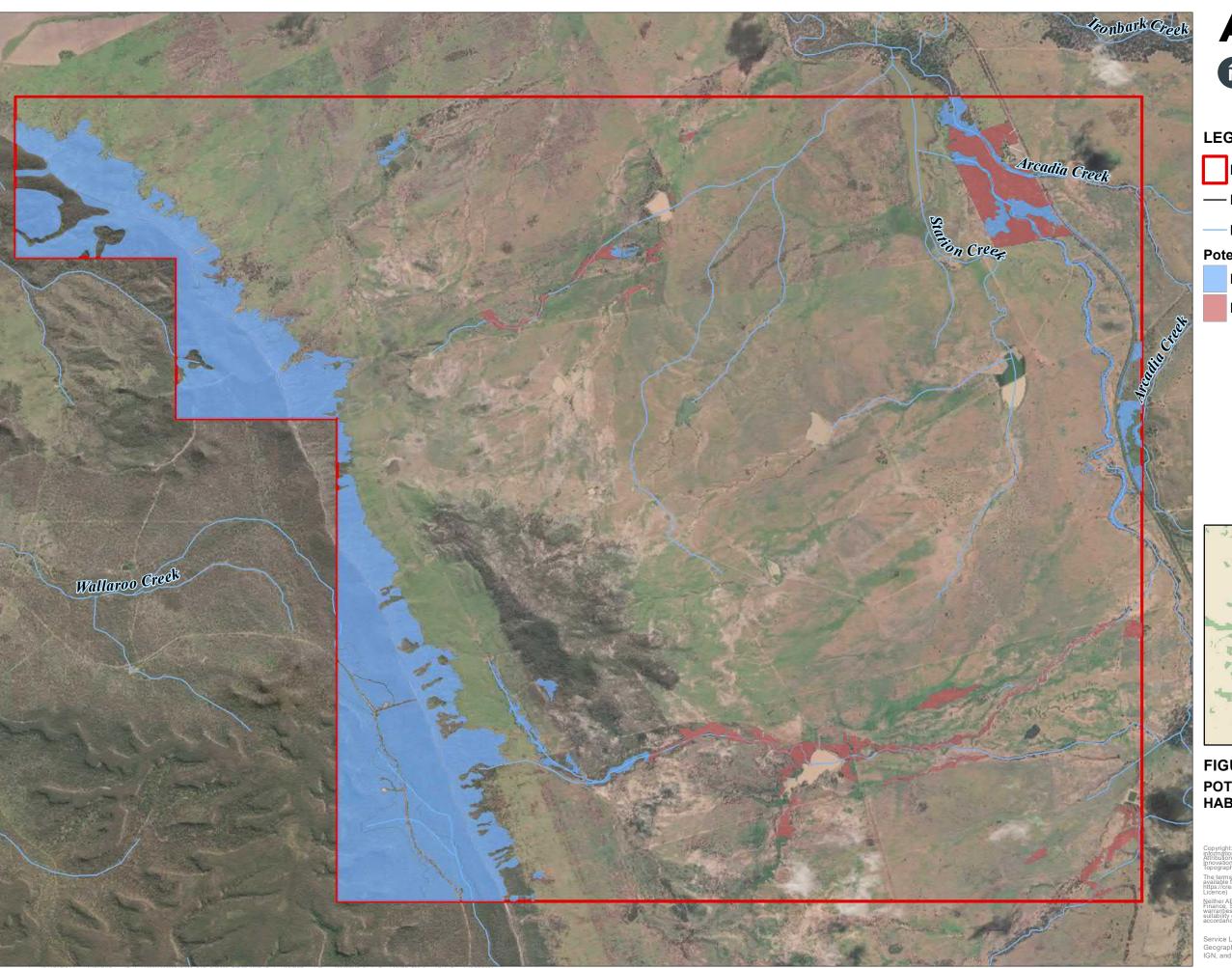
- Project Area
- Roads and Tracks
- Minor Watercourses

#### **Potential Greater Glider** Habitat

- Breeding, denning & foraging
- Foraging & dispersal



#### FIGURE 21 POTENTIAL GREATER **GLIDER HABITAT**





0 0.5 1

#### **LEGEND**

- Project Area
- Roads and Tracks
- Minor Watercourses

#### Potential Koala Habitat

- Refuge and foraging
- Foraging and dispersal

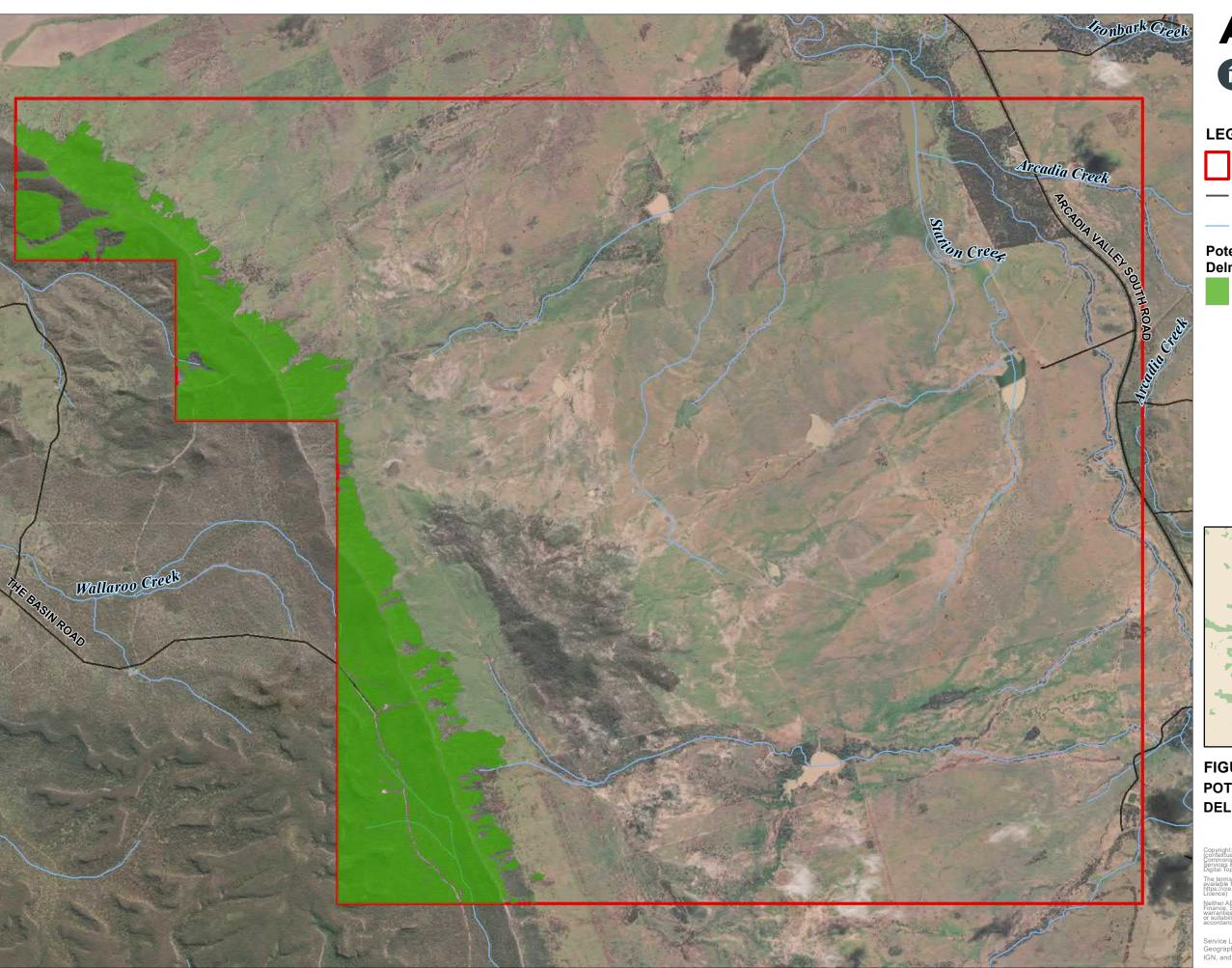


#### FIGURE 22 POTENTIAL KOALA HABITAT

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#### **LEGEND**

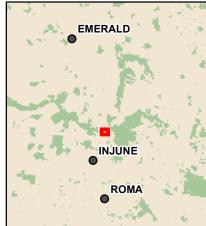


— Roads and Tracks

--- Minor Watercourses

#### Potential Adorned Delma Habitat

Breeding & foraging

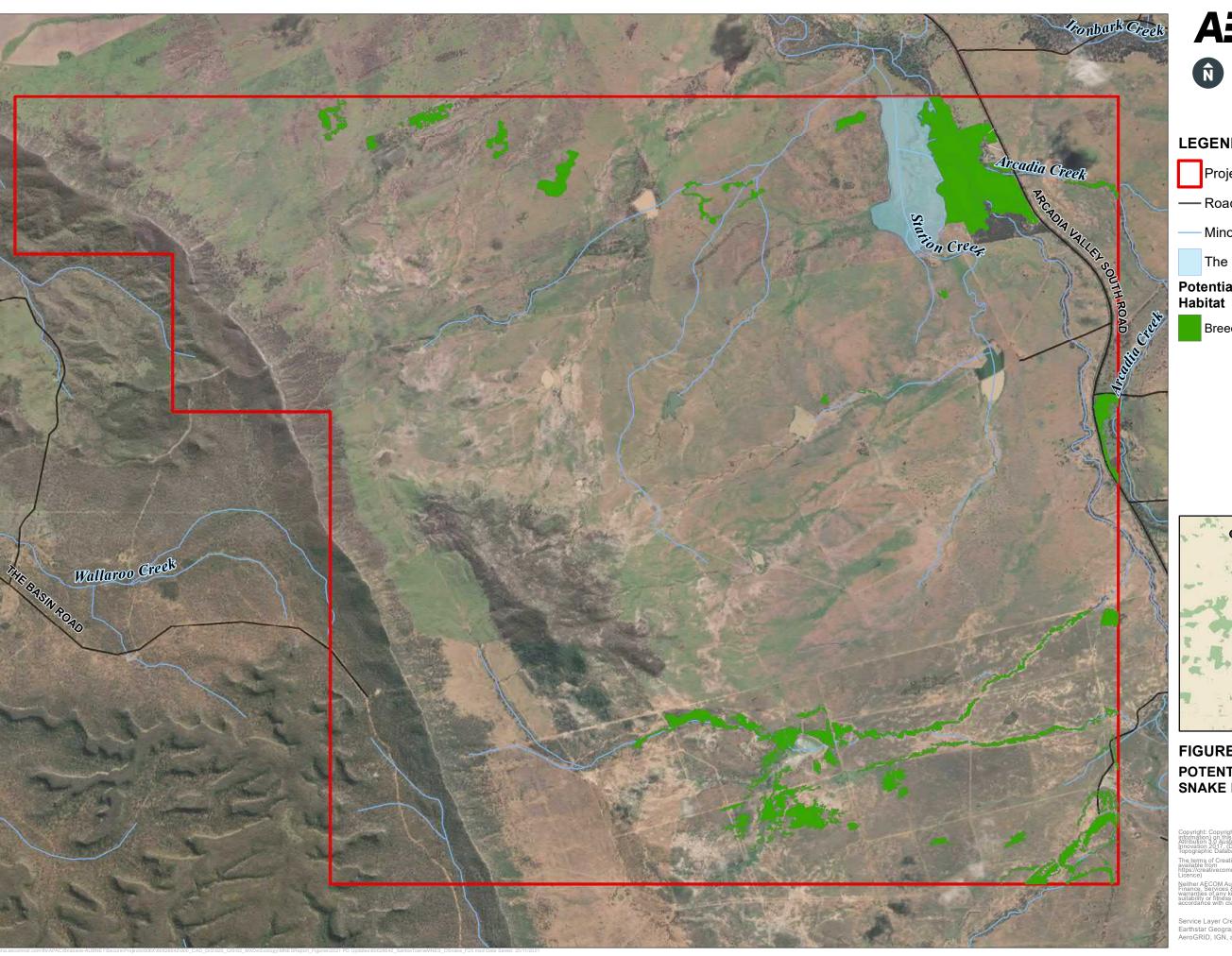


# FIGURE 23 POTENTIAL ADORNED DELMA HABITAT

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#### **LEGEND**

Project Area

— Roads and Tracks

Minor Watercourses

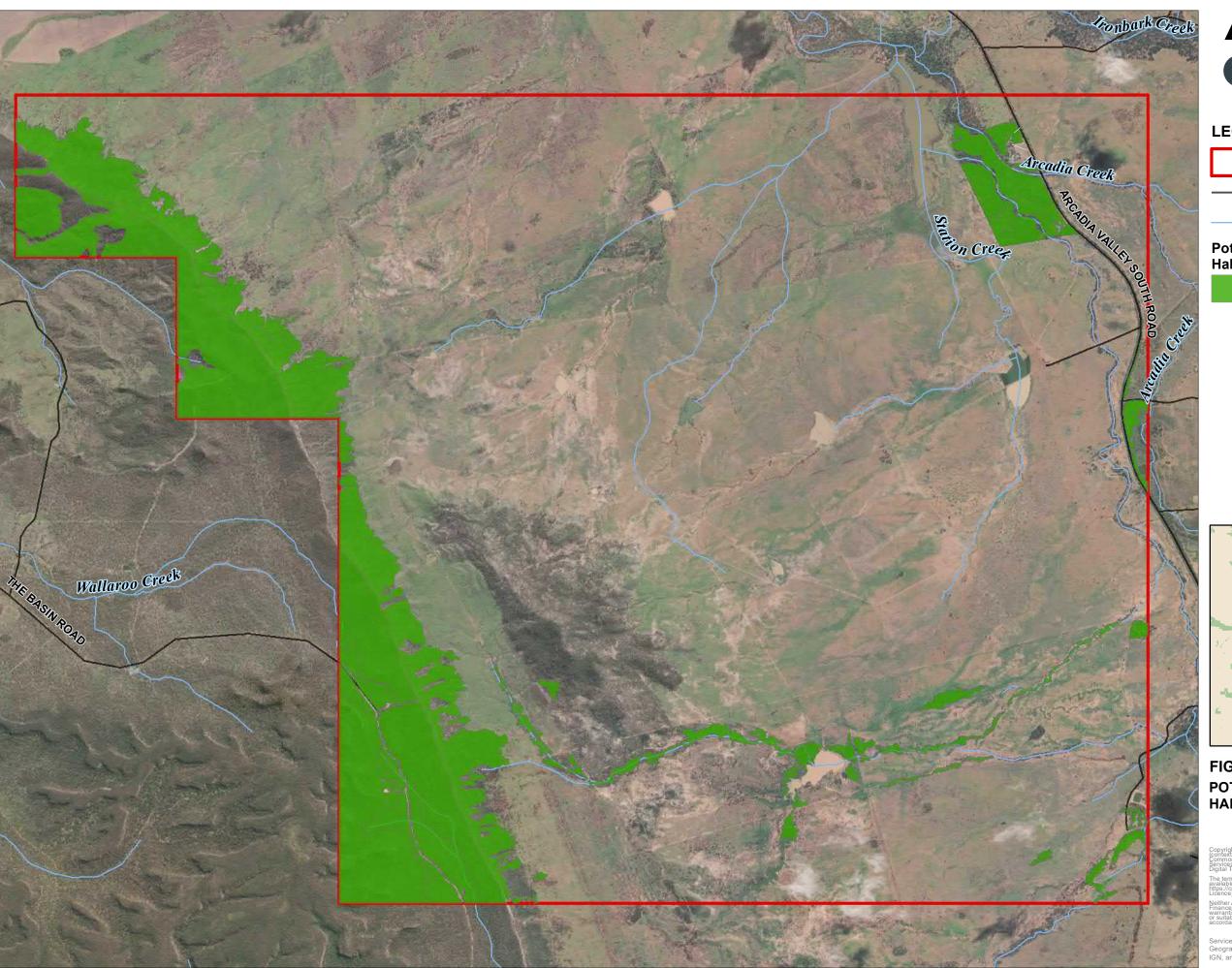
The Wetland

### **Potential Ornamental Snake**

Breeding & foraging



#### FIGURE 24 POTENTIAL ORNAMENTAL **SNAKE HABITAT**





#### **LEGEND**

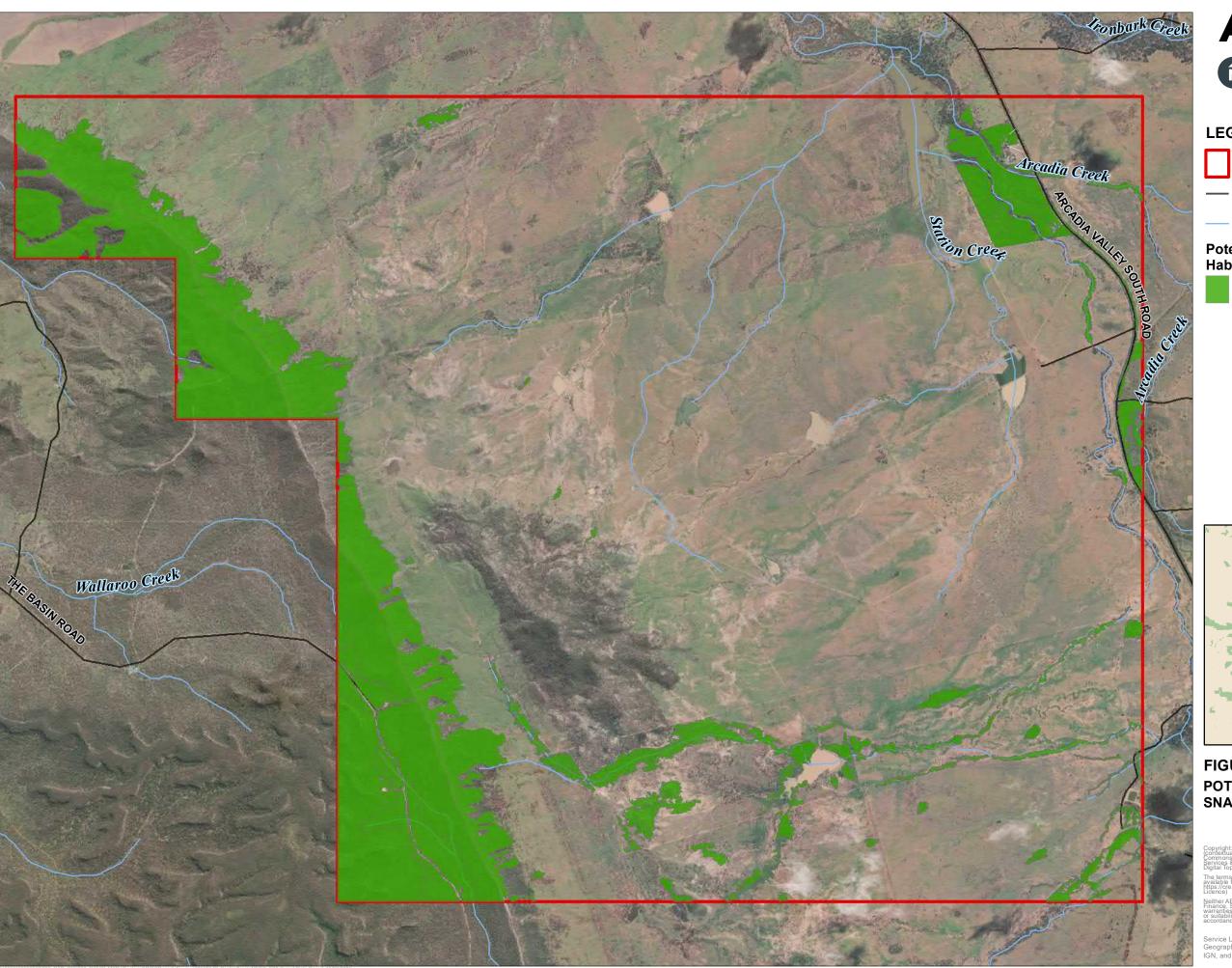
- Project Area
- Roads and Tracks
- --- Minor Watercourses

#### **Potential Yakka Skink** Habitat

Breeding & foraging



#### FIGURE 25 POTENTIAL YAKKA SKINK HABITAT





0 0.5 1

#### **LEGEND**

Project Area

— Roads and Tracks

--- Minor Watercourses

### Potential Dunmall's Snake Habitat

Breeding & foraging



# FIGURE 26 POTENTIAL DUNMALL'S SNAKE HABITAT

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#### 6.8 Listed migratory species

Excluding species also listed as critically endangered, endangered or vulnerable, the PMST identified an additional eleven migratory species as potentially occurring within the Project Area and surrounds. Of the eleven migratory species, one was confirmed during the field survey. Approximately six glossy ibis were recorded during the December 2020 field survey at the Wetland in the north-eastern Project Area (Figure 27).

A likelihood assessment was conducted for the remaining species identified in the desktop assessment to determine which species are possible or unlikely to occur within the Project Area. This evaluation was based on an understanding of the preferred habitats of the species, knowledge of the type and condition of habitats present at the Project Area as well as field records and the proximity of publicly available records.

The assessment determined five species were 'potential' or 'likely' to occur within the Project Area. A total of five migratory species were found to be unlikely occurrences. These species and the reason for this determination is as follows:

- Yellow wagtail (Motacilla flava): no records occur within the area surrounding the Project Area.
   Only small numbers of this species visit Australia, and while some very marginal habitat does occur within the Project Area it is unlikely to be preferential to migrating individuals.
- Common sandpiper (Actitis hypoleucos), sharp-tailed sandpiper (Calidris acuminata), pectoral
  sandpiper (Calidris melanotos): no records occur within the area surrounding the Project Area. This
  species is typically found along the Queensland coastline and the Project Area is greater than 250
  km from the coast. The Project Area also does not contain the required habitat to support the
  presence of the species, namely exposed mudflat surrounding lagoons, wetlands or estuarine
  habitats.
- Osprey (Pandion haliaetus): no records occur within the area surrounding the Project Area. This
  species is typically found along the Queensland coastline and the Project Area is greater than 250
  km from the coast. The Project Area also does not contain extensive fresh, brackish or saline water
  to support sufficient foraging resources for the species.

The detailed likelihood of occurrence assessment is detailed in Table 16 below. Potential migratory bird habitat as well as confirmed records of glossy ibis identified during the field survey within the Project Area are displayed on Figure 27.

Table 16 Likelihood of occurrence assessment – migratory species

Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Potential hat	oitat utilisation in Project	Records	Likelihood of	
			Breeding habitat	Foraging and dispersal habitat		occurrence	
Migratory ma	arine birds						
Fork-tailed swift Apus pacificus	Migratory; Special Least Concern	The fork-tailed swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. This species mostly occurs over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes  The fork-tailed swift is recorded generally east of the Great Dividing Range from Cooktown to the New South Wales border, but extends further west in southern Queensland (Department of Agriculture Water and the Environment, 2021b).	No Non- breeding migrant to Australia	Yes Species is predominantly aerial and therefore could be foraging and dispersing above the Project Area.	No A single undated ALA record occurs immediately east of the Project Area, otherwise no records occur within 50 km (from a centre coordinate).	Potential	
Glossy ibis  Plegadis falcinellus	Migratory; Special Least Concern	The glossy ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. Within Australia, this species moves in response to good rainfalls, expanding its range, however the core breeding areas used are within the Murray-Darling Basin region of New South Wales and Victoria, the Macquarie Marshes in New South Wales, and in southern Queensland. The glossy lbis often moves north in autumn, then return south to the main breeding areas in spring and summer (Department of Agriculture Water and the Environment, 2021b).	No Project Area does not occur at one of the known breeding locations for the species	Yes The constructed wetland in Lot 2 on TR13 as well as some of the larger farm dams within the Project Area provide suitable foraging and dispersal habitat for the species (Figure 27).	Yes Six individuals were recorded during the field survey within the constructed wetland within the Project Area (Figure 27). This species was also recorded in 2017 by BooBook on a property approximately 10 km to the south east.	Known	

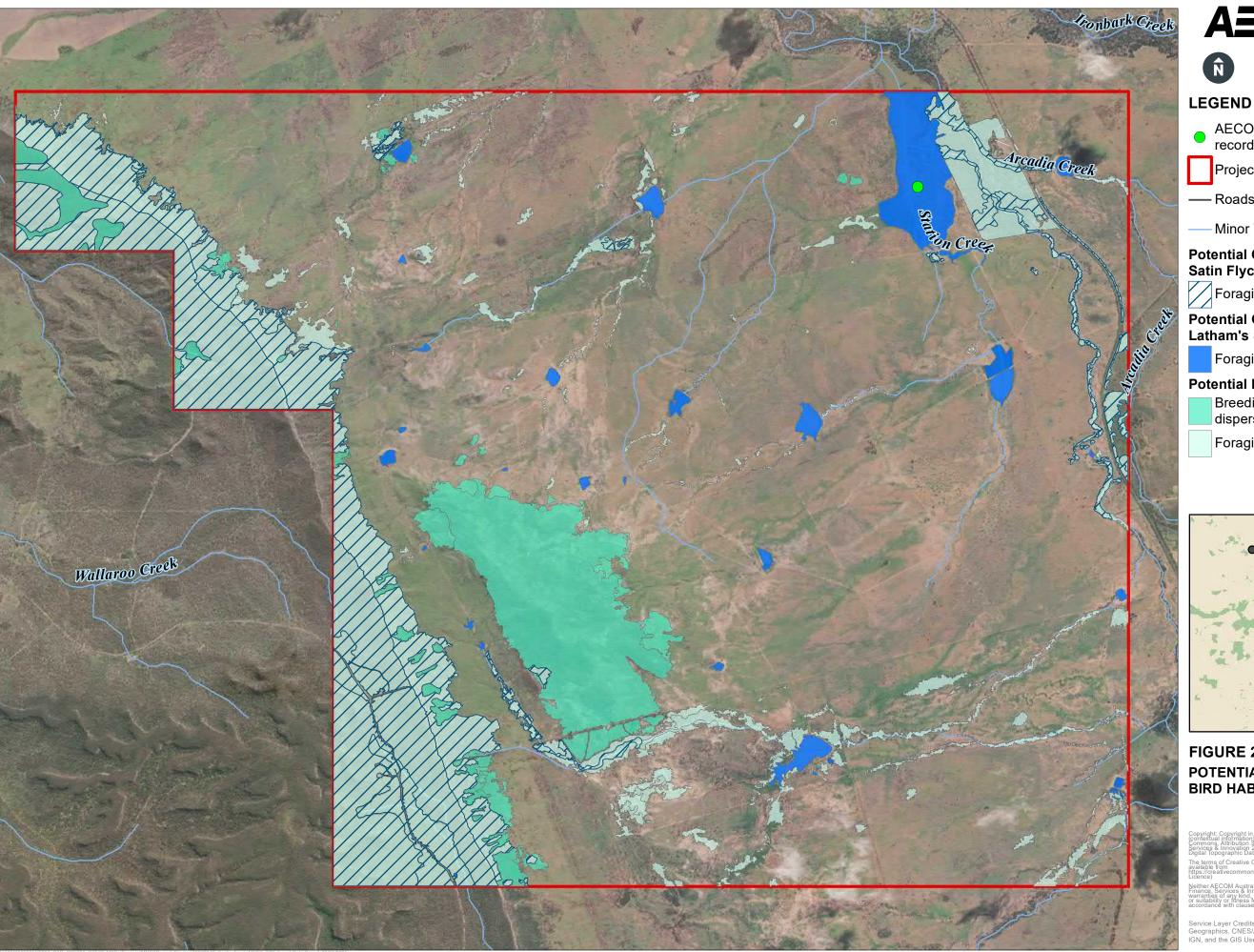
Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Potential ha	bitat utilisation in Project	Records	Likelihood of	
			Breeding habitat	Foraging and dispersal habitat		occurrence	
Migratory te	errestrial species						
Oriental cuckoo  Cuculus optatus	Migratory; Special Least Concern	This species uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types.  The oriental cuckoo is a regular migrant to Australia, where it spends the non-breeding season (Sept- May) in coastal regions across northern and eastern Australia as well as offshore islands (Department of Agriculture Water and the Environment, 2021b).	No Non- breeding migrant	Yes The Eucalypt woodland in the western extent of the Project Area along the ridgeline provides the intact habitat that the species could utilise for foraging and dispersal.	No No ALA records occur within 50 km of the Project Area, however two records from 2001 are present within 80 km (one west of Injune and the other to the east in Presho Forest Reserve).	Potential	
Yellow wagtail <i>Motacilla</i> <i>flava</i>	Migratory; Special Least Concern	Habitat requirements for the yellow wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves.  The yellow wagtail is considered an 'extremely uncommon migrant', but when in Australia occurs mostly in northern Australia during the wet season. In Queensland this species is a regular visitor from Mossman south to Townsville. The species is a vagrant further south and on Heron Island (Department of the Environment, 2015b).	No Non- breeding migrant	No Only small numbers of this species visit Australia, and while some very marginal habitat does occur within the Project Area it is unlikely to be preferential to migrating individuals. The Project Area does not support large exposed mudflat areas.	No ALA records occur within 100 km of the Project Area (from a centre coordinate).	Unlikely	
Satin flycatcher	Migratory; Special Least Concern	Satin flycatchers are eucalypt forest and woodland inhabitants. During the non-breeding period, some individuals winter in northern Queensland around	No Non- breeding	Yes The Eucalypt woodland in the western extent of the	No Three ALA records occur	Potential	

Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Potential hat	oitat utilisation in Project	Records	Likelihood of	
			Breeding habitat	Foraging and dispersal habitat		occurrence	
Myiagra cyanoleuca		Innisfail and farther north around Atherton; however, their movements are described as erratic. Wintering birds in northern Queensland will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.  In Queensland, this species is widespread but scattered in the east, being recorded on passage on a few islands in the western Torres Strait. Satin flycatchers are also found extensively along the Great Dividing Range (Department of Agriculture Water and the Environment, 2021b).	migrant to southern central Queensland	Project Area along the ridgeline provides the intact habitat that the species could utilise for foraging and dispersal.	within 50 km of the Project Area; two from 2015 located east in Belington Hut State Forest, and a single undated record north at Nuga Nuga National Park.		
Rufous fantail Rhipidura rufifrons	Migratory; Special Least Concern	In east and south-east Australia, the rufous fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts, usually with a dense shrubby understorey often including ferns. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including <i>Eucalyptus maculata</i> , <i>Eucalyptus melliodora</i> , ironbarks or stringybarks, often with a shrubby or heath understorey.  The rufous fantail is found in northern and eastern coastal Australia, being more common in the north. This species migrates to south-east Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Department of Agriculture Water and the Environment, 2021b).	Yes Areas of intact SEVT (remnant and high value regrowth) provide the dense habitat that the species requires for nesting (Figure 27).	Yes Woodland and regrowth habitat in the Project Area provide the dense shrubby understorey that may be utilised by this species while on passage (Figure 27).	Yes This species was recorded in 2017 by Boobook on a property approximately 10 km to the north east. Four ALA records occur within 50 km of the Project Area; a single record located east in Expedition National Park from 2017, and three records north at Nuga Nuga National Park (2012, 2018 and undated).	Likely	

Species	Status (EPBC Act, NC Act)	Distribution and habitat requirements	Potential hat	oitat utilisation in Project	Records	Likelihood of occurrence	
			Breeding habitat	Foraging and dispersal habitat			
Migratory we	tland species						
Common sandpiper  Actitis hypoleucos	Migratory; Special Least Concern	The common sandpiper is known to occur in a range of wetland environments, both coastal and inland. Their primary habitat is rocky shorelines and narrow muddy margins of billabongs, lakes, estuaries and mangroves. Found along all coastlines of Australia and in many areas inland, the common sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (Department of Agriculture Water and the Environment, 2021b).	No Non- breeding migrant to Australia	No This species is primarily coastal, and the Project Area is approximately 250 km inland. The Project Area does not contain large exposed mudflat areas surrounding wetland areas. Farm dams are highly degraded and not suitable.	No ALA records occur within 100 km.	Unlikely	
Sharp-tailed sandpiper  Calidris acuminata	Migratory; Special Least Concern	In Australasia, the sharp-tailed sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland.  In Queensland, the sharp-tailed sandpiper is recorded in most regions, being widespread along much of the coast and are very sparsely scattered inland, particularly in central and south-western regions (Department of Agriculture Water and the Environment, 2021b).	No Non- breeding migrant to Australia	No This species is primarily coastal, and the Project Area is approximately 250 km inland. The Project Area does not contain large exposed mudflat areas surrounding wetland areas. Farm dams are highly degraded and not suitable.	No There are no ALA records within 50 km, however there are three within 100 km (two from 1994 south west near Injune and one to the east from 1979 near Alkoomie).	Unlikely	
Pectoral sandpiper  Calidris melanotos	Migratory; Special Least Concern	This species is usually found in coastal or near coastal habitat but very occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire.	No Non- breeding migrant to Australia	No This species is primarily coastal, and the Project Area is approximately 250 km inland. The Project	No No ALA records occur within 100 km	Unlikely	

Species Status (EPBC Act, NC Act)		Distribution and habitat requirements	Potential hal Area	bitat utilisation in Project	Records	Likelihood of
			Breeding habitat			occurrence
		In Queensland, most records for the pectoral sandpiper occur around Cairns. There are scattered records elsewhere, mainly from east of the Great Divide between Townsville and Yeppoon. Records also exist in the south-east of the state as well as a few inland records at Mount Isa, Longreach and Oakley (Department of Agriculture Water and the Environment, 2021b).		Area does not contain large exposed mudflat areas surrounding wetland areas. Farm dams are highly degraded and not suitable.		
Latham's snipe Gallinago hardwickii	Migratory; Special Least Concern	In Australia, the Latham's snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies).  Latham's snipe is a non-breeding visitor to southeastern Australia, and is a passage migrant through northern Australia. This species has been recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. In Queensland, the range extends inland over the eastern tablelands in south-eastern Queensland (Department of Agriculture Water and the Environment, 2021b).	No Non- breeding migrant to Australia	Yes The constructed wetland in Lot 2 on TR13 as well as some of the larger farm dams contain fringing aquatic habitat that could provide sufficient coverage for the species whilst foraging and dispersing (Figure 27).	No No records occur within the area surrounding the Project Area. However, two ALA records occur within 50 km of the Project Area; one located south near Doonkuna State Forest (2003) and the other further west with a high spatial uncertainty (1979).	Potential
Osprey  Pandion haliaetus	Migratory; Special Least Concern	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northwestern Australia. They require extensive areas of open fresh, brackish or saline water for foraging.	No Project Area is not coastal	No Project Area does not contain the extensive areas of fresh, saline or brackish water for foraging.	No No records occur within the area surrounding the Project Area. Two records occur within 100 km of	Unlikely Suitable habitat occurs within the Project Area, however no

Species		Status (EPBC Act, NC Act)	Distribution and habitat requirements	Potential ha Area	bitat utilisation in Project	Records	Likelihood of	
				Breeding habitat	Foraging and dispersal habitat		occurrence	
			The breeding range of the osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in New South Wales; with a second isolated breeding population on the coast of South Australia, extending from Head of Bight east to Cape Spencer and Kangaroo Island (Department of Agriculture Water and the Environment, 2021b).			the Project Area at Carnarvon National Park to the west (undated and 1998).	major rivers occur within or nearby.	



- AECOM 2020 Glossy Ibis record
- Project Area
- Roads and Tracks
- Minor Watercourses

#### Potential Oriental Cuckoo & Satin Flycatcher Habitat

Foraging & dispersal

### Potential Glossy Ibis & Latham's Snipe Habitat

Foraging & dispersal

#### **Potential Rufous Fantail Habitat**

- Breeding, foraging and dispersal
- Foraging and dispersal



#### FIGURE 27 **POTENTIAL MIGRATORY BIRD HABITAT**

#### 6.9 Nuclear actions

The Project is not and does not involve a nuclear action.

### 6.10 A water resource, in relation to coal seam gas development and large coal mining development

Impacts to water resources as a result of the Project have been assessed by KCB. Findings of the KCB assessment indicate no significant impacts to a water resource should occur as a result of the Project. This assessment is provided in Attachment D of the PD.

#### 7.0 Potential impacts

Information on the potential impacts associated with the Project are outlined below. Proposed mitigation measures to minimise the potential impacts on the relevant MNES values are outlined in Section 8.0.

#### 7.1 Construction phase

The greatest risk of potential impact on MNES values from the Project will occur during the construction phase. The construction activities to support the installation of gas wells, associated distribution gathering lines and access tracks will involve vegetation clearing, trenching or excavation and ground reinstatement. Direct and indirect impacts potentially associated with this are described below.

#### 7.1.1 Direct impacts

Vegetation clearing is a direct impact that can result in the loss of vegetation values and habitat, with the severity of impacts more pronounced in habitats that provide values for conservation significant species and communities. Potential impacts resulting from clearing native vegetation can include:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat
- Loss of habitat causing a reduction of biological diversity or loss of local populations and genotypes
- Loss of or disturbance to microhabitat features such as tree hollows, leaf litter, ground timber, dense shrubs and hollows
- Loss of floristic diversity and the food resources this provides such as foliage, flowers, nectar, fruit and seeds
- Fragmentation of habitats resulting in reduced dispersal opportunities for fauna
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

The extent of potential clearing impacts to each relevant MNES are detailed in Table 17. As construction will occur in phases, direct impacts will be limited to a relatively small area within the Project Area at a time. The staging will increase the frequency of direct impacts to values; however it will substantially reduce the duration of the overall permanent impact by gradually and progressively undertaking the clearing.

For MNES identified as potential, likely or known to occur, direct impact areas and the percent of habitat loss this equates to in relation to the extent of remaining habitat within the Project Area has been provided as a maximum value in Table 17 below. Whilst impacts are proposed and anticipated for these MNES (i.e. stated as 'permissible' in the table below), the nature and extent of impacts are only permissible in accordance with the Protocol (i.e. activity is permitted as per constraints category), up to the maximum areas identified below. Overall, the direct loss of potential MNES habitat is low in magnitude given the extent that will remain. No direct impacts will occur to MNES identified as unlikely to occur (see Section 6.0) due to the lack of potential presence of these values within the Project Area and associated habitat. Given this, direct impacts are considered to be predictable and known.

At the time of this assessment not all areas within the Project Area had been field validated (i.e. lot and plan 2SP200046). However, a conservative and precautionary approach was implemented in the mapping of potential MNES habitat. Additionally, as specified in the Protocol, Project works will not be permissible in areas that have not already been field validated until detailed ecological assessments have been completed. In the rare event that a greater extent of habitat supporting potential MNES is identified through detailed ecological assessment, the Project will be designed to ensure compliance with the proposed maximum clearing extent. The process will be managed through the Project's Protocol (refer to Section 2.2). If MNES identified as unlikely to occur at the time of this assessment are identified during future detailed ecological assessments, direct impacts on such will not be permissible (see Table 17 below). Given this, direct impacts are considered to be predictable and known.

Direct impacts have been specifically excluded from the two areas that are considered to provide the greatest habitat value within the Project Area: the western ridgeline and Middle Hill. These areas form the 'no-go' constraint category, where no petroleum activities are permitted. By ensuring these areas of

habitat are retained and undisturbed, the extent of direct impact on a number of MNES values has been significantly reduced and targeted to areas of lower quality on the valley floor. As a result, extensive areas of habitat will remain following the development of the Project for the following values:

- Ooline
- Red goshawk
- Squatter pigeon
- White-throated needletail
- Large-eared pied bat
- Northern quoll
- South-eastern long-eared bat
- Greater glider
- Koala
- Adorned delma
- Yakka skink
- Dunmall's snake
- Fork-tailed swift
- Satin flycatcher
- Rufous fantail.

Habitat that occurs in the 'no-go' constraints category would also meet the area requirements to be considered nationally important habitat for the satin flycatcher and rufous fantail as outlined in the *Referral Guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015b). Total avoidance of this habitat area ensures no direct impacts to nationally important habitat for migratory species will occur.

Table 17 Direct impacts on MNES

MNES	Status (EPBC Act)	Likelihood of Occurrence	Project Area habitat utilisation	Total potential habitat within Project Area (ha)	Direct impacts permissible	Maximum direct impact (ha)	Percentage of available habitat to be impacted
TEC							
Brigalow	Endangered	Known	-	253.65	Yes	2	0.79%
Poplar box	Endangered	Known	-	39.41	Yes	0.5	1.22%
SEVT	Endangered	Known	-	534.49	No	0	0%
Coolibah	Endangered	Unlikely	-	0.0	No	0	-
Weeping myall	Endangered	Unlikely	-	0.0	No	0	-
Threatened flo	ra			·			
Acacia grandifolia	Vulnerable	Potential	-	920.37	No	0	0%
Bertya opponens	Vulnerable	Potential	-	1,450.39	No	0	0%
Dichanthium setosum	Vulnerable	Unlikely	-	0.0	No	0	-
Hairy-joint grass	Vulnerable	Unlikely		0.0	No	0	-
Ooline	Vulnerable	Known	-	772.42	Yes	5 <sup>A</sup>	0.65%
Thesium australe	Vulnerable	Unlikely	-	0.0	No	0	-
Tylophora linearis	Endangered	Unlikely	-	0.0	No	0	-
Xerothamnella herbacea	Endangered	Likely	-	250.45	Yes	2 <sup>B</sup>	0.80%

MNES	Status (EPBC Act)	Likelihood of Occurrence	Project Area habitat utilisation	Total potential habitat within Project Area (ha)	Direct impacts permissible	Maximum direct impact (ha)	Percentage of available habitat to be impacted
Threatened birds							
Australian	Endangered	Potential	Breeding / nesting	96.12	No	0	0%
painted snipe			Foraging or temporary foraging and dispersal	201.12	Yes	5	2.5%
Curlew sandpiper	Critically endangered	Unlikely	-	0.0	No	0	-
Grey falcon	Vulnerable	Potential	Breeding	41.65	No	0	-
			Foraging and dispersal	799.78	Yes	13	1.63%
Painted honeyeater	Vulnerable	Potential	Foraging and dispersal only	411.53	Yes	12	2.92%
Red goshawk	Vulnerable	Potential	Foraging only	1,694.43	Yes	2	0.12%
Squatter pigeon (southern)	Vulnerable	Potential	Dispersal only	2,122.63	Yes	13	0.61%
Star finch	Endangered	Unlikely	-	0.0	No	-	-
White- throated needletail	Vulnerable / Migratory	Potential	Roosting and foraging	922.89	No		0%
			Foraging and dispersal	1,199.75	Yes	13	1.08%
Greater sand plover	Vulnerable / Migratory	Unlikely	-	0.0	No	-	-
Threatened mammals							
	Vulnerable	Potential	Breeding / denning / foraging	1,002.63	Yes	1	0.1%

MNES	Status (EPBC Act)	Likelihood of Occurrence	Project Area habitat utilisation	Total potential habitat within Project Area (ha)	Direct impacts permissible	Maximum direct impact (ha)	Percentage of available habitat to be impacted
Greater glider			Foraging and dispersal	1.50	Yes		0.1%
Koala	Vulnerable	Potential	Refuge/ foraging	1,013.1	Yes	2	0.2%
			Foraging and dispersal	160.57	Yes		0.2%
Large-eared	Vulnerable	Known	Breeding / roosting	1,003.87	No	0	0%
pied bat			Foraging and dispersal	864.23	Yes	4	0.46%
Northern quoll	Endangered	Potential	Breeding / denning	1,422.67	No	0	0%
			Foraging and dispersal	206.08	Yes	3	1.46%
South-eastern long-eared bat	Vulnerable	Likely	Roosting / foraging	1,223.60	Yes	4	0.36%
			Foraging and dispersal	644.5	Yes		0.62%
Threatened reptiles							
Adorned delma	Vulnerable	Potential	Breeding and foraging	920.37	Yes	1	0.1%
Dunmall's snake	Vulnerable	Likely	Breeding and foraging	1,216.43	Yes	2	0.16%
Fitzroy River turtle	Vulnerable	Unlikely	-	0.0	No	-	-
Ornamental snake	Vulnerable	Potential	Breeding and foraging	257.71	Yes	2	0.7%
White- throated snapping turtle	Critically endangered	Unlikely	-	0.0	No	-	-
Yakka skink	Vulnerable	Potential	Breeding and foraging	1,104.89	Yes	2	0.18%

MNES	Status (EPBC Act)	Likelihood of Occurrence	Project Area habitat utilisation	Total potential habitat within Project Area (ha)	Direct impacts permissible	Maximum direct impact (ha)	Percentage of available habitat to be impacted
Migratory birds							
Common sandpiper	Migratory	Unlikely	-	0.0	No	0	-
Fork-tailed swift	Migratory	Potential	Foraging and dispersal	2,122.64	Yes	13	0.6%
Glossy ibis	Migratory	Known	Foraging and dispersal	164.0	Yes	1	0.6%
Latham's snipe	Migratory	Potential	Foraging and dispersal	164.0	Yes	1	0.6%
Oriental cuckoo	Migratory	Potential	Foraging and dispersal	1,015.19	Yes	13	1.2%
Osprey	Migratory	Unlikely	-	0.0	No	0	-
Pectoral sandpiper	Migratory	Unlikely	-	0.0	No	0	-
Rufous fantail	Migratory	Likely	Breeding, foraging and dispersal	536.60	No	0	0%
			Foraging and dispersal	1,350.17	Yes	13*	1%
Satin flycatcher	Migratory	Potential	Foraging and dispersal	1,015.19	Yes	13*	1.2%
Sharp-tailed sandpiper	Migratory	Unlikely	-	0.0	No	0	-
Yellow wagtail	Migratory	Unlikely	-	0.0	No	0	-

<sup>\*</sup> Not within habitat that meets area threshold for nationally important habitat as per Referrable Guideline for 14 listed migratory species under the EPBC Act

A: Based on field survey data an estimated density of 1 individual per 0.2 ha has been assumed. Based on this density, direct impacts to 5 ha of potential habitat may result in the loss of up 25 individual ooline plants.

<sup>B</sup>: *Xerothamnella herbacea* is a sparse, sprawling, perennial herb. The stems arise from a central point but can root at the nodes where they contact the soil. As such, it is difficult to tell individuals plants apart and therefore no predicted number of individuals that may be directly impacted has been provided.

The largest portions of potential MNES habitat within the Project Area that may be impacted consist of small, fragmented patches, which are likely to be already disturbed due to historical clearing and thinning, exotic weeds and cattle grazing. Connectivity across the Project Area is already compromised. However, further fragmentation of these patches, or fragmentation of the infrequent larger intact patches may occur via vegetation clearing, as required namely for the construction of the linear components of the Project. Vegetation clearing can fragment and disconnect vegetation communities, creating or further isolating patches which can impact on the success of seed dispersal, species recruitment and ultimately the long-term viability and persistence of a vegetation community within the landscape. Creating isolated patches and barriers for fauna movement which can impact on species recruitment, genetic flow and ultimately the long-term viability and persistence of fauna populations within the landscape.

MNES that are most susceptible to fragmentation impacts as a result of the construction of the Project include Brigalow TEC, ooline, *X. herbacea* and yakka skink. As the clearing widths for gathering infrastructure are in the order of 10-25 m, fragmentation impacts to greater glider, koala and northern quoll are considered negligible. All other threatened and migratory species are either highly mobile, adapted to fragmented landscapes or are known to still traverse cleared or modified areas without significant risk. Infrastructure siting will maximise the use of existing gaps between vegetation patches to ensure fragmentation impacts are minimised. Furthermore, the main significant vegetation corridor within the Project Area, which occurs along the western ridgeline falls within the proposed exclusion area (or 'no-go' constraint category) as per the Project's constraints protocol and therefore will not be subject to fragmentation impacts. Clearing at the Public Reserve will be limited to the southern edge which is already impacted by edge effects due to an existing track directly adjacent.

Fauna mortality is another direct impact that may occur to MNES species during the construction phase. Fauna may be injured or killed during construction principally through:

- Strike from moving vehicles/machinery key issue for ground dwelling species, particularly those with poor mobility
- Entrapment in habitat during removal key issue during tree felling for species that use tree hollows or hollow logs for roosting and denning
- Entrapment in trenches/holes key issue for ground dwelling species (reptiles and small mammals), particularly those that are active at night and cannot detect trenches to avoid.

MNES that are most susceptible to fauna mortality as a result of construction of the Project includes all threatened reptile species, greater glider, koala and south-eastern long-eared bat. The potential impact of fauna mortality as the result of the Project is likely to be at a very low frequency given the extent and condition of habitat (i.e. cleared pasture and cropping) within areas where vehicles will be regularly traversing and the mitigation measures that will be implemented (spotter catcher pre-clearance surveys, appropriate speed limits, minimal night works). The duration of the impact will be limited to the construction period and the magnitude is considered to be very low (rare occurrence of one individual).

No impacts on potential denning habitat for the northern quoll will occur as a result of the Project, as well as no impact on roosting habitat for large-eared pied bat, nesting habitat for Australian painted snipe and grey falcon.

## 7.1.2 Indirect impacts

The loss of vegetation and habitat as well as the construction activities required to be undertaken to clear vegetation or complete construction, can potentially result in indirect or secondary impacts to the associated fauna and floristic values in the form of habitat degradation. This includes:

- Increased edge effects reducing the condition of quality of remaining vegetation communities and habitat types. This would occur primarily in the few locations where larger intact patches may be disturbed as the majority of the Project Area consists of small fragmented patches which are likely to be already impacted by edge effects.
- Although exotic weeds are likely to be abundant across the Project Area, further disturbance can
  permit the establishment and spread of exotic species that may displace native species, native
  habitat resources and alter fire regimes.

- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats.
- Increased risk of contamination associated with activities such as refuelling or storage of chemicals.
- Changes in hydrology from installation of infrastructure creating a barrier to surface flow and increasing stormwater run-off.
- Extraction of water from the wetland and farm dams leading to temporary changes in water levels / habitat extent and potentially water quality. Increased activity at these locations resulting in avoidance from some fauna species, and potentially altered foraging and breeding behaviour.
- Generation of dust emissions leading to excessive deposition of dust on leaved of plants suppressing photosynthesis and growth.
- Increased noise and light levels affecting foraging and breeding behaviour for some fauna species or resulting in complete avoidance and displacement from habitats.
- Periodic burst of elevated noise levels may startle and disorientate fauna species within proximity.
- Although the Project will not increase food resources or facilitate the movement of pests via the
  creation of new pathways, increased anthropogenic activity may lead to temporary increased pest
  levels.

All MNES are susceptible to these indirect impacts to some degree; however, some are known to be more susceptible than others, or have been identified as key threatening processes for the MNES. The susceptibility of the specific MNES values identified within the Project Area to the potential indirect impacts is outlined in Table 18.

Santos may extract water from existing farm dams within the Project Area for construction purposes, where lawful, sufficient water supplies are available, and an agreement is in place with the landholder. This may include the Wetland within lot and plan 2TR13 within the Project Area that provides potential habitat for Latham's snipe (migratory), glossy ibis (migratory) and Australian painted snipe (endangered).

The precise timing and volume of water extracted would vary depending on the work program and prevailing weather conditions. During the dry season, water levels and the extent of fringing aquatic habitat for migratory wetland bird species (i.e. Latham's snipe and glossy ibis) will naturally be fluctuating. However, given the absence of migratory birds during this period any potential indirect impact associated with water extraction (noise disturbance and minor alterations in hydrology, habitat extent and water quality) will be irrelevant. Any potential indirect impacts during this time are considered temporary and are unlikely to persist into the wet season when migratory species could return. During the wet season when these migratory species may be present, a larger extent of potential habitat is available. This larger extent of habitat allows any individuals present the opportunity to avoid localised disturbances that may arise from water extraction activities. Therefore, the potential for impact during this time is reduced.

Australian painted snipe is a threatened wetland species which only disperses as a result of changing local conditions, such as drying wetlands. Within the Project Area the Wetland is the most permanent source of water; as such, individuals in the local area may relocate during the dry season to this habitat. Habitat extent will naturally be contracted during this time as a result of the dry conditions. Further extraction for construction purposes on top of what the landholder generally extracts for agricultural purposes may exacerbate this but is unlikely to substantially reduce habitat extent.

During this time, indirect impacts of water extraction, including noise disturbance, is also likely to be limited to foraging habitat and foraging individuals of Australian painted snipe. Breeding and nesting habitat is only available when the constructed wetland is inundated and the constructed beams convert to islands, which generally occurs during the wet season. A level of uncertainty does exist with this assumption as an above average wet season may result in a large retention of water within the constructed wetland and the presence of islands during the dry season. However, it is anticipated that indirect impacts on nesting individuals of Australian painted snipe are considered less likely and

potential indirect impacts are considered more relevant to potential foraging habitat and foraging individuals.

Although the assessment of indirect impacts should not be understated, it's important to note that many of these impacts are already present in the Project Area. For example, indirect impacts such as noise disturbance associated with water extraction already occurs through water extraction for agricultural purposes.

For MNES identified as unlikely, no indirect impacts are anticipated to occur due to the lack of potential presence of these values within the Project Area and associated habitat. It is noted that not all areas within the Project Area have been field validated. Whilst a conservative and precautionary approach has been implemented in the mapping of potential MNES, in the event that these values are actually found to be present, the Project will be designed to avoid these values. As such for these values, impacts, including indirect impacts will not be permissible. The process will be managed through the Project's Protocol with field scouting and detailed ecological assessments (where required) aiming to identify any MNES present (refer to Section 2.2).

Indirect impacts on MNES relating to migratory species habitat are considered negligible within the large tract of potential habitat that occurs along the western ridgeline within the Project Area. This area would meet the area requirements to be considered nationally important habitat for the satin flycatcher and rufous fantail as per the area thresholds outlined in the *Referral Guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015b). However, as per the Project's Protocol, this extent of the Project Area that contains this habitat falls within a no-go constraints area, which means no petroleum activities are permitted within this area (refer to Section 2.2). Whilst activities are still proposed in adjacent areas, given the extent and intact nature of the ridgeline habitat as well as the elevation of the ridgeline above the valley floor, the potential for indirect impacts to encroach and cause a substantial change to condition is considered to be low. This is due to the temporary and low impact nature of works in the adjacent areas, the active management of potential indirect impacts as per Section 8.0.

Table 18 MNES at risk to indirect impacts associated with the Project

Indirect Impact	Relevant MNES	Potential Impact	Frequency	Duration	Magnitude
Edge effects causing habitat degradation	Brigalow TEC and Poplar Box TEC	Habitat degradation could result in areas within the Project Area dropping below required condition thresholds to meet TEC status.			
	Ooline	Species is known to be affected by changes in micro-climate and insect attack (when exposed). Therefore edge effects as a result of the Project, could threaten the health and viability of retained individuals. It is noted that recorded ooline was primarily found as isolated individuals or in isolated small patches in the landscape with average to poor health. Any additional areas or individual ooline trees are likely to already be disturbed by edge effects.	Infrequent – substantial cleared areas within the Project Area which will allow for siting to	Permanent – throughout lifetime of infrastructure and	Localised / low – will only effect edges of habitat. Most habitat within the Project Area is already highly impacted by edge effects
	Xerothemnella harbacea	Species requires specific micro-climatic conditions to persistent, specifically shady and moist conditions. Clearing and the subsequent edge effects such as increase solar radiation may alter habitat conditions and reduce the extent of available habitat for the species. This reduction in habitat extent could reduce population viability for any occurrences of this species within the Project Area.	occur away from existing habitat	post rehabilitation	
Weed and pest incursion	Brigalow TEC, Poplar box TEC, SEVT TEC and Xerothemnella harbacea	Encroachment of exotic pasture grass could result in an increase of fuel loads and more incidence of high intensity fires within the TEC or retained threatened flora habitat. Although the Project is highly unlikely to lead to increased pest animal populations, increased access by ungulates such as feral pigs, horses and cattle, could lead to further trampling, overgrazing and damage to the understorey and recruiting potential of the TECs and threatened flora species potentially occurring in the Project Area.	Infrequent / periodic - fluctuate seasonally and with land management	Temporary – outbreaks addressed via general land	Localised, but could extend to the broader Project Area. Magnitude also considered low
	Squatter pigeon	Only dispersal habitat identified within the Project Area. Individuals utilising the Project Area to disperse will be highly susceptible to an increase in pest predator species such as feral cats and foxes. However, the Project is considered highly unlikely to lead to a notable increase in pest populations.	breaches in general construction protocols (weed management obligations under State laws		given existing condition of habitat is already impacted by weeds and pests
	Grey falcon	This species may roost on areas of bare ground within the Project Area at night. As such, this species is considered highly	washdowns, etc)		

Indirect Impact	Relevant MNES	Potential Impact	Frequency	Duration	Magnitude
		susceptible to an increase in pest predator species such as feral cats and foxes. However, the Project is considered highly unlikely to lead to a notable increase in pest populations.			
	Australian painted snipe and other wetland migratory birds	Quality and availability of foraging resources are directly related to condition of aquatic habitat and therefore increased weed incursion could impact on species habitat in the Project Area. Species are also high susceptible to predation however the Project is considered highly unlikely to lead to a notable increase in pest populations.			
	Northern quoll	Any potential increase in cane toad populations or pest predator species as a result of the Project could threaten any potential northern quoll populations within the Project Area. However, the Project will not lead to increased areas of inundation which would be suitable for the cane toad.			
	Koala	Any potential increase in wild dog populations as a result of the Project could threaten any potential koala populations within the Project Area. However, the Project is considered highly unlikely to lead to a notable increase in pest populations and Santos actively manages wild dog numbers through regular trapping at the Bottle Tree property to the north east.			
	Threatened reptiles	Potential breeding, foraging and dispersal habitat identified within the Project Area. Individuals utilising the Project Area will be highly susceptible to an increase in pest predator species such as feral cats, cane toads and foxes. As above, it is considered highly unlikely the Project will lead to a notable increase in pest populations.			
Erosion, sedimentation and reduced water quality	Australian painted snipe and other wetland migratory bird species	Quality and availability of foraging resources are directly related to condition of aquatic habitat and therefore any reduction in water quality could impact on species habitat in the Project Area.	Infrequent / periodic - fluctuate seasonally and with land	Temporary – limited to once off incident or rectified through seasonal	Localised / low – will only effect immediate area. Most habitat within the Project
	Ornamental snake	Quality and availability of foraging resources (frogs) are directly related to condition of gilgai habitat and therefore any reduction	management practices or	inundation diluting to background	Area is already highly impacted

Indirect Impact	Relevant MNES	Potential Impact	Frequency	Duration	Magnitude	
		in water quality could impact on species habitat in the Project Area.	breaches in general	levels given the ephemeral nature	by erosion and reduced water	
Ooline		Species is known to be affected by tunnel and sheet erosion, therefore potential erosion impacts as a result of the Project could threaten the health and viability of retained individuals.	construction protocols	of most waterbodies	quality	
Soil and water contamination	Australian painted snipe and other wetland migratory bird species	Quality and availability of foraging resources are directly related to condition of aquatic habitat and therefore an impact to water quality could impact on species habitat in the Project Area.	Infrequent – associated with breaches in general construction	Temporary – limited to once off incident or rectified through seasonal	Localised / low – will only effect immediate area. Most habitat	
	Ornamental snake	Quality and availability of foraging resources (frogs) are directly related to condition of gilgai habitat and therefore any water contamination could impact on species habitat in the Project Area.	to background levels given the ephemeral nature	within the Project Area is already highly impacted by reduced water quality		
Altered hydrology	Australian painted snipe and other wetland migratory birds	Quality and availability of foraging resources are directly related to condition of aquatic habitat and therefore alteration to hydrology could impact on species habitat in the Project Area.	Infrequent – associated with breaches in	Temporary – limited to one season. Potential		
	Northern quoll	Increased runoff or ponding of water can encourage the proliferation of cane toads and could threaten any potential northern quoll populations within the Project Area.	general water extraction and construction	general water impacts rectified extraction and through next	Localised to the Project Area	
	Ornamental snake	Quality and availability of foraging resources (frogs) are directly related to condition of gilgai habitat and therefore alteration of hydrology could impact on species habitat in the Project Area.	protocols	inundation		
Elevated dust	Brigalow TEC and Poplar box TEC	Impacts on tree health and growth could result in areas within the Project Area dropping below required condition thresholds to meet TEC status.	Infrequent – associated with breaches in	Temporary – Potential impacts rectified through	Localised – will	
	Ooline	Deposition of dust as a result of the Project could threaten the health and viability of retained individuals.	general general construction construction management or	only effect immediate area		

Indirect Impact	Relevant MNES	Potential Impact	Frequency	Duration	Magnitude
				through natural processes such as rainfall	
Noise and light disturbance	Australian painted snipe and other wetland migratory birds	Most species are known to be easily startled. Noisy activities directly adjacent to potential habitat within the Project Area may disturb foraging individuals.		Temporary – minimal night work	Localised – restricted to confined worksite within Project Area
	Threatened bats	Increased lighting within or adjacent to potential foraging habitat within the Project Area could alter foraging behaviour and success.			
	Greater glider	Increased lighting within or adjacent to potential foraging and denning habitat within the Project Area could increase predation of the species by visual predators or could alter foraging and breeding behaviours.	Infrequent – minimal night work		
	Ornamental snake and Dunmall's snake	Increased lighting within or adjacent to potential foraging and denning habitat within the Project Area could increase predation of the species by visual predators or could alter foraging and breeding behaviours.			
	Yakka Skink	This species is easily startled and increase noise levels may impact on important functional requirements such as basking.			

## 7.2 Operation phase

Potential impacts on MNES associated with the operation phase of the Project are considered to be very low as activities will be limited to periodic maintenance. Traversing maintenance vehicles may inadvertently introduce weeds and potentially collide with ground dwelling MNES resulting in injury or mortality. Any impacts would be mitigated through implementation of the Environmental Management Plan and specific controls like weed hygiene procedures and site speed limits.

## 7.3 Decommissioning and rehabilitation phase

Similar to the operational phase of the Project, decommissioning and rehabilitation activities are also considered to have only minor and temporary impacts on MNES values as they will be completed progressively until 2057. Other than for surface rehabilitation, no ground disturbance will occur as subsurface components of the gathering network will remain in-situ.

Temporary and localised increases in noise and potentially dust may occur, but will be managed using the same methods used during construction. Traversing vehicles required to complete decommissioning or rehabilitation activities may inadvertently introduce weeds and potentially collide with ground dwelling MNES resulting in injury or mortality. Any impacts would be mitigated through implementation of the Environmental Management Plan and specific controls like weed hygiene procedures and site speed limits.

## 7.4 Facilitated impacts

Another indirect impact on MNES that should be considered as a result of the Project is 'facilitated impacts'. As per the *EPBC Act Significant Impact Guideline Policy Statement 1.1* (Department of the Environment, 2013b), facilitated impacts are impacts that result from further actions (including actions by third parties) which are made possible or facilitated by the action, such as the construction of a dam or other infrastructure in a previously undeveloped area. Future industrialisation of the Project Area or adjacent areas is the primary facilitated impact risk.

The Project will result in the construction of basic CSG infrastructure and other ancillary infrastructure such as tracks and fences. No new dams will be created. Other than the wells and monitoring bores, new CSG infrastructure will be subterranean. Other ancillary infrastructure will be built strictly on a need-to-have basis and maximise the use of existing infrastructure. Development will also be restricted to the valley floor and ensure all large and intact areas of MNES habitat are avoided. Based on this, the characteristics of the Project Area and the current dominant land use (agriculture) are considered highly unlikely to change.

As discussed in Section 1.2, the wider Arcadia Valley is dominated by agricultural practices as well as coal seam gas operations and conventional gas operations. The Arcadia Valley has already been subject to this merge of landuses and the Project will be consistent with this. Given the low impact nature of the Project and the lack of overall dominant land use change, it is considered unlikely that the Project will facilitate further changes to the landscape that would not occur if the Project did not proceed.

## 7.5 Cumulative impacts

The other dominant activity within the Arcadia Valley that could impact on MNES is the existing and ongoing agricultural practices.

The Statewide Landcover and Tree Study (SLATS) undertaken by the Queensland government can provide an indication of the magnitude of potential direct MNES habitat loss as a result of agriculture through its data on clearing extents. This is an indication only as clearing of vegetation may not necessarily equate to clearing of MNES habitat.

Based on SLATS data from 2014 to 2018, clearing within the Arcadia Valley for agricultural purposes generally ranges from 300 ha to 600 ha a year (Table 19). In comparison, clearing associated with the Project is anticipated to be within the range of 10 ha – 30 ha. In the context of the regional clearing extents, the impacts associate with the Project are unlikely to significantly contribute to overall potential

impacts on MNES within the region. As such the cumulative impacts associated with the Project are considered to be low.

Table 19 Clearing in Arcadia Valley 2014 - 2018

Classing land use	Clearing Period					
Clearing land use	2014 - 2015	2015 - 2016	2016-2017	2017-2018		
Pasture (ha)	303.1	413.3	474.3	597.6		
Thinning (ha)	0	11.3	0	16.2		
Missed clearing in previous era (ha)	7.5	0	18.3	0		
TOTAL (ha)	310.6	424.6	492.6	613.8		

## 8.0 Mitigation measures

Santos implements the following hierarchy of management principles when planning for and implementing new petroleum activities that have the potential to disturb land:

- 1. Avoid locating activities to avoid direct and indirect impacts on MNES
- 2. Minimise minimising direct and indirect impacts where they cannot be completely avoided
- 3. Mitigate implementing mitigation and management measures to reduce direct, indirect and cumulative impacts
- Remediate and rehabilitate actively remediate and rehabilitate impacted areas to promote longterm recovery
- 5. Offset (where necessary) provide suitable offsets for activities that result in significant residual impacts to MNES even with the implementation of the above principles.

Santos will implement the Protocol as well as a series of management plans for the Project based on the above hierarchy. These are:

- The Environmental Protocol for Constraints Planning and Field Development (the Protocol; Attachment B of the PD) – this document details how the above principles will be implemented throughout the project lifecycle but particularly during the planning and design of gas field infrastructure;
- Environmental Management Plan (EMP; Attachment C of the PD) this document details how the
  proposed action will be carried out during the construction, operation, decommissioning and
  rehabilitation phases and mitigation measures to be applied during these phases. The EMP also
  details the environmental objectives and performance indicators for key environmental values
  including MNES;
- Significant Species Management Plan (SSMP; Attachment F of the PD) this document provides
  detailed species/community profiles for relevant MNES including habitat and range descriptions,
  biological information and species-specific mitigation measures;
- Draft Rehabilitation Monitoring Plan (Attachment C of the PD) this document outlines final rehabilitation completion criteria and monitoring requirements.

The EMP (Attachment C of the PD) identifies the following key environmental objectives relating to biodiversity and rehabilitation for the Project:

- Avoid or minimise impacts on terrestrial and aquatic ecosystems and associated flora, fauna and habitat of state and national significance.
- Avoid or minimise habitat loss and fauna mortality.
- Prevent introduction and control spread of weed and pest plant and animal species.
- To rehabilitate land significantly disturbed by project activities to a condition that is stable, non-polluting and safe to humans and wildlife.
- To rehabilitate significant disturbances within remnant vegetation areas to a condition that allows return of pre-disturbance biodiversity values.
- To rehabilitate significant disturbances within non-remnant areas to match the surrounding agricultural land-use (or other use as determined by the landholder).

Sections 8.1 and 8.2 describe how impacts will be avoided and minimised for the Project and Section 8.3 describes mitigation measures.

### 8.1 Avoidance

The avoidance of MNES values was assessed using constraints mapping, informed by multiple data sources including the MNES mapping detailed in Section 4.6. Five constraint categories were developed and applied to mapped MNES values as detailed in Table 20. The constraint categories outlined in the Protocol will direct the location of infrastructure and petroleum activities permitted within the Project Area. As detailed in Section 7.1.1, the two areas that are considered to provide the greatest habitat value within the Project Area (the western ridgeline and Middle Hill) are 'no-go areas' which ensures they will be completely avoided by the Project (over 60% of mapped MNES habitat). This is the key avoidance measure adopted for the Project.

For MNES identified as unlikely, it is anticipated that all impacts on these values will be avoided due to the lack of potential presence within the Project Area. It is noted that not all areas within the Project Area have been field validated. Whilst a conservative and precautionary approach has been implemented in the mapping of potential MNES, in the event that these values are actually found to be present, the Project will not impact these values. As such, any 'unlikely' MNES that are later identified to be present will fall within the 'no-go areas' constraints category (Table 20).

For MNES identified as potential, likely or known, impacts to habitat or particular habitat types (i.e. breeding) are largely anticipated to be avoided. In the event that a greater extent of habitat supporting these known or potentially occurring MNES are later identified in areas not field validated at the time of this report, the Project will be designed to ensure these values are avoided and disturbance limits adhered to.

Any changes to the MNES mapping and assigned constraint category may only be completed following additional targeted ecological assessment as per the Protocol (refer to Section 2.2).

Table 20 Constrai	nts category	approach
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Constraint category	Low impact petroleum activities	Linear infrastructure	All petroleum activities	Water extraction for construction purposes
No-go area	No	No	No	No
High constraint area	Yes	Yes	No	No
Moderate constraint area	Yes	Yes	Yes	No
Low constraint area	Yes	Yes	Yes	No
Dams and constructed wetlands	No	No	No	Yes

#### 8.2 Minimise

Opportunities to minimise direct impacts to MNES including important habitat features to known, likely or potentially occurring MNES will be investigated during the field scout. As detailed in the Protocol, draft refinements to the infrastructure design will be made where possible to avoid habitat features within moderate and high constraint areas in the following order of priority:

- 1. Hollow-bearing trees and large hollow logs
- 2. Koala food trees
- Mistletoe
- 4. Gilgai
- 5. Termite mounds and raptor nests
- 6. Other such as decorticating bark and rock piles.

As development within the Project Area will occur progressively, only a small subset of the Project Area will be impacted at a time. By doing this, the area that may be impacted at one time will be minimised and allow MNES fauna to relocate to adjacent areas of potential habitat. Indirect impacts resulting from

the construction of the Project will be localised and temporary, and actively managed as detailed below. Furthermore, disturbance limits detailed in Table 17 represent a maximum area.

Through the implementation of the Protocol, impacts on MNES will also be minimised by:

- Allowing only low impact and linear infrastructure within the high constraint areas
- Restricting impacts to Public Reserve to the already edge effected southern boundary to facilitate access
- Ensuring vegetation clearing will not exacerbate habitat fragmentation. Infrastructure siting will
  preferentially maximise the use of existing gaps. Where clearing is required in an area comprising
  narrow linear patches, clearing will not result in gaps between patches greater than 100 m (usually
  less than 25 m for linear infrastructure) which would be impassable for some MNES fauna such as
  the greater glider.

## 8.3 Mitigate

To mitigate potential impacts to potentially occurring MNES values, an EMP and SSMP has been developed for the Project (Attachment C and F of the PD respectively). Both general and species-specific mitigation and management measures are outlined in this plan as detailed in the sections below.

#### 8.3.1 General mitigation measures

A number of general mitigation measures included in the EMP and SSMP are relevant to the management of potential impacts on MNES. The key themes and associated measures are detailed below:

- · Biodiversity:
  - Exclusion zones comprising vegetation/MNES habitat to be protected will be demarcated to avoid unauthorised disturbance and access to. This will be done with fencing and/or signage as necessary
  - When siting infrastructure, existing breaks between patches of potential MNES will be utilised as much as practical to minimise habitat fragmentation
  - All clearing will be conducted with a suitably qualified suitably qualified spotter catcher present
  - In areas of potential MNES habitat comprising woody vegetation, spotter-catchers will scout the area to be disturbed for the presence of fauna species immediately prior to the commencement of disturbance and relocate the fauna to an undisturbed location
  - Exclusion zones will be established around identified active breeding places and any fauna habitat features to be retained (eg mature trees, inactive breeding places) and appropriately marked out. Active breeding places will be monitored to ensure the breeding site has been vacated prior to the exclusion zone being removed
  - Microhabitat features such as large fallen logs will be relocated to adjacent areas of undisturbed vegetation prior to vegetation clearing where practicable.
  - Well leases and low hazard dams not on well leases will be fenced to prevent access by large terrestrial fauna.
- Light and noise:
  - All reasonable and feasible noise mitigation measures during noise generating activities will be implemented
  - Night works within or adjacent to areas of MNES will be avoided where possible. Where night works are required, lights will be directed to minimise light spill into adjacent habitats.
  - Construction activities that may result in loud sudden noise will be not permitted in proximity to areas determined to contain potential breeding habitat for threatened fauna species.
- Weed, pest and disease management:

- Wash down protocols are required for any vehicles or machinery entering and leaving the Project Area.
- Ongoing monitoring of the Project Area to identify any new incidence of weed and pest infestation
- Hygiene procedures will be applicable to any machinery or vehicle entering the Project Area as a result of the Project
- Movement within the Project Area will be via approved access tracks only with speed limits enforced. The requirement to enter and traverse the Project Area will be minimised where possible and limited to those required for essential Project activities.

#### Landform, soils and contamination:

- Disturbed areas will be assessed and progressively rehabilitated in accordance with the Draft Rehabilitation Monitoring Plan of the EMP
- Dust suppression measures will be implemented as required i.e. on high wind days during dry periods. Frequency and intensity of produced water used for dust suppression will be managed carefully.
- Appropriate erosion and sediment controls will be installed and maintained around significant disturbance areas
- Storage and handling of chemicals, fuels and oils will occur in accordance with applicable Australian Standards
- SDSs and risk dossiers will be readily available to emergency responders, health and safety managers, and environmental hazard clean-up teams.
- Residual drilling materials will only be applied to the Project Area under specific conditions to ensure no run-off impacts.

#### Water:

- Where approved, Santos may extract water from select farm dams for construction purposes.
   Santos will only take water where available supplies provide continuity of habitat function and quality
- Authorised releases will be carried out in a manner that ensures no runoff to surface waters, ponding or damage to vegetation
- A 50 m buffer between sewage effluent irrigation areas and watercourses, wetlands or significant vegetation will be maintained and a 100 m buffer from potable water supply or stock drinking water
- Water quality monitoring downstream of works in watercourses will occur to confirm compliance with release limits specified under the Environmental Authority.

#### Other:

- Threat of wildfire caused by Santos activities will be minimised through maintenance of firebreaks around ignition sources as appropriate.

## 8.3.2 Species-specific mitigation measures

Mitigation measures specific to the potentially occurring MNES in the SSMP are detailed in Table 21 below.

Table 21 Species-specific mitigation measures

MNES	Mitigation measure
Brigalow TEC Poplar box TEC	<ul> <li>Clearing works will not intersect or dissect a patch of Brigalow TEC in a way that reduces the patch size below 0.5 ha</li> <li>Clearing works will not intersect or dissect a patch of Poplar TEC in a way that reduces the patch size below 1 ha</li> <li>Rehabilitation works will utilise appropriate native species to reduce the potential proliferation of harmful species within the patch.</li> </ul>
Ooline  Xerothemnella herbacea	<ul> <li>Any populations should be identified and the extent mapped during preclearance surveys. Confirmation of population avoidance should be completed during final scouting. The siting of infrastructure should avoid areas of known occurrence as a priority.</li> <li>Clearing works should maintain a sufficient vegetation buffer where possible around identified locations of ooline and <i>Xerothemnella herbacea</i> to maintain suitable micro-climatic conditions.</li> <li>Siting of infrastructure should aim to minimise fragmentation of potential habitat as much as possible (i.e. clear edges rather than dissect patches) to maintain core patch and population viability.</li> </ul>
Koala Cray falsan	<ul> <li>Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention.</li> <li>Retain tall trees that contain bird nests (even if abandoned), especially where</li> </ul>
Grey falcon	Retain tall trees that contain bird nests (even if abandoned), especially where located along watercourses where possible.
Painted honeyeater	Retain trees that contain mistletoe where possible
Ground-dwelling MNES fauna	<ul> <li>Open trenches will be checked for trapped fauna in the morning and at the end of the day by a spotter catcher</li> <li>Trench ladders, ramps, sticks, ropes and the use of moist hessian sacks at regular intervals (or similar) will be utilised to help trapped fauna escape and/or survive until removed by a fauna spotter-catcher.</li> </ul>
Greater glider  South-eastern long- eared bat	<ul> <li>All hollow-bearing trees will be inspected by a fauna spotter-catcher prior to clearing to identify any denning or roosting individuals.</li> <li>Where clearing is required in an area of potential greater glider habitat comprising narrow linear patches, clearing will not reduce the size of patches so that gaps between become greater than 100 m.</li> </ul>
Ornamental snake	Clearing works that occur in areas of potential ornamental snake habitat will prioritise avoiding gilgai formations.
Yakka skink	<ul> <li>Survey works conducted prior to clearing will include colony searches in areas of potential yakka skink habitat.</li> </ul>
Australian painted snipe and wetland migratory birds	<ul> <li>Prior to construction works commencing, the spotter catcher will ensure no migratory birds are roosting or breeding Australian painted snipe in proximity that may be disturbed by the activity.</li> <li>Water extraction will be conducted at an alternative location within the Project Area should an Australian painted snipe or migratory wetland bird be identified utlising the habitat.</li> <li>Construction works that will occur in the direct vicinity of the constructed wetland should only be conducted outside of the migratory bird period (August to May)</li> <li>Water extraction activities will be strictly controlled and monitored in liaison with the landholder to ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring individuals to avoid the</li> </ul>

MNES	Mitigation measure
	same area during construction. Existing access points to wetlands will be used preferentially over the creation of new ones.

# 9.0 Significant impact assessment

Potential impacts have been considered for MNES that have either been identified within the Project Area or assessed as potentially present. MNES identified as unlikely to be present have not been further considered. MNES subject to further impact assessment and those that have been excluded are summarised in Table 22 below.

Table 22 MNES subject to or discounted from Project impact considerations

Endangered Endangered Endangered Vulnerable Vulnerable Vulnerable Endangered Vulnerable Endangered Vulnerable Vulnerable Vulnerable Vulnerable Vulnerable Vulnerable Vulnerable	Known Known Known Potential Potential Known Likely Potential Likely Potential Potential  Potential  Potential  Potential  Potential
Endangered  Endangered  Vulnerable  Vulnerable  Vulnerable  Endangered  Vulnerable  Endangered  Vulnerable  Vulnerable  Vulnerable  Vulnerable  Vulnerable  Vulnerable	Known Known Potential Potential Known Likely Potential Potential Likely Potential Likely Potential Potential
Endangered  Vulnerable  Vulnerable  Vulnerable  Endangered  Vulnerable  Endangered  Vulnerable  Vulnerable  Vulnerable  Vulnerable  Vulnerable	Known  Potential  Potential  Known  Likely  Potential  Potential  Likely  Potential  Likely  Potential  Potential
Vulnerable Vulnerable Vulnerable Endangered Vulnerable Endangered Vulnerable Vulnerable Vulnerable Vulnerable	Potential Potential Known Likely Potential Potential Likely Potential Likely Potential Potential
Vulnerable Vulnerable Endangered Vulnerable Endangered Vulnerable Vulnerable Vulnerable Vulnerable	Potential Known Likely Potential Potential Likely Potential Potential Potential
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Vulnerable Endangered Vulnerable Vulnerable Vulnerable	Potential Potential Likely Potential Potential
Endangered Vulnerable Vulnerable Vulnerable	Potential Likely Potential Potential
Vulnerable Vulnerable Vulnerable	Likely Potential Potential
Vulnerable Vulnerable	Potential Potential
Vulnerable	Potential
Vulnerable	Detential
	Potential
Vulnerable	Known
Vulnerable	Potential
Endangered	Potential
Vulnerable	Potential
Vulnerable	Potential
Vulnerable	Likely
Vulnerable	Potential
Vulnerable / Migratory	Potential
Vulnerable	Potential
r in the Project Area; re	efer to Section 6.6
Endangered	Unlikely
Endangered	Unlikely
Vulnerable	Unlikely
Vulnerable	Unlikely
Vulnerable	Unlikely
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	/ulnerable / Migratory /ulnerable in the Project Area; re Endangered Endangered /ulnerable /ulnerable

MNES	EPBC Act status	Likelihood of occurrence
Tylophora linearis	Endangered	Unlikely
Curlew sandpiper	Critically endangered	Unlikely
Greater sand plover	Vulnerable	Unlikely
Fitzroy River turtle	Vulnerable	Unlikely
Star finch	Endangered	Unlikely
White-throated snapping turtle	Critically endangered	Unlikely

#### 9.1 Initial risk assessment

As detailed in Section 7.0, MNES values within the Project Area may be directly or indirectly impacted by the development of the Project. However the overall risk to MNES values, that is the risk of Project impacts constituting an impact which is "important, notable, or of consequence, having regard to its context or intensity", will differ based on a combination of factors including the community or species' ecological characteristics and the likely consequence of such impacts. As such, an initial risk assessment was undertaken in accordance with the developed risk framework (Appendix D) and the approach detailed in Section 4.7.1, to identify MNES that are at low risk of potential Project impacts and MNES that are at potential risk and require further assessment. The duration, frequency and magnitude of impacts, as determined in Section 7.0, has also been considered as part of the risk assessment for each potential MNES value.

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

- Brigalow TEC
- Ooline
- X. herbacea
- Painted honeyeater
- Koala
- Ornamental snake
- Yakka skink
- South-eastern long-eared bat
- Australian painted snipe
- Latham's snipe
- · Glossy ibis.

Significant impact assessments are discussed in Section 9.2.

Table 23 Initial risk assessment

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
Endangered Sp	oecies and Communities	'			
Brigalow TEC	The Brigalow TEC occurs within Queensland and New South Wales (NSW). Within Queensland, this community occurs mostly west of the Great Dividing Range, stretching in a broad swathe east of Blackall, Charleville and Cunnamulla, north almost to Townsville. However, the Brigalow TEC is associated mostly with the Mulga Lands and Brigalow Belt South Bioregions. Areas considered critical to the survival of the Brigalow TEC includes all patches that meet the key diagnostic characteristics and condition thresholds for the TEC as well as buffer zones of native vegetation. The most important threats and risks, in order of significance, include clearing, fire, weeds, feral animals and inappropriate grazing (Threatened Species Scientific Committee, 2001).	A total of 253.65 ha of Brigalow TEC is modelled within the Project Area based on the field survey and LiDAR assessment findings. Survey works conducted prior to construction will confirm the extent of TEC. A maximum of 2.0 ha of Brigalow TEC will be directly impacted via vegetation clearing for the Project. Given that some components of the Project are linear, clearing may fragment existing patches and reduce their size below TEC status threshold. The construction of the Project may also exacerbate competition from weed species, which is a known threat to this community and remove adjacent native vegetation. This community is also considered sensitive to other potential indirect impacts including edge effects and elevated dust levels which ultimately lead to habitat degradation if not managed appropriately. The Arcadia Valley has historically been extensively cleared of Brigalow vegetation and therefore the regional context of potential impacts needs to be considered.	3	Possible	Potential risk, further assessment required
Poplar box TEC	The Poplar box TEC occurs within Queensland and NSW. The community is scattered across a broad distribution west of the Great Dividing Range at altitudes less than 300 m above sea level. The areas most critical to the survival of the community are the best quality, most intact patches (patches greater than 1 ha with little to no perennial weeds, and patches greater than 5 ha with low perennial weeds). Key threats to this community include clearing and fragmentation, weed invasion, inappropriate fire and	A total of 39.41 ha of poplar box TEC is modelled within the Project Area based on the results of the field surveys and findings of the LiDAR assessment. Survey works conducted prior to construction will confirm the extent of TEC. Only 0.5 ha of vegetation clearing is proposed as a result of the Project. Patch sizes of the TEC within the Project Area are large enough to allow this minor clearing whilst still maintaining patch size thresholds for the TEC. Therefore there is	2	Unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	grazing, dieback, agricultural chemicals, hydrological changes, salinisation, nutrient enrichment, invasive fauna and climate change (Department of the Environment and Energy, 2019).	no risk of clearing changing the TEC status of existing patches of Poplar Box TEC. Furthermore, should vegetation clearing occur in areas directly adjacent, some indirect impacts from elevated dust levels may occur however these will be temporary and localised. Potential incursion of new weeds will be managed as per the Project EMP. All other key threats to this community are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0. Given very minimal direct impacts will occur, the persistence of the TEC in the region will not be affected.			
SEVT TEC	The SEVT TEC distribution occurs from the Townsville area in Queensland to northern NSW, however it mostly occurs within the Brigalow Belt Bioregion. Substantial areas of remnant SEVT (>500ha) are found in 23 of the 32 subregions, with more than 50% (78,000 ha) accounted for by six subregions, one of which is Arcadia. Clearing, inappropriate fire regimes, invasion by weeds and increased grazing by domestic stock and native animals and coastal development are all considered to be current threats to the community. Specific activities considered important for the management of SEVT thickets include: maintaining the size and integrity of vine thicket patches, controlling fire and pigs to prevent vine thickets being opened up and invaded by Lantana camara and trying to prevent Cryptostegia grandiflora (rubber vine) from invading new SEVT areas (McDonald, 2010).	A total of 534.49 ha of SEVT TEC is modelled within the Project Area, including areas within Middle Hill and the western ridgeline. Survey works conducted prior to construction will confirm the extent of the TEC. No direct impacts (vegetation clearing) will be permissible in all areas of confirmed SEVT TEC. Should vegetation clearing occur in areas directly adjacent, some indirect impacts from elevated dust levels may occur however these will be temporary. Potential incursion of new weeds will be managed as per the Project EMP. All other key threats to this community are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0. Given no direct impacts will occur, the persistence of the TEC in the region will not be affected.	1	Highly unlikely	Low risk
Xerothemnella herbacea	X. herbacea is known to occur from the Banana- Theodore area, north of Injune, Durong-Chinchilla	This species is considered a likely occurrence within the Project Area due to the presence of	3	Possible	Potential risk, further

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	area and north of Yelarbon. <i>X. herbacea</i> has a localised distribution in the broader landscape, which has been further reduced by extensive clearing in the Brigalow Belt. The 12 known populations are mostly located within the largest tracts of remaining suitable habitat in the Banana-Theodore area. Shapcott et al. (2017) modelled 111,842 ha of high quality habitat for <i>X. herbacea</i> between Goondiwindi and Banana in the north. <i>X. herbacea</i> is known to occur in communities associated with Brigalow including RE 11.9.5, 11.9.2, 11.10.1, 11.9.1, 11.3.17 and 11.3.1. The species is effectively ephemeral in the landscape and presence or absence of the species and variations in population size may in part reflect local moisture conditions. The species is known to occur in very specific micro-topographic locations, particularly on stream terraces within 20m of the stream channel, where moisture is retained. The main threat to <i>X. herbacea</i> is competition from invasive shade-tolerant species. Department of the Environment Water Heritage and the Arts (2008) also identified the main potential threats to the species as road widening and maintenance activities, surface erosion and grazing and trampling by cattle and native macropods.	suitable Brigalow habitat and confirmed records within 30 km of the Project Area. A total of 250.45 ha of potential habitat occurs within the Project Area, of which 226.78 ha is considered habitat critical to the survival of the species (intact Brigalow habitat on alluvial plains likely to support appropriate micro-climatic conditions). A maximum of two hectares of potential habitat is proposed to be cleared as part of the Project. Potential indirect impacts from the Project also include weed incursion, creation of edge effects (increased solar radiation) and elevated dust. This species has already been heavily impacted and now persists in only small fragmented populations. These small populations are important in maintaining genetic diversity for the species. Uncertainty exists in population presence, extent and dynamics (i.e. population reproduction and viability) within the Project Area, which in turn creates uncertainty on potential impacts on the species as a result of the Project. This requires further assessment.			assessment required
Australian painted snipe	The Australian painted snipe is a wading bird found in shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans generally across eastern Australia. Important areas for this species in the past have included the Murray-Darling Basin (particularly the Riverina of Victoria and New South Wales), Queensland Channel Country, Fitzroy Basin of Central Queensland, south-eastern South	This species is considered a potential occurrence within the Project Area due to the presence of suitable habitat. However, no ALA records occur within 50 km of the Project Area and as such it is likely that the species utilises potential habitat on a transitory basis only. Within the Project Area a total of 297.24 ha suitable habitat occurs, of which 96.12 ha is considered to comprise habitat critical to the survival of the species (wetlands	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	Australia and adjacent parts of Victoria. Within Queensland, records are most common in coastal areas however also occur at scattered locations inland. Nest records are nearly all from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Department of Agriculture Water and the Environment, 2021b). The main identified threat to the Australian painted snipe is the loss and degradation of wetlands, through drainage and the diversion of water for agriculture and reservoirs.	providing potential breeding or foraging and roosting habitat). No direct impacts via vegetation clearing will occur to critical habitat (i.e. wetlands), however some water extraction activities may be required. This may have an impact on foraging habitat and disturb foraging individuals that could be utilising wetland habitat areas. A level of uncertainty exists on whether indirect impacts may or may not occur on breeding and nesting habitat as the presence of this habitat during the dry season when water extraction is likely to occur, is dependent on seasonal conditions. Whilst impacts are anticipated to be low and most likely limited to foraging habitat, this level of uncertainty on the type of habitat impacted (i.e. breeding / nesting or foraging) requires further assessment.			
Vulnerable Spec	cies	The second secon			
Acacia grandifolia	This species is endemic to south-east Queensland (QLD) and restricted to the Mundubbera area in the Burnett district (Department of the Environment, 2014a). It has a range of approximately 100 km and an occurrence extent of approximately 4200 km². It occurs in ironbark gum and spotted gum forests and woodlands, growing on hilly terrain of varying aspects and slope. The most frequently recorded associated tree species are <i>Eucalyptus crebra</i> , <i>Corymbia citriodora</i> , <i>Corymbia trachyphloia</i> and <i>Eucalyptus exserta</i> . It is reported to respond well to disturbance, growing well on roadsides and after fire. Threats to this species include habitat modification through timber harvesting, inappropriate fire regimes and inappropriate grazing regimes.	This species is considered a potential occurrence within the Project Area due to the presence of suitable habitat and records within 30 km of the Project Area. However the species was not detected during field surveys. A total of 920.37 ha of habitat is modelled within the Project Area, including areas within Middle Hill and the western ridgeline. Survey works conducted prior to construction will confirm any individuals of <i>Acacia grandifolia</i> and associated habitat within the Project Area. No direct impacts (vegetation clearing) will be permissible in any confirmed <i>Acacia grandifolia</i> habitat. Should vegetation clearing occur in areas directly adjacent, some indirect impacts from elevated dust levels may occur however these will be temporary. Potential	1	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
		incursion of new weeds will be managed as per the Project EMP. All other key threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0. Given no direct impacts will occur, the persistence of the species in the region will not be affected.			
Bertya opponens	This species occurs in QLD and New South Wales. In QLD, its distribution ranges from Emerald in the north and Charleville in the west, with an outlier near Charters Towers. It has been recorded in a variety of communities including mixed shrubland, lancewood woodland, mallee woodland, Eucalyptus/Acacia open forest with shrubby understorey, Eucalypt/Callitris open woodland and semi-evergreen vine-thicket (SEVT) on shallow and rocky or much deeper and well-drained soils (Department of Agriculture Water and the Environment, 2021b). Threats to this species include grazing, inappropriate disturbance and fire regimes, clearing and drought. The geographic distribution of the species is highly restricted and therefore the species is sensitive to the effects of human activities or stochastic events.	This species is considered a potential occurrence within the Project Area due to the presence of suitable habitat and records within 50 km of the Project Area. This species was not detected during field surveys. A total of 1,450.39 ha of habitat is modelled within the Project Area, including areas within Middle Hill and the western ridgeline. Survey works conducted prior to construction will confirm any individuals of <i>Bertya opponens</i> and associated habitat within the Project Area. No direct impacts (vegetation clearing) will be permissible in any confirmed <i>Bertya opponens</i> habitat. Should vegetation clearing occur in areas directly adjacent, some indirect impacts from elevated dust levels may occur however these will be temporary. Potential incursion of new weeds will be managed as per the Project EMP. All other key threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0. Given no direct impacts will occur, the persistence of the species in the region will not be affected.	1	Highly unlikely	Low risk
Ooline	Ooline occurs on the western edge of the NSW north-west slopes, from Mt Black Jack near	Numerous individuals and stands of this species were confirmed during the field survey across in	3	Possible	Potential risk, further

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	Gunnadah to west of Tenterfield, and extends into Queensland to Carnarvon Range and Callide Valley, south-west of Rockhampton. This species is conserved within a number of national parks, including the Carnarvon Gorge national park. which has more than 1,000 individuals. Some existing stands are on private property. This species is found in a range of vegetation communities including dry rainforest, semi-evergreen vine thickets, brigalow-belah, poplar box and bendee communities. Ooline often occurs on the edge of sandstone or basalt escarpments and prefers moderately fertile soils favoured by agriculture (Department of Environment and Science, 2020c). Threats to this species include fragmentation and vegetation clearing, inbreeding, inappropriate fire regimes, intensive grazing, insect attack, local extinction of small scattered populations and low seed viability.	the northern portion of the Project Area (lot and plan 2TR13). Suitable habitat also occurs across the Project Area in the form of SEVT and brigalow-dominated open forests. The LiDAR assessment indicated that these areas also occur in the wider Project Area. Large viable stands of ooline are considered an important population. A total of 772.42 ha of potential habitat occurs within the Project Area, of which 466.28 ha is considered habitat critical to the survival of the species (intact SEVT habitat not impacted by edge effects). A maximum of five hectares of potential habitat is proposed to be cleared as part of the Project. Potential indirect impacts from the Project also include weed incursion, creation of edge effects (increased solar radiation) and elevated dust. Records of ooline identified during the field survey within the valley floor occur as small stands and were already found to be in poor health due to existing threats. Given the viability of these stands are already compromised, they may be more sensitive to Project impacts. As such further assessment is required.			assessment required
Red goshawk	The red goshawk is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia, from western Kimberley Division to northeastern New South Wales. It inhabits coastal and sub-coastal tall open forests and woodlands, tropical savannas traversed by wooded or forested rivers, and the edges of rainforests. Nesting habitat usually comprises a tall stand of trees (average 31 m) within 1 km of permanent water, often adjacent to rivers or clearings. Habitat critical for red goshawk survival needs to contain all known sites for nesting, food	This species is considered a potential occurrence within the Project Area due to the presence of suitable habitat. No ALA records occur within 50 km however records of this species are considered rare. Any individuals within the Project Area are considered an important population.  Within the Project Area a total of 1,694.43 ha of suitable habitat (foraging only) occurs. However, as no habitat is considered suitable for nesting, habitat is not considered habitat critical to the	2	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	resources, water, shelter, essential travel routes, dispersal, buffer areas, and sites needed for the future recovery (Department of Environment and Resource Management, 2012). Important populations are not defined; there is limited population information and available data is considered unreliable. The main identified threats to the species include habitat loss, fragmentation, disturbance of nest sites, threats to prey and information/education gaps (Threatened Species Scientific Committee, 2015c).	survival of the species. A total of 2 ha of potential foraging habitat will be directly impacted via vegetation clearing. However, given the vast areas of suitable habitat within the Project Area and adjacent (the Carnarvon Ranges), these impacts are expected to be low and inconsequential to the foraging success of the species. As this species is highly mobile and construction works will be completed in phases, areas of disturbance can be temporarily avoided. Habitat fragmentation and threats to prey (birds) are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.			
Grey falcon	The grey falcon is widely distributed across the arid and semi-arid regions of Australia including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia (extent of occurrence estimated at 6.1 million km²). Across this distribution the species occurs at low densities. Current population estimates indicate <1000 individuals remain. It occurs in timbered lowland plains, particularly <i>Acacia</i> shrublands that are crossed by tree-lined water courses. It also frequents treeless areas, tussock grassland and open woodland (Threatened Species Scientific Committee, 2020). At night, roosting may occur on areas of bare ground (Schoenjahn, 2018). When breeding, this species utilises the disused nests of other raptors or corvids. Nests that occur in the tallest trees along watercourses, particularly <i>Eucalyptus camaldulensis</i> and <i>E. coolabah</i> , are preferred. Important populations and habitat critical to the survival of the species are not defined. Threats to the grey falcon are not well established, however very high priority	This species is considered a potential occurrence within the Project Area due to the presence of suitable habitat. This species is rare and occurs at low densities; as such, any individuals utilising the Project Area are likely to constitute an important population. Within the Project Area, a total of 841.43 ha of potential habitat occurs comprising breeding (41.65 ha) and foraging only habitat (799.78 ha). Although suitable for breeding due to the presence of tall Eucalypt trees suitable for nesting, breeding habitat is degraded by existing grazing cattle (a known threat to the species). Conservatively, this habitat is still assumed to be habitat critical to the survival of the species. In total, a maximum of 13 ha potential foraging habitat only will be directly impact via vegetation clearing. No nesting and breeding habitat will be impacted. Given the species' expansive range, the vast areas of suitable habitat within the Project Area and adjacent (the Carnarvon Ranges), habitat loss or	2	Likely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	likely threats include predation by cats, increased temperatures due to climate change and habitat loss / fragmentation as a result of grazing exotic herbivores (Threatened Species Scientific Committee, 2020)	fragmentation impacts are expected to be low and inconsequential to the breeding or foraging success of any individuals present. Additionally, large trees within potential breeding habitat that contain nests (including vacant) will be retained where possible. As this species is highly mobile and construction works will be completed in phases, areas of disturbance can be temporarily avoided. Feral cats are a known threat to the species, however population levels are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.			
Squatter pigeon (southern)	The squatter pigeon (southern) is a ground-dwelling bird that inhabits the grassy understorey of open woodland, as well as sown grasslands with scattered remnant trees, disturbed areas, scrubland, and <i>Acacia</i> regrowth. Its current distribution extends from the Burdekin-Lynd Divide in central Queensland, south to West Wyalong in northern NSW. In Queensland, foraging and breeding habitat is known to be associated with the soil landscapes of Land Zone 5 and 7 (Department of Agriculture Water and the Environment, 2021b). Breeding habitat is within 1 km of suitable waterbodies, whereas foraging can occur up to 3 km from such waterbodies. All relatively small, isolated and sparsely distributed sub-populations occurring in the south of the subspecies' range are considered important for conservation purposes, including those south of the Carnarvon Ranges. However, the species is widely distributed with the extent of occurrence estimated to be 440,000 km² and the area of occupancy to be 10,000 km². The main identified threats to the	This species is considered a potential occurrence within the Project Area due to the presence of suitable dispersal habitat and records within 25 km. As the Project Area occurs close to the southern extent noted to be of conservation significance for the species, all populations have been assumed important. Within the Project Area, a total of 2,122.63 ha of suitable habitat is modelled. However, as habitat does not occur on Land Zone 5 or 7 it is suitable for dispersal only and is not considered habitat critical or important for the survival of the species. A total of 13 ha of potential dispersal habitat will be directly impacted via vegetation clearing. However, given the vast areas of suitable habitat within the Project Area and wider local area, this reduction in habitat is inconsequential and unlikely to affect the persistence of the species. As this species is ground-dwelling, indirect impacts such as an increased pest presence and traffic within the Project Area may lead to greater mortalities.	2	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	farming or development purposes; grazing of habitat by livestock and feral herbivores; and predation, especially by feral cats ( <i>Felis catus</i> ) and foxes ( <i>Vulpes vulpes</i> ).	temporary (primarily during construction) and pest levels are unlikely to be exacerbated beyond current levels. Potential indirect impacts will be low and managed via the mitigation measures detailed in Section 8.0.			
Painted honeyeater	The painted honeyeater is highly nomadic, with a sparse distribution from south-eastern Australian to north-western Queensland and eastern Northern Territory. The Conservation Advice for this species states "The greatest concentrations and almost all records of breeding come from south of 26°S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland". This species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, Callitris, and trees on farmland or gardens. The species undertakes north-south movements, governed principally by the fruiting of mistletoe, with which its breeding season is closely matched. Birds rely heavily on two species in particular during breeding, grey mistletoe ( <i>A. cambagei</i> ). Although not defined, important populations of this species are considered to occur in core areas that support breeding individuals. Habitat critical to the survival of this species is considered breeding habitat as well as high quality foraging habitat that allows dispersal and regional movements. Key threats to this species include habitat loss and degradation, destruction of mistletoe, competition and nest predation with native birds, predation by invasive species (Threatened Species Scientific Committee, 2015a).	This species is considered a potential occurrence within the Project Area due to the presence of suitable habitat. No ALA records occur within 50 km however this species is considered highly nomadic and recent records occur at Carnarvon National Park to the north west. Given this species is known to be highly nomadic, any individuals within the Project Area are likely dispersing and foraging and do not constitute an important population. Grey mistletoe was frequently recorded within the brigalow communities of the Survey Area. Within the Project Area, a total of 411.53 ha of suitable foraging and dispersal occurs, based on the assumption that mistletoe is also common within the wider Project Area. Given grey mistletoe is a known important resource to the species, all potential habitat within the Project Area is considered habitat critical to the survival of the species.  Direct impacts via vegetation clearing will occur to 12 ha of potential foraging and dispersal habitat. The loss of this habitat which was found to contain an important resource to the species triggers further assessment.	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
White-throated needletail	The white-throated needletail breeds in the northern hemisphere and migrates in the austral summer months to Australia. While in Australia, this species is widespread and predominately aerial. There is no current accurate population estimate, however the global population is estimated at greater than 10,000 birds (Higgins, 1999). Important populations are not defined, however important habitat includes large tracts of native vegetation, particularly forest. The species usually roosts in tall trees on cliffs or steep slopes that have vantage points, amongst dense foliage in the canopy or in hollows.  Identified threats to this species whilst in Australia include habitat loss and fragmentation, mortality due to collision with wind turbines and overhead wires, poisoning and pesticides.	This species may potentially occur in the airspace above the Project Area. Four ALA records also occur within 50 km of the Project Area. A total of 2,122.64 ha of potential suitable habitat occurs within the Project Area. Of this total area, 922.89 is considered to comprise important habitat (suitable for roosting and foraging). As important habitat for the species occurs, any individuals within the Project Area are considered an important population. No direct impacts will occur to important habitat, however 13 ha of foraging and dispersal habitat will be impacted via vegetation clearing. Given this species is predominately aerial, is widespread within Australia and has broad habitat requirements, impacts are unlikely to affect the persistence of the species. All other key threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.	2	Highly unlikely	Low risk
Large-eared pied bat	This species occurs from Rockhampton in Queensland to Ulladulla in NSW. Records are known in Queensland from Shoalwater Bay, and sandstone escarpments in the Carnarvon and Expedition Ranges and Blackdown Tablelands. The national recovery plan for this species states that these areas are likely to support a high proportion of the Queensland populations (important populations). However, population information is limited and the true size and distribution of populations are not known. Habitat critical to the survival of the species is sandstone cliffs and fertile wooded valley habitat within close proximity of each other (Department of Environment and Resource Management, 2011).	This species is known to occur within the Project Area as it was recorded via bat call within potential foraging habitat. It was also recorded by Terrestria during the Bottle Tree Area Ecological Monitoring and Assessment: Summer 2021 (see Section 4.2). The presence of sandstone escarpments associated with the Carnarvon Ranges also provides suitable roosting habitat for the species. Any individuals within the Project Area are considered an important population. A total of 1,868.10 ha of potentially suitable habitat occurs, including 864.23 ha of foraging habitat and 1,003.87 ha of roosting habitat. Potential roosting habitat is considered habitat	2	Unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	The major threatening processes for the species have not been clearly established. Destruction of, or interference with, subterranean roosts and maternity sites is a confirmed threat but other threats are yet to be clearly identified.	critical to the survival of the species. No direct impacts will occur to roosting habitat, however 4 ha of foraging habitat will be directly impacted via vegetation clearing. As the Project Area and wider Arcadia Valley is flanked by sandstone escarpments, habitat availability in the area is high and the removal of foraging habitat is not expected affect the species' persistence in the area. No known roost sites occur within the Project area and as such no impacts to the species' breeding success is anticipated. This species is highly mobile, nocturnal and not considered sensitive to potential indirect impacts associated with the Project.			
Northern quoll	This species has a discontinuous distribution across northern Australia. In Queensland, populations have persisted despite the presence of cane toads in upland rocky areas and several coastal sites. This species is known to occur in the Carnarvon National Park area. Although northern quolls can be found in a variety of habitat across their range, habitat critical to the survival of the species is considered offshore islands, rocky habitats and structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs. Populations important for the long-term survival of the northern quoll (important populations) include high density quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present. As specified by the EPBC Act Referral guideline for the northern quoll, actions which are likely to have a significant impact on the northern quoll are those that: result in the loss of critical habitat, decrease the size of an important population and therefore interfere with the recovery	This species is considered potentially occurring within the Project Area due to the presence of suitable habitat. The Project Area also occurs within the 'potential' area of the species' distribution as identified in the referral guideline document. Any individuals within the Project Area are considered an important population. A total of 1,628.75 ha of potentially suitable habitat occurs, including 1,422.67 ha of denning and foraging habitat and 206.08 ha of foraging and dispersal habitat. All potential habitat is considered habitat critical to the survival of the species. No direct impacts will occur to denning habitat; however, 3 ha of foraging and dispersal habitat may be directly impacted via vegetation clearing.  The referral guideline for this species does not nominate impact area thresholds that may result in a significant impact. However, as there is a high availability of suitable habitat within the Project Area and the protected areas directly	2	Unlikely to highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	of the species, introduce inappropriate fire regimes or grazing activities, fragment an important population or result in invasive species or increases of them that are harmful to the northern quoll becoming established in its habitat, namely cane toads, feral cats, red foxes or exotic grasses which increase fire risk (Department of Sustainability, Environment, Water, 2011a).	east and west of the valley (comprising main core habitat), removal of this habitat is unlikely to decrease the size of an important population. All other key threats to this species including weeds and pests are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.			
South-eastern long-eared bat	The south-eastern long-eared bat (SELEB) has a patchy distribution from southern central Queensland to eastern South Australia. Most records are from inland of the Great Dividing Range, however records are generally rare. Within Queensland, this species is known from 30 localities mainly from within the Brigalow Belt South bioregion. This species inhabits a wide range of inland woodland vegetation types but is more common in box/ ironbark /cypress-pine vegetation. Roosting occurs in tree hollows, under bark or in deep bark fissures, however most roost sites are used only for a single day. Although important populations are not defined, they are assessed to occur in areas containing large contiguous extents of high quality breeding, roosting and foraging habitat that can support large source populations. Habitat loss and fragmentation is considered the only known threat to this species. Fire, reduction in hollow availability, agriculture chemicals, grazing and predation by feral animals are potential threats (Threatened Species Scientific Committee, 2015b).	This species is likely to occur within the Project Area based on the presence of suitable habitat and two records within 50 km. Calls from the <i>Nyctophilus</i> genus were also recorded within the Project Area. Any individuals within the Project Area are considered an important population due to the western ridgeline within the Project Area forming part of a large vegetation tract and possibly supporting a large number of individuals. A total of 1,868.1 ha of potentially suitable habitat occurs, including 644.5 ha of foraging only habitat and 1,223.6 ha of roosting and foraging habitat. The latter of which is considered habitat critical to the survival of the species. A total of 4 ha of roosting and foraging habitat will be directly impacted via vegetation clearing. There is a high availability of suitable habitat in similar condition within the Project Area and protected areas east and west of the valley. Also, other threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0. This species is highly mobile, nocturnal and not considered sensitive to potential indirect impacts as a result of the Project.	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
		Some uncertainty does exist regarding population density as detection has been based on potential calls from bat recorders, which can only identify to genus level. However, most SELEB records in Queensland are known to occur in large tracts of relatively undisturbed forest and woodland, with very few in highly disturbed landscapes (G. Ford 2021, pers com, 18 November). It is unlikely that the narrow linear habitat patches within the Project Area would be suitable to support the species. Any individuals are likely to be inhabiting the western ridgeline, middle hill or the public reserve (G. Ford 2021, pers com, 18 November). Therefore, it is anticipated that if a population does occur within Project Area, density would be very low and individuals would be restricted to the large vegetation patches. Notwithstanding, further assessment via a significant impact assessment has been completed to determine full extent of impacts.			
Greater glider	The greater glider occurs in eucalypt forests and woodlands within eastern Australia from the Windsor Tableland in north Queensland through to central Victoria. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. Habitat critical to the survival of the species is not defined however is considered to comprise large contiguous tracts of suitable habitat that may support a source population. As there are no reliable estimates of population size or population trends, important populations are not defined either. In Queensland especially, the abundance of greater gliders is continuing to decline largely due to the removal of	This species potentially occurs within the Project Area due to the presence of suitable habitat and records occur within 25 km. Any individuals within the Project Area are considered an important population. A total of 1,004.14 ha of potential habitat occurs, including 1,002.63 ha of breeding, foraging and dispersal habitat that is also considered habitat critical to the survival of the species. A total of 1 ha of breeding, foraging and dispersal habitat will be directly impacted via vegetation clearing. Given the extent of suitable habitat within the Project Area and in the connecting areas directly west, removal of this habitat is expected to have only a minor impact.	2	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	hollow-bearing trees during logging and repeated prescribed burning. Other key threats to the species include habitat fragmentation due to the species low dispersal ability, climate change and hyper predation by owls (Threatened Species Scientific Committee, 2016a).	As this species is known to be susceptible to habitat fragmentation and have a low dispersal ability, a specific mitigation measure will be implemented to ensure no existing breaks in the areas of suitable habitat are widened beyond 100 m. Hollow-bearing trees will be retained where possible. Other threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.			
Koala	The koala has a large distribution across eastern Australia and occurs within a variety of vegetation types, particularly those that contain koala food trees. To ensure potential significant impacts on the koala are appropriately assessed, the EPBC Act referral guidelines for the vulnerable koala were developed (Department of the Environment, 2014c). Habitat critical to the survival of the species is defined using the habitat assessment tool specific to the geographical context. The Project occurs within the inland context. Key habitat types identified as important to species recovery are riparian corridors and large contiguous tracts of vegetation that buffer and provide connectivity to riparian corridors – all dominated by Koala food trees. Important populations are not defined for this species. Known threats to this species include habitat loss, fragmentation, collision with vehicles and predation by dogs.	This species potentially occurs within the Project Area based on the presence of suitable habitat and records within 50 km. A total of 1,173.66 ha of potentially suitable habitat occurs, including 160.57 ha of foraging and habitat and 1,013.1 ha of refuge and foraging habitat. Assessment against the tool indicates the presence of habitat critical to the survival of the species within the Project Area. Direct impacts via vegetation clearing will occur to 2 ha of potential koala habitat. The referral guidance indicates the clearing of 2 ha of potential koala habitat as a potential high risk. As such, further assessment is required given clearing impacts are close to this threshold level.	3	Possible	Potential risk, further assessment required
Adorned delma	The adorned delma has a scattered distribution in Queensland, known from only a few localities including: western Brisbane, Bunya Mountains, Blackdown Tableland National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP, Expedition	This species potentially occurs within the Project Area based on the presence of suitable habitat and records within 50 km. Any individuals that may occur are considered an important population. A total of 920.37 ha of potential	2	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran and the Toowoomba Range. The Arcadia Valley is also mapped as likely habitat. Suitable habitat comprises open-forests, woodlands and adjacent exposed rocky areas in Land Zones 3, 9 and 10. Known important habitats include "suitable habitat within the Known / Likely-to-occur distribution of the species". The loss and modification of habitat from urban and agricultural development is the main known threat to the species (Department of the Environment Water Heritage and the Arts, 2008a). The Approved Conservation Advice for this species also states that 'the removal of surface rocks during the development process poses a significant threat, as these rocks are critical habitat for this species'. The species is likely to be highly sensitive to disturbance due to its sedentary nature, staying within a very small area, possibly using the same rock for shelter. Other threats to the species include fire and invasive weeds, particularly <i>Lantana montevidensis</i> .	breeding and foraging habitat occurs. The Project Area occurs within or directly adjacent to a known or likely to occur part of the species distribution. A total of 1 ha of breeding and foraging habitat will be directly impacted via vegetation clearing. The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles indicates that clearing one hectare or less of important habitat (providing that important habitat connectivity is not compromised) has a low risk of significant impacts. Given the high availability of potential habitat within the Project Area and connecting areas to the west (the Carnarvon Ranges), the removal of this habitat is expected to have only minor impacts on the species. This species is not considered sensitive to potential indirect impacts. Other threats to this species including weeds are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.			
Ornamental snake	The ornamental snake is known only from the Fitzroy and Dawson River drainage systems within Queensland. The distribution of this species is associated with the Brigalow TEC. The species occurs within floodplains, undulating clay pans and along the margins of swamps, lakes and watercourses. It also occurs on adjoining areas of elevated ground and has been recorded in woodlands and open woodlands of coolabah, poplar box, and brigalow, and in fringing vegetation along watercourses (Threatened Species Scientific Committee, 2014a). The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles defines areas of gilgai depressions and mounds as important	This species has potential to occur within the Project Area based on the modelling indicating suitable habitat and a single record within 50 km. Targeted surveys did not detect this species within the Project Area. The Project Area occurs within the southern limit of the species likely range. A total of 257.71 ha potential breeding and foraging habitat occurs within the Project Area, all of which is considered important habitat as per the referral guideline definition. However, large areas of this habitat are highly degraded and considered marginal. Direct impacts via vegetation clearing will occur to 2 ha of important habitat. The Draft Referral guidelines for the	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	habitat. Known threats to the species include habitat loss and degradation, loss of frog habitat and poisoning from cane toads.	nationally listed Brigalow Belt reptiles indicates that there is a potential high risk of significant impacts when clearing more than 2 ha of important habitat for the ornamental snake. As the proposed action would involve clearing of up to 2 ha, assessment against the Significant Impact Assessment criteria has been carried out in line with the precautionary approach.			
Yakka skink	The yakka skink has a patchy distribution within Queensland. The core habitat of this species is within the Mulga Lands and Brigalow Belt South Bioregions. It occurs within open dry sclerophyll forest or woodland, often taking refuge among dense ground vegetation, large hollow logs, cavities in soilbound root systems of fallen trees and beneath rocks. They are extremely secretive and seldom venture far from shelter sites, where they retreat to at the first sign of disturbance (Threatened Species Scientific Committee, 2008). The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles defines important habitat for this species as "any contiguous patch of suitable habitat, particularly remnant vegetation, where a colony is known or identified and any microhabitat where colonies are likely to be found". Likely habitat is mapped across portions of the Arcadia Valley. This species is not highly mobile, has a low fecundity and exhibits a high site-fidelity. Due to existing levels of habitat fragmentation, this species is susceptible to localised extinctions.	This species potentially occurs within the Project Area based on the modelling indicating suitable habitat and records within 50 km. A total of 1,104.89 ha of potential breeding and foraging habitat occurs within the Project Area, all of which is considered important habitat due to the potential presence of suitable microhabitat. most patches were found to have a high level of disturbance from exotic grass, grazing and edge effects. Microhabitat features needed to support colonies were only abundant in the larger contiguous patches of habitat (western ridgeline and Public Reserve). No yakka skink colonies were confirmed within the Survey Area, however it is possible they occur within the wider Project Area. Survey works prior to construction will search for colonies and confirm the location and extent of habitat. Direct impacts to vegetation clearing will occur to 2 ha of important habitat. The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles states that "the removal of any microhabitat features within 200 m of a colony" results in a high risk of significant impacts on the species. Due to the unknown nature of whether colonies are present and the proximity of Project works to any potentially present colonies, further assessment is required.	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
Dunmall's snake  Migratory Spe	Dunmall's snake occurs from south-central NSW to Yeppoon and the expedition Range in Queensland, largely between elevations of 200 and 500 metres above sea level. It inhabits open forest, particularly brigalow forest and woodlands on floodplains generally with deep-cracking black slay and clay loam soils. This species is reported to be nocturnal, sheltering under fallen timber and in deep soil cracks during the day. The Draft Referral guidelines for the nationally listed Brigalow Belt reptiles defines important habitat for this species as "suitable habitat within the Known / Likely-to-occur distribution of the species and any habitat corridors between". The Arcadia Valley is not included within mapped likely distributions.  The main identified threat to Dunmall's Snake is a continued legacy of past broadscale land clearing and habitat modification. Habitat continues to be threatened by overgrazing by stock, modification for grazing and agriculture, pasture improvement, crop production and urban development.	This species is considered a 'likely' occurrence within the Project Area based on the presence of suitable habitat and the 2021 Terrestria record of the species on the Santos Bottle Tree property less than 5 km to the north east (see Section 4.2). A total of 1,216.43 ha of potential breeding and foraging habitat occurs within the Project Area. However, as the Project Area does not occur within the 'known or likely-to-occur' distribution of the species identified in the Draft Referral guidelines, potential habitat is not considered important habitat for the species. A total of 2 ha of breeding and foraging habitat will be directly impacted via vegetation clearing. As habitat is not considered low as per the Draft Referral guidelines for the nationally listed Brigalow Belt reptiles. Threatening processes (weeds and grazing cattle) already occur within the Project Area that indicate the long-term persistence of the species in potential habitat is unlikely regardless of the Project. Indirect impacts such as increased noise and light are likely to be temporary and localised, and will be managed via the mitigation measures detailed in Section 8.0.	2	Unlikely	Low risk
Fork-tailed swift	The fork-tailed swift is almost exclusively aerial, recorded generally east of the Great Dividing Range from Cooktown to the New South Wales border, but extends further west in southern Queensland (Department of Agriculture Water and the Environment, 2021b). This species mostly occurs over dry or open habitats, including riparian	This species may potentially occur in the airspace above the Project Area due to the presence of suitable habitat. Any individuals within the Project Area are considered an important population. A total of 2,122.63ha of potential suitable habitat occurs within the Project Area. No areas of potential habitat are	2	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	woodland and tea-tree swamps, low scrub, heathland or saltmarsh. The fork-tailed swift does not breed in Australia. As per the species SPRAT profile, there are no significant threats to the species in Australia. Potential threats include habitat destruction and predation by feral animals.	considered habitat critical to the survival of the species, due to the broad habitat requirements. Direct impacts will occur to 13 ha of foraging only habitat via vegetation clearing. Given this species is predominately aerial and is widespread within Australia, impacts are unlikely to affect the persistence of the species. All other key threats to this species are unlikely to be increased beyond current levels with the implementation of mitigation measures detailed in Section 8.0.			
Glossy ibis	Within Australia, this species is widely distributed generally occurring east of the Kimberley in Western Australia and Eyra Peninsula in South Australia. It moves in response to good rainfalls, expanding its range, however the core breeding areas used are within the Murray-Darling Basin region of New South Wales and Victoria, the Macquarie Marshes in New South Wales, and in southern Queensland. The glossy lbis often moves north in autumn, then return south to the main breeding areas in spring and summer (Department of Agriculture Water and the Environment, 2021b). Regular migration to locations outside of Australia is also suspected but has not been confirmed.  Preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is also occasionally found in coastal locations. Wetland destruction or degradation is the major threat to the species. Clearing, grazing, burning, increased salinity, groundwater extraction and invasion by	This species is known to occur within the Project Area, with approximately six individuals recorded in the constructed wetland. This wetland on Lot 2 on TR13 as well as some of the other large farm dams provide suitable wetland habitat,. A total of 164.0 ha of potential habitat occurs within the Project Area. Potential habitat is considered suitable for foraging only due to the Project Area not occurring within one of the known breeding locations for this species. Up to 1 ha of potential foraging and dispersal habitat may be cleared. Water extraction activities may occur at some wetland locations during construction, however this is likely to occur during the dry season when the species is likely to have migrated from the Project Area. No substantial or permanent impacts on the wetland hydrology and therefore habitat extent is anticipated. The Project will not create a barrier that may hinder access to wetland habitat. Indirect impacts such as increased erosion, sedimentation and contamination will be managed as per Section 8.0. Other indirect impacts such increased dust, light and noise will be temporary and localised.	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	exotic plants and fish species are also threats to the species through habitat modification (Department of Agriculture Water and the Environment, 2021b).	However, multiple records of this species were recorded during the field survey and the constructed wetland has the potential to support numerous individuals. Therefore, further assessment is required.			
Oriental cuckoo	The oriental cuckoo is a non-breeding migrant that occurs in coastal regions across northern and eastern Australia from September to May. While in Australia, the species inhabits a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types (Department of the Environment, 2015a). The Referral guideline for 14 birds listed as migratory species under the EPBC Act, defines important habitat for the species as "monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. Frequently at edges or ecotones between habitat types". Based on estimates of population sizes within Europe, the global population may be greater than 20 million. An ecologically significant proportion of the population is 1000 individuals (0.1% threshold). The lower area threshold for impacts on important habitat is 25,000 ha. There is no information regarding known threats to this species while in Australia.	This species potentially occurs within the Project Area based on the presence of suitable habitat and two records within 80 km. A total of 1,015.19 ha of potential habitat occurs within the Project Area. All potential habitat is suitable for foraging and dispersal. This extent of habitat does not meet the area requirements to be considered nationally or internationally significant habitat and is unlikely to support an ecologically significant proportion of the population as defined under the Referral guideline for 14 birds listed as migratory species under the EPBC Act. A total of 13 ha of potential habitat will be directly impacted via vegetation clearing. This area is well below the clearing threshold for significant impacts as defined by the referral guidelines.  This species is highly mobile and unlikely to be sensitive to potential indirect impacts associated with the Project, nonetheless these will be managed as detailed in Section 8.0.	1	Highly unlikely	Low risk
Satin flycatcher	The satin flycatcher occurs from Cape York to eastern South Australia, and migrates north-south during summer. Within Queensland, this species has a scattered but widespread distribution occurring mostly in coastal regions but also on the Great Dividing Range types (Department of the Environment, 2015a).	This species potentially occurs within the Project Area based on the presence of suitable habitat and records within 50 km. A total of 1,015.19 ha of potential habitat occurs within the Project Area. All potential habitat is suitable for foraging and dispersal and is predominantly located along the western ridgeline. The extent of habitat on	1	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	The Referral guideline for 14 birds listed as migratory species under the EPBC Act, defines important habitat for the species as "Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps".  An ecologically significant proportion of the population is 440 individuals (0.1% threshold). The lower area threshold for impacts on important habitat is 170 ha. Known threats to this species include the clearing and logging of forests in south-eastern Australia, as well as black rats and invasive vines (e.g. rubber vine) in riparian habitats.	the western ridgeline would meet the area requirements to be considered nationally significant habitat as defined under the Referral guideline for 14 birds listed as migratory species under the EPBC Act. However, as per the Project's constraints protocol, this extent of nationally significant habitat falls within the 'nogo' constraint category, which means no activities are permitted. Therefore, potential direct impacts will not occur in any nationally significant habitat for this species. For smaller areas of habitat that do not meet the area threshold for nationally significant, a total of 13 ha will be directly impacted via vegetation clearing. It is unlikely that this habitat supports an ecologically significant proportion of the population. This area is well below the clearing threshold for significant impacts.  This species is highly mobile and unlikely to be sensitive to potential indirect impacts associated with the Project, nonetheless these will be managed as detailed in Section 8.0.			
Rufous fantail	The rufous fantail occurs in coastal and near coastal districts of northern and eastern Australia. One of the two subspecies ( <i>Rhipidura rufifrons intermedia</i> ) has breeding populations occurring on and east of the Great Divide, from about the NSW-Queensland border, north to the Cairns-Atherton region, Queensland. This species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts usually with a dense shrubby understorey including ferns. The <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act</i> , defines important habitat for the species as "Moist, dense habitats, including mangroves, rainforest,	This species is likely to occur within the Project Area based on the presence of suitable habitat and the recorded occurrence by BooBook in 2017 south of the Project Area near the Lonesome holding. A total of 1,886.77 ha of potential habitat occurs within the Project Area. Of this habitat, 536.60 ha is suitable for breeding, foraging and dispersal and 1,350.17 ha is suitable for foraging and dispersal only. This habitat is predominantly located along the western ridgeline. The extent of habitat on the western ridgeline would meet the area requirements to be considered nationally	1	Highly unlikely	Low risk

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands". Movement patterns are not fully understood, but some populations of the species in east Australia are migratory. An ecologically significant proportion of the population is 4800 individuals (0.1% threshold). Depending on the subspecies, the lower area threshold for impacts on important habitat ranges from 1100 to 2200 ha. Known threats to this species include habitat fragmentation and loss of moist forest breeding habitat, the black rat, and invasive vines (e.g. rubber vine) in riparian habitat. However, in Australia this species is considered common and secure as there has been no evidence of population decline.	significant habitat as defined under the Referral guideline for 14 birds listed as migratory species under the EPBC Act. However, as per the Project's constraints protocol, this extent of nationally significant habitat falls within a category 'A' area, which means no activities are permitted. Therefore, potential direct impacts will not occur in any nationally significant habitat for this species. For smaller areas of habitat that do not meet the area threshold for nationally significant, a maximum of 13 ha of foraging habitat will be directly impacted via vegetation clearing. These areas are unlikely to support an ecologically significant proportion of the population. This area is well below the clearing threshold for significant impacts. No clearing of breeding and nesting habitat will occur. This species is not expected to be sensitive to potential indirect impacts, nonetheless these will be managed as detailed in Section 8.0. Furthermore, this species is considered common and secure in Australia and as such impacts are considered negligible.			
Latham's snipe	Latham's snipe is a non-breeding visitor to southeastern Australia and a passage migrant in northern Australia. It is known from the east coast as far north as the Cape York Peninsula and as far south as Adelaide and the Eyre Peninsula. It is also known from inland areas of Queensland in the eastern tablelands and Rockhampton. This species usually inhabits open, freshwater wetlands with low, dense vegetation however they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (Department of Agriculture Water and	This species potentially occurs within the Project Area based on the presence of suitable habitat and two ALA records within 50 km. A total of 164.0 ha potential wetland habitat occurs within the Project Area, all of which is considered important foraging habitat for the Latham's snipe. No breeding or nesting habitat occurs within the Project Area as Latham's snipe is a non-breeding migrant to Australia.  Up to 1 ha of potential foraging and dispersal habitat may be cleared. Water extraction activities may occur at some wetland locations	3	Possible	Potential risk, further assessment required

MNES	Habitat, Threats and Regional Context	Nature and Extent of Potential Impacts	Consequence	Likelihood	Risk Rating
	the Environment, 2021b). The foraging habitats of Latham's snipe are characterized by areas of mud (either exposed or beneath a very shallow covering of water) and some form of cover (e.g. low, dense vegetation). It roosts on the ground near (or sometimes in) their foraging areas. Behaviours and habitats for Latham's snipe tend to differ to many of the coastal migratory shorebird species. For example, whilst many species aggregate in large flocks, Latham's snipe typically disperse in small numbers across larger habitat areas. Consequently, important habitat for this species is identified using a different process to that of other migratory shorebird species (Department of the Environment, 2015b).  Important habitat for Latham's snipe occurs at sites that have previously been identified as internationally important for the species, or sites that:  Support at least 18 individuals of the species (ecologically significant proportion of the population), and  Are naturally occurring open freshwater wetland with vegetation cover nearby (for example, tussock grasslands, sedges, lignum or reeds within 100 m of the wetland).	during construction, however this is likely to occur during the dry season when the species is likely to have migrated from the Project Area. No substantial or permanent impacts on the wetland hydrology and therefore habitat extent is anticipated. The Project will not create a barrier that may hinder access to wetland habitat. Indirect impacts such as increased erosion, sedimentation and contamination will be managed as per Section 8.0. Other indirect impacts such increased dust, light and noise will be temporary and localised. Nonetheless, the constructed wetland on lot and plan 2TR13 in the northern portion of the Project Area is of sufficient size and condition to support an ecologically significant proportion of the population (i.e. at least 18 individuals) or close to that threshold. Therefore, further assessment is required.			

#### 9.2 Significant impact criteria assessment

Significant impact assessments were undertaken for eleven known or potentially occurring MNES values in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (Department of the Environment, 2013b).

The significant impact assessments, relevant criteria and supporting documents are detailed in Appendix F. Findings of these assessments determined <u>no significant impacts on MNES are likely</u> to occur as a result of the Project.

#### 10.0 Conclusions and recommendations

This MNES assessment was developed to support the PD of the Project for assessment under the EPBC Act. Using a combination of field-validated data, desktop information and extrapolated field survey results, the potential presence of MNES values within the Project Area was determined. A total of 28 MNES were considered known, likely or potentially occurring including three TECs, four threatened flora species, fifteen (15) threatened fauna species and six migratory species.

An impact assessment for known, likely and potentially occurring MNES within the Project Area was completed via a two-step process. The first step involved a risk assessment, to determine if the likely consequences associated with potential impacts to individual MNES warrants further assessment via the significant impact assessment process. To make this determination, potential Project impacts were assessed against likelihood and consequence criteria, with the results applied to a risk matrix to identify risk level and further assessment outcomes (Appendix E). MNES with a 'potential' risk rating triggered further assessment whilst MNES with a 'low' risk rating require no further assessment.

Based on the findings of the risk assessment, significant impact assessments were undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (Department of the Environment, 2013b) for eleven MNES values:

- Brigalow TEC
- Ooline
- X. herbacea
- Koala
- Painted honeyeater
- Ornamental snake
- Yakka skink
- South-eastern long-eared bat
- Australian painted snipe
- Latham's snipe
- Glossy ibis.

With the implementation of the Protocol and mitigation measures detailed in Section 8, findings of the assessments determined that the Project is unlikely to result in a significant impact any of the known or potential MNES values within the Project Area. As such, offsets are not required in accordance with the EPBC Act Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities, 2012).

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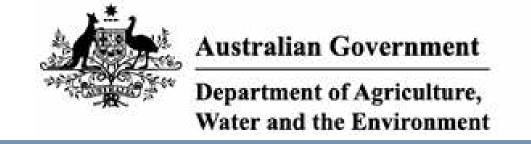
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# Appendix A

**PMST** Report



# **EPBC Act Protected Matters Report**

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

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

Information is available about <u>Environment Assessments</u> and the EPBC Act including significance guidelines, forms and application process details.

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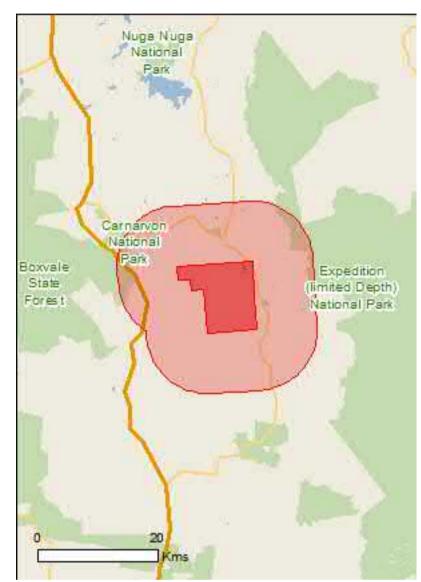
Summary

**Details** 

Matters of NES
Other Matters Protected by the EPBC Act
Extra Information

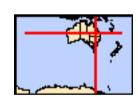
Caveat

**Acknowledgements** 



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

Coordinates
Buffer: 10.0Km



## Summary

## Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	27
Listed Migratory Species:	13

## Other Matters Protected by the EPBC Act

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

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

A <u>permit</u> 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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

#### **Extra Information**

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

# Details

## Matters of National Environmental Significance

Listed Threatened Ecological Communities

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.				
Name	Status	Type of Presence		
Brigalow (Acacia harpophylla dominant and codominant)	Endangered	Community known to occur within area		
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area		
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area		
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandowar Biorogians	Endangered	Community likely to occur within area		
(North and South) and Nandewar Bioregions Weeping Myall Woodlands	Endangered	Community likely to occur within area		
Listed Threatened Species		[ Resource Information ]		
Name	Status	Type of Presence		
Birds				
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area		
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area		
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area		
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area		
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat known to occur within area		
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area		
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern) [26027]	Endangered	Species or species habitat likely to occur within area		
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species		

[ Resource Information ]

Name	Status	Type of Presence
		habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104] Plants	NSW and the ACT) Vulnerable	Species or species habitat likely to occur within area
Acacia grandifolia [3566]	Vulnerable	Species or species habitat likely to occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
Cadellia pentastylis Ooline [9828]	Vulnerable	Species or species habitat known to occur within area
<u>Dichanthium setosum</u> bluegrass [14159]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Xerothamnella herbacea [4146]	Endangered	Species or species habitat likely to occur within area
Reptiles		
<u>Delma torquata</u> Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Denisonia maculata Ornamental Snake [1193]	Vulnerable	Species or species habitat may occur within area
Egernia rugosa Yakka Skink [1420]	Vulnerable	Species or species habitat known to occur within area
Elseya albagula Southern Snapping Turtle, White-throated Snapping Turtle [81648]	Critically Endangered	Species or species habitat likely to occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Rheodytes leukops		
Fitzroy River Turtle, Fitzroy Tortoise, Fitzroy Turtle, White-eyed River Diver [1761]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[ Resource Information ]
* Species is listed under a different scientific name on the	he EPBC Act - Threatened	Species list.
Name	Threatened	Type of Presence
Migratory Marine Birds		,
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Other Matters i Totected by the Li bo Act		
Listed Marine Species		[ Resource Information ]
* Species is listed under a different scientific name on	the EPBC Act - Threatened	d Species list.
Name	Threatened	Type of Presence
Birds		31
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea	6 W W = 1	
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within

		area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Threatened

Type of Presence

Species or species

## **Extra Information**

Pig [6]

Name

State and Territory Reserves	[ Resource Information ]
Name	State
Carnarvon	QLD
Expedition (Limited Depth)	QLD
Invasiva Chasica	[ Doggurgo Information ]
Invasive Species	[ Resource Information ]

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

Landscape Health Froject, National Land and Wate	i Nesouces Addit, 200	/1.
Name	Status	Type of Presence
Birds		71
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris		
Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus		
Horse [5]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa		
		_

Name	Status	Type of Presence
Vulpag vulpag		habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913] Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area  Species or species habitat
		likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]	<del>)</del>	Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Vachellia nilotica Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area

### Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

## Coordinates

-25.25089 148.71226,-25.24436 148.82453,-25.33656 148.83071,-25.34059 148.75655,-25.28255 148.75071,-25.28349 148.7332,-25.2689 148.73217,-25.26983 148.71466,-25.25089 148.71226

## 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.

# Appendix B

# DES Wildlife Online Report



#### Wildlife Online Extract

Search Criteria: Species List for a Specified Point

Species: All Type: All Status: All

Records: All

Date: Since 1980 Latitude: -25.2913 Longitude: 148.7868

Distance: 25

Email: jessie.mckee@aecom.com

Date submitted: Thursday 22 Apr 2021 12:12:42 Date extracted: Thursday 22 Apr 2021 12:20:02

The number of records retrieved = 922

#### **Disclaimer**

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

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

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

Kingdom	Class	Family	Scientific Name	Common Name	1	Q	Α	Records
animals	amphibians	Bufonidae	Rhinella marina	cane toad	Υ			9
animals	amphibians	Hylidae	Litoria fallax	eastern sedgefrog		С		2
animals	amphibians	Hylidae	Litoria inermis	bumpy rocketfrog		С		1
animals	amphibians	Hylidae	Litoria peronii	emerald spotted treefrog		С		3
animals	amphibians	Hylidae	Litoria rubella	ruddy treefrog		С		6
animals	amphibians	Hylidae	Litoria caerulea	common green treefrog		С		6
animals	amphibians	Hylidae	Cyclorana brevipes	superb collared frog		С		3
animals	amphibians .	Hylidae	Litoria latopalmata	broad palmed rocketfrog		С		3
animals	amphibians	Limnodynastidae	Limnodynastes tasmaniensis	spotted grassfrog		С		1
animals	amphibians	Limnodynastidae	Limnodynastes terraereginae	scarlet sided pobblebonk		С		1
animals	amphibians	Limnodynastidae	Platyplectrum ornatum	ornate burrowing frog		С		6
animals	amphibians	Limnodynastidae	Limnodynastes peronii	striped marshfrog		С		1
animals	amphibians	Myobatrachidae	Crinia parinsignifera	beeping froglet		С		2
animals	amphibians	Myobatrachidae	Uperoleia laevigata	eastern gungan		С		1
animals	amphibians	Myobatrachidae	Pseudophryne major	great brown broodfrog		С		3
animals	amphibians	Myobatrachidae	Uperoleia rugosa	chubby gungan		С		1
animals	amphibians	Myobatrachidae	Pseudophryne sp.			C C		2
animals	birds	Acanthizidae	Smicrornis brevirostris	weebill		С		23/1
animals	birds	Acanthizidae	Pyrrholaemus sagittatus	speckled warbler		С		1
animals	birds	Acanthizidae	Acanthiza nana	yellow thornbill		С		8
animals	birds	Acanthizidae	Gerygone fusca	western gerygone		С		6/1
animals	birds	Acanthizidae	Acanthiza lineata	striated thornbill		С		4
animals	birds	Acanthizidae	Acanthiza chrysorrhoa	yellow-rumped thornbill		С		3
animals	birds	Acanthizidae	Gerygone olivacea	white-throated gerygone		C		12
animals	birds	Acanthizidae	Acanthiza apicalis	inland thornbill		C		4
animals	birds	Acanthizidae	Acanthiza reguloides	buff-rumped thornbill		C C		1 <u>5</u> /7
animals	birds	Acanthizidae	Sericornis frontalis	white-browed scrubwren		C		7
animals	birds	Acanthizidae	Acanthiza pusilla	brown thornbill		С		9/1
animals	birds	Accipitridae	Accipiter cirrocephalus	collared sparrowhawk		C		3
animals	birds	Accipitridae	Haliaeetus leucogaster	white-bellied sea-eagle		C		2
animals	birds	Accipitridae	Haliastur sphenurus	whistling kite		С		6
animals	birds	Accipitridae	Aquila audax	wedge-tailed eagle		С		17
animals	birds	Accipitridae	Milvus migrans	black kite		C		2
animals	birds	Accipitridae	Circus assimilis	spotted harrier		С		2
animals	birds	Accipitridae	Elanus axillaris	black-shouldered kite		C		2
animals	birds	Accipitridae	Accipiter fasciatus	brown goshawk		C		6
animals	birds	Accipitridae	Aviceda subcristata	Pacific baza		С		1
animals	birds	Acrocephalidae	Acrocephalus australis	Australian reed-warbler		C		3
animals	birds	Aegothelidae	Aegotheles cristatus	Australian owlet-nightjar		C		13
animals	birds	Alaudidae	Mirafra javanica	Horsfield's bushlark		С		3
animals	birds	Anatidae	Nettapus coromandelianus	cotton pygmy-goose		C		1
animals	birds	Anatidae	Malacorhynchus membranaceus	pink-eared duck		C		3
animals	birds	Anatidae	Anas gracilis	grey teal		С		10
animals	birds	Anatidae	Cygnus atratus	black swan		C C		3
animals	birds	Anatidae	Aythya australis	hardhead		Ċ		5
animals	birds	Anatidae	Anas superciliosa	Pacific black duck		С		17

Kingdom	Class	Family	Scientific Name	Common Name	I Q	Α	Records
animals	birds	Anatidae	Chenonetta jubata	Australian wood duck	С		11
animals	birds	Anatidae	Dendrocygna eytoni	plumed whistling-duck	С		6
animals	birds	Anatidae	Spatula rhynchotis	Australasian shoveler	С		3
animals	birds	Anatidae	Dendrocygna arcuata	wandering whistling-duck	С		2
animals	birds	Anhingidae	Anhinga novaehollandiae	Australasian darter	С		5
animals	birds	Ardeidae	Ardea intermedia	intermediate egret	С		1
animals	birds	Ardeidae	Ardea pacifica	white-necked heron	С		5
animals	birds	Ardeidae	Egretta novaehollandiae	white-faced heron	С		7
animals	birds	Ardeidae	Nycticorax caledonicus	nankeen night-heron	С		3
animals	birds	Ardeidae	Árdea alba modesta	eastern great egret	С		5
animals	birds	Artamidae	Artamus superciliosus	white-browed woodswallow	С		3
animals	birds	Artamidae	Cracticus nigrogularis	pied butcherbird	С		19
animals	birds	Artamidae	Artamus leucorynchus	white-breasted woodswallow	С		4
animals	birds	Artamidae	Cracticus torquatus	grey butcherbird	С		40
animals	birds	Artamidae	Strepera graculina	pied currawong	С		44
animals	birds	Artamidae	Gymnorhina tibicen	Australian magpie	С		31
animals	birds	Artamidae	Artamus cinereus	black-faced woodswallow	С		6
animals	birds	Artamidae	Artamus minor	little woodswallow	С		1
animals	birds	Artamidae	Artamus personatus	masked woodswallow	C		1
animals	birds	Burhinidae	Burhinus grallarius	bush stone-curlew	С		3
animals	birds	Cacatuidae	Cacatua galerita	sulphur-crested cockatoo	С		25
animals	birds	Cacatuidae	Eolophus roseicapilla	galah	С		9
animals	birds	Cacatuidae	Calyptorhynchus funereus	yellow-tailed black-cockatoo	С		2
animals	birds	Cacatuidae	Nymphicus hollandicus	cockatiel	С		10
animals	birds	Campephagidae	Lalage tricolor	white-winged triller	С		3
animals	birds	Campephagidae	Coracina papuensis	white-bellied cuckoo-shrike	С		4
animals	birds	Campephagidae	Lalage leucomela	varied triller	С		4
animals	birds	Campephagidae	Coracina novaehollandiae	black-faced cuckoo-shrike	С		11
animals	birds	Campephagidae	Coracina tenuirostris	cicadabird	С		4
animals	birds	Casuariidae	Dromaius novaehollandiae	emu	С		11
animals	birds	Charadriidae	Vanellus miles	masked lapwing	С		8
animals	birds	Charadriidae	Vanellus miles novaehollandiae	masked lapwing (southern subspecies)	С		4
animals	birds	Charadriidae	Elseyornis melanops	black-fronted dotterel	С		2
animals	birds	Cisticolidae	Cisticola exilis	golden-headed cisticola	С		3
animals	birds	Climacteridae	Cormobates leucophaea	white-throated treecreeper	С		3
animals	birds	Climacteridae	Cormobates leucophaea metastasis	white-throated treecreeper (southern)	С		6
animals	birds	Columbidae	Geophaps scripta scripta	squatter pigeon (southern subspecies)	V	V	10
animals	birds	Columbidae	Leucosarcia melanoleuca	wonga pigeon	С		5
animals	birds	Columbidae	Geopelia humeralis	bar-shouldered dove	С		8
animals	birds	Columbidae	Phaps chalcoptera	common bronzewing	С		10
animals	birds	Columbidae	Ocyphaps lophotes	crested pigeon	С		14
animals	birds	Columbidae	Geopelia striata	peaceful dove	С		9
animals	birds	Columbidae	Geopelia cuneata	diamond dove	С		2
animals	birds	Columbidae	Chalcophaps indica	emerald dove	С		3
animals	birds	Coraciidae	Eurystomus orientalis	dollarbird	С		5
animals	birds	Corcoracidae	Corcorax melanorhamphos	white-winged chough	С		7

Kingdom	Class	Family	Scientific Name	Common Name	<u> </u>	Q	Α	Records
animals	birds	Corcoracidae	Struthidea cinerea	apostlebird		С		17
animals	birds	Corvidae	Corvus sp.	·		С		3
animals	birds	Corvidae	Corvus orru	Torresian crow				31
animals	birds	Corvidae	Corvus coronoides	Australian raven		CCC		15
animals	birds	Cuculidae	Scythrops novaehollandiae	channel-billed cuckoo		С		4
animals	birds	Cuculidae	Chalcites lucidus	shining bronze-cuckoo		С		2
animals	birds	Cuculidae	Cacomantis flabelliformis	fan-tailed cuckoo		CCC		9
animals	birds	Cuculidae	Chalcites minutillus	little bronze-cuckoo		Č		1
animals	birds	Cuculidae	Eudynamys orientalis	eastern koel		C		4
animals	birds	Cuculidae	Centropus phasianinus	pheasant coucal		CCC		17
animals	birds	Cuculidae	Cacomantis pallidus	pallid cuckoo		Č		4
animals	birds	Dicruridae	Dicrurus bracteatus	spangled drongo		Č		2
animals	birds	Estrildidae	Neochmia temporalis	red-browed finch		Č		5
animals	birds	Estrildidae	Taeniopygia bichenovii	double-barred finch		CCC		5
animals	birds	Estrildidae	Neochmia modesta	plum-headed finch				3
animals	birds	Estrildidae	Lonchura castaneothorax	chestnut-breasted mannikin		Č		2
animals	birds	Estrildidae	Taeniopygia guttata	zebra finch		CCC		4
animals	birds	Eurostopodidae	Eurostopodus mystacalis	white-throated nightjar		Č		1
animals	birds	Eurostopodidae	Eurostopodus argus	spotted nightjar		Č		1
animals	birds	Falconidae	Falco berigora	brown falcon		Č		7
animals	birds	Falconidae	Falco subniger	black falcon		C		, 1
animals	birds	Falconidae	Falco longipennis	Australian hobby		Ċ		i
animals	birds	Falconidae	Falco cenchroides	nankeen kestrel		Č		6
animals	birds	Falconidae	Falco peregrinus	peregrine falcon		000000000		2
animals	birds	Gruidae	Antigone rubicunda	brolga		Č		2 2
animals	birds	Halcyonidae	Dacelo novaeguineae	laughing kookaburra		C		32
animals	birds	Halcyonidae	Todiramphus macleayii	forest kingfisher		Č		1
animals	birds	Hirundinidae	Petrochelidon ariel	fairy martin		C		2
animals	birds	Hirundinidae	Hirundo neoxena	welcome swallow		č		3
animals	birds	Hirundinidae	Petrochelidon nigricans	tree martin		Ċ		3
animals	birds	Maluridae	Malurus cyaneus	superb fairy-wren		C		2
animals	birds	Maluridae	Malurus melanocephalus	red-backed fairy-wren		č		15
animals	birds	Maluridae	Malurus lamberti	variegated fairy-wren		Ċ		12
animals	birds	Megaluridae	Megalurus gramineus	little grassbird		C		3
animals	birds	Megaluridae	Cincloramphus mathewsi	rufous songlark		č		1
animals	birds	Megapodiidae	Alectura lathami	Australian brush-turkey		Ċ		7
animals	birds	Meliphagidae	Plectorhyncha lanceolata	striped honeyeater		C		11
animals	birds	Meliphagidae	Melithreptus albogularis	white-throated honeyeater		Č		4
animals	birds	Meliphagidae	Acanthagenys rufogularis	spiny-cheeked honeyeater				6
animals	birds	Meliphagidae	Melithreptus brevirostris	brown-headed honeyeater		C C		4
animals	birds	Meliphagidae	Ptilotula fusca	fuscous honeyeater		Č		2
animals	birds	Meliphagidae	Meliphaga lewinii	Lewin's honeyeater		Č		13
animals	birds	Meliphagidae	Caligavis chrysops	yellow-faced honeyeater		CCC		11
animals	birds	Meliphagidae	Entomyzon cyanotis	blue-faced honeyeater		0		12
animals	birds	Meliphagidae	Manorina flavigula	yellow-throated miner		0		7
animals	birds	Meliphagidae	Gavicalis virescens	singing honeyeater		C C		3
aiiiiiais	טוועט	Menphayluae	Gavicalis VII ESCELIS	Singing noneyeater		U		J

Kingdom	Class	Family	Scientific Name	Common Name	 Q	Α	Records
animals	birds	Meliphagidae	Lichmera indistincta	brown honeyeater	С		8
animals	birds	Meliphagidae	Melithreptus lunatus	white-naped honeyeater	С		13
animals	birds	Meliphagidae	Nesoptilotis leucotis	white-eared honeyeater	С		16
animals	birds	Meliphagidae	Philemon corniculatus	noisy friarbird	С		19
animals	birds	Meliphagidae	Ptilotula penicillata	white-plumed honeyeater	С		1
animals	birds	Meliphagidae	Lichenostomus melanops	yellow-tufted honeyeater	С		5
animals	birds	Meliphagidae	Manorina melanocephala	noisy miner	С		82
animals	birds	Meliphagidae	Myzomela sanguinolenta	scarlet honeyeater	С		5
animals	birds	Meliphagidae	Philemon citreogularis	little friarbird	С		9
animals	birds	Meropidae	Merops ornatus	rainbow bee-eater	С		6
animals	birds	Monarchidae	Myiagra inquieta	restless flycatcher	С		2
animals	birds	Monarchidae	Myiagra rubecula	leaden flycatcher	С		5
animals	birds	Monarchidae	Grallina cyanoleuca	magpie-lark	С		27
animals	birds	Motacillidae	Anthus novaeseelandiae	Australasian pipit	С		5
animals	birds	Nectariniidae	Dicaeum hirundinaceum	mistletoebird	С		13
animals	birds	Neosittidae	Daphoenositta chrysoptera	varied sittella	С		4
animals	birds	Oriolidae	Sphecotheres vieilloti	Australasian figbird	С		3
animals	birds	Oriolidae	Öriolus sagittatus	olive-backed oriole	С		5
animals	birds	Otididae	Ardeotis australis	Australian bustard	С		4
animals	birds	Pachycephalidae	Pachycephala rufiventris	rufous whistler	С		23
animals	birds	Pachycephalidae	Colluricincla harmonica	grey shrike-thrush	С		16
animals	birds	Pachycephalidae	Pachycephala pectoralis	golden whistler	С		7
animals	birds	Pardalotidae	Pardalotus punctatus	spotted pardalote	С		5
animals	birds	Pardalotidae	Pardalotus striatus	striated pardalote	С		56
animals	birds	Pardalotidae	Pardalotus rubricatus	red-browed pardalote	С		1
animals	birds	Pelecanidae	Pelecanus conspicillatus	Australian pelican	С		3
animals	birds	Petroicidae	Petroica rosea <sup>'</sup>	rose robin '	С		1
animals	birds	Petroicidae	Microeca fascinans	jacky winter	С		3
animals	birds	Petroicidae	Eopsaltria australis	eastern yellow robin	С		3
animals	birds	Phalacrocoracidae	Phalacrocorax sulcirostris	little black cormorant	С		5
animals	birds	Phalacrocoracidae	Phalacrocorax carbo	great cormorant	С		3
animals	birds	Phalacrocoracidae	Phalacrocorax varius	pied cormorant	С		3
animals	birds	Phalacrocoracidae	Microcarbo melanoleucos	little pied cormorant	С		8
animals	birds	Phasianidae	Coturnix ypsilophora	brown quail	С		1
animals	birds	Podargidae	Podargus strigoides	tawny frogmouth	С		3
animals	birds	Podicipedidae	Poliocephalus poliocephalus	hoary-headed grebe	С		1
animals	birds	Podicipedidae	Tachybaptus novaehollandiae	Australasian grebe	С		9
animals	birds	Pomatostomidae	Pomatostomus temporalis	grey-crowned babbler	С		2
animals	birds	Psittacidae	Trichoglossus chlorolepidotus	scaly-breasted lorikeet	С		10
animals	birds	Psittacidae	Aprosmictus erythropterus	red-winged parrot	С		11
animals	birds	Psittacidae	Melopsittacus undulatus	budgerigar	С		3
animals	birds	Psittacidae	Platycercus adscitus	pale-headed rosella	С		27
animals	birds	Psittacidae	Alisterus scapularis	Australian king-parrot	С		15
animals	birds	Psittacidae	Trichoglossus haematodus moluccanus	rainbow lorikeet	С		48
animals	birds	Psittacidae	Parvipsitta pusilla	little lorikeet	С		6
animals	birds	Psophodidae	Cinclosoma punctatum	spotted quail-thrush	С		1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	Α	Records
animals	birds	Ptilonorhynchidae	Ptilonorhynchus maculatus	spotted bowerbird		С		7
animals	birds	Rallidae	Fulica atra	Eurasian coot		С		4
animals	birds	Rallidae	Gallinula tenebrosa	dusky moorhen		С		4
animals	birds	Rallidae	Porphyrio melanotus	purple swamphen		C		1
animals	birds	Recurvirostridae	Himantopus himantopus	black-winged stilt		Č		2
animals	birds	Rhipiduridae	Rhipidura leucophrys	willie wagtail		Č		14
animals	birds	Rhipiduridae	Rhipidura albiscapa	grey fantail		Č		17
animals	birds	Scolopacidae	Gallinago hardwickii	Latham's snipe		ŠL		1
animals	birds	Strigidae	Ninox boobook	southern boobook		C		8
animals	birds	Strigidae	Ninox connivens	barking owl		Č		1
animals	birds	Sturnidae	Sturnus vulgaris	common starling	Υ	O		1
animals	birds	Threskiornithidae	Platalea flavipes	yellow-billed spoonbill	•	С		1
animals	birds	Threskiornithidae	Threskiornis spinicollis	straw-necked ibis		C		4
animals	birds	Threskiornithidae	Threskiornis molucca	Australian white ibis		Č		3
								4
animals	birds	Threskiornithidae	Platalea regia	royal spoonbill		C		
animals	birds	Timaliidae	Zosterops lateralis	silvereye		С		6
animals	birds	Turnicidae	Turnix velox	little button-quail		С		l a
animals	birds	Turnicidae	Turnix varius	painted button-quail		C		1
animals	birds .	Tytonidae	Tyto delicatula .	eastern barn owl		С		2
animals	insects	Aeshnidae	Anax papuensis	Australian Emperor				3
animals	insects	Libellulidae	Orthetrum caledonicum	blue skimmer				3
animals	insects	Libellulidae	Diplacodes haematodes	scarlet percher				1
animals	insects	Libellulidae	Diplacodes bipunctata	wandering percher				1
animals	insects	Lycaenidae	Zizina otis labradus	common grass-blue (Australian				5
				subspecies)				
animals	insects	Nymphalidae	Ypthima arctous arctous	dusky knight				1
animals	insects	Nymphalidae	Hypolimnas bolina nerina	varied eggfly				1
animals	insects	Nymphalidae	Heteronympha merope merope	common brown				1
animals	insects	Nymphalidae	Junonia orithya albicincta	blue argus				1
animals	insects	Nymphalidae	Acraea andromacha andromacha	glasswing				3
animals	insects	Nymphalidae	Junonia villida villida	meadow argus				3
animals	insects	Nymphalidae	Tirumala hamata hamata	blue tiger				2
animals	insects	Nymphalidae	Danaus plexippus	monarch	Υ			1
animals	insects	Nymphalidae	Hypocysta irius	orange-streaked ringlet				1
animals	insects	Nymphalidae	Euploea corinna	common crow				3
animals	insects	Nymphalidae	Danaus petilia	lesser wanderer				4
animals	insects	Papilionidae	Papilio aegeus aegeus	orchard swallowtail (Australian				2
arminaio		. apmormado	r apmo aogeae aogeae	subspecies)				_
animals	insects	Pieridae	Eurema smilax	small grass-yellow				2
animals	insects	Pieridae	Catopsilia pomona	lemon migrant				2
animals	insects	Pieridae	Belenois java teutonia	caper white				6
animals								1
	insects	Pieridae Pieridae	Eurema brigitta australis	no-brand grass-yellow				 
animals	insects		Catopsilia pyranthe crokera	white migrant				I -4
animals	insects	Synthemistidae	Parasynthemis regina	royal tigertail		0		l 4
animals	mammals	Acrobatidae	Acrobates pygmaeus	feathertail glider	1/	С		]
animals	mammals	Canidae	Canis familiaris	dog	Υ			1

animals animals mammals Canidae Canis familiaris (dingo) dingo common dument C 2/2 animals mammals animals ani	Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
animals mammals Dasyuridae Sminthopsis murima common dunnart C 2/2 animals mammals Dasyuridae Plangale maculata common planigale C 7/6 93 animals mammals Emballoruridae Taphozous troughtoni Troughton's sheathtail bat C 93 animals animals mammals Leporidae Oryctolagus cuniculus rather than animals animals mammals Macropodidae Notamacropus parryi whipitali wallaby C 10 animals mammals Macropodidae Notamacropus dorsalis black-striped wallaby C 11 animals mammals Macropodidae Ophranter robustus common wallaroo C 2 animals mammals Macropodidae Macropus dorsalis black-striped wallaby C 1 animals mammals Macropodidae Macropus dorsalis black-striped wallaby C 1 animals mammals Macropodidae Macropus dorsalis black-striped wallaby C 1 animals mammals Macropodidae Macropus giganieus eastern grey kanagraroo C 1 2 animals mammals Miniopteridae Macropus giganieus eastern grey kanagraroo C 1 2 animals mammals Miniopteridae Macropus dorsalis Color Macropus australis animals mammals Muridae Mus musculus house mouse y C 1 animals mammals Muridae Mus musculus house mouse y C 1 animals mammals Petauridae Petaurus norfolcensis australis australis australis australis australis australis australis australis australis aunimals mammals Petauridae Petaurus norfolcensis aus	animals	mammals	Canidae	Canis familiaris (dingo)	dingo				1
animals mammals   Emballonuridae   Taphözous troughtori   Catasis	animals	mammals	Dasyuridae		common dunnart		С		2/2
animals mammals Emballonuridae Taphozous troughtoni Toughton's sheathtail bat V 1 1 mammals Felidae Felidae Felidae Cortocatus Corto	animals	mammals	Dasyuridae	Planigale maculata	common planigale		С		7/6
animals         mammals mammals         Laporidae         Oryctolagus curiculus         rabbit         Y         1           animals mammals         Macropodidae         Notamacropus parryi         whiptall wallaby         C         10           animals mammals         Macropodidae         Notamacropus dorsalis         back-striped wallaby         C         4           animals mammals         Macropodidae         Notamacropus dorsalis         back-striped wallaby         C         2           animals mammals         Macropodidae         Osphranter robustus         common wallarou         C         2           animals mammals         Macropodidae         Petrogale herberti         Herbort's rock-wallaby         C         3           animals mammals         Macropodidae         Macropodidae         Wallabia bicolor         eastern bren-twing bat         C         97           animals mammals         Minolpterias schriebersii oceanensis         eastern bren-twing bat         C         97           animals mammals         Molossidae         Austronomus australis         white-striped freetail bat         C         2           animals mammals         Muridae         Melonys cervinipes         eastern free-tailed bat         C         3           animals mammals         Muridae <td>animals</td> <td>mammals</td> <td></td> <td></td> <td></td> <td></td> <td>С</td> <td></td> <td>93</td>	animals	mammals					С		93
animals mammals Macropodidae Notamacropus indigriseus red-necked wallaby C 1 1 animals mammals Macropodidae Notamacropus utgoriseus red-necked wallaby C 2 1 animals mammals Macropodidae Osphranter robustus common wallaroo C 2 2 animals mammals Macropodidae Osphranter robustus common wallaroo C 2 2 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Macropodidae Macropus giganteus eastern grey kangaroo C C 12 animals mammals Molossidae Macropodidae Minipetrus schreibersii oceanensis eastern grey kangaroo C C 12 animals mammals Molossidae Mormopterus fidei eastern grey kangaroo C C 3 animals mammals Muridae Molossidae Mormopterus indei eastern free-tailed bat C 3 animals mammals Muridae Mus musculus favo G 1 animals mammals Muridae Mus musculus favo G 1 animals mammals Muridae Mus musculus favo G 1 animals mammals Petauridae Petaurus norfolcensis squirrel gilder C 1 animals mammals Petauridae Petaurus norfolcensis squirrel gilder C 1 animals mammals Petauridae Petaurus australis sustralis squirrel gilder C 1 animals mammals Patochocheridae Petaurus australis sustralis squirrel gilder C 1 animals mammals Patochocheridae Petaurus australis squirrel gilder C 2 animals mammals Patochocheridae Petaurus australis squirrel gilder C 1 animals mammals Patochocheridae Petaurus australis squirrel gilder C 1 animals mammals Patochocheridae Petaurus australis squirrel gilder C 1 animals mammals Patochocheridae Petaurus australis australis squirrel gilder C 1 animals mammals Patochocheridae Petaurus australis australis contral greater gilder C 1 animals mammals Patochocheridae Petaurus australis australis con	animals	mammals	Felidae			Υ			1
animals mammals Macropodidae Notamacropus parryi whiptail wallaby C 1 1 animals mammals Macropodidae Notamacropus unfogriseus red-necked wallaby C 2 1 animals mammals Macropodidae Notamacropus unfogriseus plack-striped wallaby C 2 2 animals mammals Macropodidae Osphranter robustus common wallaroo C 2 2 animals mammals Macropodidae Macropodidae Hotopus giganteus eastern grey kangaroo C 1 12 animals mammals Macropodidae Macropos giganteus eastern grey kangaroo C 1 12 animals mammals Macropodidae Macropos giganteus eastern grey kangaroo C 1 12 animals mammals Macropodidae Macropos giganteus eastern grey kangaroo C 1 12 animals mammals Macropodidae Macropos giganteus eastern grey kangaroo C 2 3 animals mammals Molossidae Mormopterus schreibersii oceanensis eastern bent-wing bat C 2 3 animals mammals Molossidae Mormopterus unisotenae northern free-tailed bat C 2 3 animals mammals Molossidae Mormopterus fidei eastern free-tailed bat C 3 3 animals mammals Molossidae Mormopterus fidei eastern free-tailed bat C 3 3 animals mammals Muridae Melomys cervinipes favi-footed melomys C 1 1 animals mammals Muridae Mus musculus Huridae Petaurus nortoloensis squirrel gilder C 1 1 animals mammals Petauridae Petaurus nortoloensis squirrel gilder C 2 2 animals mammals Petauridae Petaurus nortoloensis squirrel gilder C 2 2 animals mammals Petauridae Petaurus sustralis sustralis squirrel gilder C 2 2 animals mammals Petauridae Petaurus sustralis sustralis squirrel gilder C 2 2 animals mammals Petauridae Petaurus sustralis sustralis squirrel gilder C 2 2 animals mammals Petauridae P	animals	mammals	Leporidae	Oryctolagus cuniculus	rabbit	Υ			1
animals mammals Macropodidae Notamacropus ulogriseus pred-necked wallaby C 4 4 animals mammals Macropodidae Notamacropus dorasils black-striped wallaby C 2 3 animals mammals Macropodidae Petropustus common wallaroo C 3 3 animals mammals Macropodidae Petropustus eastern grey kangaroo C 1 2 animals mammals Macropodidae Petropus giganteus eastern grey kangaroo C 3 3 animals Macropodidae Wallabia bicolor swamp wallaby C 3 3 animals Macropodidae Wallabia bicolor swamp wallaby C 2 3 animals Macropodidae Wallabia bicolor swamp wallaby C 2 3 animals Macropodidae Wallabia bicolor swamp wallaby C 2 2 animals Macropodidae Multabia bicolor swamp wallaby C 2 2 animals Macropodidae Multabia bicolor swamp wallaby C 2 2 animals Mammals Molossidae Austronomus australis mammals Molossidae Mormopterus irdei eastern free-tailed bat C 3 3 animals Mammals Muridae Molosyidae Molosyidae Mormopterus irdei eastern free-tailed bat C 3 3 animals Muridae Multabia	animals	mammals	Macropodidae		whiptail wallaby				10
animals marmals Macropodidae Osphranter robustus common wallaroo C 2 3 animals marmals Macropodidae Petrogale herberti Herbert's rock-wallaby C 3 3 animals marmals Macropodidae Macropus giganteus eastern grey kangaroo C 12 animals marmals Macropodidae Macropus giganteus eastern bent-wing bat C 9 97 animals marmals Minopteridae Miniopterus schreibersii oceanensis eastern bent-wing bat C 9 2 animals marmals Molossidae Austromuse australis white-striped freetail bat C 2 3 animals marmals Molossidae Mormopterus lumsdenae northern free-tailed bat C 3 animals marmals Muridae Melomys cervinipes fawn-footed melomys C 1 animals marmals Muridae Melomys cervinipes fawn-footed melomys C 1 animals marmals Muridae Melomys cervinipes fawn-footed melomys C 1 animals marmals Muridae Melomys cervinipes (animals marmals Muridae Melomys cervinipes (animals marmals Muridae Petaurus notolosnis) (animals marmals Petauridae Petaurus notolosnis) (animals marmals Petauridae Petaurus australis sustralis yellow-bellied gilder (southern C 2 animals marmals Phascolarotidae Petaurus notatus (animals marmals Phascolarotidae Petaurus australis sustralis (animals marmals Phascolarotidae Petaurus australis (animals marmals Phascolarotidae Petauros controles (animals marmals Phascolarotidae Petauros phasconi (animals marmals Phascolarotidae Petauros phasconi (animals marmals Phascolarotidae Petauros Phascolarotidae Phascolarotidae Phascolarotidae Phascolarotidae Phascolarotidae Phascol	animals	mammals	Macropodidae		red-necked wallaby				1
animals mammals Macropodidae Marcopodidae Ma	animals	mammals	Macropodidae	Notamacropus dorsalis	black-striped wallaby				4
animals mammals Macropodidae Petrogale herberti Herberts rock-wallaby C 12 animals mammals Macropodidae Marcopous giganetus eastem grey kangaroo C 12 animals mammals Macropodidae Mallabia bicolor swamp wallaby C 33 mammals Macropodidae Mallabia bicolor swamp wallaby C 34 animals mammals Molossidae Mormopterus lumsdenae northern free-tailed bat C 3 animals mammals Molossidae Mormopterus lumsdenae northern free-tailed bat C 3 animals mammals Molossidae Mormopterus ridei eastem free-tailed bat C 3 animals mammals Muridae Melomys cervinipes (astem free-tailed bat C 3 animals mammals Muridae Melomys cervinipes (astem free-tailed bat C 3 animals mammals Muridae Melomys cervinipes (astem free-tailed bat C 3 animals mammals Muridae Melomys cervinipes (astem free-tailed bat C 3 animals mammals Petauridae Petaurus australis sustralis sustralis valier gilder (astem free-tailed bat C 3 animals mammals Petauridae Petaurus australis sustralis squirrel gilder (couthern C 2 animals mammals Petauridae Petaurus australis sustralis squirrel gilder (southern C 2 animals mammals Petauridae Petaurus australis sustralis valier gilder (southern C 2 animals mammals Petauridae Petaurus australis sustralis valier gilder (southern C 2 animals mammals Petauridae Petaurus australis sustralis valier gilder (southern C 2 animals mammals Petauridae Peta	animals	mammals	Macropodidae	Osphranter robustus	common wallaroo		С		2
animals mammals Macropodidae Mallabia bicolor swamp wallaby C 9/7 animals mammals Miniopteridae Mini	animals	mammals	Macropodidae	Petrogale herberti	Herbert's rock-wallaby		С		3
animals mammals Macropodidae Mallabia bicolor swamp wallaby C 9/7 animals mammals Miniopteridae Mini	animals	mammals	Macropodidae	Macropus giganteus	eastern grey kangaroo		С		12
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animals mammals Vespertilionidae Scotorepens sp.  animals mammals Vespertilionidae Vespadelus sp.  animals mammals Vespertilionidae Nyctophilus geoffroyi lesser long-eared bat C 8  animals mammals Vespertilionidae Scotorepens greyii little broad-nosed bat C 39/6  animals ray-finned fishes Ambassidae Ambassis agassizii Agassiz's glassfish 1  animals ray-finned fishes Atherinidae Craterocephalus stercusmuscarum flyspecked hardyhead 1	animals	mammals		Vespadelus pumilus	eastern forest bat		С		2/1
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animals ray-finned fishes Atherinidae Craterocephalus stercusmuscarum flyspecked hardyhead 1	animals	ray-finned fishes	Ambassidae		Agassiz's glassfish				1
			Atherinidae						1
	animals	ray-finned fishes	Clupeidae		bony bream				1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	Α	Records
animals	ray-finned fishes	Eleotridae	Hypseleotris species 1	Midgley's carp gudgeon				1
animals	ray-finned fishes	Eleotridae	Hypseleotris klunzingeri	western carp gudgeon				1
animals	ray-finned fishes	Melanotaeniidae	Melanotaenia splendida splendida	eastern rainbowfish				2
animals	ray-finned fishes	Terapontidae	Leiopotherapon unicolor	spangled perch				1
animals	reptiles	Agamidae	Pogona barbata	bearded dragon		С		1
animals	reptiles	Agamidae	Intellagama lesueurii	eastern water dragon		С		1
animals	reptiles	Agamidae	Diporiphora australis	tommy roundhead		С		2/2
animals	reptiles	Boidae	Aspidites melanocephalus	black-headed python		С		1
animals	reptiles	Boidae	Morelia spilota	carpet python		С		4
animals	reptiles	Carphodactylidae	Underwoodisaurus milii	thick-tailed gecko		С		6/1
animals	reptiles	Carphodactylidae	Saltuarius salebrosus	rough-throated leaf-tailed gecko		С		8
animals	reptiles	Chelidae	Emydura macquarii krefftii	Krefft's river turtle		С		1
animals	reptiles	Chelidae	Chelodina longicollis	eastern snake-necked turtle		С		1
animals	reptiles	Colubridae	Boiga irregularis	brown tree snake		С		2
animals	reptiles	Diplodactylidae	Oedura tryoni	southern spotted velvet gecko		С		3/1
animals	reptiles	Diplodactylidae	Nebulifera robusta	robust velvet gecko		С		1/1
animals	reptiles	Diplodactylidae	Oedura lineata	Arcadia velvet gecko		С		7
animals	reptiles	Diplodactylidae	Oedura elegans	elegant velvet gecko		С		5/4
animals	reptiles	Diplodactylidae	Diplodactylus vittatus	wood gecko		С		3/1
animals	reptiles	Diplodactylidae	Oedura monilis sensu lato	ocellated velvet gecko		С		1/1
animals	reptiles	Diplodactylidae	Strophurus taenicauda	golden-tailed gecko		NT		3
animals	reptiles	Elapidae	Pseudonaja textilis	eastern brown snake		С		2
animals	reptiles	Elapidae	Cryptophis nigrescens	eastern small-eyed snake		С		5/1
animals	reptiles	Gekkonidae	Gehyra dubia	dubious dtella		С		13/1
animals	reptiles	Gekkonidae	Gehyra catenata	chain-backed dtella		С		2/2
animals	reptiles	Gekkonidae	Heteronotia binoei	Bynoe's gecko		С		10
animals	reptiles	Pygopodidae	Paradelma orientalis	brigalow scaly-foot		С		2
animals	reptiles	Scincidae	Cryptoblepharus pulcher pulcher	elegant snake-eyed skink		С		11
animals	reptiles	Scincidae	Carlia pectoralis sensu lato			С		15
animals	reptiles	Scincidae	Eremiascincus richardsonii	broad-banded sand swimmer		С		1
animals	reptiles	Scincidae	Lerista punctatovittata	eastern robust slider		С		1
animals	reptiles	Scincidae	Pygmaeascincus timlowi	dwarf litter-skink		С		4/3
animals	reptiles	Scincidae	Morethia taeniopleura	fire-tailed skink		С		2/1
animals	reptiles	Scincidae	Anomalopus verreauxii	three-clawed worm-skink		С		3/2
animals	reptiles	Scincidae	Anomalopus leuckartii	two-clawed worm-skink		С		1
animals	reptiles	Scincidae	Ctenotus taeniolatus	copper-tailed skink		С		4/4
animals	reptiles	Scincidae	Lygisaurus foliorum	tree-base litter-skink		С		17/1
animals	reptiles	Scincidae	Čtenotus spaldingi	straight-browed ctenotus		С		1
animals	reptiles	Scincidae	Concinnia martini	dark bar-sided skink		С		1
animals	reptiles	Scincidae	Carlia schmeltzii	robust rainbow-skink		С		6
animals	reptiles	Scincidae	Carlia pectoralis	open-litter rainbow skink		С		4
animals	reptiles	Scincidae	Lerista fragilis	eastern mulch slider		С		27/1
animals	reptiles	Scincidae	Carlia sp.			С		1
animals	reptiles	Scincidae	Eulamprus sp.			С		3/3
animals	reptiles	Scincidae	Lampropholis sp.			С		1/1
animals	reptiles	Scincidae	Lerista sp.			С		1

Kingdom	Class	Family	Scientific Name	Common Name	<u> </u>	Q	Α	Records
animals	reptiles	Varanidae	Varanus gouldii	sand monitor		С		2
animals	reptiles	Varanidae	Varanus varius	lace monitor		С		6/1
animals	reptiles	Varanidae	Varanus tristis	black-tailed monitor		С		1
animals	reptiles	Varanidae	Varanus panoptes	yellow-spotted monitor		С		2
animals	uncertain	Indeterminate	Indeterminate	Únknown or Code Pending				6
fungi	lecanoromycetes	Acarosporaceae	Acarospora citrina	_		С		2/2
fungi	lecanoromycetes		Buellia <sup>*</sup>					1/1
fungi	lecanoromycetes	Caliciaceae	Dirinaria applanata			С		1/1
fungi	lecanoromycetes	Caliciaceae	Dirinaria flava			C C		1/1
fungi	lecanoromycetes	Cladoniaceae	Cladia muelleri			С		1/1
fungi	lecanoromycetes	Cladoniaceae	Cladonia					2/2
fungi	lecanoromycetes	Lecideaceae	Lecidea					2/2
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia tasmanica			С		4/4
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia verrucella			С		4/4
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia subrugulosa			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia neoquintaria			CCC		1/1
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia blackdownensis			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia hypoconstictica			000000		2/2
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia mexicana			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia immutata			С		2/2
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia congesta			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Parmotrema reticulatum			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Parmotrema subsumptum			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Parmotrema tinctorum			С		1/1
fungi	lecanoromycetes	Parmeliaceae	Punctelia subflava			C		2/2
fungi	lecanoromycetes	Parmeliaceae	Xanthoparmelia loxodella			С		1/1
fungi	lecanoromycetes	Pertusariaceae	Pertusaria Pertusaria					2/2
fungi	lecanoromycetes	Pertusariaceae	Pertusaria xanthoplaca			С		1/1
fungi	lecanoromycetes	Teloschistaceae	Caloplaca					1/1
fungi	lecanoromycetes	Teloschistaceae	Caloplaca cinnabarina			С		2/2
fungi	lecanoromycetes	Teloschistaceae	Caloplaca crenulatella			CCC		1/1
fungi	lecanoromycetes	Teloschistaceae	Teloschistes sieberianus			С		1/1
plants	land plants	Acanthaceae	Hypoestes floribunda			С		1/1
plants	land plants	Acanthaceae	Brunoniella australis	blue trumpet		C C E C		7
plants	land plants	Acanthaceae	Xerothamnella herbacea			Ε	Е	12/9
plants	land plants	Acanthaceae	Rostellularia adscendens var. latifolia					1/1
plants	land plants	Aizoaceae	Zaleya galericulata subsp. galericulata			С		1/1
plants	land plants	Alismataceae	Damasonium minus	starfruit		С		1/1
plants	land plants	Amaranthaceae	Alternanthera denticulata	lesser joyweed		С		1/1
plants	land plants	Amaranthaceae	Alternanthera denticulata var. micrantha			С		2/2
plants	land plants	Amaranthaceae	Deeringia amaranthoides	redberry		С		2/2
plants	land plants	Amaranthaceae	Amaranthus interruptus			С		1/1
plants	land plants	Amaranthaceae	Gomphrena celosioides	gomphrena weed	Υ			1/1
plants	land plants	Amaranthaceae	Nyssanthes diffusa	barbed-wire weed		С		3/3
plants	land plants	Amaranthaceae	Amaranthus viridis	green amaranth	Υ			1/1
plants	land plants	Amaranthaceae	Alternanthera nana	hairy joyweed		С		2/2

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
plants	land plants	Amaranthaceae	Achyranthes aspera			С		1/1
plants	land plants	Annonaceae	Meľodorum leichhardtii			С		1/1
plants	land plants	Apiaceae	Actinotus periculosus			С		2/2
plants	land plants	Apiaceae	Centella asiatica			С		2/1
plants	land plants	Apocynaceae	Marsdenia Iloydii			С		1/1
plants	land plants	Apocynaceae	Parsonsia velutina	hairy silkpod		000000		1/1
plants	land plants	Apocynaceae	Secamone elliptica	, ,		С		5/4
plants	land plants	Apocynaceae	Alstonia constricta	bitterbark		С		2/1
plants	land plants	Apocynaceae	Marsdenia micradenia	gymnema		С		1/1
plants	land plants	Apocynaceae	Marsdenia microlepis	0,		С		3/3
plants	land plants	Apocynaceae	Marsdenia pleiadenia			С		2/2
plants	land plants	Apocynaceae	Parsonsia lanceolata	northern silkpod		С		2/2
plants	land plants	Apocynaceae	Asclepias curassavica	red-head cottonbush	Υ			1
plants	land plants	Apocynaceae	Gomphocarpus physocarpus	balloon cottonbush	Υ			1
plants	land plants	Apocynaceae	Cynanchum viminale subsp. brunonianum			С		1/1
plants	land plants	Apocynaceae	Carissa ovata	currantbush		Č		3/2
plants	land plants	Apocynaceae	Parsonsia rotata	veinless silkpod		Č		1/1
plants	land plants	Araliaceae	Hydrocotyle acutiloba			Č		2/1
plants	land plants	Araliaceae	Astrotricha cordata			Č		2/2
plants	land plants	Asphodelaceae	Bulbine alata	native leek		Č		<u> </u>
plants	land plants	Aspleniaceae	Asplenium carnarvonense			Č		1/1
plants	land plants	Aspleniaceae	Asplenium attenuatum var. attenuatum			Č		2/2
plants	land plants	Aspleniaceae	Asplenium attenuatum x Asplenium paleaceum			Č		1/1
plants	land plants	Aspleniaceae	Asplenium subglandulosum subsp. subglandulosum			00000000		1/1
plants	land plants	Asteraceae	Glossocardia bidens	native cobbler's pegs		Č		3/1
plants	land plants	Asteraceae	Brachyscome	nauvo occosioi o poge		Ū		1/1
plants	land plants	Asteraceae	Calotis dentex	white burr daisy		С		2/2
plants	land plants	Asteraceae	Cassinia laevis	Willo ball daley		Č		1
plants	land plants	Asteraceae	Cirsium vulgare	spear thistle	Υ	J		2/1
plants	land plants	Asteraceae	Bidens bipinnata	bipinnate beggar's ticks	Ý			1/1
plants	land plants	Asteraceae	Cassinia cinerea	Dipilitato boggai o tiono	•	С		1/1
plants	land plants	Asteraceae	Youngia japonica			Č		1/1
plants	land plants	Asteraceae	Camptacra barbata			Č		1/1
plants	land plants	Asteraceae	Erigeron pusillus		Υ	J		1
plants	land plants	Asteraceae	Olearia canescens		•	С		1/1
plants	land plants	Asteraceae	Olearia xerophila			Č		2/2
plants	land plants	Asteraceae	Schkuhria pinnata		Υ	J		2/2
plants	land plants	Asteraceae	Sonchus oleraceus	common sowthistle	Ý			1/1
	land plants	Asteraceae	Tridax procumbens	tridax daisy	Ϋ́			1/1
piants plants	land plants	Asteraceae	Xanthium spinosum	Bathurst burr	Ý			1/1
plants	land plants	Asteraceae	Calotis cuneifolia	burr daisy	•	С		1/1
plants	land plants	Asteraceae	Calotis currendia Calotis lappulacea	yellow burr daisy		Č		1/1
plants	land plants	Asteraceae	Hemisteptia lyrata	y chow bull daisy		C		1/1
plants	land plants	Asteraceae	Vittadinia sulcata	native daisy		0		2/1
plants	land plants	Asteraceae	Euchiton sphaericus	Hative daisy		C		2/1
plants	land plants	Asteraceae	Picris angustifolia subsp. carolorum-henricorum			C		1/1
ριαιτιδ	ianu pianis	ASICIALEAE	i iona anguamona aubap. Carolorum-nemiolium			0		1/ 1

Kingdom	Class	Family	Scientific Name	Common Name	1	Q	Α	Records
plants	land plants	Asteraceae	Olearia microphylla			С		4/4
plants	land plants	Asteraceae	Senecio tenuiflorus			С		1/1
plants	land plants	Asteraceae	Soliva anthemifolia	dwarf jo jo weed	Υ			1/1
plants	land plants	Asteraceae	Brachyscome stuartii	• •		С		1/1
plants	land plants	Asteraceae	Erigeron bonariensis		Υ			1
plants	land plants	Asteraceae	Gamochaeta calviceps		Υ			1/1
plants	land plants	Asteraceae	Peripleura hispidula			С		1
plants	land plants	Asteraceae	Pterocaulon ciliosum			С		1/1
plants	land plants	Asteraceae	Pterocaulon redolens			С		1/1
plants	land plants	Asteraceae	Xanthium occidentale		Υ			2/1
plants	land plants	Asteraceae	Coronidium glutinosum			С		6/5
plants	land plants	Asteraceae	Cyanthillium cinereum			С		5/1
plants	land plants	Asteraceae	Podolepis longipedata	tall copper-wire daisy		С		1/1
plants	land plants	Asteraceae	Senecio brigalowensis			С		3/3
plants	land plants	Asteraceae	Sigesbeckia orientalis	Indian weed		С		1/1
plants	land plants	Asteraceae	Gamochaeta pensylvanica		Υ			1/1
plants	land plants	Asteraceae	Ozothamnus cassinioides			С		1/1
plants	land plants	Asteraceae	Pterocaulon sphacelatum	applebush		С		1
plants	land plants	Asteraceae	Parthenium hysterophorus	parthenium weed	Υ			1/1
plants	land plants	Asteraceae	Chrysocephalum apiculatum	yellow buttons		С		2/1
plants	land plants	Asteraceae	Peripleura hispidula var. setosa	•		С		1/1
plants	land plants	Asteraceae	Gynura drymophila var. drymophila			С		1/1
plants	land plants	Asteraceae	Coronidium oxylepis subsp. lanatum			С		1/1
plants	land plants	Asteraceae	Olearia canescens subsp. canescens			С		2/2
plants	land plants	Asteraceae	Cassinia laevis subsp. rosmarinifolia			C		2/2
plants	land plants	Asteraceae	Verbesina encelioides var. encelioides		Υ			2/2
plants	land plants	Asteraceae	Brachyscome microcarpa subsp. darlingensis			С		2/2
plants	land plants	Aytoniaceae	Plagiochasma rupestre			С		1/1
plants	land plants	Bignoniaceae	Pandorea pandorana	wonga vine		С		1
plants	land plants	Bignoniaceae	Tecoma stans var. stans	3	Υ			1/1
plants	land plants	Blechnaceae	Blechnum nudum	fishbone water fern		С		1/1
plants	land plants	Boraginaceae	Heliotropium amplexicaule	blue heliotrope	Υ			1/1
plants	land plants	Byttneriaceae	Commersonia	'				2/2
plants	land plants	Byttneriaceae	Seringia corollata			С		5/4
plants	land plants	Byttneriaceae	Commersonia argentea			С		2/2
plants	land plants	Cactaceae	Opuntia aurantiaca	tiger pear	Υ			1
plants	land plants	Cactaceae	Opuntia tomentosa	velvety tree pear	Υ			3
plants	land plants	Caesalpiniaceae	Senna acclinis	,		С		1/1
plants	land plants	Caesalpiniaceae	Senna sophera var. (40Mile Scrub J.R.Clarkson+6908)			С		1
plants	land plants	Caesalpiniaceae	Senna artemisioides subsp. zygophylla			С		1/1
plants	land plants	Caesalpiniaceae	Petalostylis labicheoides			CCC		2/2
plants	land plants	Caesalpiniaceae	Lysiphyllum carronii	ebony tree		Č		4/4
plants	land plants	Caesalpiniaceae	Senna gaudichaudii	,		Č		2/2
plants	land plants	Caesalpiniaceae	Cassia tomentella			C		7/7
plants	land plants	Caesalpiniaceae	Senna circinnata			Č		1/1
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Kingdom	Class	Family	Scientific Name	Common Name	1	Q	Α	Records
plants	land plants	Caesalpiniaceae	Cassia brewsteri			С		1
plants	land plants	Campanulaceae	Wahlenbergia capillaris			С		2/2
plants	land plants	Campanulaceae	Wahlenbergia tumidifructa			С		3/3
plants	land plants	Campanulaceae	Wahlenbergia celata			C		1/1
plants	land plants	Campanulaceae	Wahlenbergia stricta			С		1/1
plants	land plants	Campanulaceae	Wahlenbergia islensis			C		8/8
plants	land plants	Campanulaceae	Wahlenbergia gracilis	sprawling bluebell		C		3/2
plants	land plants	Capparaceae	Capparis lasiantha	nipan		C		1
plants	land plants	Capparaceae	Capparis anomala			C		2/2
plants	land plants	Capparaceae	Capparis canescens			C		2/2
plants	land plants	Capparaceae	Capparis mitchellii			С		1/1
plants	land plants	Caryophyllaceae	Polycarpon tetraphyllum		Υ	_		1/1
plants	land plants	Casuarinaceae	Allocasuarina inophloia			C		1/1
plants	land plants	Casuarinaceae	Allocasuarina luehmannii	bull oak		С		1
plants	land plants	Casuarinaceae	Allocasuarina torulosa			CCC		1
plants	land plants	Celastraceae	Denhamia disperma			C		1/1
plants	land plants	Celastraceae	Siphonodon australis	ivorywood		C		1/1
plants	land plants	Celastraceae	Denhamia cunninghamii			C		3/1
plants	land plants	Celastraceae	Elaeodendron australe			C		1
plants	land plants	Celastraceae	Apatophyllum teretifolium			NT		3/3
plants	land plants	Celastraceae	Elaeodendron australe var. integrifolium			C		1/1
plants	land plants	Celastraceae	Denhamia pittosporoides subsp. pittosporoides			C		2/2
plants	land plants	Chenopodiaceae	Dysphania pumilio	fat han	V	С		1/1
plants	land plants	Chenopodiaceae	Chenopodium album	fat-hen	Y	0		1/1
plants	land plants	Chenopodiaceae	Rhagodia parabolica	and remised brown		C		2/2
plants	land plants	Chenopodiaceae	Sclerolaena birchii	galvanised burr		C		1/1
plants	land plants	Chenopodiaceae	Maireana microphylla			C		2/2
plants	land plants	Chenopodiaceae	Enchylaena tomentosa var. tomentosa			C		1/1
plants	land plants	Colchicaceae Commelinaceae	Wurmbea dioica subsp. dioica Commelina diffusa	wondering jow		0		1/1 2/1
plants	land plants		Aneilema biflorum	wandering jew		0		2/ I 1/ 1
plants	land plants	Commelinaceae				000000		1/ 1
plants	land plants	Convolvulaceae Convolvulaceae	Evolvulus alsinoides Evolvulus alsinoides var. decumbens			0		2/2
plants plants	land plants land plants	Convolvulaceae		bellvine		$\sim$		ے/ ک 1
	land plants	Crassulaceae	lpomoea plebeia Crassula tetramera	Delivine		C		1/1
plants plants	land plants	Cucurbitaceae	Sicyos australis	star cucumber		Č		2/2
plants	land plants	Cucurbitaceae	Cucumis myriocarpus subsp. myriocarpus	prickly pademelon	Υ	U		1/1
plants	land plants	Cupressaceae	Callitris glaucophylla		'	С		1/ 1
plants	land plants	Cupressaceae	Callitris endlicheri	white cypress pine black cypress pine		Č		1/1
plants	land plants	Cyatheaceae	Cyathea cooperi	black cypress pille		Č		1/1
plants	land plants	Cyperaceae	Cyperus haspan subsp. haspan			Č		1/1
plants	land plants	Cyperaceae	Cyperus dietrichiae var. dietrichiae			Č		1/1
plants	land plants	Cyperaceae	Caustis sp. (Robinson Gorge P.I.Forster+ PIF11256)			Č		2/2
plants	land plants	Cyperaceae	Eleocharis cylindrostachys			Č		2/2
plants	land plants	Cyperaceae	Fimbristylis aestivalis			Č		1/1
plants	land plants	Cyperaceae	Fimbristylis destivalis	common fringe-rush		Č		2
piants	iana pianto	Cyperaceae	i imonotyno dionotoma	common imige rusin		J		_

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
plants	land plants	Cyperaceae	Cyperus alterniflorus			С		2/1
plants	land plants	Cyperaceae	Scleria mackaviensis			С		2
plants	land plants	Cyperaceae	Rhynchospora brownii	beak rush		С		1/1
plants	land plants	Cyperaceae	Cyperus polystachyos			С		1
plants	land plants	Cyperaceae	Bulbostylis barbata			С		1/1
plants	land plants	Cyperaceae	Scleria sphacelata			С		4/3
plants	land plants	Cyperaceae	Cyperus aggregatus		Υ			1/1
plants	land plants	Cyperaceae	Isolepis inundata	swamp club rush		С		1/1
plants	land plants	Cyperaceae	Cyperus trinervis	•		С		3/3
plants	land plants	Cyperaceae	Cyperus gracilis			С		2/1
plants	land plants	Cyperaceae	Cyperus bowmanni			С		1/1
plants	land plants	Cyperaceae	Schoenus kennyi			С		1
plants	land plants	Cyperaceae	Cyperus fulvus			C		5/3
plants	land plants	Cyperaceae	Gahnia aspera			С		2/1
plants	land plants	Cyperaceae	Carex inversa	knob sedge		С		4/4
plants	land plants	Cyperaceae	Cyperus bifax	western nutgrass		C		1/1
plants	land plants	Dilleniaceae	Hibbertia stricta	3		С		1/1
plants	land plants	Dilleniaceae	Hibbertia cistoidea			С		2/2
plants	land plants	Dilleniaceae	Hibbertia stricta var. hirtiflora			Č		1/1
plants	land plants	Dilleniaceae	Hibbertia linearis var. obtusifolia			C		1
plants	land plants	Dryopteridaceae	Lastreopsis tenera			С		1/1
plants	land plants	Ebenaceae	Diospyros humilis	small-leaved ebony		Č		4/3
plants	land plants	Elatinaceae	Elatine gratioloides	waterwort		C		1/1
plants	land plants	Ericaceae	Lissanthe pluriloculata			C		2/2
plants	land plants	Ericaceae	Agiortia pleiosperma			C		3/3
plants	land plants	Ericaceae	Styphelia biflora			C		1/1
plants	land plants	Ericaceae	Styphelia blakei			C		6/6
plants	land plants	Ericaceae	Lissanthe strigosa subsp. subulata			Ċ		1/1
plants	land plants	Ericaceae	Melichrus sp. (Isla Gorge P.Sharpe+ 601)			C		8/6
plants	land plants	Ericaceae	Styphelia grandiflora			С		7/7
plants	land plants	Euphorbiaceae	Euphorbia tannensis subsp. eremophila			C		2/2
plants	land plants	Euphorbiaceae	Bertya lapicola subsp. brevifolia			С		2/2
plants	land plants	Euphorbiaceae	Adriana tomentosa var. tomentosa			C		1/1
plants	land plants	Euphorbiaceae	Excoecaria dallachyana	scrub poison tree		С		2/2
plants	land plants	Euphorbiaceae	Euphorbia dallachyana	'		С		2
plants	land plants	Euphorbiaceae	Croton phebalioides	narrow-leaved croton		С		2/2
plants	land plants	Euphorbiaceae	Acalypha eremorum	soft acalypha		С		5/4
plants	land plants	Euphorbiaceae	Croton insularis	Queensland cascarilla		С		6/5
plants	land plants	Euphorbiaceae	Claoxylon tenerifolium subsp. tenerifolium			C		1/1
plants	land plants	Euphorbiaceae	Bertya opponens			C	V	2/2
plants	land plants	Fabaceae	Hovea					3/3
plants	land plants	Fabaceae	Indigofera australis subsp. australis			С		1/1
plants	land plants	Fabaceae	Hovea lorata			Č		8/8
plants	land plants	Fabaceae	Bossiaea brownii			Č		1/1
plants	land plants	Fabaceae	Glycine tabacina	glycine pea		Č		3
plants	land plants	Fabaceae	Hovea planifolia	0, 1		Č		2/2

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
plants	land plants	Fabaceae	Crotalaria juncea	sunhemp	Υ			1/1
plants	land plants	Fabaceae	Desmodium varians	slender tick trefoil		С		1
plants	land plants	Fabaceae	Hovea tholiformis			С		2/2
plants	land plants	Fabaceae	Mirbelia aotoides			С		4/4
plants	land plants	Fabaceae	Pultenaea spinosa			С		4/4
plants	land plants	Fabaceae	Swainsona luteola	dwarf darling pea				1/1
plants	land plants	Fabaceae	Jacksonia scoparia	<b>5</b> .		00000		2
plants	land plants	Fabaceae	Sesbania cannabina			С		1
plants	land plants	Fabaceae	Daviesia acicularis			С		2/2
plants	land plants	Fabaceae	Galactia tenuiflora			С		1
plants	land plants	Fabaceae	Glycine microphylla			С		1/1
plants	land plants	Fabaceae	Medicago polymorpha	burr medic	Υ			1/1
plants	land plants	Fabaceae	Indigofera australis			С		1
plants	land plants	Fabaceae	Indigofera brevidens			С		1/1
plants	land plants	Fabaceae	Indigofera linifolia			Ċ		1/1
plants	land plants	Fabaceae	Indigofera pratensis			C		1
plants	land plants	Fabaceae	Desmodium brachypodum	large ticktrefoil		Č		1
plants	land plants	Fabaceae	Swainsona galegifolia	smooth Darling pea		Č		1/1
plants	land plants	Fabaceae	Jacksonia rhadinoclona	Miles dogwood		Č		4/4
plants	land plants	Fabaceae	Macroptilium lathyroides	·····oo dog.rood	Υ	•		1/1
plants	land plants	Fabaceae	Hardenbergia perbrevidens		•	С		1/1
plants	land plants	Fabaceae	Rhynchosia minima var. minima			Č		1
plants	land plants	Fabaceae	Daviesia filipes subsp. filipes			Č		1/1
plants	land plants	Fabaceae	Neonotonia wightii var. wightii		Υ	•		1/1
plants	land plants	Fabaceae	Pultenaea millarii var. millarii		•	С		1/1
plants	land plants	Fabaceae	Rhynchosia minima var. australis			Č		1/1
plants	land plants	Fabaceae	Vigna vexillata var. angustifolia			Ĉ		1/1
plants	land plants	Fabaceae	Mirbelia speciosa subsp. ringrosei			C		1/1
plants	land plants	Fabaceae	Zornia muriculata subsp. angustata			Č		1/1
plants	land plants	Fabaceae	Crotalaria montana var. angustifolia			č		1/1
plants	land plants	Fabaceae	Pultenaea millarii var. angustifolia			Č		1/1
plants	land plants	Fabaceae	Glycine			0		1/1
plants	land plants	Goodeniaceae	Goodenia glabra			C		3/3
plants	land plants	Goodeniaceae	Velleia paradoxa	spur velleia		C		1/1
plants	land plants	Goodeniaceae	Goodenia delicata	Spai vencia		Č		3/2
plants	land plants	Goodeniaceae	Goodenia sp. (Mt Castletower M.D.Crisp 2753)			č		1/1
plants	land plants	Goodeniaceae	Goodenia grandiflora			Č		1/1
plants	land plants	Goodeniaceae	Goodenia grandiliora Goodenia rotundifolia			Č		1/1
plants	land plants	Goodeniaceae	Goodenia rotundiiolia Goodenia bellidifolia subsp. argentea			C		4/4
plants	land plants	Goodeniaceae	Goodenia disperma			Č		1/1
plants	land plants	Haloragaceae	Haloragis heterophylla	rough raspweed		C		1/ 1
plants	land plants	Haloragaceae	Gonocarpus elatus	Toughtaspweed		$\sim$		1/1
plants	land plants	Hemerocallidaceae	Dianella revoluta var. revoluta			C		3
		Hemerocallidaceae				C		3 2/1
plants	land plants	Hemerocallidaceae	Dianella longifolia var. longifolia			0		2/ I 5
plants	land plants	Iridaceae	Dianella longifolia Patersonia sericea var. sericea			C		5 1/1
plants	land plants	inuaceae	ratersoriia Sericea var. Sericea			U		1/ 1

Kingdom	Class	Family	Scientific Name	Common Name		Q	Α	Records
plants	land plants	Johnsoniaceae	Tricoryne elatior	yellow autumn lily		С		2/2
plants	land plants	Juncaceae	Juncus usitatus	•		С		2/1
plants	land plants	Juncaceae	Juncus prismatocarpus	branching rush		С		2/1
plants	land plants	Juncaginaceae	Cycnogeton multifructus	_		С		1/1
plants	land plants	Lamiaceae	Salvia reflexa		Υ			1/1
plants	land plants	Lamiaceae	Teucrium fallax			С		2/2
plants	land plants	Lamiaceae	Coleus australis			С		2/2
plants	land plants	Lamiaceae	Teucrium argutum			С		1/1
plants	land plants	Lamiaceae	Teucrium junceum			C		2/2
plants	land plants	Lamiaceae	Mentha grandiflora			С		1/1
plants	land plants	Lamiaceae	Prostanthera cryptandroides subsp. euphrasioides			С		1/1
plants	land plants	Lamiaceae	Westringia cheelii			С		1/1
plants	land plants	Lamiaceae	Hemigenia cuneifolia			C		2/2
plants	land plants	Lamiaceae	Prostanthera ringens			С		2/2
plants	land plants	Lamiaceae	Glossocarya hemiderma			Ċ		1/1
plants	land plants	Lamiaceae	Clerodendrum floribundum			C		2/2
plants	land plants	Lamiaceae	Microcorys queenslandica			Č		3/3
plants	land plants	Lamiaceae	Teucrium daucoides			Č		1/1
plants	land plants	Lauraceae	Cassytha			Ū		1/1
plants	land plants	Laxmanniaceae	Lomandra glauca	pale matrush		С		2/2
plants	land plants	Laxmanniaceae	Lomandra multiflora subsp. multiflora	paid mandom		Ċ		3/2
plants	land plants	Laxmanniaceae	Lomandra filiformis subsp. filiformis			C		2/1
plants	land plants	Laxmanniaceae	Lomandra confertifolia subsp. pallida			č		9/3
plants	land plants	Laxmanniaceae	Eustrephus latifolius	wombat berry		Ċ		3
plants	land plants	Laxmanniaceae	Lomandra longifolia	Wormbat Borry		C		2
plants	land plants	Laxmanniaceae	Lomandra leucocephala subsp. leucocephala			Č		_ 1
plants	land plants	Laxmanniaceae	Laxmannia gracilis	slender wire lily		Ċ		2/1
plants	land plants	Loganiaceae	Mitrasacme oasena	diction with my		C		<u></u>
plants	land plants	Loganiaceae	Logania albiflora			č		3/3
plants	land plants	Loranthaceae	Amyema congener subsp. rotundifolia			Ċ		1/1
plants	land plants	Loranthaceae	Amyema quandang var. bancroftii	broad-leaved grey mistletoe		C		2/2
plants	land plants	Loranthaceae	Lysiana subfalcata	broad leaved grey misticioe		Č		6/6
plants	land plants	Loranthaceae	Amyema quandang			Č		1
plants	land plants	Macarthuriaceae	Macarthuria neocambrica			Č		7/7
plants	land plants	Malvaceae	Abutilon oxycarpum var. subsagittatum			Č		1/1
plants	land plants	Malvaceae	Sida cordifolia		Υ	O		2/1
plants	land plants	Malvaceae	Abutilon auritum	Chinese lantern	•	С		1/1
plants	land plants	Malvaceae	Hibiscus sturtii	Offinese faritern		Č		2/1
plants	land plants	Malvaceae	Abutilon fraseri subsp. fraseri			C		3/3
plants	land plants	Malvaceae	Sida hackettiana			Č		4/2
plants	land plants	Malvaceae	Sida rhombifolia		Υ	U		2/1
plants	land plants	Malvaceae	Abutilon tubulosum			$^{\circ}$		1/1
plants	land plants	Malvaceae	Hibiscus splendens	pink hibiscus		C		1/1
	land plants	Malvaceae	Abutilon calliphyllum	velvet lanternflower		C		1/1
plants	land plants	Malvaceae		veivet iantenniowei		C		1/1
plants			Sida aprica var. aprica Sida sp. (Musselbrook M.B.Thomas+ MRS437)			C		2/1
plants	land plants	Malvaceae	οιυα ερ. (ινιυεδειοιουκ ινι.σ. ι ποιπας+ ινιπο437)			C		∠/ I

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
plants	land plants	Malvaceae	Malva parviflora	small-flowered mallow	Υ			1/1
plants	land plants	Meliaceae	Owenia acidula	emu apple		С		1/1
plants	land plants	Meliaceae	Turraea pubescens	native honeysuckle		С		1/1
plants	land plants	Menyanthaceae	Nymphoides crenata	wavy marshwort		С		2/2
plants	land plants	Menyanthaceae	Nymphoides geminata	•		С		2/2
plants	land plants	Mimosaceae	Acacia jucunda			С		3/3
plants	land plants	Mimosaceae	Acacia burrowii			000000		3/3
plants	land plants	Mimosaceae	Acacia oswaldii	miljee		С		1/1
plants	land plants	Mimosaceae	Acacia salicina	doolan		С		1/1
plants	land plants	Mimosaceae	Acacia shirleyi	lancewood		С		1/1
plants	land plants	Mimosaceae	Acacia everistii			С		1/1
plants	land plants	Mimosaceae	Acacia gittinsii			С		3/3
plants	land plants	Mimosaceae	Acacia leiocalyx			С		4
plants	land plants	Mimosaceae	Acacia complanata	flatstem wattle		000000		2/2
plants	land plants	Mimosaceae	Acacia holotricha			С		3/3
plants	land plants	Mimosaceae	Acacia juncifolia			Č		1/1
plants	land plants	Mimosaceae	Acacia macradenia	zig-zag wattle		Č		2/2
plants	land plants	Mimosaceae	Acacia neriifolia	pechey wattle		Ċ		4/4
plants	land plants	Mimosaceae	Acacia ulicifolia	F		CCC		1/1
plants	land plants	Mimosaceae	Acacia falciformis	broad-leaved hickory		Č		5/4
plants	land plants	Mimosaceae	Acacia glaucocarpa	hickory wattle		Č		2
plants	land plants	Mimosaceae	Acacia grandifolia	monery manus		C	V	_ 1
plants	land plants	Mimosaceae	Acacia harpophylla	brigalow		Č		3/3
plants	land plants	Mimosaceae	Acacia omalophylla	g		Č		1/1
plants	land plants	Mimosaceae	Acacia sparsiflora			C		2/1
plants	land plants	Mimosaceae	Acacia tenuinervis			Č		1
plants	land plants	Mimosaceae	Acacia leichhardtii			Č		1/1
plants	land plants	Mimosaceae	Acacia leptostachya	Townsville wattle		C		1/1
plants	land plants	Mimosaceae	Acacia longispicata	Townsome name		Č		5/4
plants	land plants	Mimosaceae	Acacia bancroftiorum			Č		3/3
plants	land plants	Mimosaceae	Acacia fasciculifera	scaly bark		Č		1
plants	land plants	Mimosaceae	Acacia neobrachycarpa	Journ James		Č		1/1
plants	land plants	Mimosaceae	Acacia blakei subsp. blakei			Č		4/4
plants	land plants	Mimosaceae	Acacia excelsa subsp. excelsa			00000		2/1
plants	land plants	Mimosaceae	Acacia julifera subsp. julifera			Č		2/2
plants	land plants	Mimosaceae	Acacia sp. (Comet L.Pedley 4091)			Č		1/1
plants	land plants	Mimosaceae	Neptunia gracilis forma gracilis			C		1/1
plants	land plants	Mimosaceae	Acacia buxifolia subsp. pubiflora			Č		1/1
plants	land plants	Mimosaceae	Acacia leiocalyx subsp. leiocalyx			Č		5/3
plants	land plants	Mimosaceae	Acacia penninervis var. penninervis			Č		2/2
plants	land plants	Mimosaceae	Acacia deanei			Č		1/1
plants	land plants	Mimosaceae	Acacia decora	pretty wattle		Č		5
plants	land plants	Molluginaceae	Glinus lotoides	hairy carpet weed		C		1/1
plants	land plants	Moraceae	Ficus rubiginosa forma rubiginosa	han, darpot wood		Č		1/1
plants	land plants	Moraceae	Trophis scandens subsp. scandens			Ċ		1/1
plants	land plants	Moraceae	Ficus rubiginosa	Port Jackson fig		C		6
ριαιτιο	ιατα ριατιίδ	Wioraccac	r ious rubigiriosa	7 Off backsoff fig		J		J

Kingdom	Class	Family	Scientific Name	Common Name	1	Q	Α	Records
plants	land plants	Moraceae	Ficus opposita			С		2/2
plants	land plants	Myrsinaceae	Myrsine variabilis			С		2/2
plants	land plants	Myrtaceae	Eucalyptus exserta	Queensland peppermint		С		2/2
plants	land plants	Myrtaceae	Melaleuca groveana			NT		1/1
plants	land plants	Myrtaceae	Melaleuca uncinata			С		2/2
plants	land plants	Myrtaceae	Angophora leiocarpa	rusty gum				2
plants	land plants	Myrtaceae	Corymbia citriodora	spotted gum		CCC		3
plants	land plants	Myrtaceae	Eucalyptus populnea	poplar box		С		1/1
plants	land plants	Myrtaceae	Eucalyptus rhombica			C		2/2
plants	land plants	Myrtaceae	Eucalyptus tenuipes	narrow-leaved white mahogany		С		4/3
plants	land plants	Myrtaceae	Harmogia densifolia	ű,		С		5/5
plants	land plants	Myrtaceae	Melaleuca viminalis			С		1/1
plants	land plants	Myrtaceae	Triplarina paludosa			C		1/1
plants	land plants	Myrtaceae	Angophora floribunda	rough-barked apple		C		14/1
plants	land plants	Myrtaceae	Eucalyptus tereticornis subsp. tereticornis	2 - 3		C		17/1
plants	land plants	Myrtaceae	Eucalyptus cloeziana	Gympie messmate		C C		1/1
plants	land plants	Myrtaceae	Eucalyptus mediocris	- <b>,,</b>		Č		1/1
plants	land plants	Myrtaceae	Melaleuca thymifolia	thyme honeymyrtle		C		2/2
plants	land plants	Myrtaceae	Corymbia clarksoniana	,		00000		1/1
plants	land plants	Myrtaceae	Corymbia trachyphloia			Č		1
plants	land plants	Myrtaceae	Eucalyptus microcarpa	inland grey box		Č		1/1
plants	land plants	Myrtaceae	Eucalyptus suffulgens	mana g. o, oon		Č		2/2
plants	land plants	Myrtaceae	Corymbia erythrophloia	variable-barked bloodwood		Č		8
plants	land plants	Myrtaceae	Eucalyptus chloroclada	Baradine red gum		Č		1/1
plants	land plants	Myrtaceae	Eucalyptus tholiformis			C		7/7
plants	land plants	Myrtaceae	Leptospermum sericatum			Č		2/2
plants	land plants	Myrtaceae	Thryptomene parviflora			Č		2/2
plants	land plants	Myrtaceae	Backhousia angustifolia	narrow-leaved backhousia		C		5/5
plants	land plants	Myrtaceae	Eucalyptus melanophloia			Č		73
plants	land plants	Myrtaceae	Leptospermum lamellatum			Č		4/2
plants	land plants	Myrtaceae	Melaleuca diosmatifolia	mauve honey myrtle		C		1/1
plants	land plants	Myrtaceae	Eucalyptus longirostrata	maare neney my ne		Č		4/1
plants	land plants	Myrtaceae	Lysicarpus angustifolius	budgeroo		Č		5/3
plants	land plants	Myrtaceae	Corymbia citriodora subsp. variegata	2aago. oo		C		2
plants	land plants	Myrtaceae	Corymbia watsoniana subsp. watsoniana			Č		<u>-</u> 2/2
plants	land plants	Myrtaceae	Eucalyptus camaldulensis subsp. acuta			Č		2/2
plants	land plants	Myrtaceae	Corymbia trachyphloia subsp. carnarvonica			č		1/1
plants	land plants	Myrtaceae	Eucalyptus melanophloia subsp. melanophloia			Č		2/2
plants	land plants	Myrtaceae	Eucalyptus crebra	narrow-leaved red ironbark				48/2
plants	land plants	Myrtaceae	Gossia bidwillii	nanow loavou rou nonbank		C		4/4
plants	land plants	Myrtaceae	Eucalyptus panda			Č		2/2
plants	land plants	Myrtaceae	Eucalyptus major	mountain grey gum		Č		1/1
plants	land plants	Myrtaceae	Eucalyptus	mountain groy gain		9		1/1
plants	land plants	Myrtaceae	Melaleuca					2/2
plants	land plants	Myrtaceae	Corymbia hendersonii			C		2/1
plants	land plants	Oleaceae	Jasminum didymum			C		1
piarits	ιατία μιατίιδ	Oleaceae	oasimilani alayinani			J		ı

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
plants	land plants	Oleaceae	Notelaea microcarpa			С		4/2
plants	land plants	Oleaceae	Jasminum didymum subsp. lineare			С		4/2
plants	land plants	Oleaceae	Jasminum didymum subsp. racemosum			С		1/1
plants	land plants	Onagraceae	Ludwigia peploides subsp. montevidensis			С		3/3
plants	land plants	Orchidaceae	Caladenia fuscata			C		1/1
plants	land plants	Orchidaceae	Cymbidium canaliculatum			С		1/1
plants	land plants	Orchidaceae	Šarcochilus hillii			С		2/2
plants	land plants	Orchidaceae	Calochilus campestris	copper beard orchid		С		1/1
plants	land plants	Orchidaceae	Sarcochilus dilatatus	brown sarcochilus		С		1/1
plants	land plants	Oxalidaceae	Oxalis radicosa			С		1/1
plants	land plants	Oxalidaceae	Oxalis corniculata		Υ			1/1
plants	land plants	Passifloraceae	Passiflora aurantia var. aurantia			С		3/3
plants	land plants	Phyllanthaceae	Phyllanthus gunnii			С		2/2
plants	land plants	Phyllanthaceae	Synostemon spinosus			С		1/1
plants	land plants	Phyllanthaceae	Phyllanthus carpentariae			С		1/1
plants	land plants	Phyllanthaceae	Bridelia leichhardtii			С		2/1
plants	land plants	Phyllanthaceae	Breynia oblongifolia			Ċ		2/1
plants	land plants	Picrodendraceae	Petalostigma pubescens	quinine tree		00000		1
plants	land plants	Picrodendraceae	Petalostigma pachyphyllum	4-		C		1/1
plants	land plants	Pittosporaceae	Pittosporum spinescens			C		2/2
plants	land plants	Pittosporaceae	Auranticarpa rhombifolia			C		2/2
plants	land plants	Plantaginaceae	Plantago debilis	shade plantain		Č		2/1
plants	land plants	Plantaginaceae	Veronica plebeia	trailing speedwell		Č		1/1
plants	land plants	Plumbaginaceae	Plumbago zeylanica	native plumbago		CCC		1/1
plants	land plants	Poaceae	Chrysopogon fallax	man a promisalge		Č		1/1
plants	land plants	Poaceae	Bothriochloa decipiens var. decipiens			C		4/1
plants	land plants	Poaceae	Bothriochloa bladhii subsp. bladhii			C C		2
plants	land plants	Poaceae	Amphipogon caricinus var. scaber			Č		
plants	land plants	Poaceae	Aristida calycina var. calycina			C		1/1
plants	land plants	Poaceae	Cynodon dactylon var. dactylon		Υ			2/1
plants	land plants	Poaceae	Hyparrhenia rufa subsp. rufa		Y Y			1/1
plants	land plants	Poaceae	Cymbopogon queenslandicus			С		2/2
plants	land plants	Poaceae	Aristida jerichoensis var. subspinulifera			C		1
plants	land plants	Poaceae	Eriachne mucronata forma (Alpha C.E.Hubbard 788	82)		C		1/1
plants	land plants	Poaceae	Poaceae	- ,				9
plants	land plants	Poaceae	Aristida					1
plants	land plants	Poaceae	Perotis rara	comet grass		С		1/1
plants	land plants	Poaceae	Chloris gayana	rhodes grass	Υ	_		1/1
plants	land plants	Poaceae	Melinis repens	red natal grass	Ý			3/1
plants	land plants	Poaceae	Aristida ramosa	purple wiregrass		С		2/2
plants	land plants	Poaceae	Chloris virgata	feathertop rhodes grass	Υ	-		1/1
plants	land plants	Poaceae	Panicum effusum		•	С		6
plants	land plants	Poaceae	Setaria surgens			Č		2/2
plants	land plants	Poaceae	Cynodon dactylon		Υ	•		_, _ 1
plants	land plants	Poaceae	Leersia hexandra	swamp rice grass	•	С		1
plants	land plants	Poaceae	Sarga leiocladum			Č		2

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	Α	Records
plants	land plants	Poaceae	Themeda triandra	kangaroo grass		С		6
plants	land plants	Poaceae	Urochloa foliosa	g g		С		1/1
plants	land plants	Poaceae	Cenchrus ciliaris		Υ			1/1
plants	land plants	Poaceae	Entolasia stricta	wiry panic		С		2
plants	land plants	Poaceae	Eriochloa procera	slender cupgrass		С		1
plants	land plants	Poaceae	Sporobolus creber	. •				2
plants	land plants	Poaceae	Aristida personata			CCC		2 2
plants	land plants	Poaceae	Chloris ventricosa	tall chloris		С		1
plants	land plants	Poaceae	Aristida queenslandica var. dissimilis			С		1
plants	land plants	Poaceae	Oplismenus aemulus	creeping shade grass		С		1
plants	land plants	Poaceae	Paspalum dilatatum	paspalum	Υ			1/1
plants	land plants	Poaceae	Triodia mitchellii	buck spinifex		С		2/2
, plants	land plants	Poaceae	Digitaria ramularis	•		С		1/1
, plants	land plants	Poaceae	Eragrostis elongata			С		1/1
plants	land plants	Poaceae	Imperata cylindrica	blady grass		С		1
plants	land plants	Poaceae	Cymbopogon refractus	barbed-wire grass		Ċ		8/1
plants	land plants	Poaceae	Dimorphochloa rigida	3		CCC		1/1
plants	land plants	Poaceae	Eragrostis pubescens			C		1/1
plants	land plants	Poaceae	Phragmites australis	common reed		00000		1
plants	land plants	Poaceae	Sporobolus elongatus			Č		2
plants	land plants	Poaceae	Eremochloa bimaculata	poverty grass		Ċ		1
plants	land plants	Poaceae	Heteropogon contortus	black speargrass		Č		4/1
plants	land plants	Poaceae	Alloteropsis semialata	cockatoo grass		С		1/1
plants	land plants	Poaceae	Arundinella nepalensis	reedgrass		C		5/1
plants	land plants	Poaceae	Cleistochloa subjuncea	<b>3</b>		C C		3/2
plants	land plants	Poaceae	Eragrostis alveiformis			С		1/1
plants	land plants	Poaceae	Paspalidium criniforme			Ċ		1/1
, plants	land plants	Poaceae	Paspalidium caespitosum	brigalow grass		C		1/1
plants	land plants	Poaceae	Austrostipa verticillata	slender bamboo grass		С		2/1
plants	land plants	Poaceae	Paspalidium albovillosum	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3		Ċ		1/1
, plants	land plants	Poaceae	Waİwhalleya subxerophila			C C		2/2
plants	land plants	Polygalaceae	Comesperma sylvestre			С		2/2
plants	land plants	Polygonaceae	Persicaria prostrata	creeping knotweed		Ċ		4/4
, plants	land plants	Polygonaceae	Persicaria decipiens	slender knotweed		C		1
plants	land plants	Polygonaceae	Polygonum plebeium	small knotweed		С		2/2
plants	land plants	Polygonaceae	Rumex brownii	swamp dock		С		1/1
plants	land plants	Polypodiaceae	Pyrrosia confluens var. confluens	р		C		1/1
plants	land plants	Polypodiaceae	Pyrrosia rupestris	rock felt fern		С		1/1
plants	land plants	Portulacaceae	Calandrinia pickeringii			Ċ		1/1
plants	land plants	Proteaceae	Xylomelum cunninghamianum			C		2
plants	land plants	Proteaceae	Grevillea floribunda subsp. floribunda			С		2/2
plants	land plants	Proteaceae	Persoonia falcata			Č		2/2
plants	land plants	Proteaceae	Hakea lorea subsp. lorea			C		1/1
plants	land plants	Proteaceae	Grevillea longistyla			С		3/2
plants	land plants	Proteaceae	Conospermum sphacelatum			Č		1/1
plants	land plants	Proteaceae	Persoonia subtilis			C		2/2
plants	land plants	Proteaceae	Persoonia subtilis			C		2

Kingdom	Class	Family	Scientific Name	Common Name		Q	Α	Records
plants	land plants	Psilotaceae	Psilotum nudum	skeleton fork fern		С		1/1
plants	land plants	Pteridaceae	Adiantum hispidulum var. minus			С		1/1
plants	land plants	Pteridaceae	Cheilanthes sieberi subsp. sieberi			С		5/2
plants	land plants	Pteridaceae	Adiantum hispidulum var. hispidulum			С		1/1
plants	land plants	Pteridaceae	Pellaea nana			С		1/1
plants	land plants	Pteridaceae	Pellaea falcata			С		1/1
plants	land plants	Pteridaceae	Cheilanthes distans	bristly cloak fern		00000		2/1
plants	land plants	Pteridaceae	Adiantum aethiopicum	-		С		2/2
plants	land plants	Pteridaceae	Doryopteris concolor			С		2/2
plants	land plants	Putranjivaceae	Drypetes deplanchei	grey boxwood		С		2/2
plants	land plants	Rhamnaceae	Alphitonia excelsa	soap tree		С		6/2
plants	land plants	Rosaceae	Rubus parvifolius	pink-flowered native raspberry		C		1/1
plants	land plants	Rubiaceae	Psydrax odorata			С		1
plants	land plants	Rubiaceae	Everistia vacciniifolia forma vacciniifolia			С		2/2
plants	land plants	Rubiaceae	Cyclophyllum coprosmoides var. coprosmoides			C C		1/1
plants	land plants	Rubiaceae	Everistia vacciniifolia var. vacciniifolia			С		1/1
plants	land plants	Rubiaceae	Psydrax odorata subsp. australiana			С		2/2
plants	land plants	Rubiaceae	Psydrax odorata forma australiana			С		1/1
plants	land plants	Rubiaceae	Psydrax odorata forma subnitida			CCC		1/1
plants	land plants	Rubiaceae	Triflorensia ixoroides			С		2/2
plants	land plants	Rubiaceae	Spermacoce multicaulis			C		4/2
plants	land plants	Rubiaceae	Spermacoce brachystema			С		1
plants	land plants	Rubiaceae	Opercularia diphylla			С		2/2
plants	land plants	Rubiaceae	Pomax umbellata			C		4/3
plants	land plants	Rubiaceae	Psydrax johnsonii			С		3/3
plants	land plants	Rubiaceae	Psydrax oleifolia			С		2/2
plants	land plants	Rutaceae	Citrus glauca			C		1
plants	land plants	Rutaceae	Philotheca difformis subsp. difformis			С		1/1
plants	land plants	Rutaceae	Zanthoxylum brachyacanthum			С		3/3
plants	land plants	Rutaceae	Acronychia pauciflora	soft acronychia		C		2/2
plants	land plants	Rutaceae	Boronia occidentalis			С		5/5
plants	land plants	Rutaceae	Zieria smithii			С		1/1
plants	land plants	Rutaceae	Zieria cytisoides	downy zieria		C		1/1
plants	land plants	Rutaceae	Boronia bipinnata	rock boronia		С		3/3
plants	land plants	Rutaceae	Phebalium nottii	pink phebalium		С		2/2
plants	land plants	Rutaceae	Boronia odorata			С		1/1
plants	land plants	Rutaceae	Geijera parviflora	wilga		С		3/1
plants	land plants	Santalaceae	Santalum lanceolatum			С		2
plants	land plants	Santalaceae	Exocarpos latifolius			С		1/1
plants	land plants	Santalaceae	Exocarpos cupressiformis	native cherry		С		2
plants	land plants	Sapindaceae	Alectryon diversifolius	scrub boonaree		С		4/3
plants	land plants	Sapindaceae	Dodonaea triangularis			00000		2/1
plants	land plants	Sapindaceae	Dodonaea peduncularis			С		2/2
plants	land plants	Sapindaceae	Dodonaea heteromorpha			С		1/1
plants	land plants	Sapindaceae	Alectryon subdentatus			С		1/1
plants	land plants	Sapindaceae	Dodonaea tenuifolia			С		2/2

Kingdom	Class	Family	Scientific Name	Common Name	l	Q	Α	Records
plants	land plants	Sapindaceae	Alectryon pubescens			С		1/1
plants	land plants	Sapindaceae	Dodonaea vestita			С		1/1
plants	land plants	Sapindaceae	Alectryon connatus	grey birds-eye		C		1/1
plants	land plants	Sapindaceae	Cupaniopsis anacardioides	tuckeroo		С		1/1
plants	land plants	Sapindaceae	Dodonaea viscosa subsp. spatulata			С		2/2
plants	land plants	Sapindaceae	Dodonaea filifolia					3/2
plants	land plants	Sapindaceae	Dodonaea lanceolata var. subsessilifolia			CCC		1/1
plants	land plants	Sapotaceae	Planchonella cotinifolia var. pubescens			С		1/1
plants	land plants	Scrophulariaceae	Eremophila debilis	winter apple		C C		3/1
plants	land plants	Scrophulariaceae	Myoporum acuminatum	coastal boobialla		С		1/1
plants	land plants	Scrophulariaceae	Éremophila longifolia	berrigan		С		1/1
plants	land plants	Scrophulariaceae	Eremophila mitchellii	ŭ		С		1
plants	land plants	Solanaceae	Solanum nemophilum			C		3/2
plants	land plants	Solanaceae	Solanum ellipticum	potato bush		C		3/3
plants	land plants	Solanaceae	Physalis pubescens	h	Υ			1/1
plants	land plants	Solanaceae	Solanum dumicola			С		2/2
plants	land plants	Solanaceae	Datura leichhardtii	native thornapple	Υ	_		1/1
plants	land plants	Solanaceae	Solanum parvifolium	······································	•	С		1
plants	land plants	Solanaceae	Solanum parvifolium subsp. parvifolium			Č		2/2
plants	land plants	Solanaceae	Nicotiana amplexicaulis			Č		1/1
plants	land plants	Solanaceae	Solanum mitchellianum			Č		5/5
plants	land plants	Sparrmanniaceae	Corchorus tomentellus			C		1/1
plants	land plants	Sparrmanniaceae	Corchorus reynoldsiae			Č		1/1
plants	land plants	Sparrmanniaceae	Grewia latifolia	dysentery plant		Č		3/3
plants	land plants	Sterculiaceae	Brachychiton australis	broad-leaved bottle tree		C C		2/1
plants	land plants	Sterculiaceae	Brachychiton populneus subsp. trilobus			Č		3/3
plants	land plants	Sterculiaceae	Brachychiton rupestris			Č		1
plants	land plants	Stylidiaceae	Stylidium laricifolium	tree trigger plant		C		4/4
plants	land plants	Stylidiaceae	Stylidium eglandulosum	a de a gger plant		Č		1/1
plants	land plants	Surianaceae	Cadellia pentastylis	ooline		V	V	11/11
plants	land plants	Thelypteridaceae	Christella arida			Ċ	•	1/1
plants	land plants	Thelypteridaceae	Christella dentata	creek fern		Č		1
plants	land plants	Thymelaeaceae	Pimelea linifolia subsp. linifolia	0.001.101.11		Č		1/1
plants	land plants	Thymelaeaceae	Pimelea strigosa			C		1/1
plants	land plants	Thymelaeaceae	Pimelea mollis			Č		4/4
plants	land plants	Thymelaeaceae	Pimelea leptostachya			Č		2/2
plants	land plants	Urticaceae	Urtica incisa	stinging nettle		Č		1/1
plants	land plants	Verbenaceae	Verbena litoralis var. litoralis	ounging nous	Υ	•		1/1
plants	land plants	Verbenaceae	Glandularia aristigera		Ý			3/2
plants	land plants	Verbenaceae	Verbena litoralis	verbena	Ý			2/1
plants	land plants	Viburnaceae	Sambucus gaudichaudiana	white elder	•	С		<u> </u>
plants	land plants	Violaceae	Viola betonicifolia			č		1
plants	land plants	Violaceae	Hybanthus monopetalus			č		1/1
plants	land plants	Viscaceae	Viscum articulatum	flat mistletoe		č		1/1
plants	land plants	Vitaceae	Causonis clematidea	nat motiotoo		Č		1/1
plants	land plants	Vitaceae	Clematicissus opaca			Č		1, 1
Piairio	and plants	Vitabbab	Cicinationodo opada			9		•

Kingdon	n Class	Family	Scientific Name	Common Name	1	Q	Α	Records
plants	land plants	Xanthorrhoeaceae	Xanthorrhoea johnsonii			С		1/1
plants	land plants	Xanthorrhoeaceae	Xanthorrhoea					1
plants	land plants	Zamiaceae	Macrozamia moorei			С		10/9
plants	land plants	Zamiaceae	Macrozamia fearnsidei			С		4/4
plants	land plants	Zamiaceae	Macrozamia fearnsidei x Macrozamia moorei			С		1
plants	land plants	Zygophyllaceae	Tribulus terrestris	caltrop		С		1/1

### CODES

- I Y indicates that the taxon is introduced to Queensland and has naturalised.
- Q Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992*. The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ().
- A Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999*. The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens). This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon. This number is output as 999 if it equals or exceeds this value.

### Appendix C

# Balance! Environmental Bat Call Analysis Report



### **Microbat Call Identification Report**

Prepared for ("Client"):	AECOM
Survey location name:	Arcadia Valley (Santos Towrie Project)
Survey dates:	15 <sup>th</sup> – 20 <sup>th</sup> December 2020
Client project reference:	60626642 Task 2.0
Job no.:	AEC-2102
Report date:	19 March 2021

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### **Methods**

### **Data received**

Balance! Environmental received 6225 WAV format full-spectrum ultrasonic acoustic files, which were recorded on three Anabat Swift detectors (Titley Scientific, Brisbane). The detectors were deployed over a five-night period (15<sup>th</sup> – 19<sup>th</sup> December 2020), with two units (Anabat 1 & Anabat 3) sampling for only the first four of those nights. Based on the GPS coordinates within the WAV file metadata, detectors Anabat 2 and Anabat 3 appear to have been moved to new sites every night during the survey (see Figure 1). Anabat 1 apparently remained at the same site on the nights of 16<sup>th</sup> and 17<sup>th</sup> December, and possibly also on 15<sup>th</sup> December, but was moved to a different site on 18<sup>th</sup> December.

### Call analysis and species identification

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

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

### **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 <a href="http://www.ausbats.org.au/">http://www.ausbats.org.au/</a>.

Species nomenclature follows Armstrong et al. (2020).





Figure 1 Arcadia Valley bat detector locations, 15<sup>th</sup> – 19<sup>th</sup> December 2020. Positions derived from GPS coordinates in detector metadata



### **Results & Discussion**

Noise filtration excluded 934 of the WAV files from further analysis. The other 5291 WAV files contained 5670 identifiable bat calls. Over 75% (4299) of those calls were positively identified, while the other 1371 "unresolved" calls had characteristics potentially attributable to two or more species and were assigned to multi-species groups. **Appendix 2** gives a breakdown of the number of calls allocated to each species and unresolved group.

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

The survey detected at least 18 and up to 21 species.

Seventeen species were positively identified, including the **threatened Large-eared Pied Bat** (*Chalinolobus dwyeri*). All *C. dwyeri* calls were detected at sites adjacent to the escarpment in the west of the study area (see **Figure 1**), suggesting that those wooded foot-slopes are important foraging habitat for the species. The escarpment evidently provides important roosting (and presumably breeding) habitat for *C. dwyeri*.

One additional call type was attributed reliably to the *Nyctophilus* genus, within which species' calls cannot be reliably differentiated. Three *Nyctophilus* species potentially occur in the study area, including: *N. geoffroyi*; *N. gouldii*: and the **threatened Eastern Long-eared Bat** (*N. corbeni*). The latter species potentially occurs throughout the study area, although it is possibly limited to larger tracts of suitable habitat, such as the large remnant vegetation block in the east of the study area.

Most of the unresolved calls belonged to species that were otherwise positively identified; however, 14 calls potentially represented one additional species (*Vespadelus vulturnus*). Those calls were all short duration with ill-defined pulse characteristics and could equally have represented *Vespadelus baverstocki* and/or *Miniopterus orianae*, both of which were positively identified at the same sites.

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

### References

Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). *A current taxonomic list of Australian Chiroptera*. Australasian Bat Society. Version 2020-06-09. URL: http://ausbats.org.au/species-list/4593775065

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

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

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



**Table 1** Bats recorded during the Arcadia Valley (Santos Towrie Project) survey, 15<sup>th</sup> – 19<sup>th</sup> December 2020.

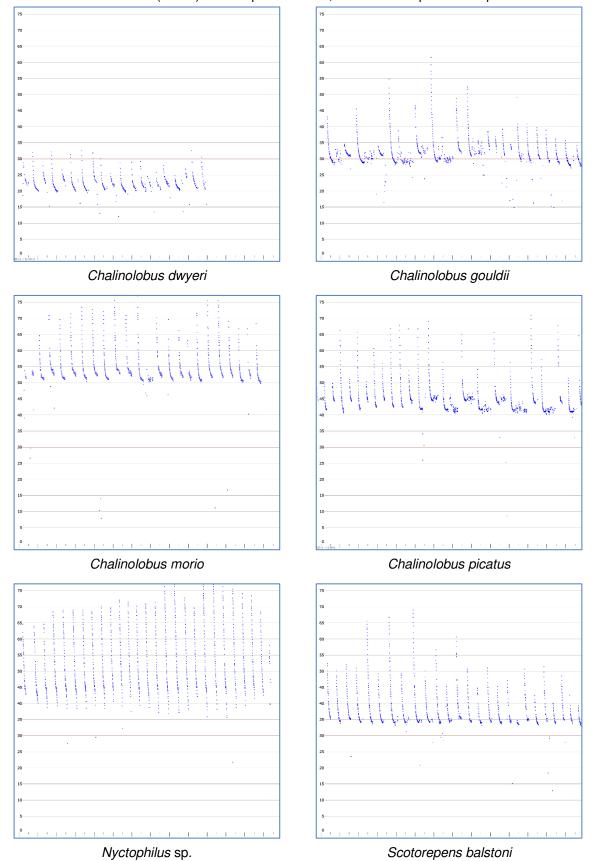
- ♦ = Definite at least one call from the relevant site was identified unequivocally.
- $\Box$  = Possible calls like those of the species were recorded but could not be reliably identified.

Detector:		Ana	bat 1				Anabat 2				Ana	bat 3	
Night:	15/12	16/12	17/12	18/12	15/12	16/12	17/12	18/12	19/12	15/12	16/12	17/12	18/12
Chalinolobus dwyeri	<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>								
Chalinolobus gouldii	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Chalinolobus morio	<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>				<b>*</b>			<b>*</b>
Chalinolobus picatus	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>
Nyctophilus sp.	<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>
Scotorepens balstoni	<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Scotorepens greyii	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>
Vespadelus baverstocki		<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>			<b>*</b>
Vespadelus troughtoni	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>			<b>*</b>			<b>*</b>
Vespadelus vulturnus													
Miniopterus orianae	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>							<b>*</b>
Austronomus australis		<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Chaerephon jobensis	<b>*</b>			<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Ozimops lumsdenae	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Ozimops petersi				<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	
Ozimops ridei	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Setirostris eleryi	<b>*</b>			<b>*</b>	<b>*</b>		<b>*</b>						
Saccolaimus flaviventris	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	•	<b>*</b>	<b>*</b>	•	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>
Taphozous troughtoni			<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>		<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>	<b>*</b>

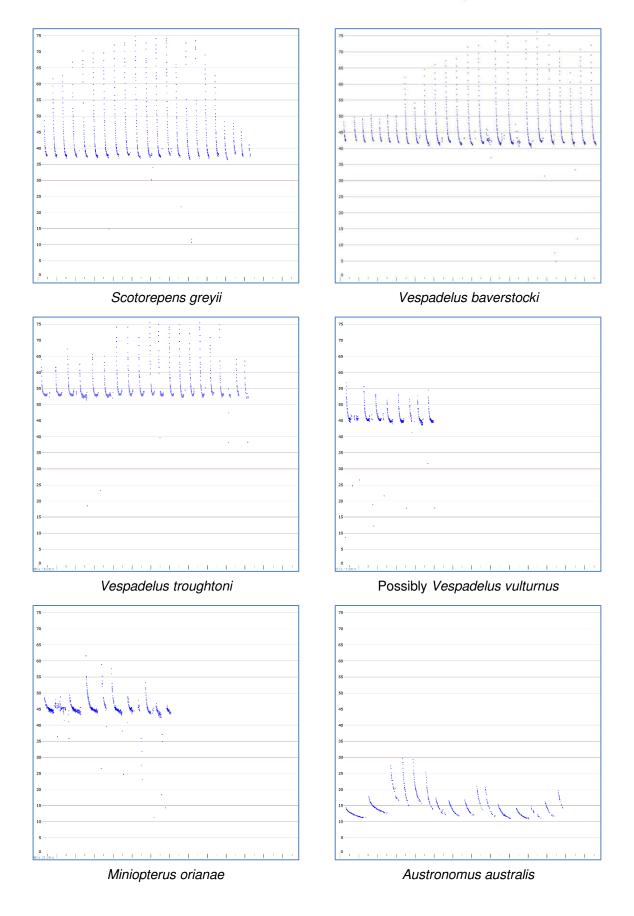


**Appendix 1** Sample spectrograms of calls recorded during the Arcadia Valley survey.

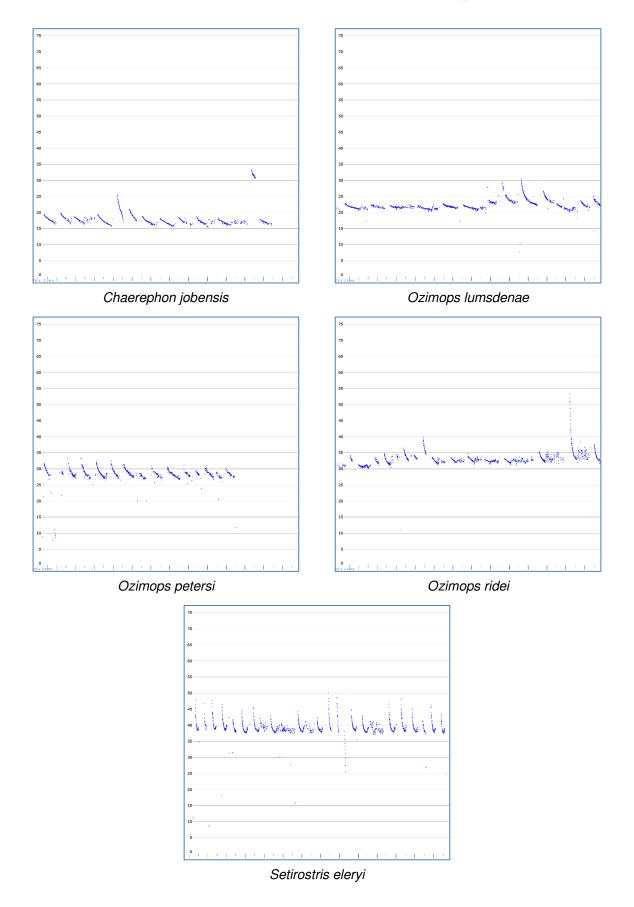
Timescale (*x*-axis) = 10ms per tick-mark; time between pulses compressed



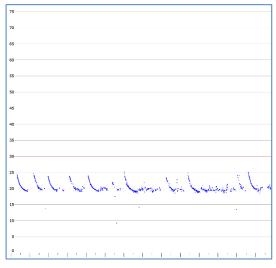


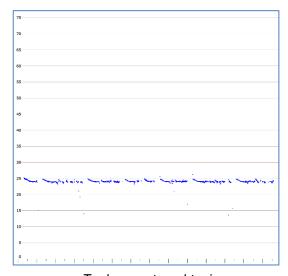












Saccolaimus flaviventris

Taphozous troughtoni



**Appendix 2** Bat species detected during the Arcadia Valley (Santos Towrie Project) survey, 15<sup>th</sup> – 19<sup>th</sup> December 2020. Number of calls attributed to each species and unresolved species group.

Detector:		Anabat 1					Anabat 2				Anal	oat 3		Species
Night:	15/12	16/12	17/12	18/12	15/12	16/12	17/12	18/12	19/12	15/12	16/12	17/12	18/12	Total
Positively identified calls	Positively identified calls													
Chalinolobus dwyeri	5		1	1	2									9
Chalinolobus gouldii	190	7	15	80	42	60	110	218	61	42	27	83	209	1144
Chalinolobus morio	12	4		1	11	1				9			1	39
Chalinolobus picatus	6	17	23	49	12	8	9	1	16	19		1	245	406
Nyctophilus sp.	7		2	15	3	60	68	6	5	4		5	10	185
Scotorepens balstoni	21		2	25	8	3	1	11	39	7	3	1	29	150
Scotorepens greyii	40	13	12	59	27	127	319	7	95	40		9	304	1052
Vespadelus baverstocki		1	1		4	2	10		1	3			1	23
Vespadelus troughtoni	8	10	4	1	6	5	1			6			9	50
Miniopterus orianae	8	4	3	8	3	1							4	31
Austronomus australis		2		9	9	11	2	9	39	9	5	22	31	148
Chaerephon jobensis	3			22	22	25	27	25	21	62	10	20	13	250
Ozimops lumsdenae	89	3	4	32	55	12	37	28	42	93	4	17	24	440
Ozimops petersi				2	4	1	1	3	4	1	3	10		29
Ozimops ridei	9	1	2	4	6	6	7	13	17	3	2	2	1	73
Setirostris eleryi	1			3	5		1							10
Saccolaimus flaviventris	9	3	2	9	12	6	32	22	11	34	33	32	26	231
Taphozous troughtoni			1	1	1	3		1	6	2	1	4	9	29



Detector:		Anal	bat 1				Anabat 2				Anal	oat 3		Species
Night:	15/12	16/12	17/12	18/12	15/12	16/12	17/12	18/12	19/12	15/12	16/12	17/12	18/12	Total
Unresolved calls														
C. gouldii / O. ridei	3	2	5	14	32	14	23	38	421	9	10	42	17	630
C. gouldii / S. balstoni			2			4	11	29	2	20		5	7	80
C. morio / V. troughtoni	29	17	12	5	31		1	2		4			4	105
C. picatus / V. baverstocki	2		1				7			2	1		12	25
C. picatus / S. greyii	4	2	15	9	6	173	106	16	10	10		3	16	370
S. greyii / S. eleryi					62	9	11		3	1		1	5	92
V. baverstocki / V. vulturnus	2	1											1	4
M. oceanensis / Vespadelus sp.	2	3			4								1	10
O. petersi / O. ridei	1				1	2	1	1	5	2	2	9	3	27
S. flaviventris / C. jobensis	1				2		2	6	4	2	2	3	6	28
Detector-night Total	452	90	107	349	370	533	787	436	802	384	103	269	988	5670

# Appendix D

### MNES Habitat Mapping Rules

### Appendix D MNES Habitat Mapping Rules

Table 24 MNES habitat mapping rules

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules	GIS approach	Assumptions (desktop data only)							
Threatened Eco	Threatened Ecological Community (TEC)											
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Known	Remnant and HVR vegetation communities 0.5 ha in size or greater, associated with any of the following Brigalow Belt bioregion REs: 11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.6, 11.11.14, 11.12.21.	Field validated to meet the key diagnostic criteria and condition thresholds of the TEC.  Desktop assessment = Remnant and HVR 11.3.1,11.9.5, 11.9.5a and is >0.5 ha.	Where field-validated data is not available, analogous REs have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. HVR and remnant communities assumed to contain structural and conditional requirements that will meet key diagnostic and condition thresholds of TEC							
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	Likely	Remnant and HVR vegetation communities associated with any of the following Brigalow Belt bioregion REs: 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18.	Field validated to meet the key diagnostic criteria and condition thresholds of the TEC.  Desktop assessment = Remnant and HVR 11.9.4.	Where field-validated data is not available, analogous REs have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets							

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules	GIS approach	Assumptions (desktop data only)
					remnant or HVR status. HVR and remnant communities assumed to contain structural and conditional requirements that will meet key diagnostic and condition thresholds of TEC
Poplar box on alluvial plains	Endangered	Likely	Remnant communities associated with the following Brigalow Belt bioregion REs: 11.3.2, 11.3.17, 11.4.7, 11.4.12.	Field validated to meet the key diagnostic criteria and condition thresholds of the TEC.  Desktop assessment = Remnant RE 11.3.2 and >1 ha.	Where field-validated data is not available, analogous REs have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. Remnant communities assumed to contain structural, diversity and conditional requirements that will meet key diagnostic and condition thresholds of TEC.
Plants  Acacia	Vulnerable	Potential	Ironbark gum and spotted gum forests and	Field validated as Associa grandifolia	Where field-validated data is not
grandifolia	vuirierable	rotential	Ironbark gum and spotted gum forests and woodlands on hilly terrain associated with land zone 9, 10, 11 and 12.	Field validated as <i>Acacia grandifolia</i> .  Desktop assessment = Remnant or HVR RE 11.10.4 and 11.10.11.	available, vegetation communities have been identified based a combination
Cadellia pentastylis Ooline	Vulnerable	Likely	Semi-evergreen vine thicket (SEVT) and brigalow communities including brigalow with softwood scrub understorey (i.e. RE 11.9.5a).	Field validated as Ooline.  Desktop assessment = Remnant, HVR and regrowth RE 11.9.4, 11.9.5, 11.9.5a	of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time

MNES	EPBC Act status	Likelihood of occurrence	Habitat defin	ition rules	GIS approach	Assumptions (desktop data only)
					and Middle Hill AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	since last clearing event) and LIDAR point cloud data (canopy
Bertya opponens	Vulnerable	Potential	mallee woodla forest with shr Eucalyptus/Ca	and, lancewood woodland, and, Eucalyptus/Acacia open rubby understorey, allitris open woodland and zones 7, 9, 10, 11 and 12.	Field validated as <i>Bertya opponens</i> .  Desktop assessment = Remnant or HVR RE 11.9.4, 11.10.1, 11.10.4, 11.10.11.	height) was used to confirm whether patch meets remnant or HVR status. Use of LIDAR DEM (ground returns) to determine terrain.
Xerothamnella herbacea	Endangered	Likely	Brigalow dom on heavy clay	inated communities and gilgai soils.	Field validated as <i>Xerothamnella herbacea</i> .  Desktop assessment = Remnant and HVR RE 11.3.1, 11.9.5 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	
Birds						
Red goshawk (Erythrotriorchis radiatus)	Vulnerable	Potential	Nesting / Foraging	Tall emergent trees in areas of permanent water (watercourses and wetlands) within a landscape that supports a mosaic of vegetation types.	Field validated wetlands and watercourses identified as containing tall emergent trees (no areas identified).  Desktop assessment = Remnant Eucalypt communities along watercourses or surrounding wetlands with trees >30m (no areas identified)	Tree's greater than 30 m are suitable. Use of LIDAR allowed tree height to be estimated and potential nesting trees to be identified.
			Foraging only	Remnant open forest and woodland that support a mosaic of vegetation types. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins.	Field validated remnant woodland and forest areas.  Desktop assessment = Remnant areas, including ridgeline and Middle Hill.	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules		GIS approach	Assumptions (desktop data only)	
Grey falcon (Falco hypoleucos)	Vulnerable	Potential	Potential	Breeding / Foraging	Areas containing tall Eucalypt trees, located in association with ephemeral or permanent water.	Field validated areas of RE 11.3.25.  Desktop assessment = Remnant areas of RE 11.3.25.	LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. Use of LIDAR DEM
			Foraging only	Lowland vegetation in any condition (regrowth, HVR or remnant).	Field validated vegetation (not including grasslands) in lowland areas (regrowth, HVR or remnant).	(ground returns) to determine terrain.	
					Desktop assessment = Remnant, HVR or regrowth vegetation (not including grasslands) outside of middle hill and the western ridgeline.		
Squatter pigeon (southern) (Geophaps scripta scripta)	Vulnerable	Potential	Breeding / Foraging	Open forest to sparse, open woodland or scrub vegetation on land zones 5 and 7, within 1 km of permanent water.	Field validated remnant and HVR vegetation on land zone 5 or 7 adjacent to waterbodies (no areas identified). Field validated farm dams and the constructed Wetland identified as water sources.	Where field-validated data is not available, vegetation communities (including analogous RE and land zone) have been identified based a combination of state vegetation	
					Desktop assessment = Remnant and HVR vegetation on land zone 5 or 7 adjacent to waterbodies (no areas identified). Farm dams identified as water sources.	mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used	
			Foraging only	Open forest to sparse, open woodland or scrub vegetation on land zones 5 and 7, 1-3 km from permanent water.	Field validated remnant and HVR vegetation on land zone 5 or 7 adjacent to wetlands (no areas identified). Field validated dams and wetland areas identified as water source	to confirm whether patch meets remnant or HVR status.	
					Desktop assessment = Remnant and HVR vegetation on land zone 5 or 7 adjacent to waterbodies (no areas		

MNES	EPBC Act status	Likelihood of occurrence	Habitat defin	ition rules	GIS approach	Assumptions (desktop data only)
					identified). Desktop assessment = Farm dams as 'water source'	
			Dispersal	Any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies; OR woody vegetation (regrowth, HVR or remnant) that facilitates the local movement of the subspecies between patches of foraging habitat, breeding habitat and/or waterbodies, or the wider dispersal of individuals in search of reliable water sources during the dry season or during droughts.	Field validated remnant, HVR and regrowth vegetation.  Desktop assessment = all remaining remnant, HVR and regrowth areas (excluding exotic pasture).	Within the Project Area, cleared exotic pasture occurs as large contiguous patches in which paddock trees are rare and highly isolated. Due to the high exposure to predators in these areas and ability for the bird to instead utilise the wooded vegetation patches to access waterbodies or other suitable habitat, exotic pasture areas are not considered to provide dispersal opportunities. This is in accordance with the species SPRAT profile description for dispersal habitat.
Painted honeyeater ( <i>Grantiella</i> picta)	Vulnerable	Potential	Foraging / Dispersal	Dry forests and woodlands and riparian woodland communities (remnant or HVR condition) dominated by eucalypt species such as <i>Eucalyptus camaldulensis</i> , where there is an abundance of mistletoes in the genus <i>Amyema</i> .	Field validated remnant, HVR and regrowth areas containing mistletoe.  Desktop assessment = Remnant, HVR and regrowth RE 11.3.1, 11.3.25, 11.9.5 AND is a viable patch (i.e. excludes isolated patches <0.5 ha and linear patches that are very narrow).	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. All areas of dry forest, woodland and riparian woodland communities

MNES EPBC Act status		Ot .		of Habitat definition rules			GIS approach	Assumptions (desktop data only)
						dominated by eucalypt or Brigalow species are assumed to contain abundant mistletoe.		
White-throated needletail ( <i>Hirundapus</i> caudacutus)	Vulnerable	Potential	Roosting / Foraging	Remnant woodland areas on high elevations or hilly terrain.	Field validated remnant habitat containing roosting trees on hilly terrain.  Desktop assessment = RE 11.10.4 and 11.10.11 (ridgeline only).	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE		
			Foraging only	Above woodlands, HVR and regrowth or cleared paddocks (aerial species).	Field validated and desktop assessment = remnant, HVR and regrowth areas.	and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status.		
Australian painted snipe ( <i>Rostratula</i> australis)	Endangered	Potential	Breeding	Small exposed islands within freshwater wetlands with a combination of exposed muddy areas, dense tall or low vegetation cover.	Field validated permanent wetlands with fringing vegetation and exposed islands (i.e. wetland area on 2TR13).  Desktop assessment = dams with exposed islands	Aerial imagery and LIDAR DEM (ground returns) to identify dams with identified dams assumed to provide suitable values.		
			Foraging / Roosting	Permanent freshwater wetlands with areas of bare wet mud and both upper and canopy cover nearby.	Field verified wetland areas with fringing vegetation and muddy margins.  Desktop assessment = Wetland / dam areas AND is a viable patch (i.e. excludes isolated patches <0.5 ha)			
			Temporary foraging /	Ephemeral shallow waterbodies including gilgai.	No areas able to be field validated.	LIDAR DEM (ground returns) and hillshade utilised to identify		

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules		GIS approach	Assumptions (desktop data only)
			dispersal only		Desktop assessment = Gilgai areas AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	gilgai areas with gilgai assumed to provide suitable values
Mammals						
Large-eared pied bat  (Chalinolobus	Vulnerable	Likely	Roosting	Sandstone cliffs and escarpments, disused mineshafts, caves and overhangs adjacent to suitable foraging	Field validated cliffs, escarpments, caves and overhangs adjacent to potential foraging habitat.	Ground DEM utilised to identify escarpment terrain with areas assumed to caves / crevices for roosting bats
dwyeri)				habitat.	Desktop assessment = RE 11.10.4 and 11.10.11 (ridgeline only).	
			Foraging	Fertile valley woodland areas (remnant and HVR) within 10 km of roosting habitat.	Field validated and desktop assessment = All remnant, HVR and non-remnant woodland areas AND is a viable patch (i.e. excludes isolated patches <0.5 ha and linear patches that are very narrow).	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status.
Northern quoll (Dasyurus hallucatus)	Endangered	Potential	Denning / Foraging	Remnant eucalypt forest or woodland with high structural diversity containing large diameter trees, termite mounds or hollow logs and rocky habitats such as escarpments, caves and hill slopes with large boulders.	Field validated eucalypt forest or woodland that is complex and/or has rocky denning habitats.  Desktop assessment = Ridgeline and Middle Hill (excluding disturbed areas on lower slopes).	Vegetation community identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Use of historical aerial imagery and LIDAR to confirm whether patch meets remnant status. Use of ground DEM to determine

MNES	EPBC Act status	Likelihood of occurrence	Habitat defin	ition rules	GIS approach	Assumptions (desktop data only)
						terrain. Identified areas assumed to contain denning features.
			Foraging / Dispersal	Eucalypt forest and woodlands, rainforests, shrubland, grasslands and desert in proximity to denning habitat and permanent water.	Field validated remnant or HVR vegetation connected to potential denning habitat and water.  Desktop assessment = Areas within 1 km to potential denning habitat if there is a creek or dam AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	Vegetation community identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Use of historical aerial imagery and LIDAR to confirm whether patch meets HVR or remnant status. Use of LIDAR DEM to determine terrain and presence of water features.
South-eastern long-eared bat ( <i>Nyctophilus</i> corbeni)	Vulnerable	Likely	Roosting / Foraging	Forests and woodlands dominated by Allocasuarina luehmannii, Acacia harpophylla, Casuarina cristata, Eucalyptus camaldulensis, and various other types with a dense cluttered understorey AND with hollow bearing trees or trees with decorticating bark.	Field validated remnant vegetation containing hollow-bearing trees or decorticating bark and a cluttered understorey.  Desktop assessment = Remnant RE 11.3.25, 11.3.2, 11.3.1, 11.9.5, 11.10.1, 11.10.4, 11.10.11 AND is a viable patch (i.e. excludes isolated patches <0.5 ha and linear patches that are very narrow).	Vegetation community identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Use of historical aerial imagery and LIDAR to confirm whether patch meets remnant status. All areas of suitable remnant vegetation type assumed to contain hollow bearing trees and or trees with decorticating bark.
			Foraging only	Woodlands and low woodlands (remnant, HVR or regrowth) with a dense cluttered understorey (lacks hollow bearing trees and trees with decorticating bark).	Field validated remnant, HVR, regrowth and non-remnant vegetation with a cluttered understorey but absent roosting features.  Desktop assessment = HVR RE 11.3.1,	Vegetation community identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Use of historical aerial imagery and

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules		GIS approach	Assumptions (desktop data only)
					11.9.5, 11.9.5a and remnant or HVR RE 11.9.4 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	LIDAR to confirm whether patch meets remnant and HVR status. All areas of suitable habitat assumed to contain cluttered understorey.
Greater glider (Petauroides Volans)	Vulnerable	Potential	Breeding / Denning / Foraging	Highly connected, eucalypt-dominated woodlands containing 2-4 hollows medium-large in size per ha.	Field validated connected eucalypt woodland areas with correct hollow density.  Desktop = Remnant RE 11.3.25, 11.3.2, 11.10.4, 11.10.1, non-remnant woodland AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. Based on the findings of field surveys, only mature vegetation was found to contain hollow-bearing trees. All mature vegetation in the southern Project Area has been attributed as a 'remnant' condition RE which are assumed to contain 2-4 hollows/ha medium-large in size.
			Foraging / Dispersal only	All other connected eucalypt- dominated woodlands within 120 m of breeding / denning habitat.	Field validated eucalypt woodland areas that are mostly connected to breeding habitat but do not contain sufficient hollow density.	-

MNES	EPBC Act status	Likelihood of occurrence	Habitat defin	ition rules	GIS approach	Assumptions (desktop data only)
					No desktop assessment as all areas captured under Breeding / denning / foraging habitat.	
Koala (Phascolarctos cinereus)	Vulnerable	Potential	Refuge / Foraging	Vegetation with at least two koala food trees, OR one koala food tree with more than 50% cover, on alluvial substrates (land zone 3) OR more than 200 ha contiguous.	Field validated connected, remnant areas dominated by koala tree species on land zone 3.  Desktop assessment = connected remnant and HVR RE11.3.25, 11.3.2, 11.10.4, 11.10.1 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation.  Historical aerial imagery (time
Doubles			Foraging / Dispersal	Other vegetation containing at least one koala food tree and / or shelter trees. Shelter trees may occur as isolated individuals.	Field validated and desktop assessment = any small fragments and HVR patches of the Refuge / Foraging habitat (above), as well as remnant RE 11.3.1 (excluding highly isolated patches).	since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. Vegetation communities characterised as RE 11.3.25, 11.3.2, 11.10.4 or 11.10.1 are assumed to be dominated by koala food tree species. Based on the findings of field surveys, rare isolated paddock trees were highly impacted by edge effects and generally average in size. As such, no shelter trees are considered to occur.
Reptiles						
Adorned delma (Delma torquata)	Vulnerable	Potential	Breeding / Foraging	Eucalypt-dominated woodlands and open-forests or non-remnant exposed rocky areas on land zones 3,	Field-validated complex eucalypt woodland or rocky areas with sufficient microhabitat features on land zones 3, 9 and 10.	Where field-validated data is not available, vegetation communities have been identified based a combination

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules	GIS approach	Assumptions (desktop data only)
			9 and 10 that contain sufficient microhabitat features (logs, bark and other coarse woody debris as well as mats of leaf litter).	Desktop assessment = All areas of RE 11.10.4 (i.e. western ridgeline).	of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status. Results of the field survey found the eucalypt woodlands on alluvium to be highly impacted by cattle grazing and weeds (with the exception of the Public Reserve), and lacking the required microhabitat features. As such, due to their similar narrow linear shape and fragmented nature, areas of this community in the southern Project Area are also considered unsuitable.

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules		GIS approach	Assumptions (desktop data only)
Ornamental snake (Denisonia maculate)	Vulnerable	Potential	Breeding / Foraging	Woodlands and open forests associated with moist areas, particularly gilgais and depressions, but also lake margins and wetlands on clay soils containing sufficient microhabitat features (soil cracks or fallen woody debris).	Field validated areas brigalow vegetation, eucalypt-dominated floodplain communities and the margins of the constructed wetland containing microhabitat and is viable patch (i.e. excludes isolated patches <0.5 ha).  Desktop = Non-remnant / remnant / HVR / regrowth 11.9.5 and 11.3.1 containing gilgai or contiguous to areas containing gilgai or adjacent to dam/wetland/waterway AND is a viable patch (i.e. excludes isolated patches <0.5 ha and linear patches that are very narrow).	LIDAR DEM (ground returns) and hillshade used to identify gilgai and water features. All natural waterbodies (wetlands and gilgai) not field validated are assumed to contain sufficient microhabitat features.
Yakka skink (Egernia rugosa)	Vulnerable	Potential	Breeding / Foraging	Dry forest, woodland and scrub on land zone 3, 5, 7, 9 and 10 containing:  • large hollow logs  • cavities or borrows under large fallen trees  • tree stumps  • logs  • stick-racked piles of logs  • large rocks and rock piles	Field validated remnant, HVR and regrowth RE 11.3.1, 11.3.2, 11.10.4 and 11.10.11 containing microhabitat.  Desktop assessment = Remnant 11.3.1, 11.3.2, 11.10.1, 11.10.4, 11.10.11 AND is a viable patch (i.e. excludes isolated patches <0.5 ha and linear patches that are very narrow).	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy height) was used to confirm whether patch meets remnant or HVR status.

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules		GIS approach	Assumptions (desktop data only)
				deeply eroded gullies, tunnels and sinkholes.		All identified areas not field validated are assumed to contain required microhabitat features. Due to overall high level of grazing and cropping impacts within Project Area, no non-remnant areas are considered suitable.
Dunmall's snake ( <i>Furina</i> dunmalli)	Vulnerable	Potential	Breeding / Foraging	Forest and woodland areas containing sufficient microhabitat features (soil cracks, leaf litter or fallen woody debris).	Field validated areas containing microhabitat.  Desktop = Remnant and HVR areas excluding SEVT and ridgeline where dominated by Eucalypts AND is a viable patch (i.e. excludes isolated patches <0.5 ha and linear patches that are very narrow).	Only remnant and HVR vegetation areas with minimal cropping and grazing impacts considered likely to contain sufficient microhabitat features.
Migratory speciel Glossy ibis (Plegadis falcinellus)	Migratory	Likely	Foraging / Dispersal	Wetlands with either shallow or deep waters.	Field validated wetland areas with fringing vegetation.  Desktop assessment = Wetland / dam areas AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	Aerial imagery and LIDAR DEM (ground returns) to identify dams and inundated areas with identified areas assumed to provide suitable values
Fork-tailed swift (Apus pacificus)	Migratory	Potential	Foraging / Dispersal	Remnant, HVR and non- remnant vegetation (aerial species).	Field verified and desktop assessment = remnant, HVR and regrowth areas.	Where field-validated data is not available, vegetation communities have been identified based a combination of state vegetation mapping (RE
Oriental cuckoo	Migratory	Potential	Foraging / Dispersal	Monsoon rainforest, wet sclerophyll forest, open	Field validated remnant Eucalypt dominated vegetation.	

MNES	EPBC Act status	Likelihood of occurrence	Habitat definition rules		GIS approach	Assumptions (desktop data only)
(Cuculus optatus)				woodlands and ecotones between forest types.	Desktop assessment = Remnant 11.3.25, 11.3.2, 11.10.4, 11.10.11 & 11.10.1 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	and pre-clear RE) and aerial photography interpretation. Historical aerial imagery (time since last clearing event) and LIDAR point cloud data (canopy
Satin flycatcher ( <i>Myiagra</i> <i>cyanoleuca</i> )	Migratory	Potential	Foraging / Dispersal	Eucalypt forest and woodlands, at high elevations (typically breed in southeastern Australia).	Field validated remnant Eucalypt dominated vegetation.  Desktop assessment = Remnant 11.3.25, 11.3.2, 11.10.4, 11.10.11 & 11.10.1 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	height) was used to confirm whether patch meets remnant or HVR status.
Rufous fantail ( <i>Rhipidura</i> rufifrons)	Migratory	Potential	Breeding, foraging and dispersal	Dense wet forests – rainforests, mangroves, the wet fern gullies in eucalypt forests and other dense vegetation.	Field validated remnant and HVR SEVT. Desktop assessment = Remnant or HVR 11.9.4 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	
			Foraging and dispersal	Dry forests and woodlands, including HVR and regrowth.	Field validated remnant, HVR and regrowth Brigalow and Eucalypt dominated vegetation.  Desktop assessment = Remnant and HVR 11.3.1, 11.9.5, 11.3.25, 11.3.2,	
					11.10.11, 11.10.4 and 11.10.1 AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	
Latham's snipe (Gallinago hardwickii)	Migratory	Potential	Foraging / Roosting	Wetlands with either shallow or deep waters fringed with dense low vegetation.	Field verified wetland areas with dense fringing vegetation and shallow water margins.  Desktop assessment = Wetland / dam areas AND is a viable patch (i.e. excludes isolated patches <0.5 ha).	Aerial imagery and LIDAR DEM (ground returns) to identify dams and inundated areas with identified areas assumed to provide suitable values.

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# Appendix E

# Risk Assessment Criteria

#### Appendix E Risk Assessment Criteria

1. Consequence assessment criteria

Consequence	Descriptor					
level	Threatened species and communities	Migratory species				
1	<ul> <li>No impacts to threatened species populations, ecological communities, habitat extent and habitat quality; and</li> <li>No increase in threatening processes to threatened species and ecological communities; and</li> <li>Threatened species and ecological communities recovery or persistence is unaffected.</li> </ul>	<ul> <li>No impacts to migratory species habitat extent and habitat quality; and</li> <li>No increase in threatening processes to migratory species; and</li> <li>Area of habitat within the Project Area is not nationally or internationally significant and</li> <li>Migratory species recovery or persistence is unaffected.</li> </ul>				
2	<ul> <li>Impacts to threatened species, ecological communities and associated habitats are of a low magnitude or are short-term; and</li> <li>Increased threatening processes to threatened species and ecological communities can effectively be mitigated by well characterised management measures; and</li> <li>In a regional context, reduction in available habitat is inconsequential; and</li> <li>Species specific referral guidance (if available) indicates a low risk.</li> </ul>	<ul> <li>Impact area is below species-specific clearing thresholds (if available); and</li> <li>No impacts to areas supporting an ecologically significant proportion of a population; and</li> <li>Impacts to migratory species important habitat are of a low magnitude or are short-term; and</li> <li>Increased threatening processes to migratory species can effectively be mitigated by well characterised management measures; and</li> <li>In a regional context, reduction in available habitat is inconsequential.</li> </ul>				
3	<ul> <li>Species has been confirmed within the Project Area or in adjacent properties; however uncertainty on population density, population dynamics and or habitat utilisation occurs; or</li> <li>Population numbers and habitat utilisation within the Project Area may vary temporally and spatially due to dependence on climatic conditions i.e. rainfall events recharging wetlands. Therefore, full extent of potential impacts on threatened species is uncertain; or</li> </ul>	<ul> <li>Multiple individuals were recorded using habitat within the Project Area;</li> <li>Close to or above species-specific clearing thresholds (if available); or</li> <li>Impacts to areas supporting or close to supporting an ecologically significant proportion of a population; or</li> <li>Impacts to migratory species important habitat are of a moderate or high magnitude or are longer-term; or</li> </ul>				

Consequence	Descriptor					
level	Threatened species and communities	Migratory species				
	<ul> <li>Impacts to threatened species, ecological communities and associated habitats are of a moderate or high magnitude or are longer-term; or</li> <li>Increased threatening processes to threatened species and ecological communities require more intensive, longer term management or intervening measures to mitigate impacts; or</li> <li>Receiving environment is more sensitive to impacts or the consequence of the impact is uncertain; or</li> <li>In a regional context, reduction in available habitat is notable; or</li> <li>Species specific referral guidance (if available) indicates a moderate or high risk.</li> </ul>	<ul> <li>Increased threatening processes to migratory species require more intensive, longer term management or intervening measures to mitigate impacts; or</li> <li>Receiving environment is more sensitive to impacts or the consequence of the impact is uncertain; or</li> <li>In a regional context, reduction in available habitat is notable.</li> </ul>				

# 2. Likelihood criteria

Likelihood level	Descriptor
Highly unlikely	<ul> <li>May only occur in exceptional circumstances</li> <li>No previous incidence of occurring</li> </ul>
Unlikely	<ul> <li>Very low chance of occurring</li> <li>One rare previous incidence of occurring</li> </ul>
Possible	<ul> <li>Might occur in some circumstances</li> <li>Few previous incidences of occurring</li> </ul>

# 3. Risk assessment matrix and outcome

Likelihood	Severity				
Likeiiiiood	1	2	3		
Highly unlikely	Low risk – no further assessment required (green)	Low risk – no further assessment required (green)	Low risk – no further assessment required (green)		

Likelihood	Severity				
Likeiiiiood	1	2	3		
Unlikely	Low risk – no further assessment required (green)	Low risk – no further assessment required (green)	Low risk – no further assessment required (green)		
Possible	Low risk – no further assessment required (green)	Low risk – no further assessment required (green)	Potential risk – further assessment required (amber)		

# Appendix F

# Significant Impact Assessment

# Appendix F Significant Impact Assessment

The EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance (DotE, 2013) provides the framework for the assessment of potential impacts upon MNES as well as a process for determining the level of significance of impacts.

In accordance with the guideline, impacts on MNES are to be assessed utilising the broadest scope of the Project, with consideration to both direct and indirect impacts and proposed measures that may avoid and reduce impacts. Significance is tested through a set criterion stipulated in the guideline, which is tailored to each MNES and for some values, the conservation status of the MNES.

The significant impact criteria utilised in the assessment is outlined in Table 25. Results of the initial risk assessment were utilised to inform the significant impact assessment. Other Commonwealth guidelines used to support the assessment of MNES impacts include:

- EPBC Act Draft Referral guidelines for the nationally listed Brigalow Belt reptiles (Department of Sustainability Environment Water Population and Communities, 2011a)
- Referral guidelines for the 14 birds listed as migratory species under the EPBC Act (Department of the Environment, 2015b)
- EPBC Act Policy Statement 3.21: Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment and Energy, 2017)
- EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (Department of the Environment, 2014c)
- EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus* (Department of the Environment, 2016)

Additional Commonwealth resources such as threat abatement plans and approved conservation advice statements have been referred to in the impact assessments. These include:

- Threat abatement plan for predation by feral cats (The Commonwealth of Australia, 2015)
- Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (Department of Sustainability Environment Water Population and Communities, 2011b)
- Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) (Department of the Environment and Energy, 2015)
- Threat abatement plan for disease in natural ecosystems caused by *Phytophthora Cinnamomi* (Department of the Environment Water Heritage and the Arts, 2009)
- Threat abatement plan for predation by the European red fox (Department of the Environment Water Heritage and the Arts, 2008c)
- Conservation Advice *Geophaps scripta scripta* (squatter pigeon (southern)) (Threatened Species Scientific Committee, 2015d).
- Conservation Advice Hirundapus caudacutus (white-throated needletail) (Threatened Species Scientific Committee, 2019)
- Conservation Advice Grantiella picta (painted honeyeater) (Threatened Species Scientific Committee, 2015a)
- Approved Conservation Advice for Rostratula australis (Australian painted snipe) (Department of Sustainability, Environment, Water, 2013)
- Conservation Advice Petauroides volans (Greater glider) (Threatened Species Scientific Committee, 2016a)
- Approved Conservation Advice for *Phascolarctos cinereus* (combined populations in Queensland, New South Wales and the Australian Capital Territory) (Threatened Species Scientific Committee, 2012)

- Approved Conservation Advice for *Denisonia maculata* (Ornamental Snake) (Threatened Species Scientific Committee, 2014a)
- Approved Conservation Advice for *Delma torquata* (Adorned delma) (Department of the Environment Water Heritage and the Arts, 2008a)
- Approved Conservation Advice for *Furina dunmalli* (Dunmall's Snake) (Department of the Environment, 2014b)
- Approved Conservation Advice for Egernia rugosa (Yakka Skink) (Threatened Species Scientific Committee, 2008)
- Conservation Advice for *Nyctophilus corbeni* (south-eastern long-eared bat) (Threatened Species Scientific Committee, 2015b)
- Conservation Advice for Rhinolophus robertsi (greater large-eared horseshoe bat) (Threatened Species Scientific Committee, 2016b).

Table 25 Significant impact criteria and key definitions

MNES	Criteria	Key definitions
Critically endangered and endangered	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:	'Habitat critical to the survival of a species' refers to areas that are necessary:
species and ecological communities	<ul> <li>Lead to a long-term decrease in the size of a population;</li> <li>Reduce the area of occupancy of the species;</li> <li>Fragment an existing population into two or more populations;</li> <li>Adversely affect habitat critical to the survival of a species;</li> <li>Disrupt the breeding cycle of a population;</li> <li>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;</li> <li>Result in invasive species that are harmful to a Critically Endangered or Endangered species becoming established in the Endangered or Critically Endangered species' habitat;</li> <li>Introduce disease that may cause the species to decline; or</li> <li>Interfere with the recovery of the species.</li> </ul>	<ul> <li>For activities such as foraging, breeding, roosting, or dispersal;</li> <li>For the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators);</li> <li>To maintain genetic diversity and long-term evolutionary development, or</li> <li>For the reintroduction of populations or recovery of the species.</li> </ul>
Vulnerable species and ecological communities	<ul> <li>An action is likely to have a significant impact on a Vulnerable species if there is a real chance or possibility that it will:</li> <li>Lead to a long-term decrease in the size of an important population of a species;</li> <li>Reduce the area of occupancy of an important population;</li> <li>Fragment an existing important population into two or more populations;</li> <li>Adversely affect habitat critical to the survival of a species;</li> <li>Disrupt the breeding cycle of an important population;</li> <li>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;</li> <li>Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat;</li> <li>Introduce disease that may cause the species to decline; or</li> </ul>	<ul> <li>'Habitat critical to the survival of a species' as defined above.</li> <li>An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:</li> <li>Key source populations either for breeding or dispersal;</li> <li>Populations that are necessary for maintaining genetic diversity, and/or</li> <li>Populations that are near the limit of the species range.</li> </ul>

MNES	Criteria	Key definitions
	Interfere substantially with the recovery of the species.	
Migratory species	<ul> <li>An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:</li> <li>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;</li> <li>Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or</li> <li>Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.</li> </ul>	<ul> <li>An area of 'important habitat' for a migratory species is:</li> <li>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</li> <li>Habitat that is of critical importance to the species at particular life-cycle stages, and/or</li> <li>Habitat utilised by a migratory species which is at the limit of the species range, and/or</li> <li>Habitat within an area where the species is declining.</li> <li>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).</li> </ul>

# Listed threatened ecological communities

#### Brigalow (Acacia harpophylla dominant and co-dominant)

#### Description and status under the EPBC Act

The Brigalow TEC is listed as Endangered under the EPBC Act.

This TEC is characterised by *Acacia harpophylla* (brigalow) as one of the dominant species in the tree layer. The species may also be co-dominant (in some circumstances with other Myrtaceous species, most commonly *Casuarina cristata* (belah)). The community ranges in composition and structure however is typically represented by a combination of a number of species which are associated with acidic and salty clay soils (Threatened Species Scientific Committee & Department of the Environment, 2013). In Queensland, the Brigalow TEC is defined using the RE framework, where a number of REs are considered analogous with the TEC, provided that other key diagnostic criteria and condition thresholds are met.

#### Distribution

The Brigalow TEC occurs in semi-arid eastern New South Wales and Queensland, predominantly west of the Great Dividing Range (Threatened Species Scientific Committee & Department of the Environment, 2013). The TEC reaches as far north as Townsville in Queensland and as far south as Narrabri in New South Wales. In Queensland it is found in a number of bioregions including:

- 1. Brigalow Belt North
- 2. Brigalow Belt South
- Mulga Lands
- 4. Darling Riverine Plains
- 5. Southeast Queensland.

#### **Threats**

Key threats to the Brigalow TEC have been identified as those which may lead to further reduction in extent or cause a decline in condition. These are listed and discussed below in order of significance:

#### 1. Clearing

Listing of this community was a result of extensive clearing. The community has been modified at a landscape scale with clearing resulting in significant fragmentation and reduction in patch size. Clearing for resource extraction and illegal logging are an ongoing threat to the community.

#### 2. Fire

Due to the species composition of intact Brigalow TEC, fire has not historically threatened the community. However, the introduction of invasive pasture species such as *Chloris gayana\**, *Cenchrus ciliaris\** and *Megathyrsus maximus\**, can result in significant increases in biomass and fuel load. Further, fragmentation can lead to large edge to area ratios which in combination with higher fuel loads increases the risk of fire to the community (Threatened Species Scientific Committee & Department of the Environment, 2013).

#### 3. Weeds

The infestation of introduced weeds can alter the structure of the community and in turn the habitat for fauna species which it supports. As discussed above invasive pasture species also contribute to greater fire risk. Weed invasion is an ongoing threat to the Brigalow TEC (Threatened Species Scientific Committee & Department of the Environment, 2013).

#### 4. Feral animals

Feral animals are considered threats to the ecological community, many of which are listed as key threatening processes (KTP) under the EPBC Act. Pigs (*Sus scrofa\**) degrade habitat by disturbing soil and destroying young and small plants. Cane toads (*Bufo marinus\**), outcompete and feed on native frog species and cause death through toxic lethal ingestion to mammalian carnivores, snakes, birds and

goannas. Foxes (*Vulpes vulpes\**) and feral cats (*Felis catus\**) can have devastating impacts to the community through predation on native fauna and noisy miners (*Manorina melanocephala\**) aggressively exclude other native species, primarily honeyeaters (Department of the Environment, 2013a).

#### 5. Inappropriate grazing

Cattle grazing is a dominant land use in much of the distribution of the Brigalow TEC. Cattle and other large bodied herbivores can impact the ground layer through disturbing leaf litter, interfering with recruitment, altering the composition of the ground and shrub layer and compacting the soil profile (Department of the Environment, 2013a).

#### 6. Climate change

Acacia harpophylla and the flora species which typically dominate this community are generally well equipped to cope with climate change due to their ability to tolerate broad environmental stressors. However, adaptability may be compromised with the increased rate of change predicted from future climate change. The fauna which rely on this community are susceptible to impacts from hotter and drier conditions (Department of the Environment, 2013a). This will be particularly problematic where resources become scarce in small habitat patches and fragmentation eliminates their ability to disperse to locate required resources such as refuge, foraging grounds and water.

#### Survey timing, effort and coverage

Two field surveys were completed across the Project Area in 2020. The first survey was conducted at select areas on Lot and plan 2TR13 and Lot and plan 3TR12 from 19 to 26 June 2020 (five days). The second survey was conducted over six days between 14 December and 21 December 2020 across Lot and plan 2TR13 and Lot and plan 1TR50.

No guidelines to specify approach or seasonal timing for surveying the Brigalow ecological community are available. However, validating the extent, classification and condition of vegetation communities, including those dominated or co-dominated by Brigalow, or analogous to listed Brigalow TEC REs was undertaken in accordance with the Methodology for Surveying and Mapping Regional Ecosystem and Vegetation Communities in Queensland (Neldner, et al., 2019). Areas dominated or co-dominated by Brigalow TEC were further assessed against the key diagnostic and condition threshold criteria as described in the Commonwealth Approved Conservation Advice (Threatened Species Scientific Committee & Department of the Environment, 2013).

Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis.

#### Occurrence and potential habitat

The Brigalow TEC was recorded within the Survey Area during the field surveys and was found to be analogous to REs 11.3.1, 11.9.5 and 11.9.5ain either HVR and remnant condition (a total area of 38.77 ha). A further 214.88 ha of potential Brigalow TEC varying from remnant to HVR was also mapped within the wider Project Area via aerial imagery and LiDAR analysis using the application of community specific modelling rules (Appendix D). This captures areas analogous to RE 11.3.1 11.9.5 and 11.9.5a along drainage lines and adjacent lower hill slopes (Table 26).

Identified areas of Brigalow TEC or modelled Brigalow TEC within the Project Area generally comprise either narrow linear patches with overall connectivity or scattered disconnected patches. The only large and contiguous patches of Brigalow TEC identified within the Project Area are located in the Public Reserve surrounding the Arcadia Valley State School. Very narrow but moderately connected patches of Brigalow TEC are also mapped within the southern Project Area adjacent to the watercourses that run west to east.

Given the broad nature of the modelling rules and the inability to evaluate condition thresholds, it is highly likely that the extent of modelled Brigalow TEC is over-estimated within the Project Area. During the field survey, most Brigalow communities able to be surveyed were found to be too degraded to meet the required condition thresholds for TEC status (see Section 6.6 for further information). Given the similar land use and level of disturbance across the properties, it is likely that this will be the case for most areas of modelled Brigalow TEC and once field verified, will not meet TEC status.

Table 26 Brigalow TEC within the Project Area

Vegetation community	RE	Condition	Modelling rule	Project Area Total (ha)
Brigalow open forest on alluvial plains	11.3.1	Remnant	Ground-truthed to be Brigalow TEC; OR	143.28
Brigalow low open forest on alluvial plains	11.3.1	HVR	Remnant and HVR vegetation communities 0.5 ha in size or	31.73
Brigalow open forest on sedimentary rock	11.9.5	Remnant	greater, associated with any of the following Brigalow Belt bioregion REs: 11.3.1, 11.4.3, 11.4.7, 11.4.8,	38.33
Brigalow low open forest on sedimentary rock	11.9.5	HVR	11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.9.5a, 11.9.6, 11.11.14, 11.12.21.	32.52
Brigalow low open forest with SEVT understorey	11.9.5a	Remnant		8.07

#### Habitat critical to the survival of the ecological community

Areas considered critical to the survival of the Brigalow TEC includes all patches that meet the key diagnostic characteristics and condition thresholds for the ecological community; as well as the buffer zones (areas directly adjacent to the community), particularly where these include native vegetation (Department of the Environment, 2013a). Within the Project Area this equates to 253.65 ha of habitat, inclusive of 214.88 ha assessed via aerial imagery and LiDAR analysis.

#### **Potential Project impacts**

A maximum total of 2.0 ha of Brigalow TEC may be cleared as part of the Project, which may also result in further fragmentation of the community within the Project Area. Other Project related potential indirect impacts relevant to the Brigalow TEC includes:

- Further weed and pest incursion
- Increased edge effects
- Elevated dust.

#### Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following community specific mitigation measures are recommended:

- Clearing works will not intersect or dissect a patch of Brigalow TEC in a way that reduces the patch size below 0.5 ha
- Rehabilitation works will utilise appropriate native species to reduce the potential proliferation of harmful species within the patch.

# Significance assessment

An assessment of the significance of impacts to this TEC under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided in Table 27. The assessment identified that it is unlikely that the Project will have a significant impact on Brigalow TEC.

Table 27 Significant impact assessment – Brigalow TEC

EPBC Act criteria – is there a real chance or possibility that the Project will:	Assessment of significance	
Reduce the extent of an ecological community?	No.	

EPBC Act criteria – is there a real chance or possibility that the Project will:	Assessment of significance
	Only 2.0 ha of Brigalow TEC may be cleared as part of the Project, which equates to less than 1% of Brigalow TEC identified within the Project Area. Whilst the extent of Brigalow vegetation across the Arcadia Valley has been substantially reduced by historical land practices, this amount of clearing will not reduce the extent of the ecological community as remaining patches of the community will be retained within the Project Area. Avoidance, mitigation and management measures will also be undertaken to limit the extent of clearing of Brigalow TEC. This includes preclearance surveys to accurately locate the presence and extent of Brigalow TEC and further micro-siting of infrastructure to avoid areas, where possible.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?	No. Within the Project Area, Brigalow TEC occurs as either narrow linear patches that are generally connected or scattered disconnected patches. Potential exists for the Project to fragment or increase fragmentation of Brigalow TEC within the Project Area, particularly with the development of access tracks and gathering networks. However, this potential fragmentation is not considered to be extensive with clearing widths able to be minimised as far as practicable in sensitive environments. Given the narrow or disconnected nature of existing Brigalow TEC, the value of habitat and corridor functions are already compromised, therefore the effects of this level of fragmentation will be less pronounced. Brigalow also has a natural growth form that assists in reducing the impacts of fragmentation such as edge effects and the Project will not compromise this in adjacent areas that will be retained.  Avoidance, mitigation and management measures will limit the extent of clearing and fragmentation of Brigalow TEC. This includes pre-clearance surveys to accurately locate the presence and extent of Brigalow TEC and further micro-siting of infrastructure to avoid areas, where possible or at least ensure that fragmentation does not result in a patch of Brigalow TEC dropping below the area threshold of 0.5 ha. Existing access tracks will also be utilised where possible as
	well as natural or existing breaks in the community as a result of current disturbances.  Project works within the public reserve that contains that largest contiguous patch of modelled Brigalow TEC of highest value will be limited to potential minor clearing on the edges of the existing patch; therefore, no fragmentation will occur.
Adversely affect habitat critical to the survival of an ecological community?	No.  All habitat supporting Brigalow TEC within the Project Area is considered habitat critical to the survival of the community. The Project will potentially impact on 2.0 ha of modelled habitat, which equates to less than 1% of habitat critical to the survival of the community identified within the Project Area. This amount of clearing is not considered to adversely affect habitat critical to the survival of the community given the amount that will be retained within the Project Area.
	Avoidance, mitigation and management measures will limit the extent of clearing of habitat critical to the survival of the community. This includes pre-clearance surveys to accurately locate the presence and extent of Brigalow TEC and further micrositing of infrastructure to avoid areas, where possible. Other potential impacts such as fragmentation, weed incursion and elevated dust that could also adversely impact on habitat will be effectively management through the implementation of management measure during the construction phase.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or	<b>No.</b> Brigalow vegetation communities are not known to be groundwater dependent. The concentration of the species root mass in the upper soil profile allows the species to

EPBC Act criteria – is

there a real chance or possibility that the Project will:	Assessment of significance		
soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?	draw water from shallow, horizontal root systems, rather than from accessing groundwater with deep root systems. The surface water flows across the Project Area that the community will utilise will not be impacted upon by the Project. The Project will not alter the ephemeral flows along the drainage lines where Brigalow TEC occurs. It will also not alter the contours (i.e. via bunding or creating of drainage trenches) across the slopes where Brigalow TEC also occurs.  Other ways in which the Project could modify or destroy abiotic factors of the Brigalow TEC include potential erosion and sedimentation, which could impact on the soil and nutrients, as well as dust deposition, which could impact on the plants to photosynthesise. Mitigation and management measures will be		
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?	No.  The Project has the potential to change species composition of Brigalow TEC within the Project Area through weed incursion and then secondarily through altered fire regimes. Specifically, the proliferation of buffel grass has contributed to the endangered status of the Brigalow TEC as this species invades the understorey, outcompetes and suppresses brigalow species recruitment, and increases fire frequency and intensity in brigalow communities.  Effective mitigation measures will be implemented for the Project for weed control. Rehabilitation works will also utilise appropriate species to reduce the potential proliferation of harmful species. Brigalow has a natural growth form that assists in reducing the impacts of edge effects and the Project will not compromise this in adjacent areas that will be retained. Therefore, it is unlikely that the Project will cause a substantial change in the species occurrence of the TEC.		
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established; or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community?	No.  The Project has the potential to reduce the quality of Brigalow TEC within the Project Area through hydrocarbon and other chemical spills, weed incursion and then secondarily through altered fire regimes. Specifically, the proliferation of buffel grass has contributed to the endangered status of the Brigalow TEC as this species invades the understorey, outcompetes and suppresses brigalow species recruitment, and increases fire frequency and intensity in brigalow communities.  Effective mitigation and management measures will be implemented for the Project for weed control, hydrocarbon and chemical use and storage. Rehabilitation works will also utilise appropriate species to reduce the potential proliferation of harmful species. Brigalow has a natural growth form that assists in reducing the impacts of edge effects and the Project will not compromise this in adjacent areas that will be retained. Therefore, it is unlikely that the Project substantially reduce the quality and integrity of the TEC.		
Interfere with the recovery of an ecological community?	<ul> <li>No.</li> <li>The Project is not considered to interfere with the recovery of Brigalow TEC due to:</li> <li>Minimal extent of clearing resulting in a reduction of less than 1% of Brigalow TEC within the Project Area</li> <li>A total of 251.65 ha of Brigalow TEC that will remain within the Project Area, including habitat critical to the survival of the community</li> </ul>		

EPBC Act criteria – is there a real chance or possibility that the Project will:	Assessment of significance
	<ul> <li>Retention of biotic and abiotic requirements for the TEC across the Project Area</li> <li>Implementation of effective mitigation and management measures, including:         <ul> <li>Pre-clearance surveys to allow for micro-siting and further avoidance and reduced fragmentation</li> <li>Weed control and management</li> <li>Erosion and sediment control</li> <li>Dust suppression</li> <li>Hydrocarbon and chemical storage and management</li> <li>Rehabilitation of all disturbance with suitable species mix.</li> </ul> </li> </ul>

#### Listed threatened flora

#### **Endangered flora species**

#### Xerothamnella herbacea

#### Description and status under the EPBC Act

Xerothamnella herbacea is listed as Endangered under the EPBC Act.

The species is a small sprawling perennial herb to 30 cm with an ability to root at the nodes where they contact the soil. The leaves form in opposite pairs, and are soft, linear to narrowly ovate, dark green above and paler beneath. The flowers are small, two-lipped, whitish pink to mauve to 6.5 mm long, and occur in the upper leaf axils. The fruits are club-shaped to 9 mm long and sparsely glandular hairy.

#### Distribution

X. herbacea is known to occur from the Banana-Theodore area, north of Injune, Durong-Chinchilla area and north of Yelarbon (Department of the Environment Water and the Arts, 2008).

X. herbacea has a localised distribution in the broader landscape, which has been further reduced by extensive clearing in the Brigalow Belt, further fragmenting suitable habitat. The 12 known populations are mostly located within the largest tracts of remaining suitable habitat in the Banana-Theodore area. The majority of the 12 populations were identified during a field survey in 2016, as part of a study by Shapcott et al. (2017). Of these, most populations contain less than 100 individuals and occupy less than 1 ha, and at the time of survey, four populations contained less than 50 individuals. However, populations containing greater than 1,000 plants have also been recorded. Geographic extent of the species does not appear to define population size, as both the largest and smallest known populations occur in the northern extent of the species' distribution, around the Banana-Theodore area. Shapcott et al. (2017) modelled 111,842 ha of high quality habitat for X. herbacea between Goondiwindi and Banana in the north. A further 2,098,150 ha of medium quality habitat was modelled. Shapcott et al. (2017) estimated the total known population size for the species as 6,659 individuals occupying a total of 13 ha across its distribution.

#### Habitat

X. herbacea is known to occur in communities associated with Brigalow including RE 11.9.5, 11.9.2, 11.10.1, 11.9.1, 11.3.17 and 11.3.1. However, a study by Shapcott *et al.* (2017) found that the majority of high quality habitat (65%) for the species coincides with vegetation types other than Brigalow communities.

The species is effectively ephemeral in the landscape and presence or absence of the species and variations in population size may in part reflect local moisture conditions. Notwithstanding, Shapcott *et al.* (2017) created a species distribution model for *X. herbacea* and identified temperature and substrate-related variables as the most powerful predictors of habitat, whereas precipitation and topographic variables contributed less to the model's performance.

Soil moisture is suggested to be a limiting factor for the species; despite rainfall being fairly sporadic in the region (Shapcott et al., 2017). The species is known to occur in very specific micro-topographic locations, particularly on stream terraces within 20m of the stream channel, where moisture is retained. Boobook Ecological Consulting (2017) confirmed the importance of drainage lines in mature and regrowth Brigalow communities as habitat for *X. herbacea*. The canopy in Brigalow communities is also thought to play a role in providing favourable soil conditions including retaining soil moisture, allowing herbaceous species to persist in favour of pasture species. Therefore, it is expected that tree cover may be an important microhabitat feature for *X. herbacea* to create the shaded situations to retain soil moisture. The species is often found in leaf litter and in association with gilgai (Department of the Environment Water and the Arts, 2008).

#### **Ecology**

Flowering has been recorded in September and October (Boobook, 2012), whereas Shapcott *et al.* (2017) observed high levels of reproductive activity in May to July. Pollinators for *X. herbacea* are unknown but expected to be insects. The species produces tiny seed heads containing 10-16 seeds. Species of Acanthaceae are known for their limited seed dispersal methods, however typically have ballistic seed release facilitating local seed dispersal. Some members of the family have distinct hairs

on seeds which are sticky when wet, providing for long distance dispersal via animals. It is unknown if *X. herbacea* utilises similar mechanisms.

Shapcott *et al.* (2017) identified that reproductive timing among populations of *X. herbacea* was synchronous at a landscape-scale, suggesting that flowering of the species occurs in response to landscape-wide environmental conditions such as temperature, rather than localised environmental events such as rainfall. This was supported by the species distribution modelling undertaken during the study which identified that suitable habitat for *X. herbacea* was largely defined by temperature and substrate-related variables, and to a lesser-extent precipitation and topographic variables.

Patch size does not appear to be a limiting factor in population viability, as population patch sizes as small as 0.018 ha were recorded in a population at Banana during a field survey in 2016 by (Shapcott et al., 2017). Shapcott *et al.* (2017) found that *X. herbacea* has moderate to low genetic diversity, and that population size did not correlate with genetic diversity. This was consistent with studies undertaken on four species of the genus Graptophyllum (member of Acanthaceae) (Shapcott, 2007). High levels of inbreeding in the species suggests that *X. herbacea* is at least partially self-compatible, similar to *Graptophyllum* spp. (Shapcott, 2007). Vegetative reproduction was evidenced in the field and confirmed by genetic analysis of individuals of the species (Shapcott et al., 2017). It was found that the majority of plants in the populations had unique genotypes, which suggested a relatively small contribution of clonally spread individuals, and on a micro-scale. Additionally, populations were found to be genetically distinct and geographic proximity did not correlate with genetic similarity. This suggests that seed dispersal may be limited between populations. The ability to reproduce vegetatively may also slow the rate of genetic drift between populations.

Large amounts of suitable habitat for *X. herbacea* are no longer present across much of its range due to changed land use. Low genetic diversity and genetic differentiation between populations identified in (Shapcott et al., 2017) is consistent with a more recently fragmented species. It is thought that the species may use vegetative reproduction in fragmented environments to maintain populations during long periods of reduced interbreeding, in environmental conditions where seed dispersal is limited.

#### **Threats**

The main threat to *X. herbacea* identified by (Department of the Environment Water and the Arts, 2008) is competition from invasive shade-tolerant species which may persist in the higher canopy cover environments that the species prefers. *Megathyrsus maximus* and to a lesser extent *Cenchrus ciliaris* are species which may colonise these habitats and outcompete *X. herbacea*. Department of the Environment Water Heritage and the Arts (2008) also identified the main potential threats to the species as road widening and maintenance activities, surface erosion and grazing and trampling by cattle and native macropods.

Shapcott *et al.* (2017) identified that climate change leading to reduced rainfall in the region may impact the viability of *X. herbacea* in the long-term.

#### Survey effort, timing and coverage

Two field surveys were conducted across portions of the Project area from 19-26 June 2020 and 14-21 December 2020. No guidelines to specify approach or seasonal timing for surveying *X. herbacea* are available. However, the field surveys included targeted surveys in potential habitat, including Brigalow-dominated vegetation and gilgai communities. Searches *X. herbacea* were also undertaken at the 58 tertiary transects and 61 quaternary sites assessed in accordance with the Methodology for Surveying and Mapping Regional Ecosystem and Vegetation Communities in Queensland (Neldner, et al., 2019).

Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis.

#### Occurrence and potential habitat

*Xerothamnella herbacea* was not recorded within the Survey Area during the field surveys. However the presence of suitable habitat for *X. herbacea* was confirmed within the Survey Area including Brigalow-dominated vegetation and gilgai communities. Potential habitat that was field validated in the Survey Area was generally found to be in average to poor condition due to exotic grass incursion, ongoing cattle grazing impacts, historical thinning and habitat fragmentation. The notable exception to this is the

potential habitat located within the Public Reserve, which is not accessible by cattle and has had limited anthropogenic disturbance relative to the surrounding area.

A total of 250.45 ha of potential *X. herbacea* habitat has been mapped within the Project Area via aerial imagery and LiDAR analysis based on the application of community specific modelling rules (Appendix D). This includes Remnant and HVR brigalow dominated communities and gilgai on heavy clay soils (Table 28).

Given the broad nature of the modelling rules and the inability to evaluate presence of microhabitat features, it is likely that the extent of modelled *X. herbacea* habitat is over-estimated within the Project Area. As the land use practices and level of disturbance across the properties is likely to be similar, it is likely that the true extent of potential habitat is lower and when field verified, some areas (particularly those that are narrow and isolated) of modelled *X. herbacea* habitat will be deemed unlikely to support the species.

Table 28	Xerothamnella he	<i>rbacea</i> habitat with	in the Project Area
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Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Remnant and HVR brigalow dominated communities and gilgai on heavy clay soils	11.3.1, 11.9.5 & 11.9.5a	Remnant and HVR	Potential habitat	Field validated as potential X. herbacea habitat; OR  Remnant and HVR brigalow dominated communities and gilgai on heavy clay soils.	250.45 ha

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

There are no species-specific guidelines for determining habitat critical to the survival of *X. herbacea*. Therefore, the generic *Significant Impact Guidelines Policy Statement 1.1* definition of habitat critical to the survival of a species has been applied.

Based on information currently known about the habitat preferences for this species, the following micro-habitat features could be considered habitat critical to the survival of the species:

- Presence of canopy cover typical of remnant vegetation, promoting shade in the understorey to retain soil moisture.
- Associated with small ephemeral creek and drainage line terraces and flats, where soil moisture is retained.
- Limited presence of weed species in the ground cover, particularly pasture species which are high
  in biomass.
- Presence of leaf litter.
- Association with gilgai.

Potential habitat that was field validated to contain the above habitat preferences is considered habitat critical to the survival. For modelled habitat, habitat patches that are relatively large (> 1 ha) or moderately connected patches are considered to meet the definition of habitat critical to the survival of the species. Of the total area of potential habitat, approximately 226.78 ha is considered habitat critical to the survival (189.45 ha of which is modelled habitat).

#### **Potential Project impacts**

A total of 2.0 ha of potential habitat may be cleared as part of the Project. Other Project related potential indirect impacts relevant to the species includes:

further weed and pest incursion

- increased edge effects
- elevated dust.

### Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following specific mitigation measures are recommended:

- The Project team should identify and map clear no-go zones to avoid unauthorised disturbance of potential habitat for *X. herbacea*.
- Rehabilitation works will utilise appropriate native species to reduce the potential proliferation of harmful species.

#### Significance assessment

An assessment of the significance of impacts to this species under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided is provided in Table 29. The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 29 Significant impact assessment - X. herbacea

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EPBC Act Criteria – is there a real possibility that the Project will:	Assessment of Significance			
Lead to a long-term decrease in the size of a population	No.  X. herbacea was not recorded within the Study Area during the field surveys.  A total of 250.45 ha of potential X. herbacea habitat has been mapped within the Project Area via aerial imagery and LiDAR analysis based on the application of specific modelling rules.			
	A maximum of 2.0 ha of the 250.45 ha extent of suitable habitat (i.e. 0.8%) is proposed to be impacted. Siting of project infrastructure will maximise use of existing gaps between areas of potential habitat; as such, direct impacts will be focused to habitat patch edges. Potential habitat that was field validated in the Survey Area was generally found to be in average condition due to exotic grass incursion and ongoing cattle grazing impacts. Direct impacts may occur to areas of habitat critical to the species, however clearing will be limited wherever possible and potential increases in weed incursion will be actively managed. The Public Reserve will be largely untouched, with the only direct impacts at this location will be limited to the outer edges which are already disturbed. The remaining extent of habitat (248.45 ha) is considered large enough to continue to sustain a population.			
	X. herbacea exhibits low to moderate genetic diversity due to its occurrence in an already highly fragmented landscape. The species utilises vegetative reproduction to maintain populations in the medium-term when environmental conditions may be unfavourable. It is also likely that seed dispersal for the species is highly localised. The Project is unlikely to reduce the population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale.			
	Therefore, based on the extent and location of clearing (i.e. potential habitat edges only) associated with the Project, it is unlikely that the project will lead to a long-term decrease in the in the size of the population.			
Reduce the area of occupancy of the species	No.  The Project Area is located within the eastern extent of the species' distribution, and partially within the 'likely to occur' extent of the species distribution due to relatively recent records in the wider area. The current area			

EPBC Act Criteria – is there a real possibility that the Project will:	Assessment of Significance
	of occupancy is not defined in the Conservation Advice for the species. However, Shapcott <i>et al.</i> (2017) estimated the total population size in areas of known habitat across its distribution (13 ha) for the species as 6,659 individuals. Additionally, modelling identified 111,842 ha of high quality habitat for <i>X. herbacea</i> as occurring between Goondiwindi and Banana in the north. A further 2,098,150 ha of medium quality habitat was modelled. Shapcott <i>et al.</i> (2017) identified that, based on the results of the study, there is potential for new populations to be identified, particularly in the north and west. Therefore, the distribution of <i>X. herbacea</i> may be greater than currently known.
	The proposed clearing will not remove an entire population, thereby reducing the area of occupancy. Less than 1 % of potential habitat within the Project Area will be removed (maximum of 2 ha), which is unlikely to compromise the viability of a population especially given direct impacts will largely occur only to potential habitat edges. In the larger context of the species potential area of occupancy based on modelled high quality habitat (111,842 ha), Project impacts of 2.0 ha are considered very low.
	Based on the Project not resulting in the removal of a known population and the negligible extent of impacts in the context of potential habitat remaining in the landscape, it is unlikely that the Project will reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	No.  The Project involves the proposed clearing of 2.0 ha of potential habitat. A large amount of suitable habitat for the species will be retained. Siting of project infrastructure will maximise use of existing gaps between areas of potential habitat; as such, direct impacts will be focused to habitat patch edges. The extent, location and configuration of clearing is unlikely to reduce a population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale. It will not create a barrier to seed dispersal or vegetative reproduction. Therefore, the Project will not fragment the population in two or more populations.
Adversely affect habitat critical to the survival of a species	No.  A total of 226.78 ha (189.45 ha of which is modelled habitat) of habitat critical to the survival of the species has been identified within the Project Area.
	Project infrastructure will be located to occur where it least impacts habitat critical to the survival of the species (i.e. habitat edges that are already of reduced quality due to edge effects, cattle grazing and exotic grass). Direct impacts may occur to habitat critical to the survival of the species; however clearing will only be completed as necessary and potential indirect impacts to these patches of habitat such as increased weed incursion will be actively managed during construction. The extent, location and configuration of clearing (generally straight lines or small areas for well pads) will enable the species to continue to exchange genetic material between individuals and reproduce at the local site scale.
	The species has demonstrated the ability to persist in an already fragmented landscape. Patch size does not appear to be a limiting factor in population viability, as population patch sizes as small as 0.018 ha were recorded in a population at Banana in (Shapcott et al., 2017).

EPBC Act Criteria – is there a real possibility that the Project will:	Assessment of Significance
	Based on the small extent of clearing, the low risk of indirect impacts including edge effects and the extent of habitat critical to the survival of the species that will remain, the Project is not considered to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a	No.
population	Shapcott <i>et al.</i> (2017) identified that reproductive timing among populations of <i>X. herbacea</i> was synchronous at a landscape-scale, suggesting that flowering of the species occurs in response to landscape-wide environmental conditions such as temperature. This has been reported to occur at various times throughout the year and generally between May and July, as well as September and October. When conditions are unfavourable, the species reproduces vegetatively on a micro-scale to ensure persistence of the species in the short to medium-term.
	Based on the broad timing of flowering and seeding as well as the species ability to reproduce vegetatively on a micro-scale, the likelihood of potential impacts on breeding arising due to the Project is low. The extent, location and configuration of clearing is unlikely to reduce a population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale. It will not create a barrier to seed dispersal or vegetative reproduction.
	Shapcott <i>et al.</i> (2017) observed that several of the 12 populations identified in 2017, persisted in a narrow band up to approximately 2 km. Additionally, patch size does not appear to be a limiting factor in population viability, as population patch sizes as small as 0.018 ha were recorded in a population at Banana in (Shapcott et al., 2017). <i>X. herbacea</i> persists in a highly fragmented landscape with small plant and pollinator populations. The extent of proposed clearing for the Project is unlikely to reduce the size of plant and pollinator populations to the extent that it disrupts the breeding cycle of a population.
Modify, destroy, remove, isolate	No.
or decrease the availability or quality of habitat to the extent that the species is likely to decline	The species has demonstrated the ability to persist in an already fragmented landscape. Shapcott <i>et al.</i> (2017) observed that several of the 12 populations identified in 2016, persisted in a narrow band up to approximately 2 km. Additionally, patch size does not appear to be a limiting factor in population viability, as population patch sizes as small as 0.018 ha were recorded in a population at Banana in (Shapcott et al., 2017). Development of the Project will reduce total available habitat within the Project Area by less than 1 %.
	Soil moisture has been identified as an important microhabitat for <i>X</i> . <i>herbacea</i> and the Project infrastructure is not expected to substantially alter surface water drainage. Given the extent, location and configuration of clearing the Project will not create a barrier to seed dispersal or vegetative reproduction.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No.  Project construction will cause an increased risk of invasive species becoming established in the species' habitat, however this will be effectively managed through the a Weed and Pest Management Plan, which will be developed prior to construction. Therefore, it is unlikely that the Project will result in invasive species that are harmful to <i>X. herbacea</i> becoming established in the species' habitat.

EPBC Act Criteria – is there a real possibility that the Project will:	Assessment of Significance
Introduce disease that may cause the species to decline, or	<b>No.</b> Disease has not been identified as a threat to <i>X. herbacea</i> . Nonetheless, the Project will adhere to relevant biosecurity and hygiene protocols to ensure disease is not introduced.
Interfere with the recovery of	No.
the species.	The Conservation Advice identifies a number of regional priority action to support the recovery of <i>X. herbacea</i> , including weed management.
	Patch size does not appear to be a limiting factor in population viability as very small population patch sizes have been studied Shapcott <i>et al.</i> (2017). The extent, location and configuration of clearing would enable the species to continue to exchange genetic material between individuals and reproduce at the local site scale. It will not create a barrier to seed dispersal or vegetative reproduction.
	Habitat modelling for the species has identified 111,842 ha of high quality habitat as occurring between Goondiwindi and Banana in the north. A further 2,098,150 ha of medium quality habitat has also been modelled. In the larger context of the species potential area of occupancy based on modelled high-quality habitat, Project impacts of 2.0 ha of potential habitat are considered very low.
	It is therefore considered unlikely the Project will interfere with the recovery of the species.

#### Vulnerable flora species

# Ooline (Cadellia pentastylis)

#### Description and status under the EPBC Act

Ooline is listed as Vulnerable under the EPBC Act.

Ooline is a tree growing to 10m (rarely to 25m) with dark, hard and scaly bark. Its leaves are usually 1-7 cm long, and 1.5-2 cm wide, on short hairy stalks (petioles), glossy above, dull and paler below. The apex is rounded or slightly indented (emarginate), and the veins are prominent on both surfaces when dry. Flowers are usually single and have five white petals, each 5-7 mm long. The fruits are brownish, with a wrinkled surface, slightly compressed and surrounded by five enlarged, spreading red and papery sepals (the outer lobes at the base of the flower) (Department of Environment and Science, 2020c)

#### Distribution

Ooline occurs on the western edge of the NSW north-west slopes, from Mt Black Jack near Gunnadah to west of Tenterfield, and extends into Queensland to Carnarvon Range and Callide Valley, south-west of Rockhampton. This species is conserved within the Tregole National Park (NP), Sundown NP, Carnarvon Gorge NP, Mt Kaputar NP, Gamilaroi Nature Reserve (NR), Gibraltar NR, Bunal Flora Reserve (FR), Mehi FR, Campbell State Forest (SF) and Deriah SF. Both Sundown NP and Carnarvon Gorge NP have more than 1000 individuals. Some existing stands are on private property. This species occurs within the Border River–Gwydir, Namoi (NSW), Burdekin, Burnett Mary and South West Queensland Natural Resource Management Regions.

#### Habitat

This species is found in a range of vegetation communities including dry rainforest, semi-evergreen vine thickets, brigalow-belah, poplar box and bendee communities. *Cadellia pentastylis* often occurs on the edge of sandstone or basalt escarpments and prefers moderately fertile soils favoured by agriculture (Department of Environment and Science, 2020c).

# **Ecology**

Ooline flowers sporadically. In NSW, flowering events occur in spring and summer and, in Queensland, flowering events occur in spring through to autumn. Fruits are borne in November to December. Seed dispersal is probably via passive fall or via birds. Vegetative (clonal) growth has been noted as being very common. Ooline has the capacity to resprout from rootstock and coppice vigorously from stumps, a feature that may be critical to the species survival in a fire prone environment.

#### **Threats**

As per the species' SPRAT profile, the main threats that have currently been identified for ooline include:

- fragmentation and vegetation clearing (including selective logging and broadacre cropping)
- logging of tree species, such as Callitris, within habitat may have affected the microclimate in the understorey of the forest
- inbreeding depression
- inappropriate fire regimes, particularly too frequent fire
- intensive grazing (where stocking is high, seedling recruitment is likely to be hampered due to grazing and soil compaction)
- insect attack and herbivory
- risk of local extinction due to small, scattered populations
- tunnel and sheet erosion
- low seed viability
- damage to roadside populations during roadworks.

# Survey effort, timing and coverage

Two field surveys were conducted across portions of the Project Area from 19-26 June 2020 and 14-21 December 2020. No guidelines to specify approach or seasonal timing for surveying ooline are available. However, the field surveys included targeted surveys in potential habitat including remnant, HVR and regrowth vegetation communities of semi-evergreen vine thicket (SEVT) and brigalow with softwood scrub understorey (i.e. RE11.9.5a). Searches for ooline were also undertaken at the 58 tertiary transects and 61 quaternary sites assessed in accordance with the Methodology for Surveying and Mapping Regional Ecosystem and Vegetation Communities in Queensland (Neldner, et al., 2019).

Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis, and the presence of ooline was conservatively assumed even in areas of regrowth.

#### Occurrence and potential habitat

Field surveys confirmed the presence of ooline in the northern Project Area (lot and plan 2TR13). Suitable habitat occurs within the Survey Area in the form of SEVT, brigalow-dominated open forests and ooline stands. The LiDAR assessment indicated that these areas also occur in the wider Project Area. Areas of brigalow and softwood scrub regrowth vegetation in the Project Area that have not been ground-truthed are conservatively considered potential habitat for this species.

A total of 772.42 ha of ooline habitat has been mapped within the Project Area, of which approximately 44.73 ha is field validated. An additional 727.69 ha of potential habitat has been modelled via aerial imagery and LiDAR analysis based on the application of community specific modelling rules (Appendix D). This includes remnant, HVR and regrowth vegetation communities of SEVT and brigalow with softwood scrub understorey (i.e. RE 11.9.5a). (Table 30).

Table 30	Ooling	habitat	within	tha	<b>Droject</b>	Araa
i abie su	Colline	napılal	within	ıne	Project	Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Vegetation communities of semi-evergreen vine thicket (SEVT) and brigalow with softwood scrub understorey (i.e. RE11.9.5a)	11.9.4 and 11.9.5	Remnant and HVR	Potential habitat	Field validated to contain ooline; <b>OR</b> Remnant, HVR, and regrowth semi-evergreen vine thicket (SEVT) and brigalow with softwood scrub understorey (i.e. RE11.9.5a.	772.42 ha

#### Important population

The SPRAT does not identify 'important populations' of ooline. Therefore, any population potentially occurring within the Project Area has been assessed against the generic definition in the *EPBC Act Significant Impact Guidelines 1.1.* 

The Project Area is considered likely to support an important population of the species given the population present may be necessary for maintaining genetic diversity. However, given the high level of ongoing disturbance in the low undulating plains of the Project Area, important populations are likely to be restricted to areas of habitat critical to the survival of the species (see section below).

## Habitat critical to the survival of the species

There is no species-specific guidelines for determining habitat critical to the survival ooline and at present no recovery plan exists. Therefore, the generic *EPBC Act Significant Impact Guidelines 1.1* definition of habitat critical to the survival of a species has been applied.

Suitable habitat occurs within the Project Area, including within vegetation communities of SEVT, brigalow with softwood scrub understorey and ooline stands. Almost all recorded occurrences of this species within lot and plan 2TR13 found individuals to be in average to poor health, with canopy die

back evident as a result of edge effects and potentially increased insect activity. However, where this species occurred in a larger more intact patch such as the western ridgeline, health was good. On this basis, potential habitat within the Project Area that is intact and contiguous is potentially necessary for life-cycle requirements, maintaining genetic diversity, the recovery of the species or for the long-term maintenance of the species; and hence it meets the definition of habitat critical to the survival of the species. Of the total potential habitat, a total of 466.28 ha is considered habitat critical to the survival of the species (Middle Hill and patches within the lower western ridgeline).

#### **Potential Project impacts**

A total of 5.0 ha of potential and or known online habitat may be cleared as part of the Project. Potential indirect impacts relevant to the species includes:

- further weed and pest incursion
- increased edge effects
- elevated dust.

# Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following specific mitigation measures are recommended:

- Ooline individuals and areas containing ooline will be identified prior to construction commencing; no-go zones will be mapped to avoid unauthorised disturbance of ooline.
- Rehabilitation works will utilise appropriate native species to reduce the potential proliferation of harmful species.

#### Significance assessment

An assessment of the significance of impacts to this species under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided is provided in Table 31. The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 31 Significant impact assessment - Ooline

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
Lead to a long-term decrease in the size of an important population of a species.	No.  A total of 727.42 ha of known and potential habitat has been mapped within the Project Area; however the true extent of potential habitat may be lower. An important population of ooline may occur within the Project Area, although restricted to areas of habitat that is critical to the survival of the species (the western ridgeline and Middle Hill). Direct impacts via vegetation clearing will occur to a maximum of 5.0 ha of habitat representing 0.65% of the potential habitat within the Project Area. However, as the western ridgeline and Middle Hill are strict no-go areas for development, no direct impacts to areas of habitat critical to the survival of the species and thus an important population are anticipated.  Confirmed occurrences of ooline in the lower plains of the Survey Area recorded the trees to be in average to poor condition due to their highly isolated nature. Siting of project infrastructure will maximise use of existing gaps between and within areas of habitat; as such, direct impacts will be focused to habitat patch edges or isolated individuals. This will also ensure habitat patches are able to maintain their microclimates.  Vegetation clearing will be limited wherever possible and potential increases in weed incursion will be actively managed.

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
	Given the reduction in available habitat (<1 %), proposed avoidance measures and the management of potential fragmentation impacts, it is unlikely that the Project will lead to a long-term decrease in the size of an important population of ooline.
Reduce the area of occupancy of an important population.	No. Ooline has a broad distribution across the north-west slopes of New South Wales (NSW) and in central and southern Queensland. In Queensland, ooline is known from a number of locations including Carnarvon Gorge National Park which contains over 1,000 individuals and occurs to the north west of the Project Area.
	Direct impacts to habitat (5.0 ha) represents 0.65% of the total available potential habitat within the Project Area (772.42 ha). No direct impacts are anticipated to occur to an important population as habitat critical to the survival of the species (western ridgeline and Middle Hill) will be avoided. The Project Area will be developed in stages and as such only a portion of the potential habitat may be impacted at one time. Indirect impacts will be minor and temporary. Siting of Project infrastructure will maximise the use of existing breaks between patches of potential habitat to minimise habitat fragmentation and ensure habitat patches can maintain microclimates.
	Given the Project Area does not occur at the limit of the species distribution and important populations will be avoided, it is considered unlikely that the Project will reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations.	No.  Important populations of ooline are restricted to the western ridgeline and Middle Hill were habitat critical to the survival occurs. No direct impacts will occur to these areas as they are a strict no-go zone for development.  Direct impacts to ooline habitat will occur in the low-lying undulating plains of the Project Area. Recorded individuals in this area were generally sparsely or very sparsely scattered and in many areas formed only a loose vegetation 'patch'. Due to this, further habitat fragmentation as a result of the Project is considered unlikely. Although vegetation clearing is required for the construction of the Project, once built only small areas of surface infrastructure will occur. Trenching works completed as part of construction will reuse excavated soil as much as possible to ensure potential seed banks are not removed. As such, it is unlikely the Project will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species.	No. There is no Recovery Plan for this species and as such habitat critical to the survival of ooline has not been defined. However, using the generic definition, habitat critical to the survival of the species has been identified. Within the Project Area, habitat critical to the survival of the species is restricted to Middle Hill and the western ridgeline were habitat patches are intact and form a contiguous mosaic of vegetation. As detailed above, no direct impacts will occur to areas of habitat critical to the survival of the species.
	Clearing works should maintain a sufficient vegetation buffer where possible around identified locations of ooline to ensure indirect impacts to individuals and adjacent patches are also limited. Therefore, the Project is unlikely to adversely affect habitat critical to the survival of a species.

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
Disrupt the breeding cycle of an important population.	No. Ooline flowers sporadically. In Queensland, flowering events occur in spring through to autumn. Seed dispersal is probably via passive fall or via birds. Vegetative (clonal) growth has been noted as being very common. Ooline has the capacity to resprout from rootstock and coppice vigorously from stumps. Regrowth ooline was recorded in the low undulating plains of lot and plan 2TR13.
	Based on the broad timing of flowering and seeding as well as the species ability to reproduce vegetatively, the likelihood of potential impacts on breeding arising due to the Project is low. The extent, location and configuration of clearing is unlikely to reduce a population's ability to continue to exchange genetic material between individuals and reproduce at the local site scale. It will not create a barrier to seed dispersal or vegetative reproduction.
	The extent of proposed clearing for the Project is unlikely to reduce the size of plant and pollinator populations to the extent that it disrupts the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No. The species has demonstrated the ability to persist in an already fragmented landscape and a total of 767.42 ha of potential habitat will remain intact following Project development. No direct impacts to an important population and areas of habitat critical to the survival will occur. Siting of infrastructure will maximise the use of existing gaps between potential habitat to minimise further fragmentation. Clearing works will also aim to maintain a sufficient vegetation buffer where possible around identified locations of ooline to ensure indirect impacts to individuals and adjacent patches are also limited.
	It is therefore considered unlikely that the Project will modify, destroy, remove, isolate or decrease the availability of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	No. The Project will cause an increased risk of invasive species becoming established in areas of potential habitat, however this will be actively managed via a Weed and Pest Management Plan that will be developed prior to construction. Therefore, it is unlikely that the Project will result in invasive species that are harmful to ooline becoming established in the species' habitat.
Introduce disease that may cause the species to decline.	No.  Disease has not been identified as a threat to ooline. Nonetheless, the Project will adhere to relevant biosecurity and hygiene protocols to ensure disease is not introduced.
Interfere with the recovery of the species.	No. The Conservation Advice identifies a number of regional priority action to support the recovery of ooline, including weed and fire management.
	With the implementation of the mitigation measures proposed, population scale impacts would be unaffected in the long-term and interference to species recovery as a result of the Project are therefore unlikely.

#### Listed threatened fauna

#### **Endangered Species**

#### Australian painted snipe (Rostratula australis)

#### Description and status under the EPBC Act

The Australian painted snipe is listed as Endangered under the EPBC Act.

The Australian painted snipe is a wading bird found predominantly across eastern Australia in wetland habitats. It is a stocky bird around 220-250 mm in length with a long pinkish bill. The species shows some sexual dimorphism with females more colourful than males with a chestnut-coloured head, white around the eye, a white crown stripe and metallic green back and wings barred with black and chestnut. The male is more dull with buff spots on the wings and without any chestnut colouring on the head, nape or throat (Department of the Environment and Energy, 2019b).

#### Distribution

The Australian painted snipe has been recorded at wetlands in all states of Australia. It is most common in eastern Australia, where it has been recorded at scattered locations throughout much of Queensland, New South Wales, Victoria and south-eastern South Australia. It has been recorded less frequently at a smaller number of more scattered locations farther west in South Australia, the Northern Territory and Western Australia. It has also been recorded on single occasions in south-eastern Tasmania and at Lord Howe Island (Department of Agriculture Water and the Environment, 2021b).

## **Habitat requirements**

The Australian painted snipe is a wading bird found in wetland habitats. They generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. However, they have also been known to utilise areas lined with trees, as well as modified habitats such as low-lying woodlands converted to grazing pasture, sewage farms, dams, bores and irrigation schemes (Department of Agriculture Water and the Environment, 2021b).

The SPRAT for this species indicates that breeding may occur in response to wetland conditions rather than during a particular season. In southern Australia most records have been from August to February. Eggs have been recorded from mid August to March, with breeding in northern Queensland also recorded between May and October. However, it has been recorded breeding in all months in Australia. The breeding habitat requirements for this species may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are nearly all from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover. The nest is usually placed in a scrape in the ground (Geering et al., 2007). The Murray-Darling Basin is known to be a preferred breeding area for the species (Department of Agriculture Water and the Environment, 2021b).

The Australian painted snipe forages on vegetation, seeds, insects, worms and molluscs, crustaceans and other invertebrates. This species is mainly crepuscular (active at dawn and dusk), preferring to sit quietly under cover of grass, reeds or other dense cover during day, becoming more active at dawn, dusk and night. They generally remain in dense cover when feeding, although may forage over nearby mudflats and other open areas such as ploughed land or grassland.

The movements of the Australian painted snipe are poorly known, and it may be a migratory species. Sightings of individuals are erratic, and it is thought the species is likely to be nomadic in response to suitable conditions, such as floods.

#### **Threats**

The main identified threat to the Australian painted snipe is the loss and degradation of wetlands, through drainage and the diversion of water for agriculture and reservoirs. (Lane & Rogers, 2000) Rogers *et al.* (2005) state that the loss of breeding habitat in the Murray-Darling Basin has occurred through:

1. the reduced frequency of flooding in previously suitable habitat, exacerbated by a loss of fresh water to irrigation and other diversions;

- 2. water levels being stabilised in remaining wetlands so that water becomes too deep, or continuous reed beds develop; and
- changes to vegetation through increased cropping, and possibly through altered fire regimes at some sites.

These hydrological changes have occurred in parallel with an extended period of drought in Australia and these conditions have intensified the impacts of wetland degradation and water diversion in the Murray-Darling Basin.

Other threats to the Australia painted snipe include (Department of Sustainability, Environment, Water, 2013):

- Grazing and the associated trampling of wetland vegetation/nests
- Nutrient enrichment
- Reduced rainfall and runoff in the Murray-Darling Basin associated with climate change.
- Predation by feral animals (e.g. nest predation by foxes (*Vulpes vulpes\**) or cats (*Felis catus\**))
- Coastal port and infrastructure development,
- Shale oil mining near autumn-winter sites
- The replacement of native wetland vegetation by invasive weeds.

#### Survey effort, timing and coverage

The survey guidelines for Australia's threatened birds recommend (Department of the Environment Water Heritage and the Arts, 2010b):

- Area searches or transects through suitable wetlands (for sites of less than 50 ha when wetland holds water but is not flooded).
  - 10 hours over 3 days.
- Targeted stationary observations at dawn and dusk within suitable wetlands.
  - 10 hours over 5 days.
- · Spotlight shortly after dusk.
  - Survey effort not specified.

A total of 10 days of field survey was conducted in June and December 2020, equating to 162 person hours of effort. Stationary observations were undertaken at areas of best habitat during both surveys however this was not completed at dawn or dusk. Spotlighting was conducted at one wetland location during December 2020. Targeted habitat assessments were conducted at all areas of potentially suitable habitat in June and December 2020 to supplement the search effort.

No surveying has been undertaken within the southern Project Area (Lot and plan 2SP200046), however findings of the field surveys and habitat modelling indicate this property provides habitat of similar or lesser quality when compared to the rest of the Project Area. Aerial imagery and LiDAR indicate that large areas within this property have been cleared including directly adjacent to farm dams. This is likely to have been done to facilitate cattle grazing activities as is completed in the properties to the north.

This survey effort meets the requirements of the Survey Guidelines for Australia's Threatened Birds (Department of the Environment Water Heritage and the Arts, 2010b).

#### Occurrence and potential habitat

The Australian painted snipe was not recorded during the field surveys, however this species is cryptic and is difficult to detect, even when present (Department of Agriculture Water and the Environment, 2021b). While no recent (>1980) spatially valid records occur nearby, the Project Area is within the species distribution and potential habitat is present.

Three types of Australian painted snipe potential habitat occurs within the Project Area (Table 32). Although dry during the field surveys, gilgai formations may provide intermittent foraging habitat for the species following heavy rainfall and allow 'stepping stone' movement opportunities to areas of more suitable habitat. Farm dams provide a semi-permanent water source and occur in scattered locations across the Project Area. Findings of the field surveys found that some farm dams did not provide suitable habitat for Australian painted snipe due to their very small size, steep man-made banks, extensive cattle pugging at the water's edge and little to no aquatic or canopy vegetation. Elsewhere farm dams were larger and associated with naturally occurring watercourses and drainage lines. Although still impacted by steep banks on several sides and cattle pugging, small areas of wetland vegetation were present in the low-lying fringes which may provide roosting and foraging opportunities for the species. However due to steep banks and cattle access, farm dams are will only be marginally suitable for roosting and foraging when water availability in the landscape is low (i.e. the dry season).

The Wetland provides the highest value habitat. It is expansive during the wet season, and one of the largest in the local valley area. The Wetland has experienced considerable historical modification with the entire western length previously cleared and extensive damming works including the construction of an embankment at the north eastern extent. Outside of the embankment, the banks of the wetland are gentle slopes and large areas of shallow water with aquatic fringing vegetation occur especially in the south. Embankments within the constructed wetland also provide narrow, low-lying vegetated islands when the wetland is fully inundated. These areas specifically are likely to provide ideal foraging and potentially breeding conditions for Australian painted snipe. Although during the field survey exposed muddy margins were uncommon at the Wetland, these may become more prevalent under ideal climatic conditions (i.e. an above-average wet).

Habitat mapping for this species is shown in Figure 17 and the potential habitat calculations are shown in **32**.

Table 32	Potential habitat for Australian painted snipe within the Project Area				Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Gilgai	Non- remnant & 11.9.5a	Non- remnant & Remnant (RE 11.9.5a)	Temporary foraging and dispersal	Ephemeral shallow waterbodies including gilgai.	133.80
Farm dams (Part of the farm dams and the wetland)	Water	-	Foraging and roosting	Permanent freshwater wetlands with areas of bare wet mud and both upper and canopy cover nearby.	67.32
The Wetland (Part of the farm dams and the wetland)	Water	-	Breeding	Small exposed islands within freshwater wetlands with a combination of exposed muddy areas, dense tall or low vegetation cover.	96.12

#### Important populations

As this species is listed as Endangered under the EPBC Act, 'important populations' do not apply.

#### Habitat critical to the survival of the species

There is no species-specific guidelines for determining habitat critical to the survival of the Australian painted snipe and at present no recovery plan exists. Therefore, the generic EPBC Act Significant Impact Guidelines 1.1 definition of habitat critical to the survival of a species has been applied. Based on the specific habitat requirements of the species, shallow wetlands in eastern Australia are considered habitat critical to the survival of the species which are provided by the farm dams and

wetland habitat within the Project Area. Gilgai is not considered habitat critical to the survival of the species due to its temporary nature and generally highly degraded state as a result of frequent and regular cattle access.

#### **Potential Project impacts**

A total of 5.0 ha of potential foraging (including temporary), roosting and dispersal habitat may be cleared as part of the Project. Vegetation clearing and particularly the loss of fringing aquatic vegetation may result in further degradation of potential habitat within the Project Area. No significant impacts on the wetland hydrology or water quality will occur. Project relevant indirect impacts on this species include:

- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats
- Increased risk of contamination associated with activities such as refuelling or storage of chemicals
- Temporary changes in hydrology from installation of infrastructure creating a barrier to surface flow and increasing stormwater run-off
- Removal of water from existing constructed wetlands and farm dams leading to changes in hydrology / habitat extent and water quality. Increased activity at these locations resulting in avoidance and potentially altered foraging and breeding behaviour
- Periodic burst of elevated noise levels may startle and disorientate individuals within proximity
- Increased pest levels, notably those which may prey upon this species.

This species requires suitable wetland areas even in drought conditions and can move to suitable habitat if necessary. Although the Wetland is large and higher quality, due to its physical characteristics it is unlikely provide breeding habitat during the dry season (loss of vegetative islands and flooded fringing vegetation). Therefore, should water extraction occur at the Wetland during the dry season, indirect impacts are only anticipated to occur to foraging Australian painted snipe individuals. Under ideal climatic conditions (following an above average wet season), water availability in the landscape will be high and the area of available Australian painted snipe breeding habitat may be substantial; under these conditions water can be extracted from a number of sources and at a greater distance (greater extent of water providing larger buffer) allowing these individuals to be avoided.

#### Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measure is recommended:

- Prior to construction works or water extraction activities commencing, the spotter catcher will
  ensure no Australian painted snipe are breeding in proximity that may be disturbed by the activity
- Water extraction activities will be strictly controlled and monitored in liaison with the landholder to
  ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point
  will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring
  individuals to avoid the same area during construction.

#### Significance assessment

An assessment against the EPBC Act Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided in **Table 33**. The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 33 Significant impact assessment - Australian painted snipe

Table 33 Significant impact assessment - Australian painted snipe				
EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance			
Lead to a long-term decrease in	No.			
the size of a population?	The Australian painted snipe is inferred to have undergone a severe decline in the number of mature individuals since the 1950s and specifically over the last three generations (~26 years) due to the loss and degradation of its wetland habitat.			
	This species was not recorded within the Project Area during field surveys. However, potential habitat is present within the Project Area and includes temporary foraging and dispersal, foraging and roosting and breeding habitat (total area of 297.24 ha). The Project Area occurs within the 'potential' distribution of the species according to the SPRAT and as such only a small number of individuals at any one time are expected to utilise potential habitat. A maximum of 5 ha of foraging (including temporary), roosting and dispersal habitat (gilgai and farm dams habitat) may be directly impacted via vegetation clearing in the waterbody edges. This represents a loss of approximately 1 % of available foraging, roosting and dispersal habitat within the Project Area. No direct impacts will occur to potential breeding habitat (the Wetland).			
	Indirect impacts include increased activity and noise, increased weed incursion, erosion and sedimentation at waterbodies and potential changes in hydrology due to water extraction activities. However, these will be temporary and as the Project will be constructed in phases, impacts will be localised. Furthermore, indirect impacts are expected to occur to foraging individuals only. Therefore, no Project related activities are considered likely to lead to a long-term decrease in the size of a population.			
Reduce the area of occupancy	No.			
of the species?	This species' area of occupancy was estimated by Garnett, Szabo and Dutson (2011) to be 2,000 km² and decreasing; however, given the exceptional rainfall of 2010-11 this figure is currently assumed to be higher. The area of occupancy has undoubtedly declined as approximately 50 % of wetlands in Australia have been removed since European settlement.			
	Habitat within the Project Area is potentially suitable for foraging, roosting, dispersal and breeding. However direct impacts will only occur to areas of temporary foraging and dispersal (gilgai) and foraging and roosting (farm dams) which are common across the Project Area (1 % of total area to be directly impacted). No direct impacts will occur to breeding habitat and no indirect impacts on breeding individuals will occur. Water extraction activities will be strictly controlled and monitored in liaison with the landholder to ensure no waterbodies are completed drained.			
	This species is known to readily move to areas of suitable habitat, and the Project Area does not occur at the limit of the species distribution. Lake Nuga Nuga occurs north of the Project Area and is a nationally important wetland; this expansive waterbody may be preferred by the species or be utilised temporarily for displaced individuals. As such the Project is unlikely to reduce the area of occupancy of the species.			

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance	
Fragment an existing population into two or more populations?	No.  No existing population is known from the Project Area and it is likely that utilisation would be intermittent and opportunistic for transitory individuals during optimal conditions (after rain events). The species is also highly mobile and the Project will not result in the creation of barriers to movement within or between habitat for the species. As construction of the Project will occur in phases, direct and indirect impacts at one time will be localised to only a small area within the Project Area. This will allow potentially present individuals to relocate to other areas of suitable habitat within the Project Area or outside. Therefore, it is unlikely the Project will fragment an existing population into two or more populations.	
Adversely affect habitat critical to the survival of a species?	As the Project Area contains areas suitable for foraging and roosting as well as breeding, these areas (farm dams and the wetland) are considered habitat critical to the survival of the species. Direct impacts are anticipated to occur to some areas of gilgai and farm dams (a maximum of 5 ha). Although the farm dams are considered critical habitat, higher quality critical habitat is restricted to the Wetland where no direct impacts will occur. The overall loss of this habitat will only lead to a 1 % reduction in available foraging (including temporary) and roosting habitat. Water extraction activities will be strictly controlled and monitored in liaison with the landholder to ensure no waterbodies are completed drained. No reduction in potential breeding habitat will occur. As such, the Project is unlikely to adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of a population?	No.  The Australian painted snipe may breed at any time throughout the year in response to favourable wetland conditions, rather than during a particular season. Although the Wetland is large and higher quality, due to its physical characteristics it is unlikely provide breeding habitat during the dry season (loss of vegetative islands and flooded fringing vegetation). Should water extraction occur at the Wetland during dry season, indirect impacts are only anticipated to occur to foraging Australian painted snipe individuals. Under ideal climatic conditions (following an above average wet season), water availability in the landscape will be high and the area of available Australian painted snipe breeding habitat may be substantial; under these conditions water can be extracted from a number of sources and at a greater distance, allowing these individuals to be avoided. As such, the Project is unlikely to disrupt the breeding cycle of a population.	

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance			
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No.  No existing population is known from the Project Area and it is likely that utilisation would be intermittent and opportunistic for transitory individuals during optimal conditions (after rain events). The species is also highly mobile and may utlise other habitat areas in the local landscape such as Lake Nuga Nuga which is a nationally important wetland. Direct impacts are anticipated to occur to some areas of gilgai and farm dams (a maximum of 5 ha); however the loss of this habitat will only lead to a 1 % reduction in available foraging (including temporary) and roosting habitat. Water extraction activities will be strictly controlled and monitored in liaison with the landholder to ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring individuals to avoid the same area during construction. No reduction in potential breeding habitat will occur and breeding individuals will be avoided. Measures targeted to erosion and sediment control, potential contamination and pests will also be implemented during construction to ensure indirect impacts that may lead to habitat degradation or increased threat levels to the species are managed.			
	As such the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of the habitat to the extent that the species is likely to decline.			
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat?	No.  The replacement of endemic wetland vegetation by invasive, noxious weeds has been identified as a threat to the Australian painted snipe. However, the Project is unlikely to exacerbate invasive species beyond current levels. Weed and pest management controls will be developed to mitigate and manage the potential spread of pest flora and fauna species.			
Introduce disease that may cause the species to decline?	No.  Disease has not been identified as a threat to the Australia painted snipe.  Weed and pest management controls for the Project will ensure best practice site hygiene measures.			
Interfere with the recovery of the species?	No.  The SPRAT profile identifies that a Recovery Plan for the Australian painted snipe is required; however, no such plan exists at the time of this report. In 2001, a project was initiated by the Threatened Bird Network and Australasian Wader Studies Group to improve knowledge of the Australian painted snipe so that meaningful conservation actions could be proposed (Rogers et al., 2005). Recovery actions implemented as part of this study include:  1. The development of a database of records; 2. The introduction of national targeted surveys conducted twice per year at important historic and contemporary sites and other sites of interest; 3. An assessment of habitat preferences.  Based on these actions, the Project is unlikely to interfere with the recovery of the species.			

#### Vulnerable species

# Koala (*Phascolarctos cinerus*) – combined populations of Queensland, New South Wales and the Australian Capital Territory)

#### Description and status under the EPBC Act

The koala is listed as Vulnerable under the EPBC Act.

The koala is a tree-dwelling, medium-sized marsupial with a stocky body, large rounded ears, sharp claws and variable but predominantly grey-coloured fur. It is one of Australia's most distinctive and iconic wildlife species (Threatened Species Scientific Committee, 2012).

#### Distribution

With relation to the combined populations of Queensland, New South Wales and the Australian Capital Territory, the range extends from approximately the latitude of Cairns to the New South Wales-Victoria border. Although the species is often more abundant in coastal areas, inland populations do occur. The species' distribution is not continuous within its range with a number of populations isolated by cleared land or unsuitable habitat (Threatened Species Scientific Committee, 2012).

#### Habitat requirements

Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus *Eucalyptus* (Martin & Handasyde, 1999). The distribution of koalas is also affected by altitude (limited to <800 m above sea level (ASL)), temperature and, at the western and northern ends of the range, leaf moisture (Munks et al., 1996).

Within central Queensland, koalas have been studied at Tambo (Mitchell Grass Downs bioregion), Springsure and Blair Athol (both in Brigalow Belt North bioregion). Koalas in this region typically occur in low densities and have large home ranges (Ellis et al., 2002).

The koala is heavily reliant on eucalypt leaves, a diet that is extremely energy constraining. As a result, the koala is very inactive and spends around 19 hours per day sleeping (Curtis & Dennis, 2012). Koalas can live to 15 years of age in the wild (Curtis & Dennis, 2012) and females can potentially produce one offspring per year. Young are born between October and May and occupy the pouch for six to eight months (Curtis & Dennis, 2012).

Based on the geographical location of the Project Area and the annual rainfall in the region, the koala habitat is to be assessed with respect to the inland context described in the koala EPBC referral guidelines (Department of the Environment, 2014c). Thus, koala habitat is defined as:

- woodlands and forests where koala food trees have reliable access to soil moisture;
- box gum or red gum woodlands on heavier soils in remnant or regrowth vegetation patches particularly riparian zones;
- small, patchy and sparsely distributed woodlands, shrublands and forest in highly modified, agricultural-grazing landscapes or in and around rural towns.

Koala food trees are species of tree whose leaves are consumed by koalas. Koala food trees can generally be considered to be those of the following genus: *Angophora, Corymbia, Eucalyptus, Lophostemon* and *Melaleuca*. It should be noted that 'primary' and 'secondary' food trees (as defined by some resources) are all considered to be 'food trees' for the purposes of assessment using these guidelines.

#### **Threats**

The main identified threats to the species are (Threatened Species Scientific Committee, 2012):

- Loss and fragmentation of habitat
- Vehicle strike
- Disease
- Predation by dogs.

Drought and extreme heat are also known to cause very significant mortality, and post-drought recover may be substantially impaired by the range of other threatening factors (Threatened Species Scientific Committee, 2012).

# Survey effort, timing and coverage

A five-day field survey was conducted across portions of the Project Area from 19 to 26 June 2020. No targeted koala surveys were undertaken utilising methodologies outlined in the *EPBC Act Referral Guidelines For The Vulnerable Koala* (Department of the Environment, 2014c). However, species specific habitat assessments were conducted, including the assessment of presence and abundance of koala food trees. A total of 26 species specific habitat assessments were conducted as part of the field assessment. Opportunistic searches for koala presence or evidence of presence (scats and scratches) was also undertaken. Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis.

# Occurrence and potential habitat

No koalas or evidence of koala presence was identified during the field surveys, including while spotlighting and utilising call playback. Numerous historical records of koala occur across the large tracts of vegetation to the west and east of the Project Area associated with the Carnarvon Ranges and Expedition National Park. No records occur within the Arcadia Valley area.

A total of 659.42 ha of koala habitat that could be utilised by the species as refugia, foraging and dispersal purposes was recorded within the Project Area during the field surveys. This was found to be associated with the Eucalypt open woodland on alluvial plains and Eucalypt open forest on coarsegrained sedimentary rock habitat types located along the western ridgeline, within the Public Reserve, east of Arcadia Valley road and along the unnamed tributary of Station Creek. Condition of this habitat for the species was high given its remnant status, presence of a mature canopy cover, high connectivity and minimal understorey weed cover. However, signs of water stress and defoliation was noted for some food tree species within the Eucalypt open woodland on alluvial plains habitat.

A further 514.24 ha of potential koala habitat in remnant condition was also identified via aerial imagery and LiDAR analysis based on the application of community specific modelling rules (Appendix D). This habitat also includes Eucalypt open woodland on alluvial plains and Eucalypt open forest on coarsegrained sedimentary rock that would be utilised as refuge, foraging and dispersal habitat. Areas that would provide only dispersal habitat was also identified across the Brigalow open forest on alluvial plains or sedimentary rocks habitat types (Table 34).

The extent of identified and modelled refuge, foraging and dispersal koala habitat within the Project Area is limited to only a few key areas. This habitat associated with the western ridgeline provides core habitat whilst this habitat associated with the unnamed tributary of Station Creek provides one of the few linkages between core habitat on the western ridgeline with Expedition National Park. Due to the extent of clearing that has occurred across the Project Area, all other remaining habitat areas identified or modelled for foraging and dispersal only consist of disconnected scattered patches or contiguous narrow linear patches. For these areas habitat resources and movement opportunities for koala have been compromised.

Table 34 Koala habitat within the Project Area

Habitat type	RE	Utilisation	Modelling rule	Project Area Total (ha)
Eucalypt open woodland on alluvial plains  Eucalypt open forest on coarse-grained sedimentary rock	11.3.25 11.3.2 11.10.1 11.10.4 11.10.11	Refuge and foraging	Ground-truthed to be potential koala habitat; <b>OR</b> Remnant vegetation with at least one koala food tree.	1,013.1
Brigalow open forest on alluvial plains or sedimentary rocks	11.3.1	Foraging and dispersal	Ground-truthed to be potential koala habitat; <b>OR</b> All other remnant vegetation known or likely to contain koala food trees in the canopy.	160.57

The SPRAT database does not identify 'important populations' of koala (Department of Agriculture Water and the Environment, 2021b) and the concept of 'important populations' has not been used in the EPBC Act Referral Guidelines for the Vulnerable Koala (Department of the Environment, 2014c). This is due to insufficient information being available to adequately identify and separate the nature of any important populations throughout the species range. This guideline encourages the assessment of significant impacts on the koala to be completed primarily through the assessment of habitat critical to the survival of the koala (Table 35) and the actions that interfere substantially with the recovery of the koala (Table 36). As such, important populations have not been discussed in the significant impact assessment presented in Table 37.

# Habitat critical to the survival of the species

Potential significant impacts to koala habitat may occur if habitat that is considered to be *critical to the survival of the koala* is disturbed. In determining if critical habitat is present, the habitat assessment tool was applied to the Project (Table 35 below). The outcome of this assessment in turn supports the significant impact assessment.

Based on this assessment of koala habitat using the Koala Habitat Assessment Tool, the koala habitat scores an eight out of ten. This is above the threshold of five and as such the habitat is considered to be critical to the survival of the koala.

Table 35 Koala habitat assessment tool

Attribute	Ranking	Criteria for inland populations	Score	Notes	
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	0	Two historical ALA records (1987 and 1988) occur	
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.		within 25 km of the Project Area (centre coordinate), and an additional three records occur within 50 km	
	0 (low)	None of the above.		(dated 1996 and 2001).	
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees 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.	2	Eucalypt open woodland on alluvial plains habitat within the Project Area is dominated by Eucalyptus camaldulensis and E.populnea	

Attribute	Ranking	Criteria for inland populations	Score	Notes	
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.			
	0 (low)	None of the above.			
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥1,000 ha.	2	Project Area contains habitat along the western	
	+1 (medium)	Area is part of a contiguous landscape <1,000 ha, but ≥ 500 ha.		ridgeline that is connected to large bushland tracts associated with the	
	0 (low)	None of the above.		Carnarvon Ranges	
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.	2	No evidence of wild dog presence detected during the field surveys	
	+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.			
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 guideline.	2	Project Area contains refuge habitat as well as large connected areas of habitat (western ridgeline)	
+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 guideline.			
	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 guideline.			
<b>Total Score</b>			8		

# **Potential Project impacts**

A total of 2.0 ha of potential refuge, foraging and dispersal habitat may be cleared as part of the Project, which may also result in further fragmentation of potential habitat within the Project Area. Other Project related potential indirect impacts relevant to the koala includes:

## Pest incursion

Fauna mortality via strike from moving vehicles and machinery.

# Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measure is recommended:

• Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention.

#### Significance assessment

Assessing significance of impacts to the koala is a twostep process and involves assessing whether Project impacts will:

- 1. substantially interfere with the recovery of the species
- 2. adversely affect habitat critical to the survival of the species

The EPBC Act Referral Guidelines for the Vulnerable Koala (Department of the Environment, 2014c) identifies five impacts which are likely to substantially interfere with the recovery of the koala. These have been outlined in Table 36 with a discussion on whether these impacts are likely to occur as a result of the Project. The result of this assessment is that the Project is unlikely to substantially interfere with the recovery of the koala.

Table 36 Impacts which are likely to substantially interfere with the recovery of the koala

Impacts which are likely to substantially interfere with the recovery of the koala	Potential for Impact to occur as a result of the Project
'Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.'	No.  The dog ( <i>Canis lupus familiaris*</i> ) is known to the Project Area; however, evidence of presence and utilisation was not detected during the field survey. Santos actively manage the wild dog population within the Arcadia Valley by completing regular and ongoing dog trapping on their Bottle Tree property, which occurs less than 5 km north east of the Project Area. No mechanisms which would facilitate the exacerbation of this species are expected as a result of the Project. The Project is unlikely to result in multiple, ongoing mortalities.
'Increasing koala fatalities in habitat critical to the survival of the koala due to vehiclestrikes to a level that is likely to result in multiple, ongoing mortalities.'	No.  An increase in vehicle and machinery movement across the Project Area will occur during construction; however, this will be temporary and impacts to fauna will be managed through the adoption of vegetation clearing protocols and construction site restrictions (i.e. speed limits and construction times).  Once constructed is complete vehicle traverses should be minimal due to the lack of personnel required for the operation of the Project. Therefore, the Project is not expected to result in multiple, ongoing fatalities to koala due to vehicle strikes.

Impacts which are likely to substantially interfere with the recovery of the koala	Potential for Impact to occur as a result of the Project
'Facilitating the introduction or spread of disease or pathogens for example Chlamydia or Phytophthora cinnamomi, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.'	No.  The Project is not expected to introduce or exacerbate the spread of disease or pathogens (i.e. <i>Chlamydia</i> or <i>Phytophthora cinnamomi</i> ) that may reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.  Symptoms of individuals carrying <i>Chlamydia</i> can become overt when subjected to additional stress. Such stress may be caused by habitat clearing. However, due to the low impact nature of the Project within potential koala habitat (2.0 ha), it is not expected to exacerbate this disease on a population scale. Further, the Project is unlikely to lead to new pathways to dispersal into the Project Area for any individuals which may carry the disease.
	Implementation of weed and pest controls measures for the Project will ensure best practice site hygiene.
'Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.'	No.  A maximum of 2.0 ha of potential koala habitat may be cleared as a result of the Project. Fragmentation impacts will be limited to potential clearing of access tracks and gathering networks. The shape and magnitude of this impact will not create barriers to movement to the koala (i.e. is less than 2 km wide treeless area).  Mitigation and management measures will be also be undertaken to limit the extent of clearing and fragmentation of koala habitat. This includes preclearance surveys to accurately locate the presence and extent of koala habitat and further micro-siting of infrastructure to avoid areas, where possible or at least ensure minimal fragmentation. Existing access tracks will also be utilised where possible as well as natural or existing breaks in the community as a result of current disturbances.
'Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.'	No.  Changes to hydrology can potentially impact the extent of local catchments, run-off characteristics and intensity of flood flows, which can impact on the condition and stability of riparian habitats.  No significant works are proposed that will alter drainage across the ephemeral creek lines within the Project Area. No creek diversions are proposed as part of this Project. All water requirements during the construction phase will be sourced from existing supplies. Therefore, current environmental flows should not be impacted.

Habitat critical to the survival of the species has been identified for the Project Area based on the outcomes of the habitat assessment tool (score of eight out of ten). Because of this, a full assessment under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) has been undertaken and is provided in Table 37. The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to koala.

Table 37 Significant impact assessment – koala

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance
Lead to a long-term decrease in the size of an important population of a species?	As previously discussed, the concept of important populations of the species is not relevant for the vulnerable koala. The EPBC Act Referral Guidelines for the Vulnerable Koala (Department of the Environment, 2014c) identifies habitat critical to the survival of the species as important to the long term survival of populations. The Project may result in 2.0 ha of koala habitat to be cleared within the Project Area that includes habitat likely to be utilised by the species for refuge, foraging and dispersal purposes. This equates to less than 1% of koala habitat within the Project Area. This amount of clearing will not lead to a long-term decrease in any potential koala population in the region. A total of 1,171.66 ha of potential koala habitat will remain following the development of the Project, which will be able to support individuals potentially utilising the Project Area. This includes dispersal functions, which are important in maintaining viable populations.
	Mitigation and management measures will also be undertaken to limit the extent of clearing of koala habitat. This includes pre-clearance surveys to accurately locate the presence and extent of koala habitat and further micrositing of infrastructure to avoid areas, where possible.
Reduce the area of occupancy of an important population?	No.  The Project may result in 2.0 ha of potential koala habitat to be cleared within the Project Area that includes habitat likely to be utilised by the species for refuge, foraging and dispersal purposes. This equates to less than 1% of koala habitat within the Project Area. A total of 1,173.66 ha of potential koala habitat will remain within the Project Area. Whilst important population is not defined for koala, this extent of clearing will not reduce the area of occupancy for koala. The amount of habitat that will remain following the Project will still be able to support the species if present in the area. Mitigation and management measures will also be undertaken to limit the extent of clearing of koala habitat. Micro-siting of infrastructure will avoid areas of koala habitat, where possible.

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance
Fragment an existing important population into two or more populations?	Habitat that would provide dispersal opportunities for koala across the Project area comprises of small disconnected 'stepping stone' patches and narrow linear contiguous linkages. Refuge and foraging habitat along the unnamed tributary of Station Creek also provides a corridor between koala habitat to the west in the Carnarvon ranges to habitat in the east in the Expedition National Park. Potential therefore exists for the Project to fragment or increase fragmentation of koala habitat within the Project Area, particularly with the development of access tracks and gathering networks. However, potential fragmentation is not considered to be extensive with clearing widths minimised as far as practicable in sensitive environments for access tracks and gathering lines. This will not create a barrier for koala movement.
	Mitigation and management measures will be also be undertaken to limit the extent of clearing and fragmentation of koala habitat. This includes preclearance surveys to accurately locate the presence and extent of potential koala habitat and further micro-siting of infrastructure to avoid areas, where possible or at least minimise fragmentation. Existing access tracks will also be utilised where possible as well as natural or existing breaks in the habitat as a result of current disturbances.
	Project works within areas of core koala habitat along the western ridge line will be limited to potential minor clearing on the edges of habitat. Therefore, no fragmentation will occur.
Adversely affect habitat critical to the survival of a species?	No.  Direct impacts to potential koala habitat are below the clearing threshold limit of 20 ha identified in the <i>EPBC Act Referral Guidelines for the Vulnerable Koala</i> (Department of the Environment, 2014c). Whilst a maximum of 2 ha of refuge, foraging and dispersal habitat may be cleared, this clearing will be actively managed and only cleared as absolutely necessary. As such this extent of clearing is not considered to adversely affect habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population?	No.  A maximum of 2.0 ha of potential koala habitat may be cleared for Project development, resulting in an overall loss of 1 % of available habitat. The extent and duration of clearing disturbances in unlikely to disrupt the breeding cycle of individual koalas potentially utilising the Project Area. As discussed above, potential fragmentation impacts will not create a barrier, including males dispersing during the breeding season

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance			
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No.  The Project may result in 2.0 ha of potential koala habitat to be cleared within the Project Area that includes habitat likely to be utilised by the species for refuge, foraging and dispersal purposes. This equates to less than 1% of koala habitat within the Project Area. This amount of clearing will not lead to decline in the species. A total of 1,171.66 ha of potential koala habitat will remain following the development of the Project, which will be able to support individuals potentially utilising the Project Area. This includes dispersal functions, which are important in maintaining viable populations.			
	No significant works are proposed that will alter drainage across the ephemeral creek lines within the Project Area. Therefore, no changes in the condition and stability of riparian refuge habitats are expected to occur.			
	Mitigation and management measure will also be implemented to reduce risk of habitat degradation from weed and pest incursion, erosion and sedimentation and contamination.			
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat?	No.  The primary invasive species which poses a threat to koala is the dog ( <i>Canis lupus familiaris*</i> ). As identified in Table 35, evidence of presence and utilisation of dogs within the Project Area was not detected during the field survey. No mechanisms which would facilitate the exacerbation of this species are expected as a result of the Project.			
Introduce disease that may	No.			
cause the species to decline?	As identified in Table 36, the Project is not expected to introduce or exacerbate the spread of disease or pathogens (i.e. <i>Chlamydia</i> or <i>Phytophthora cinnamomi</i> ) that may reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.			
	Symptoms of individuals carrying <i>Chlamydia</i> can become overt when subjected to additional stress. Such stress may be caused by habitat clearing. However, due to the low impact nature of the Project within koala habitat (2.0 ha), it is not expected to exacerbate this disease on a population scale. Further, the Project is unlikely to lead to new pathways to dispersal into the Project Area for any individuals which may carry the disease.			
	Implementation of weed and pest controls measures for the Project will ensure best practice site hygiene.			
Interfere substantially with the recovery of the species?	No.  As identified in Table 36 the Project is unlikely to interfere substantially with the recover of the species.			

# Painted honeyeater (Grantiella picta)

# Description and status under the EPBC Act

The painted honeyeater is listed as Vulnerable under both the EPBC Act and NC Act.

The painted honeyeater is a medium-sized honeyeater bird, mostly black and white in colour with yellow edges on the flight and tail feathers. It is the only honeyeater with a wholly or mostly pink bill with the aforementioned colouration.

#### Distribution

This species is highly nomadic, sparsely and widely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of 26°S, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland (Department of the Environment, 2017). The extent of occurrence is estimated to be 2,800,000 km² and the area of occupancy estimated to be 1000 km².

#### Habitat requirements

The painted honeyeater occurs in dry forests and woodlands, where its primary food is mistletoes in the genus *Amyema*, though it will also take some nectar and insects. Invertebrates are of particular importance as a dietary item provided to nestlings and are also used by adults in the breeding season. The species is also known to occur in riparian woodland communities dominated by species such as *Eucalyptus camaldulensis*, *Casuarina sp., Callitris sp.*, and in *Acacia* dominated woodlands, paperbarks, and trees on farmland and in gardens. The species demonstrates preference for wider patches of remnant woodland and areas with higher numbers of older trees as mistletoes are largely restricted to these trees.

The species does exhibit distinct movement patterns which are influenced by the fruiting of mistletoe which also coincides with its breeding season. Many birds move after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory.

Breeding is strongly associated with fruiting of mistletoes and occurs in October to March. Two mistletoe species in particular are heavily relied on in particular during breeding: grey mistletoe (*Amyema quandang*) and needleleafed mistletoe (*A. cambagei*). Nests are cup-shaped and typically use mistletoe as a nest substrate and build them in areas where mistletoe is prevalent. They breed in loose colonies and form pairs which last for at least one breeding season. Both sexes tend to eggs and young and the male also defends the breeding territory vigorously from both competing males and other bird species. Up to two broods may be raised in one breeding season (Birdlife, 2020). The painted honeyeater shows preference for wider patches of woodland habitat, however it is known to breed in narrow roadside strips of vegetation provided that ample mistletoe is available (Threatened Species Scientific Committee, 2015a). Most records of breeding are from between the inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland.

#### **Threats**

The primary identified threat to this species is habitat loss. Both breeding and non-breeding habitat has been subject to extensive clearing in the past, or degraded to the point where they no longer provide suitable habitat. Regrowth woodland, which contains similar or higher densities of mistletoe than remnant woodland, is viewed as having little conservation value and is also being cleared at an unsustainable rate.

Other identified threats include:

- habitat degradation by grazing livestock, native macropods and rabbits leading to a collapse in mistletoe resources
- deliberate destruction of mistletoe by landholders and in production forests
- competition with the native noisy miner (Manorina melanocephala)
- predation by invasive species such as the black rat
- collision with road vehicles

 nest predation by over-abundant native birds including currawongs, butcherbirds, crows and ravens.

#### Survey effort, timing and coverage

Two field surveys were completed across the Project Area in 2020. The first survey was conducted at select areas on Lot and plan 2TR13 and Lot and plan 3TR12 from 19 to 26 June 2020 (five days). The second survey was conducted over six days between 14 December and 21 December 2020 across Lot and plan 2TR13 and Lot and plan 1TR50.

Roaming/meandering bird surveys using both visual and auditory identification were conducted throughout the surveys, commencing at dawn and continuing throughout the day. While the first survey did not occur within the the recommended period of early spring to late summer as outlined in the *Targeted species survey guidelines: Painted honeyeater* (Rowland, 2012), the second survey in December did. The recommended survey effort (a minimum of 1 hour per day for a minimum of 4 days per 50 ha) was met for the area surveyed and species-specific habitat assessments were also conducted. A total of 86 species specific habitat assessments were conducted as part of the field assessments and all occurrences of mistletoe, including incidental were recorded to a species level. Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis and conservative assumptions about mistletoe presence were used.

# Occurrence and potential habitat

No painted honeyeaters were recorded during the field surveys and no records occur within the Arcadia Valley area. However, approximately 65 km to the north west in the Carnarvon National Park are two records from 2017 and 2018 respectively.

During the field surveys a total of 47.61 ha of potential painted honeyeater habitat suitable for foraging and dispersal purposes was recorded. This was found to be associated with the Brigalow dominated communities including regrowth on the low-lying undulating plains as well as some areas of Eucalypt open woodland on alluvial plains and SEVT. The condition of this habitat for the species was generally low to moderate in both remnant and HVR communities. During the first survey especially mistletoe was generally prevalent and communities that contained it generally had mature canopy cover. However, connectivity was generally low, the understorey was commonly dominated by weeds and impacts from cattle grazing were evident.

A further 363.92 ha of potential foraging and dispersal habitat varying from remnant to regrowth was also identified via aerial imagery and LiDAR analysis based on the application of species-specific modelling rules (Appendix D). This habitat also includes Eucalypt open woodland on alluvial plains, Brigalow low open forest on alluvial plains or sedimentary rocks and Brigalow regrowth habitats that would also be utilised as foraging and dispersal habitat assuming mistletoe occurs as commonly as it did within the Survey Area (Table 38).

The extent of identified and modelled foraging and dispersal painted honeyeater habitat within the Project Area is relatively extensive although fragmented. Given this species is known to be highly nomadic, fragmentation is considered unlikely to impede the species' utilisation of potential habitat across the landscape. However, this species is reported to prefer large and wide habitat patches which are generally limited within the Project Area. Furthermore, it is likely that not all areas of modelled painted honeyeater habitat contain the important habitat features (i.e. mistletoe) to support the species.

Table 38 Painted honeyeater potential habitat within the Project Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Brigalow open forest on alluvial plains	11.3.1, 11.3.2, 11.3.25,	Remnant, HVR & non-	Foraging / dispersal	Ground-truthed to be potential painted honeyeater habitat; <b>OR</b>	411.53
Brigalow low open forest on alluvial plains	11.9.4, 11.9.5	remnant		Dry forests and woodlands and riparian woodland communities in remnant and HVR condition dominated by	

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Brigalow open forest on sedimentary rocks	HVR 11.3.1, HVR 11.9.5			Acacia harpophylla or eucalypt species such as Eucalyptus camaldulensis.	
Brigalow low open forest on sedimentary rocks	HVR 11.9.5a				
Brigalow low open forest with a SEVT understorey					
Brigalow regrowth					
SEVT					
Eucalypt open woodland on alluvial plains					

The SPRAT does not identify 'important populations' of painted honeyeater. Therefore, any population potentially occurring within the Project Area has been assessed against the generic definition in the EPBC Act Significant Impact Guidelines 1.1.

The Project Area is unlikely to support an important population, given that the species is highly nomadic, there is no evidence to suggest that any population potentially present would be a key source population for breeding or dispersal or necessary for maintaining genetic diversity and the Project Area is not near the limit of the species range.

# Habitat critical to the survival of the species

There is no species-specific guidelines for determining habitat critical to the survival of painted honeyeater and at present no recovery plan exists. Therefore, the generic *EPBC Act Significant Impact Guidelines 1.1* definition of habitat critical to the survival of a species has been applied.

Suitable foraging and dispersal habitat occurs within the Project Area, with Brigalow open forest and Brigalow low open forest recorded to commonly support grey mistletoe, a mistletoe species known to be of importance to the species. On this basis, habitat within the Project Area is potentially necessary for life-cycle requirements, maintaining genetic diversity, the recovery of the species or for the long-term maintenance of the species; and hence it meets the definition of habitat critical to the survival of the species.

#### **Potential Project impacts**

A total of 12.0 ha of potential foraging and dispersal habitat may be cleared for development of the Project, which may also result in further fragmentation of potential habitat within the Project Area. Other Project related potential indirect impacts relevant to the painted honeyeater includes:

- Pest incursion
- Fauna mortality via strike from moving vehicles and machinery.

#### Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measure is recommended:

Retain tree's that contain mistletoe where possible.

# Significance assessment

An assessment of the significance of impacts to this species under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided is provided in Table 39.

The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 39 Painted honeyeater significant impact assessment

Criterion – is there a real chance or possibility that the Proposed Action will:	Assessment
Lead to a long-term decrease in the size of an important population of a species?	No.  As detailed above, this species is highly nomadic and only dispersing and foraging individuals are expected to utilise potential habitat within the Project Area. Direct impacts to potential habitat are limited to clearing of 12.0 ha of foraging and dispersal habitat. This equates to a less than 3 % reduction in available habitat within the Project Area. Project development will occur in phases and as such only a portion of the Project Area may be disturbed at one time. The species is unlikely to experience an increase in mortality during construction or operation and the Project (largely comprising underground infrastructure) will not result in a barrier to movement for the species. It is therefore unlikely that the Project will lead to a long-term decrease in any potential population of painted honeyeater that may be present. Further, any population utilising the Project Area is not considered an important population.
Reduce the area of occupancy of an important population?	No.  The area of occupancy for the species is estimated to be 1,000 km² (Garnett et al., 2011). Habitat mapping within the Project Area has identified a total of 411.53 ha of potential foraging and dispersal habitat, of which only 12.0 ha will be directly impacted via vegetation clearing. This species is highly nomadic and the landscape in which the Project Area occurs is already highly disturbed and fragmented. The Project is linear and as such direct impacts are likely to be focused to the edges of habitat patches where disturbance is already likely to be high.  Given the extent of habitat in the region, the relatively small amount of habitat being impacted within the Project Area, and the shape and scale of clearing expected, it is considered unlikely the Project will reduce the area of occupancy of any local or important population.
Fragment an existing important population into two or more populations?	No.  The Project Area occurs in a highly modified and fragmented landscape dominated by cattle grazing. The painted honeyeater is a highly mobile species which undergoes large seasonal movements. The Project itself, nor the shape and scale of the clearing required for construction will not result in a barrier to movement for this species. Therefore, the Project will not fragment any existing local or important population into two or more populations.
Adversely affect habitat critical to the survival of a species?	No.  Of the 411.53 ha of potential foraging and dispersal habitat, only 12.0 ha will be directly impacted via vegetation clearing. Although potential habitat within the Project Area is considered to be critical to the survival of the species, habitat is already fragmented and likely to be highly disturbed by exotic grass and cattle grazing. Wherever possible, clearing will be avoided and trees containing mistletoe will be retained. The removal of this habitat is therefore considered unlikely to adversely affect habitat critical to the survival of the species.

Criterion – is there a real chance or possibility that the Proposed Action will:	Assessment
Disrupt the breeding cycle of an important population?	No.  The Project Area is not situated within the primary known breeding area of the species which is on the inland slopes of the Great Dividing Range, north to Roma. Further, within the Project Area habitat rarely comprises large, wide patches which are preferred for breeding. Breeding habitat has not been identified and no important population is expected to occur in the area. As such it is unlikely that the Project would disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No. Potential habitat within the Project Area is considered to be suitable for foraging and dispersal only and not breeding. Although potential habitat within the Project Area is considered to be critical to the survival of the species, habitat is already fragmented and likely to be highly disturbed by exotic grass and cattle grazing. Construction and operation of the Project is unlikely to exacerbate existing threatening processes beyond current levels, nonetheless potential impacts will be managed as detailed in Section 8.0. Wherever possible, clearing will be avoided and trees containing mistletoe will be retained. The amount of habitat that may be directly impacted is small in the context of suitable habitat available in the Project Area and connected protected places to the north west. Therefore, it is unlikely that the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat?	No.  Predation by black rat is considered to be a threat to the species (Environment, 2015). Although not observed during field surveys, black rat may occur in the area with numbers fluctuating according to seasonal conditions. Rats may pose a threat to the species during plague periods.  Project activities are unlikely to exacerbate black rat populations beyond current levels. Weed and pest management measures are included in the Project EMP and the SSMP.
Introduce disease that may cause the species to decline?	No. Disease has not been identified as a threat to the species. Weed and pest management measures for the Project will ensure best practice site hygiene measures.
Interfere substantially with the recovery of the species?	No.  The Project will have minimal impact to the primary conservation actions as stipulated in the Conservation Advice, with the exception of the loss of a maximum of 12.0 ha of habitat. Given the overall retention of the majority of potential habitat within the Project Area (399.53 ha remaining after direct impacts), this reduction in habitat is considered to have negligible impacts on the species in the long-term or on a population scale. The Project will not result in disruptions to breeding cycles and existing threats to the species are unlikely to be increased. As such, the Project is considered unlikely to interfere substantially with the recovery of the species.

# Ornamental snake (Denisonia maculata)

# Description and status under the EPBC Act

The ornamental snake is typically a shade of grey with a darker patch on the crown of the head and black flecks or spots along outer edges of the throat and ventral scales. It has distinctly barred lips, a white-cream belly and grows to 50 cm in length (S. Wilson, 2015). It is listed Vulnerable under the EPBC Act.

#### Distribution

The ornamental snake is found only in the Brigalow Belt North and some parts of the Brigalow Belt South biogeographical regions. The core distribution of this species in the aforementioned areas is within the Fitzroy and Dawson River drainage systems (Department of Agriculture Water and the Environment, 2021b). Within the known localities list on the species' SPRAT, the Emerald region is listed.

#### Habitat requirements

Suitable habitat for the ornamental snake is low-lying areas with deep-cracking clay soils that are subject to seasonal flooding, and in adjacent areas of clay and sandy loams. The species is found in woodlands and shrublands, such as brigalow, and in riverine habitats, and lives in soil cracks and under fallen timber. It is also known to persist in cleared, disturbed habitats, particularly where brigalow communities have been cleared.

The ornamental snake's preferred habitat is within, or close to, habitat that is favoured by its prey-frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai mounds and depressions in Queensland RE Land Zone 4, but also lake margins and wetlands.

#### **Threats**

The primary threat to the species is continued modification of potential habitat through broadscale clearing and habitat degradation. The core range of the species is within an area of high human impact through extractive industries (i.e. coal mining; coal seam gas), agriculture and urban development (Threatened Species Scientific Committee, 2014a).

Other threats include destruction of wetland habitat by feral pigs which also contributes to degradation of frog habitat and direct competition for their food source, frogs.

As the species primary food source is frogs, lethal toxic ingestion of cane toads is also a potential threat to the species (Threatened Species Scientific Committee, 2014a).

## Survey effort, timing and coverage

Two field surveys were completed across the Project Area in 2020. The first survey was conducted at select areas on Lot and plan 2TR13 and Lot and plan 3TR12 from 19 to 26 June 2020 (five days). The second survey was conducted over six days between 14 December and 21 December 2020 across lot and plan 2TR13 and 1TR50.

Targeted habitat assessments were completed across both survey periods. Targeted ornamental surveys were undertaken in the second survey in December 2020 utilising methodologies outlined in the *EPBC Act Draft Referral Guidelines For Nationally Listed Brigalow Belt Reptiles* (Department of Sustainability Environment Water Population and Communities, 2011a). This included the following:

- pitfall and funnel trapping at three sites
- 24 hours of spotlighting over four nights
- 38 hours of diurnal active searches over six days

Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis.

Targeted surveying has also been completed for this species by Terrestria (see Section 4.2) in 2021 on the Santos Bottle Tree property, which occurs less than 5 km to the north east of the Project Area. Although the ornamental snake is considered a potential occurrence on the property due to areas of

high and moderate quality potential habitat, this species has not been recorded during any assessments on site.

# Occurrence and potential habitat

Majority of the species records of ornamental snake occur north of the Project Area within the core distribution of the species. The closest record is approximately 26 km north at Lake Nuga Nuga. No records occur within the Arcadia Valley area. The Project Area occurs within the very southern extent of the species likely range and Santos has never encountered this species during pre-clearance clearing works on the neighbouring tenements.

Field surveys confirmed a total of 35.61 ha of potential ornamental snake habitat within the Survey Area, associated with the presence of gilgai formations and wetland margins adjacent to remnant woodlands. Gilgai observed during the field surveys was generally shallow and in a moderate to highly degraded state due to cattle grazing, exotic grass and in some areas historical blade ploughing. Deep soil cracks were not recorded.

An additional 222.10 ha of potential ornamental snake habitat was identified via aerial imagery and LiDAR analysis based on the application of species-specific modelling rules (Appendix D). Modelled habitat is generally associated with Brigalow open forest and low open forest on alluvial plains, which varies in condition from remnant to HVR. Brigalow regrowth as well as gilgai habitat in non-remnant condition was also identified as potential habitat. The modelled ornamental snake habitat within the Project Area generally comprises narrow linear patches adjacent to ephemeral creeks or larger permanent artificial wetland areas and dams that may provide an abundance of prey species to support ornamental snake in the area. The quality of all areas of habitat within the Project Area are likely to be compromised as a result of existing degradation processes such as historical clearing and grazing. All potential habitat is conservatively considered suitable for breeding, foraging and dispersal purposes.

A single portion of the Project Area was identified in the LiDAR DEM as containing gilgai that are known to have undergone historical clearing and significant mechanical disturbance (e.g. blade ploughing). This area covers a total of 103.06 ha and was assessed in the context of potential ornamental snake habitat in late 2021 by Terrestria (see Appendix H). Due to the likely regular occurrence of this high impact activity, ongoing mortality of individuals would be occurring in this area. As such, this area is not considered potential ornamental snake habitat as it is unlikely the area will be supporting the species or a population.

The only large and contiguous patch of higher quality Brigalow habitat identified within the Project Area is located in the Public Reserve surrounding the Arcadia Valley State School. This habitat connects to the margins of the Wetland on lot and plan 2TR13.

Given the broad nature of the modelling rules and the inability to evaluate presence of microhabitat features, it is highly likely that the extent of modelled ornamental snake habitat is over-estimated within the Project Area. Given the similar land use and level of disturbance across the properties, it is likely that this will be the case for areas of modelled ornamental snake and that the majority of areas when field verified, will not contain the important habitat features to support the species.

Table 40 Ornamental snake habitat within the Project Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Brigalow open forest on alluvial plains  Brigalow low open forest on alluvial plains  Brigalow regrowth	11.3.1	Remnant, HVR & non- remnant	Breeding / foraging / dispersal	Field validated as potential ornamental snake habitat;  OR  Gilgai depressions, mounds and wetlands on clay soils containing sufficient microhabitat features (soil cracks or fallen woody debris).	257.71

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Gilgai					

DAWE considers that the occurrence of 'important habitat' for the ornamental snake is a surrogate for an 'important population' of the species.

'Suitable habitat' for the species has been defined in the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (Department of Sustainability Environment Water Population and Communities, 2011a) as:

• 'Open-forests to woodlands associated with gilgai formations and wetlands. These are commonly mapped as QLD REs 11.3.3, 11.4.3, 11.4.6, 11.4.8, 11.4.9, 11.5.16 or mapped as cleared but where the above REs formerly occurred'.

This guideline also defines 'important habitat' as:

 'Gilgai depressions and mounds and habitat connectivity between gilgais and other suitable habitat'.

'Suitable habitat' for the ornamental snake can also be considered as 'important' if it is:

- Habitat where the species has been identified during a survey
- Near the limit of the species' known range
- Large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the
  purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive
  generations) or
- A habitat type where the species is identified during a survey, but which was previously thought not to support the species.

Although the species was not observed during field surveys, all potential habitat within the Project Area is considered suitable habitat and important habitat based on the definitions above. Whilst meeting the definition, large areas of this habitat are degraded and considered marginal.

#### Habitat critical to the survival of the species

There are no species-specific guidelines for determining habitat critical to the survival of the ornamental snake, and at present no recovery plan exists. As important habitat has been defined in the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (Department of Sustainability Environment Water Population and Communities, 2011a) as stated above, this terminology is considered to be interchangeable with 'habitat critical to the survival of the species'. As the habitat in the Project Area meets the definition of import habitat, it is considered to be critical to the survival of the species. Whilst meeting the definition, large areas of this habitat are highly degraded and considered marginal.

#### **Potential Project impacts**

Based on modelled habitat, a total of 2.0 ha of potential breeding and foraging habitat may be cleared as part of the Project. Other Project related potential indirect impacts relevant to the ornamental snake includes:

- pest incursion
- fauna mortality via entrapment in trenches
- erosion and sedimentation
- water contamination

- altered hydrology
- light disturbance.

## Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measures are recommended:

- Open trenches will be checked for trapped fauna in the morning and at the end of the day by a spotter catcher
- Trench ladders, ramps, sticks, ropes and the use of moist hessian sacks at regular intervals (or similar) will be utilised to help trapped fauna escape and/or survive until removed by a fauna spotter-catcher.
- Clearing works that occur in areas of potential ornamental snake habitat will prioritise avoiding gilgai formations.

## Significance assessment

An assessment of the significance of impacts to this species under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided is provided in Table 41. The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 41 Significant impact assessment – ornamental snake

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance
Lead to a long-term decrease in the size of an important population of a species?	No.  As previously discussed, DAWE considers that the occurrence of important habitat for the ornamental snake as a surrogate for an 'important population' of the species. Potential habitat modelled within the Project Area may meet the criteria to be considered 'important' as defined in the Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles (Department of Sustainability Environment Water Population and Communities, 2011a); however, the habitat within the Project Area is highly modified and degraded by historical clearing, cattle grazing and in some locations blade ploughing. As such, potential habitat is unlikely to contain the important habitat features to support the species.
	Based on modelled ornamental snake habitat within the Project Area, the Project may result in clearing of 2 ha or less than 1 % of habitat that could be utilised by the species for breeding, foraging and dispersal purposes. This includes areas of habitat that have been regularly blade ploughed that are unlikely to support the species. As such the extent of impact is considered to be much lower and will not lead to a long-term decrease in any potential ornamental snake population in the region. A total of 255.71 ha of potential ornamental snake habitat that is not subject to blade ploughing will remain following the development of the Project, which will be able to support individuals sufficient to maintain the viability of a population potentially present within the Project Area.
	Most importantly, avoidance, mitigation and management measures will also limit the extent of clearing of ornamental snake habitat. This includes preclearance surveys to accurately locate the presence and extent of ornamental snake habitat and further micro-siting of infrastructure to avoid areas, where possible. High priority of avoidance will be given to gilgai habitat.

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance
Reduce the area of occupancy of an important population?	No.  The Project may result in 2 ha or less than 1 % of potential ornamental snake habitat to be cleared within the Project Area. Potential habitat may be utilised by the species for breeding, foraging and dispersal purposes. This includes areas of habitat that have been regularly blade ploughed that are unlikely to support the species. As such the extent of impact is considered to be much lower. A total of 255.71 ha of potential ornamental snake habitat remaining within the Project Area will be able to support any individuals that may be present. Avoidance, mitigation and management measures will limit the extent of clearing of ornamental snake habitat. Micro-siting of infrastructure will avoid areas of ornamental snake habitat, where possible. High priority of avoidance will be given to gilgai habitat.
Fragment an existing important population into two or more populations?	No.  Based on historical clearing, blade ploughing and cattle grazing, most of the modelled ornamental snake habitat within the Project Area is already disturbed and fragmented; however, portions of potential habitat that may be utilised for dispersal purposes do have narrow linear contiguous linkages. The Project has potential to fragment or increase fragmentation of habitat within the Project Area, particularly with the development of access tracks and gathering networks; however, with clearing widths able to be minimised as far as practicable in sensitive environments, this will not create a barrier for the species. Ornamental snake is known to traverse cleared open areas whilst dispersing between habitats; based on the level of existing clearing and disturbance, any present would already be doing so in the Project Area. The Project will not inhibit or worsen this existing situation and the species current approach to adapting to conditions.
	Avoidance, mitigation and management measures will limit the extent of clearing and fragmentation of ornamental snake habitat. This includes preclearance surveys to accurately locate the presence and extent of potential ornamental snake habitat and further micro-siting of infrastructure to avoid areas, where possible or at least minimise fragmentation. Existing access tracks will also be utilised where possible as well as natural or existing breaks in the habitat as a result of current disturbances. High priority of avoidance will be given to gilgai habitat.  Project works within the public reserve that contains that largest and highest
	quality potential ornamental snake habitat will be limited to potential minor clearing on the edges of the existing patch. Therefore, no fragmentation will occur

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance
Adversely affect habitat critical to the survival of a species?	Important habitat for ornamental snake is considered habitat critical to the survival of the species. Potential habitat within the Project Area meets the definition of important habitat for the species however was found to be highly modified and degraded by historical clearing and cattle grazing during the field surveys. Areas of potential habitat within the wider Project Area are likely to be impacted by the same threatening processes and therefore are considered unlikely to contain the important habitat features to support the species. The Project will potentially impact on 2 ha of potential habitat, which equates to less than 1 % of habitat critical to the survival of the species identified within the Project Area.  Avoidance, mitigation and management measures will limit the extent of clearing of potential habitat. This includes pre-clearance surveys to accurately locate the presence and extent of ornamental snake habitat and further micro-siting of infrastructure to avoid areas, where possible. High priority of avoidance will be given to gilgai habitat. Other potential impacts such as fragmentation, pest incursion, erosion and sedimentation and
	contamination that could also adversely impact on habitat will be effectively management through the implementation of management measure during the construction phase.
Disrupt the breeding cycle of an important population?	No.  A maximum of 2 ha of potential ornamental snake habitat that may be used for breeding purposes will be cleared for the Project, resulting in a 1 % reduction in available habitat within the Project Area. A total of 255.71 ha of potential breeding habitat will remain after Project development. The extent and duration of this amount of disturbances in unlikely to disrupt the breeding cycle of ornamental snake potentially occurring within the Project Area.
	The species has live bearing young and therefore the Project will not impact on incubation or other breeding processes associated with egg laying reptiles. Gilgai habitat is utilised for foraging and mitigation measures will be implemented to ensure that these areas are avoided with priority where possible and habitat degradation does not occur. This includes pre-clearance surveys to accurately locate the presence and extent of gligai areas and further micro-siting of infrastructure to avoid areas, where possible. Pest incursion, erosion and sedimentation and contamination will be effectively management through the implementation of management measure during the construction phase.
	As discussed above, potential fragmentation impacts will not create a barrier for individuals dispersing during the breeding periods.

EPBC Act criteria – is there a real possibility that the Project will:	Assessment of significance
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No.  The Project may impact 2 ha or less than 1 % of potential ornamental snake habitat within the Project Area. Potential habitat may be utilised by the species for breeding, foraging and dispersal purposes. The habitat within the Project Area is highly modified and degraded by historical clearing and cattle grazing. Therefore it is expected that impacts on habitat are unlikely to cause the species to decline beyond current levels within the Project Area. A total of 255.71 ha of potential ornamental snake habitat not impacted by blade ploughing will remain following the development of the Project, which will be able to support individuals potentially utilising the Project Area. This includes dispersal functions, which are important in maintaining viable populations.  No significant works are proposed that will alter surface hydrology of gilgai areas. Mitigation and management measure will also be implemented to reduce risk of habitat degradation from weed and pest incursion, erosion and sedimentation and water contamination (e.g. hydrocarbon spills).
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat?	No.  Poisoning resulting from ingestion of cane toads ( <i>Rhinella marina</i> ) and destruction of wetland habitat by feral pigs ( <i>Sus scrofa</i> ) are listed as major threats in the Approved Conservation Advice for ornamental snake (Threatened Species Scientific Committee, 2014b). Populations of these species are expected to exist in the area. Activities related to the Project are not expected to exacerbate populations of these species such as creating ponded areas that could provide additional breeding habitat for cane toads.
Introduce disease that may cause the species to decline?	No.  Disease is not listed as a threatening process in the Approved Conservation Advice for ornamental snake (Threatened Species Scientific Committee, 2014b). Implementation of weed and pest controls measures for the Project will ensure best practice site hygiene.
Interfere substantially with the recovery of the species?	No.  The federal environment minister has declared that that a national recovery plan for the ornamental snake is not required. Current threats to this species include loss and fragmentation of habitat, alteration of landscape hydrology in and around gilgai environments, and alteration of water quality through chemical and sediment pollution of wet areas.  The Project is not considered to enhance these threatening processes and interfere with the recovery of ornamental snake due to the following:  Minimal extent of clearing resulting in a reduction of only <1 % of modelled potential ornamental snake habitat within the Project Area  A total of 255.71 ha of ornamental snake habitat that will remain within the Project Area, including habitat critical to the survival of the species Implementation of avoidance, mitigation and management measures, including:  Pre-clearance surveys to allow for micro-siting and further avoidance and reduced fragmentation, particularly gilgai areas  Weed control and management  Erosion and sediment control  Hydrocarbon and chemical storage and management

# Yakka skink (*Egernia rugosa*)

# Description and status under the EPBC Act

The yakka skink is listed Vulnerable under the EPBC Act.

The yakka skink is a robust, long-lived skink approximately 40 cm long (head to tail tip). It's body colour ranges from pale to dark brown, usually with a broad dark brown stripe extending along the back from the neck to the tail.

#### Distribution

The yakka skink has a broad distribution which extends from the coast to the hinterland of sub-humid to semi-arid eastern Queensland. This vast area covers portions of the Brigalow Belt, Mulga Lands, South-east Queensland, Einasleigh Uplands, Wet Tropics and Cape York Peninsula Biogeographical Regions. The Mulga Lands and Brigalow Belt South Bioregions are reported to comprise the core habitat of this species (Department of Agriculture Water and the Environment, 2021b), however populations throughout the Brigalow Belt are highly fragmented.

#### **Habitat requirements**

This species is known to occur in a diversity of habitats including in rocky outcrops, sand plain areas and dense ground vegetation, in association with open dry sclerophyll forest or woodland (i.e. poplar box / ironbark), brigalow forest and open shrubland. It occurs in a range of RE types on land zones 3, 4, 5, 7, 9 and 10 and occasionally on basalt plains and hills (land zone 8) although this is not representative of core habitat (Department of Agriculture Water and the Environment, 2021b).

The yakka skink typically occupy self-excavated burrows and cavities under microhabitat such as large fallen timber, rock crevices, tree stumps and grass tussocks (Department of Agriculture Water and the Environment, 2021b). They are also known to modify tunnel erosion, root cavities and disused rabbit warrens (Ferguson & Mathieson, 2014). The species exhibits complex sociality and within these burrows, they live in colonies or aggregations of up to 21 individuals ranging in size and age (Peck et al., 2016). Peck *et al.* (2016) suggest that these social aggregations are more likely to form in habitat with the optimum ecological requirements. This is supported by their study which found that sites in high value habitat appeared to be clumped, with multiple sites occurring in a localised area (minimum distance between sites of only 24 m).

All *Egernia* species are considered to be posturing heliotherms, meaning they modify their postural orientation to adjust to the rate of heat gain and seek shade to reduce body temperatures. Their burrows act to reduce temperature oscillations, reduce water loss and provide a stable environment (Chapple, 2003). Yakka skinks in these colonies defecate in communal latrine sites outside burrow entrances, potentially at the favoured morning basking site (Bull et al., 1999). These scat piles are conspicuous and provide a means to identify the presence of the species which is secretive and cautious and therefore often difficult to detect.

The species is crepuscular, usually leaving the burrow in the early morning and then from dusk through to early evening. They are omnivorous and consume a variety of soft plant material, including fruits as well as invertebrates. Basking and foraging is typically within close proximity to the burrow entrance, such that refuge can be easily sought at the first sign of disturbance (Threatened Species Scientific Committee, 2008).

The yakka skink exhibits strong site fidelity with one study recording adult individuals using the same site for at least 73 months and juveniles for up to 38 months (Peck et al., 2016). This study also recorded dispersal in adults and sub-adults, where individuals moved between colonies. Five individuals from a cohort of 35, moved site locations over a 5-year study period, with a mean dispersal distance of 261 m. Some of the study sites were occupied by one individual lizard and these may represent sites where only one individual has dispersed from an aggregation and a new aggregation has not yet formed.

#### **Threats**

The primary threat to the species is habitat reduction and degradation, which is prevalent within their core range primarily associated with agricultural and urban development. Other threats to the yakka skink include inappropriate roadside management, including road widening and removal of wood debris and rock microhabitat features. Predation by feral animals such as red fox (*Vulpes vulpes*) and feral cat

(*Felis catus*) as well as ripping of rabbit warrens are also known impacts the species. The species is also susceptible to potential population crashes or local extinction due to their longevity, high site-fidelity, low fecundity and given that populations are highly fragmented.

# Survey effort, timing and coverage

A five-day field survey was conducted across portions of the Project Area from 19 to 26 June 2020. No targeted yakka skink surveys were undertaken utilising methodologies outlined in the *EPBC Act Draft Referral Guidelines For Nationally Listed Brigalow Belt Reptiles* (Department of Sustainability Environment Water Population and Communities, 2011a). However, species specific habitat assessments were conducted, including the assessment of the presence and abundance of fallen logs, rocks and stones, soil cracks and ground layer vegetation. A total of 26 species specific habitat assessments were conducted as part of the field assessment. Areas of the Project Area not included in the field surveys were assessed via aerial imagery and LiDAR analysis.

#### Occurrence and potential habitat

The Project Area is located within the centre of the species distribution; scattered records of this species occur throughout its range. This species was not detected during the field surveys. In proximity to the Project Area, three ALA records occur however all have a high degree of spatial uncertainty or missing information (i.e. dates). One of these records occurs approximately 6 km to the north east of the Project Area, east of the Arcadia Valley Road.

During the field survey, suitable habitat for this species was recorded at the Public Reserve which comprises Brigalow open forest on alluvial plains (analogous to RE 11.3.1) and within the Eucalypt open forest on coarse-grained sedimentary rocks habitat of the western ridgeline. Yakka skink colony searches were conducted during the December 2020 survey, including within the Public Reserve and no colonies or signs of a colony were detected. Additional areas of potential habitat were identified via aerial imagery and LiDAR analysis based on the application of species-specific modelling rules (Appendix D). All potential habitat is considered suitable for breeding and foraging purposes. Areas of potential habitat not field validated are associated with Eucalypt open woodland on alluvial plains, and additional areas of Brigalow open forest on alluvial plains and Eucalypt open forest on coarse-grained sedimentary rocks all in remnant condition (Table 42).

The modelled yakka skink habitat within the Project Area comprises patches ranging in size, considered low to moderate quality or high quality. Large high-quality patches occur along the western ridgeline and at the Public Reserve in the north east, and contain an abundance of rock crevices and or large fallen timber.

Other area's of potential habitat within the Project Area range from small discrete patches (largely in the northern extent of the Project Area), to small and moderately sized connected patches associated with mapped watercourses (primarily in the southern and eastern Project Area). The quality of this habitat is likely to be compromised as a result of existing degradation processes such as historical clearing and grazing.

Given the broad nature of the modelling rules and the inability to evaluate presence of microhabitat feature, it is likely that the extent of modelled yakka skink habitat is over-estimated within the Project Area. During the field survey, the majority of Brigalow communities able to be surveyed were found to be degraded and lacked critical microhabitat features. Given the similar land use and level of disturbance across the properties, it is likely that this will be the case for areas of modelled yakka skink habitat and that the majority of areas when field verified, are unlikely to contain the important habitat features to support the species.

Table 42 Yakka skink habitat within the Project Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Brigalow open forest on alluvial plains	11.3.1, 11.3.2, 11.10.1,	Remnant	Breeding / foraging	Ground-truthed as potential yakka skink habitat; <b>OR</b> Remnant and non-remnant	1,104.89

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Eucalypt open woodland on alluvial plains  Eucalypt open forest on coarse- grained sedimentary rocks	11.10.4 & 11.10.11			areas on Land Zone 3, 5, 7, 9 and 10 containing:  Iarge hollow logs  cavities or borrows under large fallen trees  tree stumps  logs  stick-racked piles of logs  large rocks and rock piles.	

As per the *Draft referral guidelines for the nationally listed Brigalow Belt reptiles* (Department of Sustainability Environment Water Population and Communities, 2011a), the occurrence of known 'important habitat' is a surrogate for an 'important population' of this species.

'Suitable habitat' for the species has been defined in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (Department of Sustainability Environment Water Population and Communities, 2011a) as:

'Open-forests to low-woodlands and scrub in QLD RE Land Zones (LZ) 3, 4, 5, 7, 8, 9, 10 and 12 (LZ 8 not considered core habitat; LZ 12 in Wet Tropics bioregion only). Colonies have been found in large hollow logs, cavities or burrows under large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes'

Known 'important habitat' for the yakka skink is defined as:

- Any contiguous patch of suitable habitat, particularly remnant vegetation, where a colony is known
  or identified
- Any microhabitat where colonies are likely to be found.

Suitable habitat for the yakka skink can also be considered as 'important' if it is:

- Habitat where the species has been identified during a survey
- Near the limit of the species' known range
- Large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the
  purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive
  generations), OR
- A habitat type where the species is identified during a survey, but which was previously thought not to support the species.

Although the species was not observed during field surveys, all modelled habitat within the Project Area is considered suitable habitat and important habitat based on the definitions above.

#### Habitat critical to the survival of the species

There is no species-specific guidelines for determining habitat critical to the survival of the yakka skink, and at present no recovery plan exists. As important habitat has been defined in the *Draft Referral Guidelines for the Nationally Listed Brigalow Belt Reptiles* (Department of Sustainability Environment Water Population and Communities, 2011a) as stated above, this terminology is considered to be interchangeable with 'habitat critical to the survival of the species' in regards to this species. As such 'habitat critical to the survival of the species' is present in communities with macrohabitat and microhabitat features suitable to support a colony (mapped as breeding and foraging habitat).

# **Potential Project impacts**

A maximum of 2.0 ha of potential breeding and foraging habitat may be cleared as part of the Project. Other Project related potential indirect impacts relevant to the yakka skink includes:

- pest incursion
- fauna mortality via entrapment in trenches
- erosion and sedimentation
- light disturbance.

# Project avoidance, mitigation and management measures

In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measures are recommended:

- Open trenches will be checked for trapped fauna in the morning and at the end of the day by a spotter catcher
- Trench ladders, ramps, sticks, ropes and the use of moist hessian sacks at regular intervals (or similar) will be utilised to help trapped fauna escape and/or survive until removed by a fauna spotter-catcher.

## Significance assessment

An assessment of the significance of impacts to this species under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided in Table 43. The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 43 Significant impact assessment – yakka skink

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
Lead to a long-term decrease in the size of an important population of a species.	No.  As detailed above, the potential habitat present within the Project Area does meet the criteria to be considered 'important' as defined in these guidelines. The yakka skink, or signs of yakka skink colonies (i.e. communal latrines) were not detected during the field survey. However, suitable macrohabitat and microhabitat was recorded and as a result suitable habitat is considered to potentially occur in a number of locations across the Project Area. In total, 1,104.89 ha of potential breeding and foraging habitat has been mapped within the Project Area however the true extent of potential habitat is likely lower due to a lack of microhabitat features from cattle grazing disturbance. Direct impacts via vegetation clearing will occur to a maximum of 2.0 ha of potential habitat. High quality habitat is restricted to the Public Reserve and the western ridgeline; any potential impacts to this habitat will be restricted to the lower quality, more marginal edges only. Remaining potential habitat largely occurs as linear patches and given the linear nature of the Project, direct impacts may lead to some habitat fragmentation. To reduce any potential impact to a local population should it exist within the Project Area, a number of mitigation measures will be implemented as per Section 8. Survey works prior to construction will identify the full extent of potential yakka skink habitat and search for potential colonies. Where a colony is located, no clearing will occur within 200 m of this location. Clearing will only be conducted where required necessary and suitable microhabitat/ shelter features such as large fallen logs will be relocated to areas of adjacent potential habitat.
	The long-term persistence of any potential local population will rely on the ability of individuals to continue to disperse between known aggregations.

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
	During construction, trenching required for the installation of gas distribution infrastructure may create a temporary barrier to movement. A spotter catcher will be present during trenching works and relocate any yakka skink individuals that may fall within. Area's trenched will have the ground layer reinstated as soon as possible.
	Given the minimal area of disturbance, the management of potential fragmentation impacts and the relocation of microhabitat features, it is unlikely that the Project will lead to a long-term decrease in the size of an important population of yakka skink.
Reduce the area of occupancy of an important population.	No. The yakka skink has a broad distribution across seven bioregions in Queensland, however the brigalow belt is considered to be its core range. The area of occupancy, or extent of occurrence have not been defined for the species, however it is known to occur in a broad variety of vegetation types which are widely available surrounding the Project Area and within the broader region.
	Direct impacts to potential habitat are minimal (2.0 ha) especially in the context of total available potential habitat within the Project Area. The Project Area will be developed in stages and as such only a portion of the potential habitat may be impacted at one time. Indirect impacts will be minor and temporary (i.e. noise and light spill during construction). The critical process for maintaining any local population long-term of is to ensure that dispersal opportunities are maintained between aggregations and for individuals creating new aggregations. Barriers to movement created during construction will be temporary and monitored by a spotter catcher who will ensure any individuals that become entrapped are freed. In addition, microhabitat features suitable for the sheltering of the species will be retained and relocated. High quality habitat areas within the Project Area and directly adjacent will retain their ecological functionality and the carrying capacity of the habitat should not be significantly impacted. Based on this, it is unlikely that the Project will reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations.	No.  The yakka skink exhibits strong site fidelity, however movements between colonies/aggregations are known to occur. One study (Peck et al., 2016) has shown that these dispersal distances averaged 261 m and once an individual moved, it typically stayed at the new colony for an extended period (years). These occasional movements were necessary to prevent inbreeding within a colony. Colony searches were conducted during the December 2020 field survey in areas of high quality habitat; no colonies were detected.
	It is unlikely that the Project will reduce the ability for any dispersing individuals to move between sites as once installed, the majority of Project infrastructure will occur underground. The construction of the Project will occur in stages ensuring only a portion of the Project Area (and thus potential habitat) is disturbed at one time. Where trenching is required, these areas will be monitored by a spotter catcher to ensure no yakka skink individuals are entrapped. Additionally, suitable shelter features such as large fallen logs will be relocated to adjacent areas of suitable habitat. An important population is unlikely to be fragmented into two or more populations as a result of the Project.

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
Adversely affect habitat critical to the survival of a species.	No.  There is no Recovery Plan for this species and as such no habitat critical to the survival of the yakka skink has been defined. However, 'important habitat' has been identified within the Project Area which is considered to be a surrogate for habitat critical to the survival of this species. This habitat is considered to be important/critical due to the suitability of the macrohabitat (the community and geology) and the likely availability of microhabitat features.  The Project will not compromise the potential for any local population to persist as direct impacts will occur only to a small amount of potential habitat within the Project Area. No clearing will occur within 200 m of a colony. When siting infrastructure, existing gaps in the linear areas of potential habitat will be utilised where possible to ensure fragmentation is limited. Additionally, only a portion of the Project Area will be impacted at one time and clearing will only be completed as necessary. Potential impacts to dispersing individuals during construction will be managed as discussed above and important microhabitat features will be retained and relocated. Therefore, the Project is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population.	No.  No specific breeding habitat or breeding season is known for the yakka skink. However, as this species' births live young and they live in colonies in burrows, it is expected that these burrow systems are used as breeding places. Aggregations of yakka skink living in burrows comprise long-term family units (Peck et al., 2016) and inbreeding is avoided by the arrival of dispersing non-related lizards which establish themselves in an aggregation. The Project is not expected to fragment any existing population and as such the movements of dispersing lizards required to maintain breeding potential should not be impacted. No active burrows were observed during the field survey, however a total of 1,023.97 ha of potential habitat suitable for breeding has been identified. Surveys will be conducted by a suitably qualified person prior to construction commencing to identify any burrows in the Project Area, and up to 200m away where suitable habitat is available. If an aggregation is found within 200m of the Project Area, a buffer area should be demarcated around these sites to ensure no accidental direct or indirect impact.  Given the small scale of direct and indirect impacts, the paucity of active burrows within the Project Area and with the proposed mitigation measures adhered to, the Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	No.  High quality habitat is restricted to the Public Reserve and the western ridgeline; any potential impacts to this habitat will be restricted to the lower quality, more marginal edges only ensuring habitat maintains its ecological functionality for the species to persist (if present). Remaining potential habitat largely occurs as linear patches and are likely to have a reduced quality as a result of ongoing disturbance from weeds, adjacent cattle grazing and historical clearing. The habitat within the Project Area is likely to be typical of that found throughout the species' range and strict adherence to clearing limits will be enforced. Microhabitat features will be retained and relocated to suitable recipient areas.

EPBC Act Criteria – is there a real possibility that the Proposed Action will:	Assessment of Significance
	Indirect impacts are also considered to be minimal. Potential fragmentation impacts will be managed as previously discussed. Edge effects are not expected to be amplified significantly and light spill and increased noise are expected to be temporary and localised. The scale of direct and indirect impact is considered to be minimal in the context of available suitable habitat within the Project Area and adjacent habitat (particularly to the north west).  It is therefore considered unlikely that the Project will modify, destroy, remove, isolate or decrease the availability of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	No.  Predation by red fox and feral cat have been identified as a threat to the yakka skink in the SPRAT profile (Department of the Environment, 2020).  Neither of these species were recorded during the field survey, however they are common within the region and are likely to use the Project Area and adjacent habitats. Activities related to the Project are not expected to exacerbate populations of these species.  The implementation of weed and pest management measures will help control and prevent the establishment of invasive species.
Introduce disease that may cause the species to decline.	No. Disease has not been listed as a threat to this species under the <i>Approved Conservation Advice for Egernia rugosa (Yakka Skink)</i> , (n.d.). However, weed and pest management for the Project will ensure best practice site hygiene measures.
Interfere with the recovery of the species.	No. The Project will have minimal impact to the primary conservation actions as stipulated in the Conservation Advice, with the exception of clearing of a small area of potential habitat.  This advice does specifically reference the need for protection of habitat areas where the yakka skink occurs, to not adversely affect known populations. If any population is present within the Project Area or adjacent, adverse impacts should be minimal given that the clearing represents a small reduction in total available habitat, no fragmentation of aggregations is
	anticipated, the Project will not interfere with breeding cycles and microhabitat features will be retained and relocated which will help to facilitate dispersal.  With the implementation of the mitigation measures proposed, population scale impacts would be unaffected in the long-term and interference to species recovery as a result of the Project are therefore unlikely.

# South-eastern long-eared bat (Nyctohpilus corbeni)

# Description and status under the EPBC Act

The south-eastern long-eared bat is listed as Vulnerable under the EPBC Act.

Approximately 30% of the total distribution of the species occurs in Queensland, although there are records from fewer than 30 localities, mainly from within the Brigalow Belt South bioregion (Reardon 2012).

The Conservation Advice (Threatened Species Scientific Committee, 2015b) for this species notes that due to the lack of data available to assess the population decline of Corben's long-eared bat, providing a detailed assessment of the current threats to the survival of this species is difficult. However, it is likely that its area of occupancy is declining due to habitat loss, particularly in New South Wales and Queensland

Until recently the south-eastern long-eared bat was included as a distinct form of the Greater Long-eared Bat (*Nyctophilus timoriensis*) complex and was listed as such under the EPBC Act. In 2009 it was formally described as a separate species, *Nyctophilus corbeni* by Parnaby (2009). It is similar in size to Gould's long-eared bat (*N. gouldi*) however the south-eastern long-eared bat has a noticeably broader head and snout (Parnaby, 2009)

#### Distribution

The species prefers drier areas of Queensland, New South Wales and South Australia. It is largely restricted to the Murray–Darling basin and western slopes of the Great Dividing Range, across south–east Australia from south–central Queensland through inland New South Wales to just south of Murray River in Victoria and north of Murray River in south–east South Australia (Churchill, 2008). There are no estimates of total population, but it is recorded as a comparatively low proportion of all bat calls during surveys within its range, suggesting low comparative abundance.

# Habitat requirements

The species roosts in hollows, fissures in branches and under bark on trees and tree hollows are used for maternity sites (Churchill, 2008). It is most abundant where the vegetation has a distinct canopy and a dense, cluttered understorey layer. The species occurs in a wide variety of habitats including box/ironbark/cypress pine woodlands, buloke woodlands, brigalow woodlands, belah woodlands, smooth-barked apple woodlands, river red gum forest and black box woodland. In Queensland they have been recorded from semi-evergreen vine thicket, with *Brachychiton sp.* emergent, inland dry sclerophyll forest with *Corymbia citriodora* and ironbark, open forest with *Xanthorrhoea sp.* in the lower strata, *Callitris* forest, and open forest with midstorey of *Allocasuarina* and *Callitris* (Churchill 2008, NSW Office of Environment and Heritage, 2017).

Mating takes place in autumn with one or two young born in late spring to early summer (Office of Environment and Heritage, 2017). A study in New South Wales found maternity colonies consisting of 10-20 individuals, roosting in dead trees including ironbarks, cypress and buloke (Schulz & Lumsden, 2010).

It is insectivorous and hunts by taking flying prey, by foliage-gleaning in flight or by foraging on the ground (Lumsden & Bennett, 1999; Schulz & Lumsden, 2010). When hunting in flight it generally consumes beetles, bugs and moths (Lumsden & Bennett 2000), however it has also been recorded feeding on grasshoppers and crickets (Office of Environment and Heritage, 2017). Foraging appears to be concentrated around patches of trees in the landscape, with many individuals from different species of bat sharing the same foraging area (Office of Environment and Heritage, 2017).

#### **Threats**

Known threats to the south-eastern long-eared bat include:

- Habitat loss
- Habitat fragmentation.

Determining other potential threats is difficult due to lack of data available to assess the population decline. However, the following are considered as potential threats relating to habitat degradation:

- Unnatural fire regimes
- Reduction in hollow availability
- Exposure to agrichemicals
- Reduction of foraging habitat due to grazing
- Predation by feral animals such as feral cat or red fox.

# Survey effort, timing and coverage

The survey guidelines for Australia's threatened bats prescribes the following survey methods and effort for the south-eastern long-eared bat:

- Unattended bat recorder:
  - Calls are not distinguishable reliably from other *Nyctophilus* species using bat recorders. However, bat detectors can be used to identify areas used by long-eared bats. Acoustic detection can then be followed up with an appropriate level of trapping.
- Harp traps and/or mist nets:
  - 20 trap nights over a minimum of 5 nights. Harp traps and/or mist nets should be placed both within open fly-ways and within cluttered vegetation such as woodland, mallee or forest as the species forages below the tree canopy, often at ground level. Significant effort should also be conducted over water (artificial or naturally occurring).

Surveys are best conducted on warm nights from October through to April.

Field surveys for the Project were conducted over two 5 day periods, one in June 2020 and the other in December 2020. The June survey did not present ideal temperature conditions and was outside of the preferred survey period. Therefore, the survey method during June did not include unattended bat recorders, however other assessment methods were conducted. For both surveys the following methodology was completed:

- Roost searches: undertaken whilst conducting habitat assessments. No roosts or caves were identified
- Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.

Unattended bat recorders were utilised during the December 2020 survey which is the suitable season for detection (16 detector nights). Bat call analysis completed by Balance! Environmental confirmed *Nyctophilus sp.*, however this species cannot be identified to a species level by call. Survey effort undertaken meets the minimum survey requirements for one of the recommended methods (unattended bat recorder).

Targeted habitat assessments were conducted across a range of suitable habitat types during both survey periods (June and December 2020) to supplement survey effort. No surveying has been undertaken within southern Project Area (lot and plan 2SP200046) however findings of the field surveys and habitat modelling indicate this property provides habitat of similar or lesser quality when compared to the rest of the Project Area. A precautionary approach has been adopted in the habitat mapping and the presence of roosting and foraging habitat resources has been assumed in areas of potentially suitable habitat.

Targeted surveying including harp trapping, has also been completed for this species by Terrestria (see Section 4.2) in 2021 on the Santos Bottle Tree property, which occurs less than 5 km to the north east of the Project Area. This species was not recorded.

# Occurrence and potential habitat

Nyctophilus sp. was recorded within the Survey Area based on the bat call analysis; however calls from this genus cannot be differentiated. Two ALA records (dated 2002 and 2014) occur within 50 km of the Project Area in the Expedition National Park (from a centre coordinate). Most SELEB records in Queensland are known to occur in large tracts of relatively undisturbed forest and woodland, with very few in highly disturbed landscapes (G. Ford 2021, pers com, 18 November). Within the Project Area, this would equate to the western ridgeline, middle hill or the public reserve (G. Ford 2021, pers com, 18

November). It is unlikely that the very narrow and linear habitat patches within the Project Area would be suitable to support the species. Based on this, it is anticipated that if a population does occur within Project Area, density would be very low and individuals would generally be restricted to the larger vegetation patches that contain suitable habitat features to provide roosting and foraging habitat.

Hollow-bearing trees and stags as well as trees with loose bark were occasionally recorded during the field surveys. Where these habitat features occur or are considered likely to occur in areas of sufficient size and width, the habitat is considered suitable for roosting (Figure 20). The Project Area contains woodlands dominated by *Acacia harpophylla* and *Eucalyptus sp.* in both remnant and high value condition; these habitat types provide the more complex understorey that is suitable for foraging (Figure 20). This species is highly mobile and may disperse across the Project Area through foraging habitat.

Table 44 South-eastern long-eared bat habitat within the Project Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Eucalypt open woodland on alluvial plains  Eucalypt open forest on coarsegrained sedimentary rocks  Brigalow open forest on alluvial plains and sedimentary rock  SEVT	11.3.2, 11.3.25 11.10.1, 11.10.4, 11.10.11 11.3.1, 11.9.5, 11.9.5a	Remnant	Roosting and foraging	Field validated to be potential roosting and foraging habitat for southeastern long-eared bat; <b>OR</b> Remnant woodlands dominated by <i>Allocasuarina luehmannii</i> , <i>Acacia harpophylla</i> , <i>Casuarina cristata</i> , <i>Eucalyptus camaldulensis</i> , and various other types with a dense cluttered understorey AND with hollow bearing trees or trees with decorticating bark.	1,223.60
Eucalypt open woodland on alluvial plains  Eucalypt open forest on coarse-grained sedimentary rocks  Brigalow open forest on alluvial plains and sedimentary rock  SEVT  Other non-remnant vegetation	11.3.2 11.10.4 11.3.1, 11.9.5, 11.9.5a 11.9.4 Non-remnant	Non-remnant, HVR and remnant	Foraging and dispersal	Field validated to not be suitable for roosting however provide foraging opportunities; <b>OR</b> HVR woodlands or regrowth with a dense cluttered understorey (lacks hollow bearing trees or trees with decorticating bark).	644.50

The SPRAT does not identify 'important populations' of south-eastern long-eared bat. Therefore, any population potentially occurring within the Project Area has been assessed against the generic definition in the *EPBC Act Significant Impact Guidelines 1.1.* 

Although habitat occurs as scattered patches throughout much of the Project Area, large tracts of suitable habitat in woodland open forest and semi-evergreen vine thicket occur within the Public Reserve, Middlle Hill and the western ridgeline. These areas provide important preferred habitat for the species in a landscape that is largely modified due to their high level of connectivity to significant areas of suitable habitat to the west. As such, any population present is unlikely to be unique, isolated or genetically distinct from other populations in the region. However, given the vast areas of suitable roosting and foraging habitat in the context of the surrounding landscape, any population may be a key source population for breeding or dispersal. As such it would meet the definition of an 'important population'.

# Habitat critical to the survival of the species

There is no species-specific guidelines for determining habitat critical to the survival of south-eastern long-eared bat and at present no recovery plan exists. Therefore, the generic *EPBC Act Significant Impact Guidelines 1.1* definition of habitat critical to the survival of a species has been applied.

Suitable foraging and roosting habitat occurs as large contiguous patches in the Public Reserve, Middle Hill and the western ridgeline as well as in smaller scattered patches throughout the Project Area. Potential habitat within the Public Reserve, Middle Hill and the western ridgeline has suffered limited anthropogenic impact and may provide high value habitat refuge for the species. On this basis, habitat within the Project Area is potentially necessary for life-cycle requirements, maintaining genetic diversity, the recovery of the species or for the long-term maintenance of the species; and hence it meets the definition of habitat critical to the survival of the species.

# **Potential Project impacts**

A total of 4.0 ha of potential roosting and foraging habitat may be cleared for development of the Project. This may also result in further fragmentation of potential habitat within the Project Area and direct mortality by entrapment in hollows or bark fissures during vegetation clearing. Other Project related potential indirect impacts relevant to the species includes:

Increased noise and light levels affecting foraging and breeding behaviours.

# Project avoidance, mitigation and management measures

Avoidance, mitigation and management measures outlined in Section 8.3.1 will help to reduce impacts to south-eastern long-eared bat. No additional species-specific mitigation measures have been identified.

#### Significance assessment

An assessment of the significance of impacts to this species under the Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided in Table 39.

The outcome of this assessment is that the Project is considered unlikely to result in a significant impact to the species.

Table 45 Significant impact assessment – south-eastern long-eared bat

Table 45 Significant impact assessment – south-eastern long-eared bat				
Criterion – is there a real chance or possibility that the Proposed Action will:	Assessment			
Lead to a long-term decrease in	No.			
the size of an important population of a species?	There is little information currently available regarding population numbers and structure for the south-eastern long-eared bat. <i>Nyctophilus sp.</i> was recorded within the Survey Area based on the bat call analysis; however calls from this genus cannot be differentiated.			
	The Project Area occurs within the 'potential' distribution of the species according to the SPRAT. Potential habitat was confirmed within the Project Area and includes foraging and roosting habitat (total area of 1,868.11 ha). No direct impacts will occur to potential habitat that occurs within the western ridgeline and Middle Hill, allowing the majority of high-quality potential habitat that occurs as large contiguous patches to be completely avoided. A maximum of 4 ha of foraging and roosting habitat may be directly impacted via vegetation clearing. This represents a loss of less than 1 % of available foraging and roosting habitat within the Project Area.			
	Indirect impacts include increased activity, light and noise. However, these will be temporary and as the Project will be constructed in phases and impacts will be localised. Furthermore, given the relatively broad habitat requirements, a large amount of potential habitat is expected to occur in the area surrounding the Project Area. Therefore, no Project related activities are considered likely to lead to a long-term decrease in the size of a population.			
Reduce the area of occupancy	No.			
of an important population?	This species' area of occupancy is not known but is considered likely to be decreasing due to a number of factors including habitat loss and degradation.			
	Any south-eastern long eared bats that utilise the Project Area are conservatively considered to comprise an important population. The Project Area does not occur at the limit of the species distribution and areas of high quality habitat (the western ridgeline and Middle Hill) will be avoided. Habitat within the Project Area is potentially suitable for foraging and roosting and direct impacts are anticipated to occur to less than 1 % of total available habitat. Potential habitat that may be directly impacted occurs as small fragmented patches which are unlikely to be preferred by the species given the availability of high quality habitat in the local area. As such the Project is unlikely to reduce the area of occupancy of the species.			
Fragment an existing important	No.			
population into two or more populations?	No existing population is known from the Project Area, and any that potentially occurs is likely to primarily rely on high quality connected habitat. The species is also highly mobile and the Project will not result in the creation of barriers to movement within or between habitat for the species. As construction of the Project will occur in phases, direct and indirect impacts at one time will be localised to only a small area within the Project Area. This will allow potentially present individuals to relocate to other areas of suitable habitat within the Project Area or outside. Therefore, it is unlikely the Project will fragment an existing population into two or more populations.			

Criterion – is there a real chance or possibility that the Proposed Action will:	Assessment	
Adversely affect habitat critical to the survival of a species?	No.  Areas of high quality and connected habitat within the Project Area (Public Reserve, Middle Hill and the western ridgeline) are considered habitat critical to the survival of the species. Both Middle Hill and the western ridgeline will be treated as strict no-go zones and as such direct impacts to critical habitat will be largely avoided. A maximum of 4 ha of foraging and roosting habitat will occur however the loss of this habitat will result in less than 1 % overall reduction in habitat. As construction of the Project will occur in stages only a portion of the total potential habitat area may be disturbed at one time. Therefore, the Project is unlikely to adversely affect habitat critical to the survival of the species.	
Disrupt the breeding cycle of an important population?	No.  There is little available information on the species' reproductive biology. Breeding is likely to be seasonal, potentially occurring around November. Any population within the Project Area is considered to comprise an important population. Given the high availability of potential habitat within the Project Area, the species' is considered to prefer areas of high quality habitat for the establishment of a maternity colony. These areas occur primarily in strict nogo zones (Middle Hill and the western ridgeline). As construction of the Project will occur in stages only a portion of the total potential habitat area may be disturbed at one time and indirect impacts will be temporary. Preclearance surveys will ensure any roosting individuals including those within a maternity colony are identified. Active animal breeding places will be managed appropriately by a qualified spotter catcher. As such, the Project is unlikely to disrupt the breeding cycle of a population.	
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	No.  No existing population is known from the Project Area and it is likely that utilisation would be primarily in areas of high quality habitat. The species is also highly mobile and may utilise potential habitat areas in the local landscape such as that within the Carnarvon Range and Expedition Range. Direct impacts are anticipated to occur to some areas of potential foraging and roosting habitat (a maximum of 4 ha); however the loss of this habitat will only lead to a 1 % reduction in habitat within the Project Area. Infrastructure siting will maximise use of existing gaps between potential habitat patches and aim to not dissect patches to minimise further fragmentation. Furthermore, micro-siting activities prior to construction will ensure hollowbearing trees are retained where possible. Indirect impacts such as increased activity light and noise will be temporary and localised.  As such the Project is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of the habitat to the extent that the species is likely to	
Result in invasive species that are harmful to a Vulnerable species becoming established in the Vulnerable species' habitat?	No.  Invasive species have not been identified as a known threat to the southeastern long eared bat. Nonetheless, the Project is unlikely to exacerbate invasive species beyond current levels. Weed and pest management controls will be developed to mitigate and manage the potential spread of pest flora and fauna species.	

Criterion – is there a real chance or possibility that the Proposed Action will:	Assessment		
Introduce disease that may	No.		
cause the species to decline?	Disease has not been identified as a threat to the south-eastern long eared bat. Weed and pest management controls for the Project will ensure best practice site hygiene measures.		
Interfere substantially with the	No.		
recovery of the species?	The SPRAT profile identifies that a Recovery Plan for the south eastern long- eared bat is required; however, no such plan exists at the time of this report. No Threat Abatement Plan has been identified as being relevant for this species. The Conservation Advice for this species does include conservation and management actions however which are centred on the following themes:		
	Habitat loss disturbance and modifications, including the recommendation to retain hollow-bearing trees and provide for hollow tree recruitment where possible.		
	Invasive species		
	Impacts of domestic species		
	• Fire		
	Stakeholder engagement.		
	Based on these actions, the Project is unlikely to interfere with the recovery of the species.		

# Migratory species

# Latham's snipe (Gallinago hardwickii)

# Description and status under the EPBC Act

Latham's snipe is listed as migratory under the EPBC Act.

It is a medium sized wader (length of 29-33 cm and wingspan of 50-54 cm) with a long straight bill, short broad pointed wings and a long tail and legs. The plumage is intricately marked with barring and chevrons in shades of black and brown with a white belly and rufous and white tail. There is no distinct physical differences in appearance between sexes and no seasonal variation in plumage (Department of the Environment and Energy, 2016).

#### Distribution

Latham's snipe is a non-breeding visitor to south-eastern Australia and a passage migrant in northern Australia. It is known from the east coast far north as the Cape York Peninsula and as far south as Adelaide and the Eyre Peninsula. The species is also known from inland areas of Queensland in the eastern tablelands and Rockhampton, in New South Wales to the west of the Great Dividing Range and all regions of Victoria and Tasmania (Department of the Environment and Energy, 2016)

#### **Habitat requirements**

Latham's snipe occurs in permanent and ephemeral wetlands up to 2,000 m ASL. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity (Department of Agriculture Water and the Environment, 2021b).

The foraging habitats of Latham's snipe are characterized by areas of mud (either exposed or beneath a very shallow covering of water) and some form of cover (e.g. low, dense vegetation). It roosts on the ground near (or sometimes in) their foraging areas, usually in sites that provide some degree of shelter, e.g. beside or under clumps of vegetation, among dense tea-tree, in forests, in drainage ditches or plough marks, among boulders, or in shallow water if cover is unavailable.

# Threats

The most significant current threat to the species is destruction and degradation of wetland habitat. Processes such as drainage, diversion of water for storage or agriculture, development of land and land management practices which reduce suitable vegetative cover. Pollution of wetlands via nutrient enrichment and industrial discharge or salinisation of wetlands also presents a potential threat to Latham's snipe.

Disturbance from human and cattle intrusion is considered to be a potential threat, however populations are known to occupy areas which are prone to these disturbances such as wetlands where cattle water and habitats adjacent to roads and airfields.

# Survey effort, timing and coverage

The survey guidelines (Department of the Environment and Energy, 2017) recommend the following methods and survey effort for Latham's snipe:

- Bird surveys in suitable habitat:
  - 1 x survey in December
  - 2 x surveys in January
  - 1 x survey in February

Surveys should be conducted during the day and consist of area searches or line transects in suitable habitat (i.e. wetland or other waterbodies and their surrounding vegetation (Department of Agriculture Water and the Environment, 2021b).

Surveys should be conducted for Latham's snipe between October and February when the species arrive and depart in Australia. During this period the following survey effort was completed:

20 hours of active bird surveys over 5 days during December 2020.

90 hours of incidental bird surveys over 5 days during December 2020.

During both the June and December surveys, the following survey effort was also conducted

- Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.
- Waterholes and dams were visually surveyed for the species or signs of the species.

The survey requirements have been met for this species. The Project Area does not contain core habitat for this species given its inland location and therefore full survey effort is not required.

### Occurrence and potential habitat

This species was not recorded during field surveys but is considered to potentially occur within the Project Area based on the presence of suitable wetland habitat and two ALA records within 50 km. This species is known to utilise a range of freshwater environments and as such all farm dams greater than 0.5 ha and the Wetland are considered suitable (a total area of 164.0 ha).

Farm dams provide a semi-permanent water source and occur in scattered locations across the Project Area. Findings of the field surveys found that farm dams were generally disturbed by ongoing cattle use and historically modified. Despite the steep banks on several sides and cattle pugging, small areas of wetland vegetation were present in the low-lying fringes which may provide foraging opportunities for the species. When water availability in the landscape is low (i.e. the dry season), farm dams are expected to only provide marginal habitat as cattle use is likely to increase and fringing vegetation may be trampled.

The Wetland provides the highest value habitat. It is expansive during the wet season, and one of the largest in the local valley area. The Wetland has experienced considerable historical modification with the entire western length previously cleared and extensive damming works including the construction of an embankment at the north eastern extent. Outside of the embankment, the banks of the wetland are gentle slopes and large areas of shallow water with aquatic fringing vegetation occur especially in the south. Embankments within the constructed wetland also provide narrow, low-lying vegetated islands when the wetland is fully inundated. These areas specifically are likely to provide ideal foraging conditions for Latham's snipe. Although during the field survey exposed muddy margins were uncommon at the Wetland, these may become more prevalent under ideal climatic conditions (i.e. an above-average wet).

Habitat mapping is presented in Figure 27 and Table 46 below outlines the extent of potential habitat for the species within the Project Area.

Table 46 Potential habitat for Latham's snipe within the Project Area

Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Farm dams and the wetland	Water	-	Foraging / roosting	Wetlands with either shallow or deep waters fringed with dense low vegetation.	164.0

### Important habitat and ecologically significant proportion of the population

Behaviours and habitats for Latham's snipe tend to differ to many of the coastal migratory shorebird species. For example, whilst many species aggregate in large flocks, Latham's snipe typically disperse in small numbers across larger habitat areas. Consequently, important habitat for Latham's snipe is identified using a different process to that of other migratory shorebird species (Department of the Environment, 2015b).

Important habitat for Latham's snipe occurs at sites that have previously been identified as internationally important for the species, or sites that:

 Support at least 18 individuals of the species (ecologically significant proportion of the population), and  Are naturally occurring open freshwater wetland with vegetation cover nearby (for example, tussock grasslands, sedges, lignum or reeds within 100 m of the wetland).

Despite naturally fluctuating in size, the constructed wetland that occurs in the east of lot and plan 2TR13 is large enough to support an ecologically significant proportion of the population. As such, this area of habitat is considered important habitat for Latham's snipe.

An ecologically significant proportion of the population of Latham's snipe has not been defined in the Commonwealth guidelines (Department of the Environment and Energy, 2017). However, an area is considered to be important for the species if it supports at least 18 individuals. Therefore, this number has been adopted as the threshold for ecological significance.

### **Potential Project impacts**

A total of 1.0 ha of potential foraging and dispersal habitat may be cleared along the edges of farm dams as part of the Project. Vegetation clearing and particularly the loss of fringing aquatic vegetation may result in further degradation of potential habitat within the Project Area. Project relevant indirect impacts on this species include:

- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats
- Increased risk of contamination associated with activities such as refuelling or storage of chemicals
- Temporary changes in hydrology from installation of infrastructure creating a barrier to surface flow and increasing stormwater run-off
- Removal of water from existing constructed wetlands and farm dams leading to changes in hydrology / habitat extent and water quality. Increased activity at these locations resulting in avoidance and potentially altered foraging and breeding behaviour
- Periodic burst of elevated noise levels may startle and disorientate individuals within proximity
- Increased pest levels, notably those which may prey upon this species.

This species is a non-breeding migrant present only in Australia around and during the wet season (August to May). It is highly mobile and known to disperse readily to areas of more suitable habitat if necessary. As such, the Project Area will only be utilised by potentially occuring Latham's snipe during the wet season when water availability is at high. High water availability in the landscape will increase the extent of potential habitat.

Water extraction activities may occur at some wetland locations during construction, however this will only occur where available supplies provide continuity of habitat function. Water extraction for construction is likely to occur during the dry season and whilst water levels and the extent of fringing aquatic habitat will naturally be fluctuating at this time, given the absence of Latham's snipe individuals during this period any potential indirect impact associated with water extraction (change in hydrology, habitat extent, water quality, noise disturbance) will be irrelevant. Any potential indirect impacts during this time are considered temporary and are unlikely to persist into the wet season when migratory species could return. The Project will not create a barrier that may hinder access to wetland habitat.

### Project avoidance, mitigation and management measures

Indirect impacts such as increased erosion, sedimentation and contamination will be managed as per Section 8.0. Other indirect impacts such increased dust, light and noise will be temporary and localised. Due to the geography of the Project Area, it is likely to be used for foraging only whilst on passage to south-eastern Australia. This species does not breed in Australia.

In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measure is recommended:

Water extraction activities will be strictly controlled and monitored in liaison with the landholder to
ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point
will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring
individuals to avoid the same area during construction. Existing access points to wetlands will be
used preferentially over the creation of new ones.

### Significance assessment

An assessment of the significance of impacts on this species under EPBC Act Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided in Table 47.The outcome of this assessment was that the Project is considered unlikely to result in a significant impact to Latham's snipe.

Table 47 Significant impact assessment - Latham's snipe

Table 47 Significant impact assessment - Latham's sinpe				
Criterion – is there a real possibility that the Project will:	Assessment of significance			
Substantially modify	No.			
(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	The Project is not considered likely to result in the creation of barriers to movement to, between or within habitat, nor will it alter the fire regimes, nutrient cycles or hydrological cycles. A total of 164 ha of habitat suitable for foraging and dispersal occurs within the Project Area comprising modified farm dams and a constructed wetland. A maximum of 1 ha of vegetation clearing will occur along the boundaries of the farm dams, resulting in a less than 1 % reduction in available habitat. The constructed wetland only is considered important habitat for this species and no direct impacts will occur at this location.			
	Water extraction activities will be strictly controlled and monitored in liaison with the landholder to ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring individuals to avoid the same area during construction. Existing access points to wetlands will be used preferentially over the creation of new ones. Measures targeted to erosion and sediment control, potential contamination and pests will also be implemented during construction to ensure indirect impacts that may lead to habitat degradation or increased threat levels to the species are managed. No significant impacts on the wetland hydrology or water quality will occur. Additionally, any potential indirect impacts to waterbodies as a result of water extraction during the dry season are considered temporary and are unlikely to persist into the wet season when the species could return. The Project will not create a barrier that may hinder access to wetland habitat.			
	Therefore, while low numbers of this species may use the habitat whilst on passage to south-eastern Australia, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat for Latham's snipe.			
Result in an invasive species	No.			
that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	Invasive flora and fauna have not been identified as a threat to the species however, feral cats and dingoes may predate on the species. These species were recorded in the Project Area during field surveys, however it is unlikely that the Project will exacerbate invasive species beyond current levels.			
	Weed and pest management measures will be developed to mitigate and manage the potential spread of pest fauna species.			
Seriously disrupt the lifecycle	No.			
(breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species	An ecologically significant proportion of the population of Latham's snipe has not been defined in the Commonwealth guidelines (Department of the Environment and Energy, 2017). However, an area is considered to be important for the species if it supports at least 18 individuals. Therefore, this number has been adopted as the threshold for ecological significance. Suitable habitat within the Project Area includes farm dams and the constructed wetland in the east of lot and plan 2TR13 (a total area of 164 ha). The constructed wetland may support an ecologically significant proportion of the population			

Criterion – is there a real possibility that the Project will:	Assessment of significance
	however no direct impacts will occur to this habitat. This species is known to occupy modified and disturbed habitats, such as those adjacent to roads or near airports. As the Project will be constructed in phases only a small portion of the Project Area will be disturbed at one time. Indirect impacts such as increased noise and light will be actively managed throughout construction to ensure disturbance to farm dams and waterbodies is kept to a minimum.
	The occurrence and abundance of this species within the Project Area within successive years is likely to be variable, given the temporal availability of water. Further, the Project Area would be used by birds on passage only as residence in the non-breeding season occurs in south-eastern Australia. This species does not breed in Australia.
	Therefore, it is unlikely that the Project will seriously disrupt the lifecycle of an ecologically significant proportion of the Latham's snipe population.

### Glossy ibis (Plegadis falcinellus)

### Description and status under the EPBC Act

The glossy ibis is listed as migratory under the EPBC Act.

The glossy ibis is the smallest of the Australian ibis, averaging 55-65 cm in length with a wingspan of 80-95 cm. Similar to other ibis species found in Australia, it has a distinctive long, downwards curved bill however the colouration of the plumage is distinct with a reddish-brown neck, bronze-brown body and a metallic iridescent sheen on the wings. Colouration intensifies during the breeding season. The facial skin is blue-grey and a white line extends around the eyes. Sexes are similar in appearance, however the male is larger (Department of the Environment and Energy, 2019c).

### Distribution

The glossy ibis has a broad global distribution ranging from North America, the Carribean, Europe, Russia, Siberia, central Asia, sub-Saharan Africa, Pakistan, India, Philippines, Indonesia, Papua New Guinea and Australia. Its' global area of occupancy is estimated at 19,400,000 km².

Within Australia the species is also wide ranging and occurs from east of the Kimberley and the Eyre Peninsula. Within Western Australia, the distribution is patchy and it is considered to be a vagrant to Tasmania (Department of the Environment and Energy, 2019c).

### Habitat requirements

The glossy ibis' preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. This species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons (Department of Agriculture Water and the Environment, 2021b).

Within Australia, the largest contiguous areas of prime habitat are inland and northern floodplains. The glossy ibis is commonly in largest numbers in drying Top End grass/sedge swamps and Channel Country grass/forb meadows. This species is sometimes recorded in wooded swamps, artificial wetlands (such as irrigated fields), and in mangroves for breeding. This glossy ibis may retreat to permanent wetlands and/or coastal areas (including tidal wetlands) during drought (Marchant & Higgins, 1990).

The glossy ibis nests in mixed species colonies, either in small groups (from 5–100 pairs in Africa) or in large aggregations of thousands of pairs (del Hoyo et al., 1992). The nest is a platform of twigs and vegetation usually positioned less than one metre above water (occasionally up to 7 m) in tall dense stands of emergent vegetation (e.g. reeds or rushes), low trees or bushes (del Hoyo et al., 1992). The nest is often lined with aquatic vegetation. The glossy ibis breeds at only a limited number of locations within Australia. In Queensland, most records are from Channel Country (Department of Agriculture Water and the Environment, 2021b).

During drought periods the species may disperse to permanent wetlands and coastal regions (Department of the Environment and Energy, 2019c). The species uses trees or shrubs near their freshwater habitat to roost.

### **Threats**

The SPRAT for glossy ibis identifies a number of known threats as well as potential threats to the species. The key known threat is destruction or degradation of wetland foraging and breeding habitat for a range of activities such as water diversion, irrigation and hydroelectric power production.

Other threats include clearing, grazing, burning, increased salinity, groundwater extraction, and habitat modification as a result of invasive macrophytes and fish.

The species may also be threatened by future outbreaks of avian influenza and human disturbance may also modify foraging patterns (Department of the Environment and Energy, 2019c).

### Survey effort, timing and coverage

There are no species-specific guidelines for surveying of this species. Surveys which were suitable for detecting this species were conducted over a 10 day period in June and December 2020. This included

20 hours of diurnal bird survey and 90 hours of incidental bird surveys. Targeted habitat assessments were conducted for the species throughout the duration of the field surveys.

### Occurrence and potential habitat

Six individuals were recorded during the field survey at the constructed wetland within the north eastern Project Area. This species was also recorded in 2017 by BooBook on a property approximately 10 km to the south east.

This species is known to utilise a range of freshwater environments and as such all farm dams greater than 0.5 ha and the Wetland are considered suitable (a total area of 164.0 ha). The Project Area does not occur at one of the known breeding locations for the species, and as such no breeding habitat occurs.

Farm dams provide a semi-permanent water source and occur in scattered locations across the Project Area. Findings of the field surveys found that farm dams were generally disturbed by ongoing cattle use and historically modified. Despite the steep banks on several sides and cattle pugging, small areas of wetland vegetation were present in the low-lying fringes which may provide foraging opportunities for the species. When water availability in the landscape is low (i.e. the dry season), farm dams are expected to only provide marginal habitat as cattle use is likely to increase and fringing vegetation may be trampled.

The Wetland provides the highest value habitat. It is expansive during the wet season, and one of the largest in the local valley area. The Wetland has experienced considerable historical modification with the entire western length previously cleared and extensive damming works including the construction of an embankment at the north eastern extent. Outside of the embankment, the banks of the wetland are gentle slopes and large areas of shallow water with aquatic fringing vegetation occur especially in the south. Embankments within the constructed wetland also provide narrow, low-lying vegetated islands when the wetland is fully inundated. These areas specifically are likely to provide ideal foraging conditions for glossy ibis.

Habitat mapping is presented in Figure 28 and Table 46 below outlines the extent of potential habitat for the species within the Project Area.

Table 48	Potential habita	t for glossy	ibis within the	Project Area
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Habitat type	RE	Condition	Utilisation	Modelling rule	Project Area Total (ha)
Farm dams and the wetland	Water	-	Foraging / roosting	Wetlands with either shallow or deep waters fringed with dense low vegetation.	164.0

### Important habitat and ecologically significant proportion of the population

'Important habitat' or ecologically significant proportions of the population have not been defined for this species. The species shows preference for freshwater marshes for breeding and foraging, is found in the highest abundance in sedge swamps in the Top End and forb meadows in Channel Country and typically nests in tall dense stands of emergent vegetation.

Farm dams are not representative of this habitat due to their step man-made banks, extensive cattle pugging at the water's edge and little to no aquatic vegetation. The constructed wetland however, is expansive during the wet season and one of the largest in the local valley area. Several individuals of the species were observed here and the wetland provides high value foraging habitat. As such, this is considered to be an area of important habitat.

The species global population is estimated to be between 1,200,000 and 3,200,000. In lieu of defined ecologically significant proportions of the population, the thresholds utilised for a number of migratory species have been applied. On this basis 1% of the population could be considered as an ecologically significant proportion of the international population and 0.1% as an ecologically significant proportion of the national population. This equates to 12,000 – 32,000 individuals (1%) and 1,200 to 3,200 individuals (0.1%). The Project Area is unlikely to be used for breeding and does not provide sufficient foraging

resources to sustain a population of 1,200 individuals. It is likely the species occurs as individuals, pairs or in small groups.

### **Potential Project impacts**

A total of 1.0 ha of potential foraging and dispersal habitat may be cleared along the edges of farm dams as part of the Project. Vegetation clearing and particularly the loss of fringing aquatic vegetation may result in further degradation of potential habitat within the Project Area. Project relevant indirect impacts on this species include:

- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats
- Increased risk of contamination associated with activities such as refuelling or storage of chemicals
- Temporary changes in hydrology from installation of infrastructure creating a barrier to surface flow and increasing stormwater run-off
- Removal of water from existing constructed wetlands and farm dams leading to changes in hydrology / habitat extent and water quality. Increased activity at these locations resulting in avoidance and potentially altered foraging and breeding behaviour
- Periodic burst of elevated noise levels may startle and disorientate individuals within proximity
- Increased pest levels, notably those which may prey upon this species.

This species is known to utilise degraded habitat including those that occur close to anthropogenic disturbances such as roads and airports. Within Australia, the species moves in response to good rainfalls expanding its range. As such, this species is primarily expected to utilise potential habitat within the Project Area during the wet season only.

Water extraction activities may occur at some wetland locations during construction, however this will only occur where available supplies provide continuity of habitat function. Water extraction for construction is likely to occur during the dry season and whilst water levels and the extent of fringing aquatic habitat for will naturally be fluctuating at this time, given the absence of glossy ibis' during this period any potential indirect impact associated with water extraction (change in hydrology, habitat extent, water quality, noise disturbance) will be irrelevant. Any potential indirect impacts during this time are considered temporary and are unlikely to persist into the wet season when migratory species could return. The Project will not create a barrier that may hinder access to wetland habitat.

### Project avoidance, mitigation and management measures

Indirect impacts such as increased erosion, sedimentation and contamination will be managed as per Section 8.0. Other indirect impacts such increased dust, light and noise will be temporary and localised. In addition to the general mitigation measures outlined in Section 8.3.1, the following species-specific mitigation measure is recommended:

Water extraction activities will be strictly controlled and monitored in liaison with the landholder to
ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point
will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring
individuals to avoid the same area during construction. Existing access points to wetlands will be
used preferentially over the creation of new ones.

### Significance assessment

An assessment of the significance of impacts on this species under EPBC Act Significant Impact Guidelines Policy Statement 1.1 (Department of the Environment, 2013b) is provided in Table 49.

The assessment indicates that given that the Project is unlikely to substantially modify important habitat, result in invasive species becoming established or seriously disrupt the lifecycle of an ecologically significant proportion of the population, it is unlikely to have a significant impact on the species.

### Criterion – is there a real chance or possibility Assessment of significance that the Proposed **Action will:** Substantially modify No. (including by fragmenting, The Project is not considered likely to result in the creation of barriers to movement altering fire regimes, to, between or within habitat, nor will it alter the fire regimes, nutrient cycles or altering nutrient cycles or hydrological cycles. A total of 164 ha of habitat suitable for foraging and dispersal altering hydrological occurs within the Project Area comprising modified farm dams and a constructed cycles), destroy or isolate wetland. A maximum of 1 ha of vegetation clearing will occur along the boundaries an area of important of the farm dams, resulting in a less than 1 % reduction in available habitat. The habitat for a migratory constructed wetland only is considered important habitat for this species and no species? direct impacts will occur at this location. Water extraction activities will be strictly controlled and monitored in liaison with the landholder to ensure no waterbodies are reduced to unusually low levels. Per waterbody, a single access point will be utilised for water extraction to minimise areas of disturbance and allow potentially occurring individuals to avoid the same area during construction. Existing access points to wetlands will be used preferentially over the creation of new ones. Measures targeted to erosion and sediment control, potential contamination and pests will also be implemented during construction to ensure indirect impacts that may lead to habitat degradation or increased threat levels to the species are managed. No significant impacts on the wetland hydrology or water quality will occur. Additionally, any potential indirect impacts to waterbodies as a result of water extraction during the dry season are considered temporary and are unlikely to persist into the wet season when the species could return. The Project will not create a barrier that may hinder access to wetland habitat. Therefore, the Project is unlikely to substantially modify, destroy or isolate an area of important habitat for glossy ibis. No. Result in an invasive species that is harmful to Invasive flora and fauna have not been identified as a threat to the species the migratory species however, feral cats and dingoes may predate on the species. These species were becoming established in recorded in the Project Area during field surveys, however it is unlikely that the an area of important Project will exacerbate invasive species beyond current levels. habitat for the migratory species? Weed and pest management measures will be developed to mitigate and manage the potential spread of pest fauna species. No. Seriously disrupt the lifecycle (breeding, The Project Area does not provide sufficient foraging resources to sustain a feeding, migration or population of 1,200 individuals. This species is likely to be an occasional visitor to resting behaviour) of an the Project Area and may be present as individuals, pairs or in small groups. Given ecologically significant this species has been recorded at multiple locations within the valley (AECOM proportion of the 2020 and Boobook 2017), no single habitat area is likely to be soley relied upon by

the local population. Therefore, it is unlikely that the Project will result in a serious

disruption to the lifecycle of an ecologically significant proportion of the population.

species?

population of a migratory

## Appendix G

Survey Species Lists

## Appendix G Survey Species Lists

Table 50 Flora species list

Family	Scientific name	Common name	Exotic
Apocynaceae	Alstonia constricta	bitter bark	
	Carissa ovata	currant bush	
Araceae	Spirodela punctata	thin duckweed	
Asteraceae	Achyranthes aspera	chaff flower	
	Cirsium vulgare	spear thistle	*
	Glandularia aristigera	Mayne's pest	*
	Xanthium pungens		*
Caesalpiniaceae	Cassia tomentella	velvet cassia	
	Lysiphyllum carronii	red bauhinia	
Capparaceae	Apophyllum anomalum	warrior bush, broom bush	
очрри чосио	Capparis lasiantha	wait-a-while, split jack	
	Capparis mitchellii		
Casacininasas	Allocasuarina luehmannii	buloke	
Casaurinaceae	Casuarina cristata	chaff flower spear thistle Mayne's pest  mens  mella  velvet cassia  rronii  red bauhinia  malum  warrior bush, broom bush  wait-a-while, split jack  mellii  mehmannii  buloke mata  belah  minghamii  berry saltbush  ruby saltbush  phylla  cotton bush  roly poly	
Celastraceae	Denhamia cunninghamii		
Chenopodiaceae	Einadia nutans	berry saltbush	
	Enchylaena tomentosa	ruby saltbush	
	Maireana microphylla	cotton bush	
	Salsola australis	roly poly	
	Sclerolaena birchii	galvanised burr	

Family	Scientific name	Common name	Exotic
Cupressaceae	Callitris glaucophylla	white cypress pine	
Ebenaceae	Diospyros humilis	Queensland ebony	
Euphorbiaceae	Croton insularis	silver croton	
Fabaceae	Abrus precatorius subsp. precatorius	crab's eye	
	Sesbania cannabina		
Hemerocallidaceae	Dianella sp.		
Juncaceae	Juncus usitatus	common rush	
Lamiaceae	Clerodendrum floribundum	lolly bush	
Laxmanniaceae	Lomandra longifolia	mat rush	
	Lomandra multiflora		
Malvaceae	Abutilon oxycarpum		
	Malvastrum americanum		*
Meliaceae	Owenia acidula	emu apple	
Mimosaceae	Acacia bancroftiorum	Bancroft's wattle	
	Acacia excelsa		
	Acacia fasciculifera		
	Acacia harpophylla	brigalow	
	Acacia leiocalyx	early flowering wattle	
	Acacia salicina	sally wattle	
	Acacia shirleyi	lancewood	
	Leucaena leucocephala		*
	Vachellia farnesiana		*
Myoporaceae	Myoporum acuminatum	boobialla	

Family	Scientific name	Common name	Exotic
Myrtaceae	Angophora leiocarpa	smooth-barked apple	
	Corymbia clarksoniana	grey bloodwood	
	Corymbia tessellaris	Moreton Bay ash	
	Corymbia trachyphloia	brown bloodwood	
	Eucalyptus camaldulensis	river red gum	
	Eucalyptus chloroclada	Baradine gum	
	Eucalyptus decorticans	gum-top ironbark	
	Eucalyptus melanophloia	silver-leaved ironbark	
	Eucalyptus microcarpa	grey box	
	Eucalyptus moluccana	gum-topped box	
	Eucalyptus orgadophila	mountain coolibah	
	Eucalyptus populnea	poplar box	
	Eucalyptus virens	shiny-leaved ironbark	
Oleaceae	Jasminum didymum subsp. lineare	desert jasmine	
Orchidaceae	Cymbidium sp.		
Picrodendraceae	Petalostigma pubescens	quinine tree	
Pittosporaceae	Auranticarpa rhombifolia		
	Bursaria incana		
	Pittosporum spinescens	wallaby apple	
Poaceae	Aristida sp.		
	Arundinella nepalensis	reed grass	
	Bothriochloa bladhii		
	Brachyachne convergens	native couch	

Family	Scientific name	Common name	Exotic
	Cenchrus ciliaris	buffel grass	*
	Cymbopogon refractus	barbwire grass	
	Echinochloa colona	barnyard grass	*
	Enneapogon sp.		
	Enteropogon ramosus	curly windmill grass	
	Entolasia stricta	wiry panic	
	Eragrostis sp.		
	Leptochloa digitata	umbrella cane grass	
	Megathyrsus maximus	guinea grass	*
	Paspalidium caespitosum	brigalow grass	
	Sporobolus caroli	fairy grass	
	Themeda triandra	kangaroo grass	
	Urochloa mosambicensis	sabi grass	*
Destacases	Grevillea parallela	silver oak	
Proteaceae	Grevillea striata	beefwood	
Pteridaceae	Cheilanthes sieberi	mulga fern	
Rubiaceae	Psydrax sp.		
Rutaceae	Citrus glauca	desert lime	
	Flindersia collina	leopard ash	
	Geijera parviflora	wilga	
Santalaceae	Santalum lanceolatum	sandalwood	
Sapindaceae	Alectryon diversifolius	scrub boonaree	
	Alectryon oleifolius	boonaree	

Family	Scientific name	Common name	Exotic
	Atalaya hemiglauca	white wood	
Scrophulariaceae	Eremophila mitchellii	false sandalwood	
Sterculiaceae	Brachychiton rupestris	narrow-leaved bottle tree	
Surianaceae	Cadellia pentastylis	ooline	

Table 51 Fauna species list

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020			
Birds	Birds							
Acanthagenys rufogularis	Spiny-cheeked honeyeater	-	Least Concern	✓	✓			
Acanthiza chrysorrhoa	Yellow-rumped thornbill	-	Least Concern	✓				
Acanthiza nana	Yellow thornbill	-	Least Concern	✓				
Acanthiza reguloides	Buff-rumped thornbill	-	Least Concern		✓			
Alisterus scapularis	Australian king-parrot	-	Least Concern		✓			
Anas gracilis	Grey teal	-	Least Concern	✓	✓			
Anas superciliosa	Pacific black duck	-	Least Concern	✓	✓			
Anhinga novaehollandiae	Australasian darter	-	Least Concern	✓	✓			
Anthus novaeseelandiae	Australasian pipit	-	Least Concern	✓	✓			
Aprosmictus erythropterus	Red-winged parrot	-	Least Concern	✓	✓			
Aquila audax	Wedge-tailed eagle	-	Least Concern	✓	✓			
Ardea intermedia	Intermediate egret	-	Least Concern		✓			
Ardea modesta	Eastern great egret	-	Least Concern	✓				
Ardea pacifica	White-necked heron	-	Least Concern	✓				
Ardeotis australis	Australian bustard	-	Least Concern	✓				

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Artamus cinereus	Black-faced woodswallow	-	Least Concern	✓	
Artamus leucorynchus	White-breasted woodswallow	-	Least Concern		✓
Aythya australis	Hardhead	-	Least Concern		✓
Cacatua galerita	Sulphur-crested cockatoo	-	Least Concern	✓	✓
Centropus phasianinus	Pheasant Coucal	-	Least Concern		✓
Chenonetta jubata	Australian wood duck	-	Least Concern	✓	✓
Cincloramphus mathewsi	Rufous songlark	-	Least Concern		✓
Circus assimilis	Spotted harrier	-	Least Concern	✓	
Colluricincla harmonica	Grey shrike-thrush	-	Least Concern		✓
Coracina maxima	Ground cuckoo-shrike	-	Least Concern	✓	
Coracina novaehollandiae	Black-faced cuckoo-shrike	-	Least Concern	✓	
Corvus orru	Torresian crow	-	Least Concern	✓	✓
Coturnix ypsilophora	Brown quail	-	Least Concern	✓	✓
Cracticus nigrogularis	Pied butcherbird	-	Least Concern	✓	✓
Cracticus tibicen	Australian magpie	-	Least Concern	✓	✓
Cracticus torquatus	Grey butcherbird	-	Least Concern	✓	
Cygnus atratus	Black swan	-	Least Concern	✓	✓
Dacelo novaeguineae	Laughing kookaburra	-	Least Concern	✓	✓
Dendrocygna eytoni	Plumed whistling-duck	-	Least Concern		✓
Dicaeum hirundinaceum	Mistletoebird	-	Least Concern	✓	✓
Dicrurus bracteatus	Spangled drongo	-	Least Concern	✓	✓
Dromaius novaehollandiae	Emu	-	Least Concern	✓	
Egretta novaehollandiae	White-faced heron	-	Least Concern	✓	<b>✓</b>

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Elanus axillaris	Black-shouldered kite	-	Least Concern	✓	
Elseyornis melanops	Black-fronted dotterel	-	Least Concern	✓	✓
Entomyzon cyanotis	Blue-faced honeyeater	-	Least Concern	✓	✓
Eolophus roseicapillus	Galah	-	Least Concern	✓	
Erythrogonys cinctus	Red-kneed Dotterel	-	Least Concern		✓
Eurystomus orientalis	Dollarbird	-	Least Concern		✓
Falco berigora	Brown falcon	-	Least Concern	✓	✓
Falco cenchroides	Nankeen kestrel	-	Least Concern	✓	✓
Falco longipennis	Australian hobby	-	Least Concern	✓	
Falco peregrinus	Peregrine falcon	-	Least Concern		✓
Geopelia humeralis	Bar-shouldered dove	-	Least Concern	✓	✓
Grallina cyanoleuca	Magpie-lark	-	Least Concern	✓	
Grus rubicunda	Brolga	-	Least Concern	✓	✓
Haliaeetus leucogaster	White-bellied sea-eagle	-	Least Concern	✓	✓
Haliastur sphenurus	Whistling kite	-	Least Concern	✓	✓
Himantopus himantopus	Black-winged stilt	-	Least Concern	✓	✓
Hirundo neoxena	Welcome swallow	-	Least Concern	✓	
Lalage sueurii	White-winged triller	-	Least Concern		✓
Lichenostomus leucotis	White-eared honeyeater	-	Least Concern	✓	
Lichenostomus penicillatus	White-plumed honeyeater	-	Least Concern	✓	
Lichenostomus virescens	Singing honeyeater	-	Least Concern	✓	
Lichmera indistincta	Brown honeyeater	-	Least Concern	✓	
Malacorhynchus membranaceus	Pink-eared duck	-	Least Concern		✓

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Malurus cyaneus	Superb fairy-wren	-	Least Concern	✓	✓
Malurus lamberti	Variegated fairy-wren	-	Least Concern	✓	<b>✓</b>
Malurus melanocephalus	Red-backed fairy-wren	-	Least Concern	✓	✓
Manorina flavigula	Yellow-throated miner	-	Least Concern	✓	
Manorina melanocephala	Noisy miner	-	Least Concern		✓
Meliphaga lewinii	Lewin's honeyeater	-	Least Concern	✓	
Microcarbo melanoleucos	Little pied cormorant	-	Least Concern		<b>✓</b>
Milvus migrans	Black kite	-	Least Concern	✓	
Myiagra rubecula	Leaden flycatcher	-	Least Concern		✓
Nycticorax caledonicus	Nankeen night-heron	-	Least Concern		✓
Ocyphaps lophotes	Crested pigeon	-	Least Concern	✓	✓
Oriolus sagittatus	Olive-backed oriole	-	Least Concern	✓	
Pachycephala rufiventris	Rufous whistler	-	Least Concern	✓	✓
Pardalotus striatus	Striated pardalote	-	Least Concern	✓	
Pelecanus conspicillatus	Australian pelican	-	Least Concern	✓	✓
Philemon citreogularis	Little friarbird	-	Least Concern	✓	
Philemon corniculatus	Noisy friarbird	-	Least Concern	✓	✓
Platycercus adscitus	Pale-headed rosella	-	Least Concern	✓	✓
Plectorhyncha lanceolata	Striped honeyeater	-	Least Concern		✓
Plegadis falcinellus	Glossy ibis	Migratory	Special Least Concern		✓
Podargus strigoides	Tawny frogmouth	-	Least Concern		✓
Podiceps cristatus	Great crested grebe	-	Least Concern		✓
Pomatostomus temporalis	Grey-crowned babbler	-	Least Concern	✓	

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Recurvirostra novaehollandiae	Red-necked avocet	-	Least Concern		✓
Rhipidura leucophrys	Willie wagtail	-	Least Concern	✓	✓
Scythrops novaehollandiae	Channel-billed cuckoo	-	Least Concern		✓
Smicrornis brevirostris	Weebill	-	Least Concern	✓	✓
Sphecotheres vieilloti	Australasian figbird	-	Least Concern	✓	
Struthidea cinerea	Apostlebird	-	Least Concern	✓	✓
Sturnus tristis*	Common myna	-	Least Concern	✓	
Tachybaptus novaehollandiae	Australasian grebe	-	Least Concern	✓	✓
Taeniopygia bichenovii	Double-barred finch	-	Least Concern	✓	
Taeniopygia guttata	Zebra finch	-	Least Concern	✓	✓
Threskiornis molucca	Australian white ibis	-	Least Concern		✓
Threskiornis spinicollis	Straw-necked ibis	-	Least Concern	✓	
Trichoglossus haematodus	Rainbow lorikeet	-	Least Concern	✓	
Tyto javanica	Eastern barn owl	-	Least Concern		✓
Vanellus miles	Masked lapwing	-	Least Concern	✓	✓
Mammals					
Aepyprymnus rufescens	Rufous bettong	-	Least Concern		✓
Austronomus australis	White-striped free-tailed bat	-	Least Concern		✓
Canis lupus*	Dingo, Domestic dog	-	Least Concern	✓	
Chaerephon jobensis	Northern freetail bat	-	Least Concern		✓
Chalinolobus dwyeri	Large-eared pied bat	Vulnerable	Vulnerable		✓
Chalinolobus gouldii	Gould's wattled bat	-	Least Concern		✓
Chalinolobus morio	Chocolate wattled bat	-	Least Concern		✓

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Chalinolobus picatus	Little pied bat	-	Least Concern		✓
Felis catus*	Feral cat	-	Least Concern		✓
Macropus giganteus	Eastern grey kangaroo	-	Least Concern	✓	✓
Macropus parryi	Whiptail wallaby	-	Least Concern	✓	✓
Macropus robustus	Common wallaroo	-	Least Concern		✓
Macropus rufogriseus	Red-necked wallaby	-	Least Concern	✓	✓
Minopterus orianae	Large bent-winged bat	-	Least Concern		✓
Mus musculus*	House mouse	-	Least Concern	✓	✓
Nyctophilus sp.	Long-eared bat	NA	NA		✓
Oryctolagus cuniculus*	Rabbit	-	Least Concern	✓	✓
Ozimops lumsdenae	Northern free-tailed bat	-	Least Concern		✓
Ozimops petersi	Inland free-tailed bat	-	Least Concern		✓
Ozimops ridei	Ride's free-tailed bat	-	Least Concern		✓
Saccolaimus flaviventris	Yellow-bellied sheath-tailed bat	-	Least Concern		✓
Scotorepens balstoni	Inland broad-nosed bat	-	Least Concern		✓
Scotorepens greyii	Little broad-nosed bat	-	Least Concern		✓
Setirostris eleryi	Bristle-faced free-tailed bat	-	Least Concern		✓
Sus scrofa*	Pig	-	Least Concern		✓
Tachyglossus aculeatus	Echidna	-	Special Least Concern	✓	✓
Taphozous troughtoni	Troughton's sheath-tailed bat	-	Least Concern		✓
Trichosurus vulpecula	Common brushtail possum	-	Least Concern	✓	✓
Vespadelus baverstocki	Inland forest bat	-	Least Concern		✓
Vespadelus troughtoni	Eastern cave bat	-	Least Concern		✓

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Reptiles					
Carlia rubigo	Orange-flanked rainbow-skink	-	Least Concern		✓
Chelodina expansa	Broad-shelled turtle	-	Least Concern		✓
Cryptoblepharus pulcher	Elegant snake-eyed skink	-	Least Concern	✓	
Cryptoblepharus virgatus	Fence skink	-	Least Concern	✓	✓
Ctenotus robustus	Eastern striped skink	-	Least Concern	✓	✓
Emydura macquarii krefftii	Kreft's river turtle	-	Least Concern		✓
Gehyra catenata	Chain-backed dtella	-	Least Concern	✓	
Heteronotia binoei	Bynoes gecko	-	Least Concern	✓	✓
Lerista fragilis	Eastern mulch-slider	-	Least Concern	✓	✓
Menetia greyii	Common dwarf skink	-	Least Concern		✓
Morethia taeniopleura	Fire-tailed skink	-	Least Concern	✓	
Nebulifera robusta	Robust velvet gecko	-	Least Concern		✓
Oedura sp.	Velvet gecko	-	Least Concern	✓	
Oedura lineata	Arcadia velvet gecko	-	Least Concern		✓
Pygopus schraderi	Eastern hooded scaly-foot	-	Least Concern		✓
Tropidonophis mairii	Keelback	-	Least Concern		✓
Underwoodisaurus milii	Thick-tailed gecko	-	Least Concern		✓
Amphibians					
Cyclorana novaehollandiae	Eastern snapping frog	-	Least Concern		✓
Limnodynastes tasmaniensis	Spotted marsh frog	-	Least Concern	✓	✓
Litoria caerulea	Green tree frog	-	Least Concern		✓
Litoria rothii	Roth's tree frog	-	Least Concern		✓

Scientific name	Common name	EPBC Act Status	NC Act Status	Recorded June 2020	Recorded December 2020
Platyplectrum ornatum	Ornate burrowing frog	-	Least Concern		✓
Rhinella marina*	Cane toad	-	Least Concern		<b>√</b>

<sup>\*</sup> Denotes exotic species

# Appendix H

Terrestria 2021 Gilgai Briefing Note



### ABN 81 153 245 633

Drafted by:	AD
Reviewed	AD
by:	

20 April 2021

### Confidential

Mitch Bird Senior Environmental Advisor Environment and Access Santos Pty Ltd

### Brumby Gilgai Area Fauna Habitat Assessment

Dear Mitch,

Terrestria's field ecologists conducted a threatened fauna habitat assessment of the area identified as potential gilgai country on Brumby Station on Tuesday 16<sup>th</sup> March 2021 (**Figure 1**).

A general site walk over was conducted to assess the presence of micro-habitat features that may support threatened fauna and in particular the habitat for the Ornamental snake *Denisonia maculata*. In addition to a general habitat assessment, two BioCondition sites were conducted (site 1399 & 1401) (Figure 1).

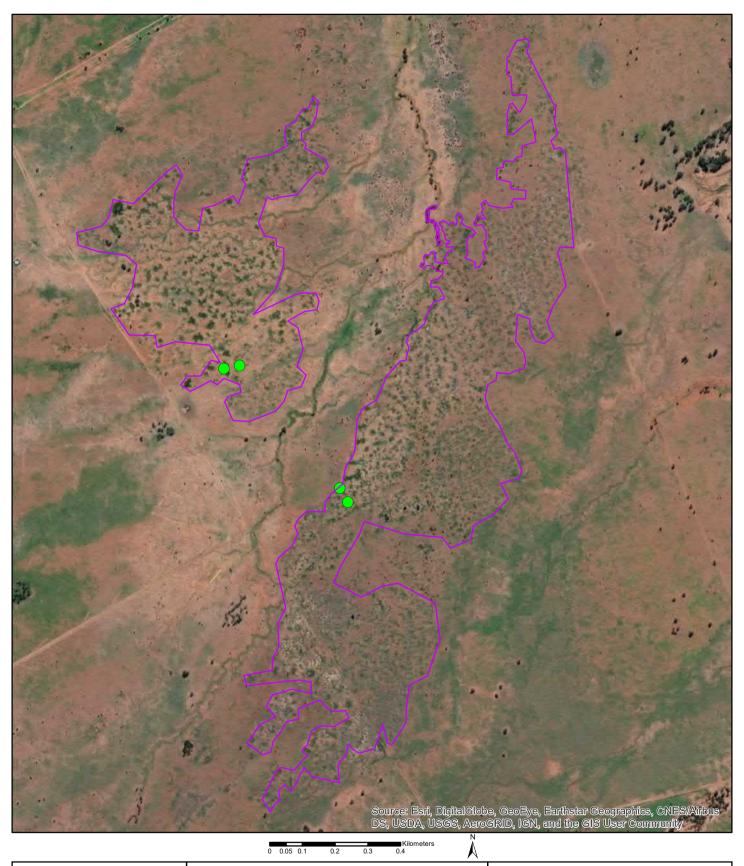
The Survey area was found to provide very low habitat values for any threatened fauna species known to occur within the locality. Having recently been blade ploughed, the Survey area supported little to no soil cracks, fallen woody material, rocks or native trees, shrubs, forbs or grasses.

Best Regards

Dr Andrew Daniel

(Managing Director of Terrestria Pty Ltd)





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## **LEGEND**



Survey Area

**BioCondition Site Locations** 

### FIGURE 1

Brumby Station Gilgai Area Fauna Habitat Assessment

AD 20/04/2021 Job No. 0221



Aerial imagery courtesy of Bing Maps.

Site ID	1399	]	Biocondition	Datasheet			Date	16/03/2021
Observers		ırp, Heath Agı	new				Dute	10,00,2021
Observers	Donovan Sna	irp, ricatii Agi	TIC VV					
Site Information:								
100x50m Area:								
Location (GPS referer	nce)	_				Bioregion	Brigalow Bel	t South
Datum	GDA94				-			-
Zone	55 J	Easting		682748	Northing		7201522	
Plot origin				682797			7201531	
Plot centre								
Plot Bearing			Plot Alignme	nt Descriptior	1			
Locality	Bottle tree							
Regional Ecosystem a	nd Tree heigh	nt						
Habitat Description	Blade plough							
Regional Ecosystem		N/A		Median Tree	canopy Heigh	nt (m)	0	
	Emergent he	ight (m)	0		Subcanopy h		0	
Site Photos	Plot centre	North	7010	South	7011		S	
Photo Numbers		East	7012	West	7013			
	Plot Origin			other				
Disturbance					100 x 50m A	rea: Tree SPP	. Richness	_
	mean fire							
Туре	scar height	severity	last event	obs type	Tree Species	None		
Wildfire	na							Tree Spp. Count
Prescribed burn	na							
Logging	na							
Treatment	na							
Grazing	yes	moderate				ea: Coarse wo	ody Debris	
Non-native plant cove					Specimen ler	ngth (mm)		1
Erosion	na							site total m
Regeneration								0
Storm	na							per ha (m)
Other (specify)	na			•				0
50 x 10m Area		Native Plar	nt Species Ric	chness			Total	
Shrub sp.	None	-						
Grass sp.	Cenchrus ci Echinochloa	a crus-galli*		Chloris virga Urochloa gi	ata Isei*			
	Eragrostis b	rownii						
Forbs/other sp.	Tui a mala a ma a	<b>.</b>						
	Trianthema Sesbania ca							
	Tabacuum f							
	Portulacca							
	Abutilon ox	ycarpon						
	Physalis per							
	Evolvus alis Xanthium p							
	Aantillulli p	ungens.						

			Bioconditio	n datasheet	(cont.)			
10 x 10m Plots: Gr	ound Cover							
Ground cover type			1	2	3	4	5	Mean
Native perennial (preferred and								
intermediate) gras			0	0	0	0	0	0
Native non-preferr	ed grass		0	0	0	0	0	
Native forbs and other species			10	0	0	0	20	6
Native shrubs (< 1m height)			0	0	0	0	0	0
Non-native grass			5	0	0	20	45	14
Non-native forbs a	nd shrubs		0	0	5	0	0	0
litter			0	0	0	0	0	0
rock			0	2.5	0	0	0	
bare ground			85	97.5	95	80	35	0
Cryptograms			0	0	0	0	0	
Total			100	100	100	100	100	100
100 x 50m Area: La	arge Trees	Plot size	100x 50		100x 20		100 x 10	
		Euc (E) Non-Euc		DBH				
Species		(N)	Diam (cm)					
эрссісэ		(14)	Diam (cm)					
	Avg DBH							
Eucalypts	threshold		RE			Euc Benchn	nark	
	No. Trees	0	No. Trees >	= Benchma	rk/ha		0	
	Avg DBH							
Non-Eucalypts	threshold		RE		Euc Benchn	Euc Benchm	nark	
	No. Trees	0	No. Trees >	= Benchma			0	
100m Transect: Tr	ee and Shruk					(SC), Emerge	nt (E), Shrub	o (S)
Distance (m)		Туре	Distance (m		Туре	Distance (m		Туре
( ')		71 -			C		<u> </u>	,,
					-			
						canopy tota	l	0
						subcanopy		
						emergent to	Jidi	0
shrub total					0			













			B: I::	5					
Site ID	1399	1	Biocondition	Datasneet			Date	16/03	3/2021
Observers	Donovan Sha	rp, Heath Agr	new					,	
Site Information: 100x50m Area:									
Location (GPS referen	nce)					Bioregion	Brigalow Bel	t South	
Datum	GDA94					Ü	U		
Zone	55 J	Easting		683109	Northing		7201158	3	
Plot origin				683127			7201114	ļ	
Plot centre									
Plot Bearing			Plot Alignme	nt Description	1			-	
Locality	Bottle tree			·					
Regional Ecosystem a	and Tree heigh	nt							
	The free fielgi								
Habitat Description	Blade plough	ned Gilgai							
Regional Ecosystem		N/A		1	canopy Heigh		0	+	
	Emergent he		0		Subcanopy h		0	)	
Site Photos	Plot centre	North		South	7016	+	S		
Photo Numbers		East	7017	West	7018				
	Plot Origin			other					
Disturbance	fi				100 x 50m A	rea: Tree SPP	. Richness	7	
Tuno	mean fire scar height	severity	last event	obs type	Tree Species	None			
Type Wildfire		severity	iast event	ous type	Tree species	INONE		Tree Spp. Co	unt
Prescribed burn	na							пее эрр. со	unt
	na na								
Logging Treatment	na								
Grazing	yes	moderate			50 v 20m Are	ea: Coarse wo	ody Dehris		
Non-native plant cove		moderate			Specimen ler		ody Debits		
Erosion	na				Specimen ici	igen (iiiii)		site total m	
Regeneration	TIG.							Site total III	0.5
Storm	na							per ha (m)	0.5
Other (specify)	na							per na (m)	5
50 x 10m Area	TTG .	Native Plan	t Species Ri	rhness			Total		
Shrub sp.		Tracive Flam	it opecies iti	Citite 33			Total		
от ал эр:	Acacia harp	ophylla							
Grass sp.		<del>.</del>							
	Cenchrus ci Echinochloa			Urochloa gi	lcai*				
	Eragrostis b			Orocinoa gi	1301				
Forbs/other sp.									
телес, селе орг	Verbena sp	_							
	Abutilon ox								
	Portulacca								
	Trianthem t	a aristigera							
	Physlis peru								
	Amaranthu								
	Fimbrystilis	dichotoma							
	Sesbania ca								
	Nicotiana fo	orsteri							

			Bioconditio	n datasheet	(cont.)			
10 x 10m Plots: G	round Cover							
Ground cover typ			1	2	3	4	5	Mean
Native perennial (preferred and								
intermediate) gras	SS		0	0	0	0	0	0
Native non-prefer			0	0	0	0	0	
	Native forbs and other species			5	0	0	0	1
Native shrubs (< 1	m height)		2.5	0	0	0	0	0.5
Non-native grass			0	5	20	0	0	5
Non-native forbs	and shrubs		0	0	0	0	0	
litter			30	10	25	10	5	
rock			0	0	0	0	0	
bare ground			67.5	80	55	90	95	0
Cryptograms			0	0	0	0	~	
Total			100	100	100	100		100
100 x 50m Area: L	arge Trees	Plot size	100x 50		100x 20		100 x 10	
		Euc (E)						
		Non-Euc		DBH				
Species		(N)	Diam (cm)					
			, , , , ,					
	Avg DBH							
Fucalizate	threshold		RE		Fue Deneha	· Fue Denehm	ممداد	
Eucalypts						Euc Benchn		
	No. Trees	0	No. Trees >	= Benchma	rk/na I		0	
	Avg DBH							
Non-Eucalypts	threshold		RE			Euc Benchn	nark	
	No. Trees		No. Trees >				0	
100m Transect: Ti	ree and Shruk					(SC), Emerge		
Distance (m)		Туре	Distance (m	)	Туре	Distance (m	)	Туре
				8	С			
	+							
	+							
	-							
						canopy tota	·I	0
						subcanopy t		
						emergent to		0
				0				
shrub total						1 0		





East West

