

# Appendix O – Offset suitability assessment report




# **MNES Offset Habitat Suitability Assessment: Gawara Baya Wind Farm**

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2Rog Pty Ltd

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# Document Management

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## Definitions

Term	Definition
Habitat Quality Score	A method of evaluating habitat quality within a particular community based on key indicators including site condition, site context and species habitat index in accordance with the <i>Guide to determining terrestrial habitat quality (Version 1.3): Methods for assessing habitat quality under the Queensland Environmental Offsets Policy</i> (Department of Environment and Science (DES), 2021). The method produces a score out of 10, where the maximum score of 10 represents a fully intact system.
Matters of National Environmental Significance (MNES)	Environmental values protected under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> . Significant impacts to these values may require offsets.
Regional Ecosystem	A vegetation community in a bioregion that is consistently associated with a combination of geology, landform, and soil. Regional Ecosystems are described in the Regional Ecosystem Description Database, produced by the Queensland Herbarium.
Regulated Vegetation	Vegetation that is mapped within the regulated vegetation management map produced by Department of Resources. The Queensland <i>Vegetation Management Act 1999</i> is applicable to regulated vegetation.
Remnant vegetation	As described by Neldner et al. (2022), vegetation which forms the predominant canopy of the community that: <ul style="list-style-type: none"> <li>a) covers more than 50% of the undisturbed predominant canopy; and</li> <li>b) averages more than 70% of the vegetation’s undisturbed height; and</li> <li>c) is composed of species characteristic of the vegetation’s undisturbed predominant canopy.</li> </ul>
Suitable habitat	A species preferred environment required to sustain a viable population. Suitable habitat may include breeding, dispersal, foraging and shelter resources for fauna.
Threatened species	Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) or Conservation Dependent (CD) under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> or extinct in the wild (PE), critically endangered (CE), endangered (E), vulnerable (V) or near threatened (NT) under the <i>Nature Conservation Act 1992</i> .
Vegetation community	An identified vegetation community (i.e. structure, composition, condition and/or underlying geology) verified from a field survey. Communities may include Regional Ecosystems, remnant vegetation and/or disturbed/novel ecosystems (e.g. parkland, disturbed roadsides etc.).



## Abbreviations

Abbreviation	Description
ALA	Atlas of Living Australia
AU	Assessment Unit
BVG	Broad Vegetation Group
DBH	Diameter at breast height
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DES	Queensland Department of Environment and Science
DoR	Queensland Department of Resources
E2M	E2M Pty Ltd
ELA	EcoLogical Australia Pty Ltd
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GPS	Global Positioning System
ha	Hectares
HVR	High Value Regrowth
MNES	Matters of National Environmental Significance
NC Act	Queensland <i>Nature Conservation Act 1992</i>
PMST	Protected Matters Search Tool used to determine matters protected under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth). The PMST generates a Protected Matters Report.
POIA	Primary Offset Investigation Area 
RE	Regional Ecosystem
SAT	Spot Assessment Technique, as detailed by Phillips & Callaghan (2011), a method used to detect indirect koala evidence.
SOIA	Secondary Offset Investigation Area 
sp.	Singular species. For example, <i>Eucalyptus</i> sp. refers to a single species of <i>Eucalyptus</i>
spp.	Multiple species. For example, <i>Eucalyptus</i> spp. refers to multiple species of <i>Eucalyptus</i>
The Project	The Gawara Baya Wind Farm Project
GBWF	Gawara Baya Wind Farm (see the Project)
VM Act	Queensland <i>Vegetation Management Act 1999</i>





# 1 Introduction

## 1.1 Project background

Windlab Developments Pty Ltd (Windlab) is proposing to develop the Gawara Baya Wind Farm (GBWF) at Kilclooney station (Lot 3198 on PH2177), approximately 65 km south-west of Ingham, in north Queensland. The proposed action includes the construction and operation of up to 69 wind turbines and supporting infrastructure (access tracks and powerlines) in the north and east of Kilclooney (see Figure 1).

The GBWF (hereafter ‘the Project’) is considered a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) (EPBC 2021/9066) due to potential Project impacts on Matters of National Environmental Significance (MNES), including nine listed threatened species:

- koala (*Phascolarctos cinereus*)
- greater glider (northern) (*Petauroides minor*)
- Sharman’s rock-wallaby (*Petrogale sharmani*)
- red goshawk (*Erythrotriorchis radiatus*)
- masked owl (northern) (*Tyto novaehollandiae kimberli*)
- grey-headed flying-fox (*Pteropus poliocephalus*)
- spectacled flying-fox (*Pteropus conspicillatus*)
- bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus*); and
- greater large-eared horseshoe bat (*Rhinolophus robertsi*).

## 1.2 Objectives and scope

2rog Pty Ltd (2rog), on behalf of Windlab, have engaged E2M Pty Ltd (E2M) to assess the suitability of proposed offset areas for the aforementioned MNES at [REDACTED] respectively. The scope of works for this offset suitability assessment included:

- surveys to determine the presence/absence of target MNES species
- verification and quantification of the extent of suitable habitat for target MNES species habitat within proposed offset areas
- the collection of habitat quality data for potential offsets for each target MNES; and
- the assessment of threats to target MNES within the proposed offset areas.

This report presents the results of field and desktop investigations undertaken by E2M to determine presence and assess the suitability of proposed offset areas for the aforementioned MNES species.

## 1.3 Offset area overview

Windlab is investigating potential offsets for the abovementioned MNES within two separate areas of interest:



- [REDACTED]
- [REDACTED]

Situated in the upper Burdekin River catchment of the Einasleigh Uplands bioregion, the POIA and SOIA comprise remnant eucalypt woodland and open-forest on plateaus, hill slopes and alluvial creek flats corresponding to land zones 3, 5, 7 and 12 (see Neldner et al., 2019). The POIA is intersected by numerous drainage lines (including first, second and third order streams) which flow north/north-west into the upper Burdekin River, while the SOIA is centred on Quartpot Creek, a third order stream flowing south-west to the Burdekin River.

The POIA and SOIA, while separate from one another, form part of an extensive, near-contiguous tract of remnant vegetation at 600-800 m elevation extending north along the Great Dividing Range to the Herberton River, west to Girringun National Park, and south towards Paluma State Forest and the Paluma Range.



Photo 1. Intact, remnant eucalypt woodland typical of the POIA.

Both the POIA and SOIA are used for cattle grazing. However, neither area appears to have been subject to broadscale clearing in the past with Statewide Landcover and Trees Study (SLATS) data showing little or no significant change in tree cover since the early 1990s (DoR, 2023), other than clearing of woody



vegetation along fence line tracks. Existing infrastructure within the surrounding landscape is limited to unsealed access tracks, scattered buildings/sheds, stock dams, and a high voltage transmission powerline in the far east and centre-east of [REDACTED] (respectively).



Photo 2. Eucalypt woodland, riparian vegetation, and granite boulder piles associated with Quartpot Creek in the SOIA.

## 1.4 Study Areas

The POIA and SOIA are both situated in remote locations with limited vehicular access. Located north of the Project footprint, the POIA comprises approximately 4000 ha of remnant eucalypt woodland and open-forest on plateaus, hill slopes and alluvial creek flats in the far north-west of [REDACTED] (Figure 1; Photo 1).

The SOIA comprises approximately 176 ha of remnant eucalypt woodland on granite hills and alluvium associated with Quartpot Creek, in the [REDACTED]. In contrast with the POIA, the SOIA features extensive rock (granite) outcropping, including complex boulder piles, providing suitable shelter for Sharman's rock-wallaby (Figure 1; Photo 2).



## 2 Assessment methodology

The suitability of habitat and of occurrence target MNES species within the POIA and SOIA was assessed via desktop and field investigations, as detailed below.

### 2.1 Desktop assessment methods

A desktop review of relevant databases, mapping, satellite imagery, reporting and published literature, was undertaken to inform the assessment of habitat suitability for target species within the POIA and SOIA. Information sources reviewed as part of this assessment include:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) EPBC Act - Protected Matters Search Tool (PMST), accessed via <https://www.dcceew.gov.au/environment/epbc/protected-matters-search-tool>
- Queensland Department of Environment and Science (DES) Wildlife Online occurrence data for conservation significant species known to occur on [REDACTED] and [REDACTED], accessed via <https://apps.des.qld.gov.au/report-request/species-list/>
- Queensland Department of Resources (DoR) Regulated Vegetation Management Map and Vegetation Management Supporting Maps, including Essential Habitat, watercourse and wetland mapping
- Koala habitat areas mapped under the Queensland Nature Conservation (Koala) Conservation Plan 2017
- Atlas of Living Australia (ALA) target species records, accessed via <https://www.ala.org.au/>
- GeoScience Australia 1:100,000 drainage network of Queensland mapping
- DES Flying Fox Monitoring Data (DES, 2022)
- National Flying-fox Monitoring Viewer (Department of Climate Change, Energy, the Environment and Water, 2023a), accessed via <https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>
- DoR historical aerial photography, accessed via the Queensland Globe portal at <https://qldglobe.information.qld.gov.au/>
- Ground-truthed vegetation mapping, Habitat Quality scoring data and MNES records from previous field investigations undertaken by Ecological Australia (ELA) within the Project Study Area (as detailed in ELA, 2022)
- ELA's methodology for assessing Habitat Quality for MNES within the Project footprint (as detailed in ELA's 'Upper Burdekin Wind Farm - 2022 Ecology Survey Report' prepared by ELA for Windlab)
- Ground-truthed RE mapping of the POIA prepared by Ecological Australia (ELA) based on previous field investigations undertaken by ELA
- Statewide Landcover and Trees Study (SLATS) mapping/data from 2022-1988, accessed via the Queensland Globe portal at <https://qldglobe.information.qld.gov.au/>
- Fire and drought history data/mapping for [REDACTED] and [REDACTED] and the surrounding landscape, accessed via <https://www.longpaddock.qld.gov.au/forage/>; and
- latest available aerial/satellite photography, accessed via the Qglobe portal at <https://qldglobe.information.qld.gov.au/>

The results of database searches undertaken for this desktop assessment are provided in Appendix A.



## 2.2 Field assessment methods

### 2.2.1 Target species survey methods

A suite of fauna survey methods tailored to detect target species presence were deployed within the POIA and SOIA in accordance with the following Commonwealth and Queensland State guidelines:

- Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act (Department of Sustainability, Environment, Water, Population and Communities, 2011)
- Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2010a)
- Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act (DEWHA, 2010b)
- National Recovery Plan for the EPBC Act listed Koala (*Phascolarctos cinereus*) (DAWE, 2022)
- A review of koala habitat assessment criteria and methods, report prepared for the Department of Agriculture, Water and the Environment, Canberra (Youngentob et al., 2021); and
- Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Version 4.0) (Eyre et al., 2022).

Methods employed to detect target MNES species during surveys are detailed below.

#### 2.2.1.1 Koala scat and scratch surveys

Searches for koala faecal pellets and scratches were undertaken around Locally Important Koala Trees (LIKTs) and ancillary koala habitat trees (see Youngentob et al., 2021) whilst traversing areas of suitable koala habitat within the POIA and SOIA on foot.

#### 2.2.1.2 Camera Traps

Baited camera traps were deployed within the SOIA and POIA to assist with the detection of predatory pest species including wild dogs, feral cats and foxes.

#### 2.2.1.3 Anabats

Ultrasonic bat call detectors (Titley Scientific Anabat Swift bat detector units) were deployed along bat flyways and in proximity to potential roost sites in order to capture the echolocation calls of microbat species. To maximise detection of the target species (in particular the bare-rumped sheath-tailed bat), Anabats were fitted with a directional microphone and set to record full-spectrum data from dusk until dawn each night. Anabat units were deployed at a total of 8 sites across the POIA and 3 sites within the SOIA (as shown in Figures 2 and 3).

#### 2.2.1.4 Acoustic Recorders

Autonomous acoustic recording devices (Titley Chorus acoustic recorders) were deployed within the POIA and SOIA to document the presence of masked owl and red goshawk in areas of suitable foraging and breeding habitat for these species. Recorders were set to record for 6 hours each day (1.5 hours before and after sunset and 1.5 hours before and after sunrise). Acoustic recording devices were deployed at a total of 6 sites within the POIA and 3 sites within the SOIA (as shown in (as shown in Figures 2 and 3).



Sound recordings downloaded from acoustic recording devices were analysed for calls of target species using the software package Kaleidoscope (Wildlife Acoustics Incorporated).

#### 2.2.1.5 Call playback

Call playback surveys were conducted for koala and masked owl in areas of suitable habitat within both the POIA and SOIA. Call playback surveys were conducted at night using a loudspeaker paired to a smart phone. At each call playback site, koala calls were broadcast for 2 minutes followed by 2 minutes of silence/listening. If no response was heard during this period, calls were broadcast for another 2 minutes, followed by another 2 minutes of silence/listening. Calls of the masked owl were played for a 5-minute period during which the surrounding area was scanned for owls flying in under cover of darkness. After this initial period, calls were broadcast for another 5 minutes during which the surrounding area was spotlighted for owls. The location of call playback survey sites is shown in Figures 2 and 3.

#### 2.2.1.6 Nocturnal spotlighting

Nocturnal spotlighting surveys were undertaken by two ecologists equipped with handheld and head torches. Nocturnal spotlighting surveys were conducted within the POIA and the SOIA within suitable habitat for the target species. Spotlighting was also undertaken when traversing access tracks within and immediately adjacent the POIA and SOIA. The location of nocturnal survey sites traversed on foot is shown in Figures 2 and 3.

### 2.2.2 Rapid habitat assessments

Rapid habitat assessments documenting the presence/absence of suitable habitat for target MNES were undertaken at numerous sites across the POIA and SOIA during survey events 1,2 and 3 (as shown Figures 2 and 3). Rapid habitat assessments aimed to document the presence of key habitat features influencing the presence/absence and/or abundance of target MNES species, including:

- the presence of locally important koala feed trees (LIKTs) and ancillary habitat koala trees (as detailed in Youngentob et al., 2021)
- the presence of greater glider feed trees and hollow-bearing trees suitable for denning (as documented in Eyre et al., 2022).
- complex rock/boulder piles providing shelter for Sharman's rock-wallaby
- caves, rock/boulder piles, and basal tree hollows providing roosting opportunities for greater large-eared horse-shoe bat
- hollow-bearing trees and stags providing roosting opportunities for bare-rumped sheath-tailed bat
- presence of suitable nest hollows for masked owl
- presence of nectar and fruit producing trees providing foraging opportunities for spectacled and/or grey-headed flying foxes
- presence of permanent/near permanent water along creek lines and presence of tall/emergent trees providing nesting opportunities for red goshawk; and
- presence and severity of threats (high intensity wildfire, weed infestations, grazing impacts).



### 2.2.3 Habitat Quality assessments

Habitat Quality assessments were conducted using the same methodology and field scoring criteria as that used by EcoLogical Australia (ELA) to assess habitat quality for MNES within the Project footprint (as detailed in ELA, 2022).

Consistent with ELA’s methodology, Habitat Quality assessments were conducted in accordance with the *Guide to Determining Terrestrial Habitat Quality* Version 1.3 (Department of Environment and Science [DES], 2020) (herein referred to as the ‘Habitat Quality Guide’) which specifies the collection of:

- landscape-scale attribute data
- site-based attribute data; and
- species habitat attribute data (as detailed below).

In determining Habitat Quality for MNES, habitat areas are first delineated into Assessment Units (AUs) with similar vegetation structure and composition, function and quality of habitat. Sampling sites are then selected for each AU and site-based attribute data in accordance with the Habitat Quality Guide (DES, 2020), and species habitat attribute data collected at each sampling site.

For the current assessment, AUs within the POIA were identified using ground-truthed RE mapping previously prepared by ELA, while AUs within the SOIA were identified using DoR RE mapping and subsequent ground-truthing of REs by E2M ecologists.

AUs identified within the POIA and SOIA and the number of Habitat Quality assessment sites established within each AU are summarised in Tables 1 and 2, below. The location of Habitat Quality assessment sites within the POIA and SOIA is shown in Figures 2 and 3.

**Table 1: Assessment units and habitat quality assessment sites within the POIA**

AU	RE	Remnant status	Area (ha)	Number of assessment sites	MNES
1	9.5.5a	Remnant	950	5	All target MNES except for Sharman’s rock-wallaby
2	9.3.1a	Remnant	103	3	All target MNES except for Sharman’s rock-wallaby
3	9.5.5f	Remnant	180.8	4	All target MNES except for Sharman’s rock-wallaby
4	9.12.2	Remnant	2567.5	6	All target MNES except for Sharman’s rock-wallaby
5	9.7.3a	Remnant	53.5	2	All target MNES except for Sharman’s rock-wallaby and greater glider
6	9.3.6a	Remnant	1.6	1	All target MNES except for Sharman’s rock-wallaby
7	9.5.5b	Remnant	54.7	2	All target MNES except for Sharman’s rock-wallaby
<b>Total</b>			<b>4001</b>	<b>23</b>	



**Table 2: Assessment units and habitat quality assessment sites within the SOIA**

AU	RE	Remnant status	Area (ha)	Number of assessment sites	MNES
1	9.12.19	Remnant	79.1	3	All target MNES
2	9.12.11	Remnant	63.4	3	All target MNES
3	7.3.34	Remnant	34.2	3	All target MNES
<b>Total</b>			<b>176.6</b>	<b>9</b>	

### 2.2.3.1 Landscape-scale attributes

An assessment of landscape-scale attributes is required to determine if an offset area is situated in a landscape that can achieve a conservation outcome (i.e. suitably connected and contains large tracts of vegetation). In keeping with ELA’s approach (ELA, 2022), offset areas were assessed against the criteria summarised in Table 3. As the POIA and SOIA are located within an ‘intact’ subregion of the Einasleigh Uplands, patch size and connectedness were not assessed as landscape-scale attributes (in keeping with the Habitat Quality Guidelines).

**Table 3: Landscape-scale attributes included in ELA assessment method**

Attribute	Description	Assessment extent	Maximum score
Distance to water	The distance to permanent water accessible to livestock	-	20
Ecological corridors	Proximity to mapped State-wide Biodiversity Corridors*	-	6
<b>Total</b>	-	-	<b>26</b>

\* Proximity of ecological corridors is included as a Landscape-scale attribute in keeping with ELA’s (ELA, 2022) approach to scoring Site Context.

### 2.2.3.2 Site-based attributes

Site-based attribute data were collected within 100 x 50 m areas (including various sub-plots) for each assessment unit, weighted in accordance with the Habitat Quality Guide and compared to BioCondition benchmark values (Queensland Herbarium, 2022). A summary of the site-based attributes assessed, plot area and associated maximum score is summarised in Table 4. The location of Habitat Quality survey sites is depicted in Figure 2 and Figure 3.

A Trimble TDC600 Global Positioning System device was used to record the location of mid-point (50 m mark) of each assessment site.

The assessment of site-based attributes was conducted under conditions consistent with a ‘late wet season’ in accordance with the Habitat Quality Guidelines.





**Table 4: Site-based attributes assessment criteria**

Attribute	Description	Assessment plot	Maximum score
Large trees	Number of large trees per hectare, as determined by existing BioCondition benchmarks for the associated RE	100 m x 50 m	15†
Tree canopy height	Median canopy height in metres of the ecologically dominant layer.	100 m x 50 m	5†
Recruitment (%)	The proportion of overstorey species present at a site that are regenerating (<5 cm diameter at breast height (DBH))	100 m x 50 m	5†
Tree canopy cover (%)	Vertical projection of the tree canopy crown cover along a transect	100 m transect	5†
Shrub layer cover (%)	Vertical projection of the shrub layer cover of native shrubs	100 m transect	5†
Coarse woody debris	The length of fallen woody logs and other coarse woody debris (>10 cm diameter and >0.5 m in length) per hectare	50 m x 20 m	5†
Native plant species richness	Native plant species richness, comprising all life forms (i.e. trees, shrubs, grasses and forbs/other)	100 m x 50 m (trees) 50 m x 10 m (shrubs, grasses, forbs/other)	5 each (20 total)
Non-native plant cover	Percentage cover of non-native/weed plant species	50 m x 10 m	10
Native perennial grass cover (%)	Average percentage cover of native perennial grass species	Five 1 m x 1 m	5
Organic litter cover	The average percentage cover of organic material such as fallen leaves, twigs, and branches <10 cm diameter	Five 1 m x 1 m	5

### 2.2.3.3 Species Habitat Attributes assessment

Species Habitat Attribute assessments evaluate the capacity of the AU to support a species for all or part of its life cycle, whether permanently or from time to time, taking into account: the quality and availability of food and foraging habitat, the quality and availability of habitat used for shelter and/or breeding, the quality and availability of dispersal habitat, and the absence of threats. The examination of species habitat attributes was conducted as part of habitat assessments completed within each AU. For the assessment of threats, the scope and severity of threats to MNES within the SPOIA and SOIA was assessed using information gathered during field and desktop investigations, including:

- The results of camera trapping surveys used to determine the presence/abundance of feral predators
- Indirect evidence of pest species presence (e.g., scats, tracks and diggings) documented during field surveys
- Observations of weed plants during field surveys
- Evidence of recent and past fire damage observed in the field (e.g., fire scarring and fire-killed trees)



- Fire scar-mapping showing the past (post-1992) fire history of [REDACTED] (accessed via <http://www.longpaddock.qld.gov.au/forage>)
- Evidence of past clearing/thinning of native vegetation cover from historical aerial imagery; and
- Information on fire and pest management strategies currently being implemented with [REDACTED] discussions with the current landholder [REDACTED]

To allow comparison of Offset and Impact site Habitat Quality scores, Species Habitat Attributes were assessed for each target MNES using the same field scoring system used by ELA within the Project footprint, as detailed in ELA (2022).

## 2.3 Habitat mapping methodology

Data from field and desktop investigations were used to map and quantify the extent of habitat suitable for offsetting Project impacts on target MNES within the POIA and SOIA. For consistency, the extent of suitable habitat for target MNES species within the POIA and SOIA was mapped in accordance with the same mapping rules used to quantify Project impacts on MNES as detailed in Appendix B, with the following exceptions:

- Areas of 19.2.11 within the POIA were not mapped as suitable habitat for Sharman’s Rock-wallaby due to the absence of suitable shelter (i.e. rock boulders, complex boulder piles) within or in close proximity to the POIA.
- Mapping of shelter and foraging habitat for the greater large-eared horseshoe bat within the POIA was constrained to watercourse and larger drainage lines, where denser shrub cover and undercut banks provide more suitable habitat for roosting and foraging.
- Mapping rules for target MNES applied to the POIA and SOIA included additional REs not present within the Project footprint.

Mapping rules for each target MNES species within the POIA and SOIA are summarised briefly in Table 5 and Table 6, below.

**Table 5: Habitat mapping rules for target MNES within the POIA**

Species	Habitat type	Mapping rules	Applicable REs
Koala	Foraging, breeding, and refuge habitat	All areas of remnant eucalypt woodland/open woodland and open forest containing LIKTs.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.7.3a*, 9.12.2
	Marginal habitat	NA	NA
Greater glider	Foraging and breeding/denning	All areas of remnant eucalypt woodland/open forest containing suitable denning and feed trees.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.12.2
	Marginal habitat	Areas of open eucalypt woodland with sparse tree cover.	9.7.3a*
Sharman’s rock-wallaby	Key breeding and shelter habitat	NA. The POIA and surrounds contain little if any suitable rock shelter for the species.	NA



Species	Habitat type	Mapping rules	Applicable REs
	Foraging habitat	NA. The POIA and surrounds contain little if any suitable rock shelter for the species. As such, habitat is unlikely to be utilised by foraging animals.	NA
	Potential connecting habitats	NA. Habitat within the POIA does not appear to provide connectivity between areas of known/likely occupied shelter/breeding habitat.	NA
Masked owl (northern)	Breeding and/or foraging habitat	All areas mapped as remnant eucalypt woodland/open forest.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.7.3a*, 9.12.2
	Potential nesting habitat	NA. Creeks within the POIA do not contain permanent water.	NA
Red goshawk	Foraging habitat	All areas mapped as remnant eucalypt woodland/open forest.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b, 9.5.5c, 9.5.5f, 9.7.3a*, 9.12.2
Spectacled flying-fox/ grey-headed flying fox	Potential foraging habitat	All areas mapped as remnant eucalypt woodland/open forest.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.7.3a*, 9.12.2
Bare-rumped sheath-tailed bat	Foraging, breeding and roost habitat	All areas mapped as remnant eucalypt woodland/open forest containing suitable hollows for roosting.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.7.3a*, 9.12.2
Greater large-eared horseshoe bat	Foraging habitat and roosting habitat	Remnant vegetation mapped as RE 9.3.1 PLUS remnant RE 9.12.2, 9.5.5a, 9.5.5b, 9.5.5c, and 9.5.5f within 10 m of a mapped watercourse.	9.3.1, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.12.2
	Potential roosting habitat	All other areas mapped as remnant eucalypt woodland/open forest.	9.3.1, 9.3.6a, 9.5.5a, 9.5.5b*, 9.5.5c*, 9.5.5f, 9.7.3a*, 9.12.2

\* REs present within the POIA not included in mapping rules for the Project footprint.



**Table 6: Habitat mapping rules for target MNES within the SOIA**

Species	Habitat type	Mapping rules	Applicable REs
Koala	Foraging, breeding, and refuge habitat	All areas of remnant eucalypt woodland/open woodland and open forest containing LIKTs.	7.3.43a, 9.12.19, 9.12.22
	Marginal habitat	NA	NA
Greater glider	Foraging and breeding/denning	All areas of remnant eucalypt woodland/open forest containing suitable denning and feed trees.	7.3.43a, 9.12.19, 9.12.22
	Marginal habitat	Areas of open eucalypt woodland with sparse tree cover.	NA
Sharman's rock-wallaby	Key breeding and shelter habitat	Remnant vegetation containing granite boulder piles/stacks.	7.3.43a
	Foraging habitat	Remnant eucalypt woodland/open forest with a grassy understory in proximity to (within 300 metres) of suitable shelter.	9.12.19 and 9.12.22
	Potential connecting habitats	NA. All mapped habitat within the SOIA is considered suitable foraging and/or breeding habitat for the species.	NA
Masked owl (northern)	Breeding and/or foraging habitat	All areas mapped as remnant eucalypt woodland/open forest.	7.3.43a, 9.12.19, 9.12.22
Red goshawk	Potential nesting habitat	Remnant eucalypt woodland in proximity to permanent water containing suitable nest trees (i.e., large emergent trees)	7.3.43a
	Foraging habitat	All other areas mapped as remnant eucalypt woodland/open forest.	9.12.19 and 9.12.22
Spectacled flying-fox/ grey-headed flying fox	Potential foraging habitat	All areas of remnant eucalypt woodland/open forest.	7.3.43a, 9.12.19, 9.12.22
Bare-rumped sheath-tailed bat	Foraging, breeding and roost habitat	All areas mapped as remnant eucalypt woodland/open forest containing suitable hollows for roosting.	7.3.43a, 9.12.19, 9.12.22
Greater large-eared horseshoe bat	Foraging habitat and roosting habitat	Remnant vegetation containing suitable roost sites (rock and boulder piles, undercut banks and basal tree hollows and nearby areas of more structurally complex vegetation (i.e., woodland/open forest with a dense or mid-dense shrub and or small tree layer).	7.3.43a



Species	Habitat type	Mapping rules	Applicable REs
	Potential roosting habitat	All other areas of remnant eucalypt woodland/open forest potentially containing tree hollows suitable for roosting.	9.12.19 and 9.12.22

\* REs present within the POIA not included in mapping rules for the Project footprint.

## 2.4 Habitat Quality scoring methodology

Habitat Quality scoring for target MNES species was undertaken separately for the POIA and SOIA. To ensure consistency in scoring between offset and impact areas, Habitat Quality scores for MNES offsets were derived using the same approach used by ELA to score Habitat Quality for habitat within the Project footprint (i.e., the Impact Area) as detailed in ELA (2022) and as summarised briefly, below.

In keeping with ELA's (ELA, 2022) approach to scoring habitat quality, field data/observations were used to derive Site Specific and Species Specific Habitat attribute scores for each assessment site in accordance with the state (Queensland) *Guide to Determining Terrestrial Habitat Quality version 1.3* (DES, 2020). Consistent with ELA's (ELA, 2022) approach, the derivation of Site Specific Habitat Attribute scores was undertaken using benchmark values from analogous REs (due to the absence of benchmark data for REs within the Project footprint). For REs not included in the Project footprint, advice regarding suitable analogous benchmarked REs was sought from the Queensland Herbarium. In keeping with ELA's (ELA, 2022) approach, Landscape-scale attributes (distance to permanent water and connectivity with state-mapped ecological corridors) were also scored for each assessment site.

Site Specific, Species Habitat and Landscape-scale Attribute scores were subsequently used to derive Site Condition and Site Context scores (out of 3) for each assessment unit (AU) and MNES. Site Condition and Site Context scores were then combined with a Stocking Rate score out of 4 for to give an overall Habitat Quality score out of 10 for each AU in accordance with the federal *Offsets Assessment Guide*. Area-weighted habitat quality scores for each AU were then combined to give a total score out of 10 for each of the target MNES species.

Site Specific, Species Habitat and Landscape-scale attribute data used to calculate Site Condition and Site Context scores, in accordance with ELA's (ELA 2022) scoring method, are detailed in Tables 8 and 9, below. Criteria used by ELA (ELA, 2022) for scoring Stocking Rate scores are summarised in Table 10.

**Table 7: Attributes used in the derivation of Site Condition scores**

Attribute type	Attribute	Score
Site Specific	Recruitment of woody perennial species	/5
	Trees spp. richness	/5
	Shrub spp. richness	/5
	Grass spp. richness	/5
	Forb spp. richness	/5
	Tree canopy height	/5



Attribute type	Attribute	Score
	Tree canopy cover over (tree canopy and sub-canopy)	/5
	Native shrub canopy cover	/5
	Native perennial grass cover	/5
	Organic litter cover	/5
	Large trees	/15
	Coarse woody debris	/5
	Weed cover	/5
Species Specific Habitat	Quality and availability of food and habitat required for foraging	/25
	Quality and availability of habitat required for shelter and breeding	/25
<b>Total (Raw) Score*</b>		<b>/130</b>

\* For the calculation of Site Condition scores, the raw total score out of 130 was converted to a score of out 3.

**Table 8: Landscape-scale and Species Habitat attributes used to derive Site Context scores**

Attribute type	Attribute	Score
Landscape-scale	Intact - Distance from water (km) (default of 0 if fragmented)	/20
	Ecological Corridors*	/6
Species Habitat	Quality and availability of habitat required for mobility	/25
	Absence of threats	/25
<b>Total (Raw) Score**</b>		<b>/76</b>

\* Proximity of ecological corridors is included as a Landscape-scale attribute in keeping with ELA's (ELA, 2022) approach to scoring Site Context.

\*\* For the calculation of Site Context scores, the raw total score out of 76 was converted to a score of out 3.

**Table 9: Criteria used to score Stocking Rate**

Criteria	Scoring	Score
Presence detected on or adjacent to site (neighbouring property with connecting habitat)	0 = not detected on or adjacent site 5= species detected adjacent site 10 = species on site	/10



Criteria	Scoring	Score
Species usage of the site (habitat type & evidenced usage)	0 = not habitat 5 = dispersal habitat 10 = foraging habitat 15 = breeding habitat	/15
Approximate density (per hectare)	Unspecified	/0*
Role/importance of species population on site	Based on supplementary table in federal offsets calculator guide.	/15
<b>Total (Raw) Score*</b>		<b>/40</b>

\* Due to uncertainty around species density estimates (as detailed in section 2.3) and ambiguity around the scoring of species' density by ELA (2022), species density was been assigned a weighting of zero.

\*\* For the calculation of Stocking Rate, the raw total score out of 40 was converted to a score out of 4.



## 3 Survey effort, timing and limitations

### 3.1 Survey timing and conditions

Field surveys were conducted during April and May of 2023. The timing of each survey and the field conditions during each survey event are summarised in Table 10, below.

Table 10: Field investigations undertaken by E2M ecologists within offset areas

Survey event	Dates	Location	Summary of activities	Field conditions <sup>1</sup>
1	1 - 5 April 2023	POIA	<ul style="list-style-type: none"> <li>• Rapid assessment/ground-truthing of habitat suitability for target species</li> <li>• Spotlighting surveys</li> <li>• Call playback surveys for koala and masked owl</li> <li>• Koala scat and scratch surveys</li> <li>• Surveys for red goshawk</li> <li>• Deployment of baited camera traps and autonomous acoustic recorders</li> </ul>	Fine and warm with maximum daily temperatures ranging from 34 - 31°C and overnight minimum temperatures ranging from 21-24 °C
2	3 - 6 May 2023	POIA SOIA	<ul style="list-style-type: none"> <li>• Surveys targeting Sharman's rock-wallaby and rapid assessment of habitat suitability for other target MNES within SOIA</li> <li>• Retrieval of camera traps and autonomous acoustic recorders from POIA</li> <li>• Deployment of ultrasonic bat detectors within POIA</li> <li>• Habitat Quality assessment within POIA and SOIA</li> </ul>	Fine and warm with maximum daily temperatures ranging from 38 - 31°C and overnight minimum temperatures ranging from 18-21 °C
3	May 23 - June 2 2023	POIA SOIA	<ul style="list-style-type: none"> <li>• Spotlighting surveys within SOIA</li> <li>• Call playback surveys for koala and masked owl within SOIA</li> <li>• Koala scat and scratch surveys within SOIA</li> <li>• Surveys for red goshawk within SOIA</li> <li>• Deployment/retrieval of baited camera traps and autonomous acoustic recorders within SOIA</li> <li>• Deployment and retrieval of ultrasonic bat detectors within POIA and SOIA</li> <li>• Habitat Quality assessment within POIA and SOIA</li> </ul>	Fine and with maximum daily temperatures ranging from 24 - 28° C and overnight minimum temperatures ranging from 4- 16 °C

<sup>1</sup> Bureau of Meteorology (2023)





## 3.2 Survey effort

Survey effort to assess the presence, abundance and distribution of target species within the POIA and SOIA is summarised in Table 11, below.

**Table 11: Summary of survey effort**

Survey Method	POIA	SOIA
Koala scat and scratch searches	10	6
Camera Trap (nights)	304	43
Anabat (nights)	47	28
Acoustic Recorders (nights)	157	35
Call playback (occasions)	7	2
Spotlighting (person hours)	12	8

## 3.3 Survey limitations

Ecological assessments have a range of inherent limitations associated with the seasonal timing of surveys, variable climatic conditions and species behaviour/detectability. The following limitations are noted with regards to the timing of surveys and detectability of target species within the POIA and SOIA:

- Conditions during surveys were suboptimal for the detection of flying fox species, with none of the dominant tree species within the POIA or SOIA flowering or fruiting during surveys. The failure to detect flying fox species may therefore be attributed to the paucity/absence of foraging resources at the time which surveys were conducted.
- Call playback surveys were not conducted in the lead-up to the breeding period for northern masked owl (the period of peak detectability for this species). The failure to detect masked owl within the POIA and SOIA may therefore be due to reduced detectability during surveys.
- Intermittent rain may have affected the detectability of some species during nocturnal surveys on the 25<sup>th</sup> of May 2023.

Site coverage during surveys was subject to several constraints, including limited vehicular access, the time required for travel to/from the study area, and (at times) steep terrain. Site coverage may therefore have been insufficient to detect the presence of highly-localised species and/or wide-ranging species occurring at very low-densities across the POIA/SOIA and surrounds (e.g., the northern masked owl).

While informative with regards to species presence/absence and relative abundance, survey results cannot be relied upon to provide an accurate estimate of density across the entirety of the POIA and SOIA, due to the aforementioned limitations. The weighting of species density when calculating stocking rate scores has been adjusted to account for this (see Table 9, section 2.4).



## 4 Results

### 4.1 Species occurrence and habitat

#### 4.1.1 Desktop assessment

Protected Matters Search Tool results indicate the known, likely or potential presence of habitat for all nine target MNES species within SOIA and all but one target species (i.e., the grey-headed flying-fox) within the POIA (see Appendix A).

Wildlife Online and ALA database searches returned records of koala and northern greater glider from both [REDACTED], including records of koala and greater glider immediately adjacent the POIA (see Appendix A). Searches of these databases also returned numerous records of Sharman's Rock-wallaby from [REDACTED] and a single record from the east of [REDACTED].

While not included in database search results for [REDACTED], northern masked owl, red goshawk, greater large-eared horseshoe bat, spectacled flying fox and bare-rumped sheath-tailed bat were recorded at one or more locations on Kilclooney station during surveys by ELA and Nature Advisory (see ELA, 2022). The grey-headed flying fox has not been recorded on [REDACTED] and there are no database records of this species from the surrounding landscape.

#### 4.1.2 Field assessment

##### 4.1.2.1 Koala

While no koalas were observed within the POIA or SOIA during surveys, evidence of koala presence (scat and scratches attributable to koala) was recorded at multiple locations across the POIA (Photo 3; Figure 4). Scratches attributable to koala were also observed in the SOIA and a single koala observed nearby during surveys, indicating likely presence of koala within the SOIA. The location of koala records within and in proximity to the POIA and SOIA is shown in Figures 4 and 5.

Both the POIA and SOIA contain an abundance of koala feed trees including the following locally important koala tree (LIKT) species:

- white mahogany (*E. acmenoides*)
- river red gum (*E. camaldulensis*) and/or blue gum (*E. tereticornis*)
- narrow-leaved ironbark (*E. crebra*)
- Queensland grey ironbark (*E. drepanophylla*); and
- gum-topped box (*E. molucana*).

Ancillary koala habitat trees (Youngentob et al., 2021) are also common within the POIA and include:

- Lemon-scented gum (*Corymbia citriodora*)
- Poplar gum (*E. platyphylla*); and
- Moreton Bay Ash (*C. tessellaris*).

Though not identified as an LIKT, *Eucalyptus portuensis* (a common canopy species within the POIA) is closely allied to and potentially conspecific with *E. acmenoides*, a recognised LIKT. As such, *E. portuensis* could potentially provide a foraging resource for koalas within the POIA.





Photo 3. Evidence of koala presence within the POIA, SOIA and surrounding landscape during surveys.

All vegetation communities within the POIA and SOIA containing LIKT species (including REs 9.3.1, 9.3.6a, 9.5.5a, 9.5.5b, 9.5.5c, and 9.5f, 9.7.3, 9.12.2, 9.1.219, 9.12.22, and 7.3.34a) are considered suitable foraging habitat for the species. Areas of suitable koala foraging habitat may also serve as breeding habitat for koala (see Youngentob et al., 2021) and, for the purposes of this report, breeding and foraging habitat are treated as one and the same. Vegetation communities containing LIKT and/or ancillary habitat trees within the POIA and SOIA are also likely to serve as dispersal habitat for the species.

Areas of riparian woodland and open forest habitat containing LIKTs within the POIA and SOIA are likely to serve as a drought refuge for koalas and, as such, may be important for sustaining an important local population of the species (DAWE, 2022).

Threats currently impacting the amenity of habitat for koala within the POIA and SOIA include wild dogs and lantana (*Lantana camara*). Wild dogs - a key threatening process challenging the sustainability of koala populations (DAWE, 2022) - pose a particular threat to koalas within the POIA (see Photo 4 and also Section 4.2, below). Localized infestations of lantana (*Lantana camara*) along gullies and creek lines within the POIA and SOIA may also hinder koala access to feed trees and limit the recruitment of canopy trees in some riparian areas (see Section 4.2 for further details).

As shown in Table 12 and Figures 4 and 5, the entire extent of the POIA, spanning 4,000.99 ha, is mapped as suitable koala foraging/breeding and dispersal habitat. The full extent of the SOIA, approximately 176.66 ha, is also mapped as suitable koala foraging/breeding and dispersal habitat.





Photo 4. Wild dogs were recorded in abundance within the POIA. Wild dogs are a key threatening process affecting the sustainability of koala populations.

Table 12: Summary of koala habitat within the offset areas

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Foraging/breeding and dispersal habitat	2657.45
	9.3.1	Remnant		103.00
	9.3.6a	Remnant		1.55
	9.5.5a	Remnant		708.44
	9.5.5a/9.5.5b	Remnant		218.77
	9.5.5f/9.5.5a	Remnant		258.29
	9.7.3a	Remnant		53.48
			Koala habitat within the POIA (ha)	4000.99
SOIA	7.3.43a	Remnant	Foraging/breeding and dispersal habitat	34.23
	9.12.19	Remnant		79.06
	9.12.22	Remnant		63.37
			Koala habitat within the SOIA (ha)	176.66



#### 4.1.2.2 Greater glider (northern subspecies)

A total of sixteen greater gliders (northern) (*Petauroides minor*) were observed across the POIA during spotlighting surveys. Though not recorded within the SOIA, a single greater glider was observed nearby during spotlighting surveys indicating likely presence of the species within the SOIA. All observations of this species were made within remnant eucalypt woodland/open forest typically with *Eucalyptus portuensis* (a preferred feed tree) as the dominant canopy species. Over half of greater gliders recorded during surveys were observed in *E. portuensis*, with the remainder spotted in spotted gum (*C. citriodora*), gum-topped box (*E. moluccana*), or narrow-leaved ironbark (*E. crebra*) trees. The location of greater glider records within and in proximity to the SOIA and POIA is shown in Figures 6 and 7, below.



Photo 5. Greater glider in the POIA during a spotlighting survey in April 2023. The POIA supported an abundance of hollow-bearing trees required by the species for denning.

The greater abundance of greater gliders within the POIA when compared with the SOIA and surrounds may be due to reduced detectability during surveys of the SOIA (due to intermittent light rain) and/or patchier tree cover within and surrounding the SOIA when compared with the POIA (with greater gliders unlikely to venture into or traverse areas with sparse tree cover).

Both the POIA and SOIA contain extensive areas of eucalypt woodland/open forest dominated by preferred greater glider feed tree species, including *E. portuensis*, *E. crebra* and *C. citriodora*. Other known greater glider feed tree species present within the POIA and/or SOIA include *E. moluccana*, *E. tereticornis*, *E. drepanophylla* and *Allocasuarina torulosa*. Large hollow-bearing trees and hollow-bearing stags suitable for denning (i.e., large trees and stags with hollow apertures > 10 cm) are common throughout the POIA and SOIA (see Photo 5).

Within the POIA and SOIA, all vegetation communities containing feed trees and denning trees are considered suitable foraging and breeding habitat for greater glider, including areas of remnant vegetation mapped as REs 9.3.1, 9.3.6a, 9.5.5a, 9.5.5b, 9.5.5c, and 9.5f, 9.7.3, 9.12.2, 9.1.219, 9.12.22, and 7.3.34a.



Existing threats to greater glider within the POIA appear limited, with clearing restricted to fence line tracks and the risk of catastrophic fires low due to fuel reduction burns within the POIA (see Photo 6 and section 4.2, below). Barbed wire fencing may pose a threat to the species in some parts of the POIA where tree cover is patchier due to thinning/clearing of vegetation along fence line trikes. Threats to greater glider within the SOIA appear negligible.



Photo 6. Controlled burns within the POIA reduce fuel loads and the potential for high intensity fires which threaten the sustainability of greater glider populations.

As shown in Table 13 and Figures 6 and 7, the entire extent of the POIA, spanning 4,000.99 ha, is considered suitable habitat for great glider. Woodland habitat within the SOIA is also considered suitable for the species and, as such, the entirety of the SOIA, approximately 176.66 ha, has been mapped as suitable greater glider habitat.

Table 13: Summary of greater glider habitat within the offset areas

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Breeding/denning and foraging habitat	2657.45
	9.3.1	Remnant		103.00
	9.3.6a	Remnant		1.55
	9.5.5a	Remnant		708.44
	9.5.5a/9.5.5b	Remnant		218.77
	9.5.5f/9.5.5a	Remnant		258.29
	9.7.3a	Remnant		53.48



Offset Area	RE	Class	Habitat Category	Area (ha)
Greater glider habitat within the POIA (ha)				4000.99
SOIA	7.3.43a	Remnant	Breeding/denning and foraging habitat	34.23
	9.12.19	Remnant		79.06
	9.12.22	Remnant		63.37
Greater glider habitat within the SOIA (ha)				176.66



#### 4.1.2.3 Sharman's rock-wallaby

Areas of woodland and open forest habitat within and adjacent the POIA were considered unsuitable for Sharman's Rock-wallaby due to the absence of suitable shelter (complex boulder piles and rocky scarps) within and adjacent this area. Suitable shelter habitat for Sharman's Rock-wallaby was however identified along Quartpot Creek within the SOIA, with a large, almost vertical, granite boulder stack providing denning and refuge habitat for the species (Photo 7). Foraging animals were also detected elsewhere along Quartpot Creek during spotlighting and camera trap surveys within the SOIA. Scats attributable to Sharman's rock-wallaby were also observed at numerous locations along Quartpot Creek (as shown in Figure 8, below). Suitable foraging habitat for the species comprises grassy woodland and open forest habitat in proximity to (within 300 metres of) shelter along and adjacent Quartpot Creek.



Photo 7. Confirmed Sharman's rock-wallaby den/refuge habitat within the SOIA along Quartpot Creek.

Existing threats to the species within the SOIA include predation by feral dogs and cats, both of which were recorded at low abundance within the SOIA area (see Photo 9 and section 4.2, below). Cattle are only present at low densities within the SOIA and, as such, competition from grazing animals is unlikely to pose a significant threat to the species.

With feral dogs/dingoes subject to culling (see section 4.2), currently, the main threat to Sharman's rock-wallaby within the SOIA appears to be predation by feral cats (see Photo 9).







Photo 8. Sharman's rock wallabies recorded on camera traps within the SOIA



Photo 9. A feral cat recorded on a camera trap in the SOIA during field studies in May 2023

Suitable habitat for Sharman's rock-wallaby was only identified within the SOIA. As shown in Table 14 and Figure 8, approximately 34.24 ha of riparian habitat within the SOIA is considered suitable or potentially suitable denning and/or shelter habitat for Sharman's Rock-wallaby with 142.43 ha of nearby woodland (comprising REs 9.12.2 and 9.12.19) comprising suitable foraging habitat for the species (176.66 ha total).



Table 14: Summary of Sharman’s rock-wallaby habitat within the SOIA

Offset Area	RE	Class	Habitat category	Area (ha)
	7.3.43a	Remnant	denning/shelter	34.23
SOIA	9.12.19	Remnant	foraging	79.06
	9.12.22	Remnant	foraging	63.37
Sharman’s rock wallaby habitat within the SOIA (ha)				176.66



#### 4.1.2.4 Red goshawk

A likely red goshawk nest was located in the SOIA during surveys in early May 2022 followed by a confirmed sighting of a single bird nearby later that month. The nest located within the SOIA was situated at a height of ~19 m within a 30 m tall, emergent blue gum (*E. tereticornis*) adjacent Quartpot Creek (Photo 10). Quartpot Creek contains permanent water and surrounding woodland/open forest habitat was found to support a high density of avian prey, including known prey species such as rainbow lorikeet, sulphur-crested cockatoo and blue-winged kookaburra.



Photo 10. Red goshawk nest along Quartpot Creek in the SOIA

The SOIA encompasses 34.24 ha of nesting/breeding habitat (comprising RE 7.3.43a) and 142.42 ha of suitable foraging habitat for the red goshawk. No areas of suitable nesting habitat near permanent water were identified within the POIA; however, the presence of known prey (including lorikeet and kookaburra species) may provide potential foraging opportunities for the Red Goshawk. As such, the entire extent of the POIA, encompassing 4000.99 ha, is mapped as potential foraging habitat for the species (Table 15, Figure 9 and Figure 10).

Table 15: Summary of red goshawk habitat within the offset areas

Offset Area	RE	Class	Habitat category	Area (ha)
	9.12.2	Remnant	Potential foraging habitat	2657.45
	9.3.1	Remnant	Potential foraging habitat	103.00
POIA	9.3.6a	Remnant	Potential foraging habitat	1.55
	9.5.5a	Remnant	Potential foraging habitat	708.44
	9.5.5a/9.5.5b	Remnant	Potential foraging habitat	218.77



Offset Area	RE	Class	Habitat category	Area (ha)
	9.5.5f/9.5.5a	Remnant	Potential foraging habitat	258.29
	9.7.3a	Remnant	Potential foraging habitat	53.48
			Red goshawk habitat within the POIA (ha)	4000.99
	7.3.43a	Remnant	Nesting habitat	34.23
SOIA	9.12.19	Remnant	Foraging habitat	79.06
	9.12.22	Remnant	Foraging habitat	63.37
			Red goshawk habitat within the SOIA (ha)	176.66



#### 4.1.2.5 Masked owl (northern subspecies)

No masked owls (northern) (*Tyto novaehollandiae kimberli*) were detected within the POIA or SOIA during field surveys. The species was, however, recorded at multiple locations within woodland/open forest habitat contiguous with the POIA and SOIA e

While not recorded during surveys, woodland and open forest within the POIA and SOIA may provide suitable foraging and/or roosting/nesting habitat for the species, with large hollow-bearing trees suitable for nesting and roosting scattered across much of the POIA and SOIA. Given the presence of suitable habitat and known occurrence of masked owl in proximity to the POIA and SOIA it is likely that the species would utilise eucalypt/woodland forest within POIA and SOIA.

The extent of mapped potential habitat for this species within the POIA and SOIA are shown Table 16 and Figures 11 and 12.

**Table 16: Summary of potential masked owl habitat within the offset areas**

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Potential breeding and/or foraging habitat	2657.45
	9.3.1	Remnant		103.00
	9.3.6a	Remnant		1.55
	9.5.5a	Remnant		708.44
	9.5.5a/9.5.5b	Remnant		218.77
	9.5.5f/9.5.5a	Remnant		258.29
	9.7.3a	Remnant		53.48
Potential masked owl habitat within the POIA (ha)				4000.99
SOIA	7.3.43a	Remnant	Potential breeding and/or foraging habitat	34.23
	9.12.19	Remnant		79.06
	9.12.22	Remnant		34.27
Potential masked owl habitat within the SOIA (ha)				176.66



#### 4.1.2.6 Grey-headed flying-fox

The grey-headed flying fox (*Pteropus poliocephalus*) was not detected within the POIA or SOIA during surveys undertaken by E2M and was not recorded within the Project study area during surveys conducted by EcoLogical Australia either (see ELA, 2022). The Project area, POIA, and SOIA are, however, located within the foraging range of animals occupying a camp near Ingham (National Flying Fox Monitoring Viewer accessed at <https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>), and, as such, could potentially be utilised by the species.

Both the POIA and SOIA contain an abundance of nectar-producing eucalypt trees (including winter and spring-flowering tree species such as *E. cerbra*, *E. tereticornis* and *C. citriodora* [DAWE, 2021]) that are known to provide an important foraging resource grey-headed flying foxes during winter and spring. In the SOIA, scattered figs (*Ficus* sp.) and other rainforest trees may also serve as a food source for the species.

With an abundance of nectar-producing myrtaceous trees, the entire extent of the POIA, spanning 4,000.99 ha is mapped as potential foraging habitat for the species (Table 17 and Figure 13). The entirety of the SOIA, approximately 176.66 ha, is also mapped as potential foraging habitat for the species (Figure 13 and Figure 14).

Threats to the grey-headed flying-fox within the SOIA and POIA are negligible at present, with entanglement of animals in barbed wire fencing the only potential threat to the species. Given animals utilising the POIA and SOIA are likely to be foraging in the canopy of woodland and forest trees, this is unlikely to represent a significant threat to the species.

Despite the presence of suitable foraging habitat, the likelihood of grey-headed flying fox utilising habitat within the POIA and SOIA appears low given: the absence of records from [REDACTED] and the broader landscape surrounding these areas (see section 4.4.1); the distance to the nearest known camp supporting the species; and the likely availability of similarly suitable foraging habitat in closer proximity to known camp sites.

**Table 17: Summary of potential grey-headed flying-fox habitat within the offset areas**

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Potential foraging habitat	2657.45
	9.3.1	Remnant		103.00
	9.3.6a	Remnant		1.55
	9.5.5a	Remnant		708.44
	9.5.5a/9.5.5b	Remnant		218.77
	9.5.5f/9.5.5a	Remnant		258.29
	9.7.3a	Remnant		53.48
Potential grey-headed flying-fox habitat within the POIA (ha)				4000.99
SOIA	7.3.43a	Remnant	Potential foraging habitat	34.23
	9.12.19	Remnant		79.06
	9.12.22	Remnant		63.37
Potential grey-headed flying-fox habitat within the SOIA (ha)				176.66



#### 4.1.2.7 Spectacled flying-fox

The spectacled flying-fox (*Pteropus conspicillatus*) was not recorded within the POIA or SOIA, due most likely to the paucity of flowering canopy trees during surveys. The species has, however, been recorded nearby within the Project study area (see ELA, 2022).

While not recorded within the SOIA and POIA, both these areas contain an abundance of nectar-producing myrtaceous trees in the genus *Eucalyptus*, *Corymbia* and *Melaleuca* which could serve as a food source for the species, particularly during times of peak flowering. In the SOIA, scattered fig trees and other rainforest species may also serve as a foraging resource for the spectacled flying-fox.

Given the species' mobility and known occurrence on Kilclooney station, areas of woodland and open forest habitat within the POIA and SOIA could readily be utilised by foraging animals. The full extent of the POIA, spanning 4,000.99 ha, is therefore mapped as potential foraging habitat for the spectacled flying-fox (Table 18 and Figure 15). Similarly, the entire SOIA, comprising 176.66 ha of remnant eucalypt woodland and open forest, is mapped as potential foraging habitat for the species (Table 18 and Figure 16).

Threats to the spectacled flying-fox within the SOIA and POIA appear negligible at present, with entanglement in barbed wire fencing the only potential threat to the species. However, with animals likely to be foraging in the canopy of woodland and forest trees, barbed wire fencing is unlikely to represent a significant threat to the species in these areas.

**Table 18: Summary of potential spectacled flying-fox habitat within the offset areas**

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Potential foraging habitat	2657.45
	9.3.1	Remnant		103.00
	9.3.6a	Remnant		1.55
	9.5.5a	Remnant		708.44
	9.5.5a/9.5.5b	Remnant		218.77
	9.5.5f/9.5.5a	Remnant		258.29
	9.7.3a	Remnant		53.48
Potential spectacled flying-fox habitat within the POIA (ha)				4000.99
SOIA	7.3.43a	Remnant	Potential foraging habitat	34.23
	9.12.19	Remnant		79.06
	9.12.22	Remnant		63.37
Potential spectacled flying-fox habitat within the SOIA (ha)				176.66



#### 4.1.2.8 Bare-rumped sheath-tailed bat

While not detected within the POIA or SOIA, the bare-rumped sheath-tailed bat was recorded elsewhere on Kilclooney station during surveys by conducted by EcoLogical Australia and Nature Advisory (see ELA, 2022). Suitable woodland/open forest habitat within the POIA and SOIA (i.e., areas of intact woodland habitat containing suitable roosting hollows) may therefore provide foraging and/or roosting habitat for the species. As such, woodland/open forest habitat across the POIA is mapped as potential breeding, foraging and/or roosting habitat for the species (Table 19 and Figure 17). The entirety of the SOIA, approximately 176.66 ha, is also mapped as potential breeding, foraging and roosting habitat for this species (see Table 19 and Figure 18).

**Table 19: Summary of potential bare-rumped sheath-tailed bat habitat within the offset areas**

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Potential breeding, foraging and roost habitat	2657.45
	9.3.1	Remnant		103.00
	9.3.6a	Remnant		1.55
	9.5.5a	Remnant		708.44
	9.5.5a/9.5.5b	Remnant		218.77
	9.5.5f/9.5.5a	Remnant		258.29
	9.7.3a	Remnant		53.48
Potential bare-rumped sheath-tailed bat habitat within the POIA (ha)				4000.99
SOIA	7.3.43a	Remnant	Potential breeding, foraging and roost habitat	34.23
	9.12.19	Remnant		79.06
	9.12.22	Remnant		63.37
Potential bare-rumped sheath-tailed bat habitat within the SOIA (ha)				176.66





#### 4.1.2.9 Greater large-eared horseshoe bat

Echolocation calls of the greater large-eared horseshoe (*Rhinolophus robersti*) bat were recorded on a bat detector deployed along Quartpot Creek, confirming the species' presence within the SOIA (see Appendix C). Suitable roosting habitat for the species was identified within complex boulder piles and rock cliff faces lining this watercourse; with areas of denser/more structurally complex vegetation fringing Quartpot Creek providing suitable foraging habitat for the species (see Photo 7). The species has also been recorded from riparian woodland/open forest habitat further north on Kilclooney station (see ELA, 2022).

The greater large-eared horseshoe bat was not recorded within the POIA during surveys. This area does, however, contain potential habitat for the species, including scattered hollow-bearing trees and areas of denser vegetation associated with drainage lines (including eroded creek lines/gullies) potentially suitable for roosting. Areas of denser/more structurally complex vegetation along drainage and creek lines within the POIA may also provide suitable foraging habitat for the species.

As shown in Table 20 and Figure 20, the entire extent of the SOIA, spanning 176.66 ha, comprises potentially suitable foraging and roosting habitat for the species. Within the POIA, approximately 3,657 ha of the POIA is mapped as potential roosting habitat for the species with an additional 288.94 ha of woodland/open forest habitat fringing drainage and creek lines mapped as potential roosting and foraging habitat (Figure 19).

**Table 20: Summary of greater large-eared horseshoe bat habitat within the offset areas**

Offset Area	RE	Class	Habitat Category	Area (ha)
POIA	9.12.2	Remnant	Potential foraging and roosting habitat	160.46
	9.12.2	Remnant	Potential roosting habitat only	2496.99
	9.3.1	Remnant	Potential foraging and roosting habitat	103.00
	9.5.5a	Remnant	Potential foraging and roosting habitat	8.92
	9.5.5a	Remnant	Potential roosting habitat only	699.52
	9.5.5a/9.5.5b	Remnant	Potential foraging and roosting habitat	9.86
	9.5.5a/9.5.5b	Remnant	Potential roosting habitat only	208.91
	9.5.5f/9.5.5a	Remnant	Potential foraging and roosting habitat	6.70
	9.5.5f/9.5.5a	Remnant	Potential roosting habitat only	251.58
	Potential Large-eared horseshoe bat habitat within the POIA (ha)			
SOIA	7.3.43a	Remnant		34.23
	9.12.19	Remnant	Roosting and foraging	79.06
	9.12.22	Remnant		63.37
Large-eared horseshoe bat habitat within the SOIA (ha)				176.66



## 4.2 Threatening Processes

Threats potentially affecting the amenity/quality of habitat for target MNES species within the POIA and SOIA are discussed below.

### 4.2.1 Pest animals

Wild dogs/dingoes are currently abundant within the POIA, as evidenced by the large number of animals captured on camera traps deployed in this area during surveys (see Table 21 and Photos 4 and 11). The presence of feral dog/dingo may therefore pose a significant threat to koalas within the POIA, with predation by dogs/dingoes considered a major threat to the species (DAWE, 2021).

In contrast with the POIA, no wild dogs/dingoes were recorded on camera within the SOIA (see Table 21); however, tracks and scats attributable to wild dog/dingo were observed in this area during surveys. The lower detectability of animals within the SOIA when compared to the POIA may be due to control measures currently being implemented in the s [REDACTED] (including the trapping and shooting of wild dogs). While present in lower numbers, wild dogs/dingoes may still pose a threat to koala and Sharman's rock-wallaby within the SOIA. Feral cats, a known threat to Sharman's rock-wallaby (Eldridge, 2012), are also present within the POIA and SOIA, albeit at lower abundance than dogs (See Photo 11 and Table 2).

Feral pigs, wild horses and cane toads were also recorded within the POIA (see Photo 11 and Table 21); however, these species are unlikely to significantly impact habitat quality for target MNES species.



Photo 11. Images of wild dog/dingo, feral cat and wild pig recorded within the POIA

Table 21: Number of individual pest animals captured on motion sensitive cameras

Location	Camera trap ID	Wild dogs/ dingo	Feral cat	Feral pigs	Wild horse
POIA	13	0	0	0	0

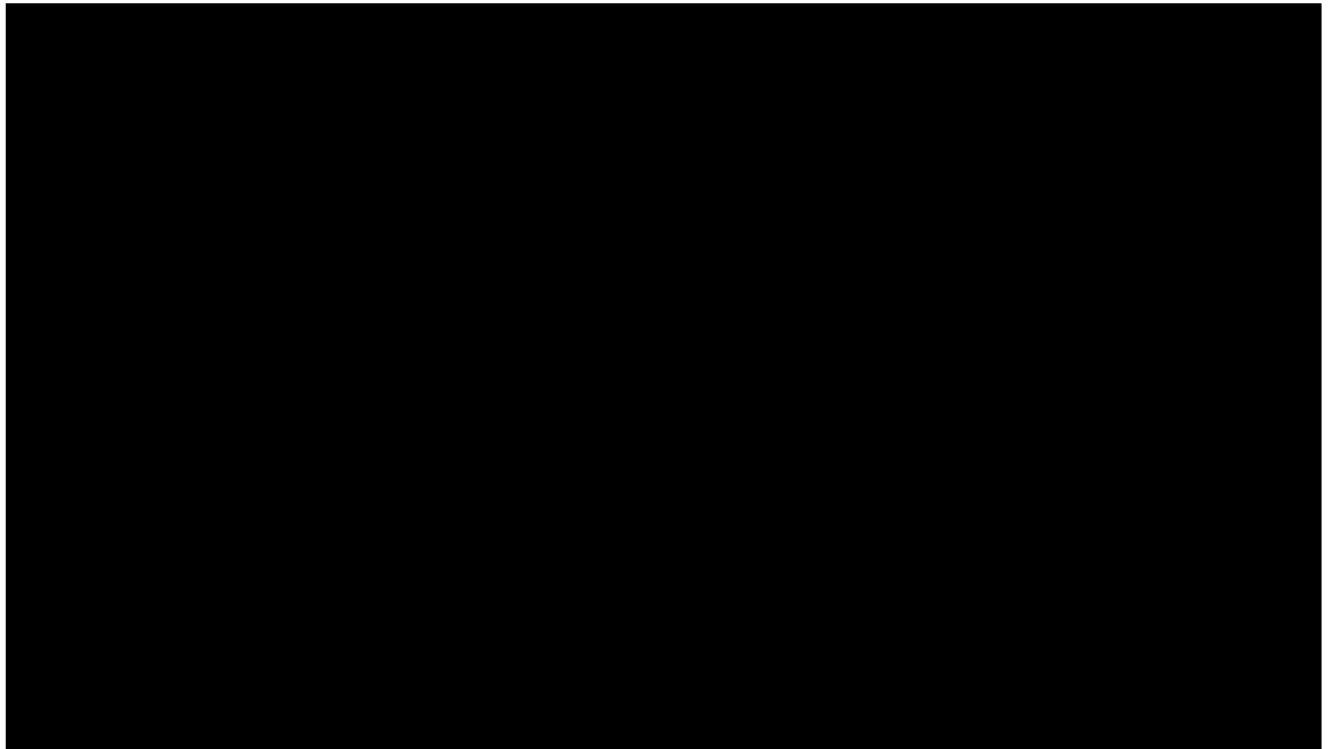


Location	Camera trap ID	Wild dogs/ dingo	Feral cat	Feral pigs	Wild horse
	19	4	1	1	3
	20	3	0	0	0
	21	3	0	0	4
	22	0	0	0	0
	23	0	0	0	0
	24	1	0	0	0
	25	4	0	1	1
	29	3	1	1	0
	30	0	0	0	0
SOIA	19	0	1	0	0
	20	0	0	0	0
	21	0	0	0	0
	23	0	0	0	0
	24	0	0	0	0
	25	0	0	0	0

#### 4.2.2 Pest plants/weeds

The overall diversity and abundance of weed species detected within the POIA and SOIA was very low. At present, the only weed species posing a potential threat to MNES species is *Lantana camara*, localised infestations of which may limit koala access to, and recruitment of, feed trees in riparian areas within the SOIA and POIA (see Photo 12).





### 4.2.3 Fire

Fire scar mapping for [REDACTED] dating back to 1992 (accessed via <http://www.longpaddock.qld.gov.au/forage>) indicates a low fire frequency, with most of the POIA (~66%) having burnt only two or three times in the past 30 years. Evidence of a past destructive fire (i.e., the death of canopy trees attributable to fire) was observed across a sizeable portion of the POIA, highlighting the potential threat posed by high intensity fires within this area. Current fire management practices within the POIA (i.e. mosaic burning suitably cool/moist conditions in the early dry season) however are likely to reduce the risk of hot fires burning through the entirety of the POIA, thereby reducing the threat posed by fire to koala and greater glider.

While reducing the risk of canopy scorch and tree death, prescribed burning of the ground stratum is likely to reduce the structural complexity of woodland/open forest communities (due to the scorching/death of shrubs and small trees in the subcanopy) and, as such, could reduce the extent and amenity of woodland/open-forest habitat for the greater large-eared horseshoe bat within the POIA.

In contrast with the POIA, the SOIA is not currently subject to fuel-reduction burns. Despite this, the potential for destructive fires resulting in the death/scorching of canopy trees appears low given sparser tree/shrub cover within and surrounding the SOIA (with the notable exception of areas impacted by *Lantana camara* [a fire-promoting species]). Within the SOIA, areas of denser vegetation fringing Quartpot Creek (including vegetation serving as foraging and shelter habitat for the greater large-eared horseshoe bat) are also afforded some protection from fire by rock (granite) outcropping. As such, fire poses a low-to-moderate threat for target MNES species occurring within the SOIA.

### 4.2.4 Clearing and fragmentation

The POIA and SOIA form part of a near-continuous expanse of intact remnant woodland/open forest extending to the north, south and east of [REDACTED] and [REDACTED]. At present, clearing within the



POIA and SOIA is largely limited to fence line and vehicular access tracks and, as such, does not pose a significant threat to MNES species occurring within the POIA and SOIA.

Clearing associated with construction of the Gawara Baya Wind Farm will result in some habitat loss on parts of Kilclooney station. However, given the extent of contiguous habitat remaining across [REDACTED], this is unlikely to affect the amenity of habitat for MNES species within the POIA and SOIA or movement of fauna to/from these areas.

#### 4.2.5 Human-wildlife interaction

Due to the remoteness of the POIA and SOIA and surrounding landscape, vehicular collision and persecution/culling of wildlife pose little if any threat to MNES fauna within these areas. And while human-built infrastructure (powerlines, wind turbines and stock fencing) may pose a threat to MNES species within the broader landscape surrounding the POIA and SOIA, the overall threat to target MNES species within the POIA and SOIA appears low, given:

- the absence of powerlines and wind turbines within or immediately adjacent these areas
- potential movement/dispersal of bird and bat species through parts of the landscape lacking powerlines or wind turbines
- the absence of stock-fencing within the SOIA
- the limited extent of stock fencing within the POIA
- the limited potential for entanglement of flying foxes in stock fencing within the POIA (with animals foraging in the canopy of flowering eucalypt trees unlikely to encounter fencing); and
- barbed wire fencing within the POIA is only likely to pose a threat to greater gliders in areas where tree cover is patchier due to thinning/clearing of vegetation along fence line tracks.

#### 4.2.6 Drought

Extreme/prolonged drought poses a particular threat to the koala in areas where animals have limited access to free-standing water and/or foliar moisture levels are likely to be low (e.g., along ridgelines and on shallow, skeletal soils) (DWAE, 2022). With Quartpot Creek containing permanent water, the threat posed by drought is likely to be low within the SOIA (with feed trees fringing Quartpot Creek also likely to provide koalas with access to foliar water during drier periods). In contrast with the SOIA, creek lines within the POIA do not appear to contain permanent water and, as such, drought may pose a greater threat to animals within the POIA than SOIA (though feed trees fringing creek lines within the POIA may still provide koalas with access to foliar water during dry periods).

#### 4.2.7 Disease

The disease status of koalas within the POIA and SOIA is largely unknown. However, given the limited presence and severity of stressors predisposing koalas to disease, the threat posed by disease within the POIA and SOIA is likely comparatively low.



## 4.3 Habitat Quality scoring

### 4.3.1.1 Koala

Koala habitat within the POIA was assigned an overall Habitat Quality of 7.65 and an overall score of 6.74 within the SOIA. This difference in scoring is due largely to the lower Site Context and Stocking rate scores within the SOIA (due to the proximity of permanent water and to failure to detect animals within the SOIA during surveys). Details of Habitat Quality scoring for koala within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 22 and Table 23, below.

**Table 22: Habitat Quality scoring for koala: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	2.16	2.23	1.96	2.30	2.54	1.98	2.06
Site Context Score (/3)	1.61	2.17	1.86	2.00	1.84	1.38	1.76
Species Stocking Rate Score (/4)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Unweighted Habitat Quality score (/10)	7.27	7.90	7.32	7.80	7.88	6.86	7.32
Assessment Unit area (ha)	950.0	103.0	180.8	2657.5	53.5	1.6	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.66	0.01	0.00	0.01
Weighted Habitat Quality Score	1.73	0.20	0.33	5.18	0.11	0.00	0.10
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>7.65</b>

**Table 23: Habitat Quality scoring for koala: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	2.20	2.32	2.40
Site Context Score (/3)	1.50	1.42	1.46
Species Stocking Rate Score (/4)	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	6.70	6.74	6.86
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	3.00	2.42	1.33
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>6.74</b>



#### 4.3.1.2 Greater glider

Northern greater glider habitat was assigned a Habitat Quality score of 8.22 within the POIA and 6.70 within the SOIA. The lower Habitat Quality score for greater glider within the SOIA is due largely to differences in Site Context scoring (due to the proximity of permanent water) and Stocking Rate scores (due to the failure to detect animals within the SOIA during surveys). Details of Habitat Quality scoring for greater glider within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 24 and Table 25, below.

**Table 24: Habitat Quality scoring for greater glider: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	2.14	1.98	2.22	2.33	2.49	2.20	1.91
Site Context Score (/3)	2.11	2.58	2.57	2.56	2.35	2.15	2.25
Species Stocking Rate Score (/4)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Unweighted Habitat Quality score (/10)	7.75	8.06	8.29	8.39	8.34	7.85	7.66
Assessment Unit area (ha)	950.1	103.0	180.8	2657.5	53.5	1.5	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.66	0.01	0.00	0.01
Weighted Habitat Quality Score	1.84	0.21	0.37	5.57	0.11	0.00	0.10
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>8.22</b>

**Table 25: Habitat Quality scoring for greater glider: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	1.91	2.09	2.27
Site Context Score (/3)	1.65	1.62	1.72
Species Stocking Rate Score (/4)	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	6.56	6.70	6.99
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	2.94	2.40	1.36
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>6.70</b>



#### 4.3.1.3 Sharman's rock-wallaby

Habitat within the POIA was considered unsuitable for Sharman's rock-wallaby due to the absence of suitable shelter (i.e., complex rock/boulder piles and rock ledges). As such, Habitat Quality was scored for the SOIA alone. The overall Habitat Quality score for Sharman's rock-wallaby in this area was 7.49. Details of Habitat Quality scoring for this species within the SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 26, below.

**Table 26: Habitat Quality scoring for Sharman's rock-wallaby: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	2.20	2.54	2.48
Site Context Score (/3)	1.58	1.65	1.60
Species Stocking Rate Score (/4)	3.5	3.5	3.5
Unweighted Habitat Quality score (/10)	7.28	7.69	7.58
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	3.26	2.76	1.47
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>7.49</b>

#### 4.3.1.4 Red goshawk

The overall Habitat Quality score for red goshawk was 6.53 within the POIA and 7.38 for the SOIA. The lower Habitat Quality score for red goshawk within the POIA is due largely to differences in Stocking Rate between these areas (due to the failure to detect animals within the POIA during surveys). Details of Habitat Quality scoring for red goshawk within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 27 and Table 28, below.

**Table 27: Habitat Quality scoring for red goshawk: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	1.88	1.87	1.92	1.96	2.15	1.91	1.56
Site Context Score (/3)	1.83	2.23	2.23	2.17	2.02	1.73	1.82
Species Stocking Rate Score (/4)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Unweighted Habitat Quality score (/10)	6.21	6.60	6.66	6.64	6.67	6.14	5.88
Assessment Unit area (ha)	950.1	103.0	180.8	2657.5	53.5	1.5	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.66	0.01	0.00	0.01





	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Weighted Habitat Quality Score	1.48	0.17	0.30	4.41	0.09	0.00	0.08
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>6.53</b>

**Table 28: Habitat Quality scoring for red goshawk: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	1.79	2.43	2.47
Site Context Score (/3)	1.64	1.79	1.80
Species Stocking Rate Score (/4)	3.5	3.5	3.5
Unweighted Habitat Quality score (/10)	6.93	7.71	7.77
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	3.10	2.77	1.51
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>7.38</b>

#### 4.3.1.5 Masked owl (northern)

The overall Habitat Quality score for masked owl within the POIA (7.64) was somewhat higher than that of the SOIA (6.80) due to the lower scoring of Site Context within the SOIA (due to the proximity of permanent water). Habitat Quality scoring for masked owl within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 29 and Table 30, below.

**Table 29: Habitat Quality scoring for masked owl: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	2.19	1.98	2.22	2.36	2.39	2.10	2.00
Site Context Score (/3)	2.02	2.38	2.44	2.45	2.15	1.82	2.15
Species Stocking Rate Score (/4)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	7.21	7.36	7.65	7.81	7.55	6.92	7.15
Assessment Unit area (ha)	950.1	103.0	180.8	2657.5	53.5	1.5	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.66	0.01	0.00	0.01
Weighted Habitat Quality Score	1.71	0.19	0.35	5.19	0.10	0.00	0.10
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>7.64</b>



**Table 30: Habitat Quality scoring for masked owl: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	2.05	2.25	2.32
Site Context Score (/3)	1.66	1.61	1.61
Species Stocking Rate Score (/4)	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	6.71	6.86	6.93
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	3.00	2.46	1.34
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>6.80</b>

#### 4.3.1.6 Bare-rumped sheath-tailed bat

The overall Habitat Quality score for bare-rumped sheath-tailed bat was higher within the POIA (7.75) compared with the SOIA (6.95), due to the lower Site Condition and Site Context scores within the SOIA (due to the presence of permanent water and lower abundance of suitable roots trees in this area). Details of Habitat Quality scoring for bare-rumped sheath-tailed bat within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 31 and Table 32, below.

**Table 31: Habitat Quality scoring for bare-rumped sheath-tailed bat: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	2.32	2.21	2.36	2.38	2.63	2.46	2.00
Site Context Score (/3)	2.14	2.55	2.53	2.47	2.28	2.06	2.16
Species Stocking Rate Score (/4)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	7.46	7.76	7.90	7.86	7.90	7.52	7.16
Assessment Unit area (ha)	950.1	103.0	180.8	2657.5	53.5	1.5	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.66	0.01	0.00	0.01
Weighted Habitat Quality Score	1.77	0.20	0.36	5.22	0.11	0.00	0.10
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>7.75</b>



**Table 32: Habitat Quality scoring for bare-rumped sheath-tailed bat: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	1.91	2.08	2.33
Site Context Score (/3)	1.92	1.82	1.98
Species Stocking Rate Score (/4)	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	6.82	6.90	7.31
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	3.05	2.47	1.42
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>6.95</b>

#### 4.3.1.7 Greater large-eared horseshoe bat

The overall Habitat Quality score for greater large-eared horseshoe bat within the POIA (6.54) was highly similar to that of the SOIA (6.57). Details of Habitat Quality scoring for greater large-eared horseshoe bat within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 33 and Table 34, below.

**Table 33: Habitat Quality scoring for greater large-eared horseshoe bat: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	2.09	2.02	2.22	2.27	2.37	2.46	2.09
Site Context Score (/3)	1.54	1.95	1.99	1.91	1.63	1.53	1.54
Species Stocking Rate Score (/4)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Unweighted Habitat Quality score (/10)	6.13	6.47	6.71	6.68	6.49	6.49	6.13
Assessment Unit area (ha)	950.1	103.0	180.8	2657.5	53.5	1.5	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.67	0.01	0.00	0.24
Weighted Habitat Quality Score	1.48	0.17	0.31	4.50	0.09	0.00	1.48
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>6.54</b>

**Table 34: Habitat Quality scoring for greater large-eared horseshoe bat: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	1.87	2.14	2.29



	AU1	AU2	AU3
Site Context Score (/3)	1.51	1.49	1.58
Species Stocking Rate Score (/4)	3.0	3.0	3.0
Unweighted Habitat Quality score (/10)	6.38	6.63	6.87
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	2.86	2.38	1.33
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>6.57</b>

#### 4.3.1.8 Spectacled and grey-headed flying-fox

The overall Habitat Quality score for both the spectacled and grey-headed flying-fox was higher within the POIA (6.04) when compared with the SOIA (5.28), due largely to the lower Site Context score for these species within the SOIA Study (due in large part to the proximity of permanent water). Details of Habitat Quality scoring for spectacled and grey-headed flying-fox within the POIA and SOIA (including Site Condition, Site Context and Species Stocking Rate scores) are provided in Table 35 and Table 36, below.

**Table 35: Habitat Quality scoring for spectacled and grey-headed flying-fox: POIA**

	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Site Condition score (/3)	2.12	1.88	2.06	2.20	2.48	2.22	1.80
Site Context Score (/3)	2.12	2.46	2.45	2.46	2.31	2.26	2.19
Species Stocking Rate Score (/4)	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Unweighted Habitat Quality score (/10)	5.74	5.83	6.01	6.16	6.29	5.98	5.49
Assessment Unit area (ha)	950.1	103.0	180.8	2657.5	53.5	1.5	54.7
Total offset area (ha) for this MNES	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0	4001.0
Size Weighting	0.24	0.03	0.05	0.66	0.01	0.00	0.01
Weighted Habitat Quality Score	1.36	0.15	0.27	4.09	0.08	0.00	0.08
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>							<b>6.04</b>

**Table 36: Habitat Quality scoring for spectacled and grey-headed flying-fox: SOIA**

	AU1	AU2	AU3
Site Condition score (/3)	1.98	2.08	2.33
Site Context Score (/3)	1.72	1.62	1.78



	AU1	AU2	AU3
Species Stocking Rate Score (/4)	1.5	1.5	1.5
Unweighted Habitat Quality score (/10)	5.20	5.20	5.61
Assessment Unit area (ha)	79.06	63.37	34.24
Total offset area (ha) for this MNES	176.67	176.67	176.67
Size Weighting	0.45	0.36	0.19
Weighted Habitat Quality Score	2.33	1.87	1.09
<b>Overall Habitat Quality score for Matter Area (out of 10)</b>			<b>5.28</b>



## 5 Summary and conclusions

Based on the current assessment (and using the same assessment and mapping methods used to assess Project impacts on MNES fauna) the POIA contains potential offsets for 8 out of 9 target MNES species, including:

- 4001 ha of known and likely foraging, dispersal and likely breeding habitat for koala comprising
- 4001 ha of known foraging, breeding and dispersal habitat for greater glider comprising REs
- 4001 ha of suitable foraging habitat for spectacled and grey-headed flying fox species comprising Res
- 4001 ha of suitable foraging and dispersal habitat for the red goshawk comprising REs
- 4001 ha of suitable foraging and roosting/nesting habitat for masked owl comprising REs
- 4001 ha of potentially suitable foraging and roosting habitat for the bare-rumped sheath-tailed bat comprising REs; and
- 3946 ha of potentially suitable foraging and roosting habitat for the greater large-eared horseshoe bat.

The POIA does not contain any suitable foraging, denning or dispersal habitat for Sharman's rock-wallaby, due to the absence of suitable shelter/denning habitat (i.e., complex rock boulder piles and rocky scarps) within or immediately adjacent this area.

Results of the current assessment indicate that the SOIA contains potential offsets for all 9 target MNES species, including:

- 176.66 ha of foraging, dispersal and likely breeding habitat for Sharman's rock-wallaby comprising REs
- 176.66 ha of foraging, dispersal and likely breeding habitat for koala comprising REs
- 176.66 ha of for foraging, breeding and dispersal habitat for greater glider comprising REs
- 176.66 ha of suitable foraging habitat for spectacled and grey-headed flying fox species comprising Res
- 176.66 ha of suitable foraging, breeding and dispersal habitat for the red goshawk comprising REs
- 176.66 ha of suitable foraging and roosting/nesting habitat for masked owl comprising REs
- 176.66 ha of potentially suitable foraging and roosting habitat for the bare-rumped sheath-tailed bat comprising REs; and
- 176.66 ha of potentially suitable foraging and roosting habitat for the greater large-eared horseshoe bat.

Habitat quality scores for potential offsets within the POIA and SOIA range from 5.28 (spectacled and grey-headed flying fox) to 8.22 (greater glider), with scores for most species higher in the POIA than the SOIA (with the notable exception of Sharman's rock-wallaby and red goshawk). For the most part, differences in habitat quality scoring amongst species reflect differences in stocking rate and threat scores, while differences in habitat quality scoring between SOIA and POIA are due largely to the presence of permanent water within the SOIA.

Opportunities for improving Habitat Quality scoring for MNES species within the SOIA and POIA are discussed in a separate stand-alone memo accompanying this report.



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## Appendix A Database search results



Australian Government

Department of Climate Change, Energy,  
the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Jul-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	23
<a href="#">Listed Migratory Species:</a>	16

## 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 <https://www.dcceew.gov.au/parks-heritage/heritage>

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

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	21
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	1
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Species

[\[ Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
Number is the current name ID.

Scientific Name

Threatened Category

Presence Text

#### BIRD

[Calidris ferruginea](#)

Curlew Sandpiper [856]

Critically Endangered

Species or species habitat may occur within area

[Erythrotriorchis radiatus](#)

Red Goshawk [942]

Endangered

Species or species habitat likely to occur within area

[Falco hypoleucos](#)

Grey Falcon [929]

Vulnerable

Species or species habitat may occur within area

[Hirundapus caudacutus](#)

White-throated Needletail [682]

Vulnerable

Species or species habitat may occur within area

[Numenius madagascariensis](#)

Eastern Curlew, Far Eastern Curlew [847]

Critically Endangered

Species or species habitat may occur within area

[Poephila cincta cincta](#)

Southern Black-throated Finch [64447]

Endangered

Species or species habitat may occur within area

[Rostratula australis](#)

Australian Painted Snipe [77037]

Endangered

Species or species habitat likely to occur within area

[Tyto novaehollandiae kimberli](#)

Masked Owl (northern) [26048]

Vulnerable

Species or species habitat likely to occur within area

#### MAMMAL

Scientific Name	Threatened Category	Presence Text
<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
<a href="#">Hipposideros semoni</a> Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Mesembriomys gouldii rattoides</a> Black-footed Tree-rat (north Queensland), Shaggy Rabbit-rat [87620]	Vulnerable	Species or species habitat may occur within area
<a href="#">Petauroides minor</a> Greater Glider (northern), Greater Glider (north-eastern Queensland) [92008]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Petrogale sharmani</a> Mount Claro Rock Wallaby, Sharman's Rock Wallaby [59281]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area
<a href="#">Pteropus conspicillatus</a> Spectacled Flying-fox [185]	Endangered	Species or species habitat may occur within area
<a href="#">Rhinolophus robertsi</a> Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Saccolaimus saccolaimus nudicluniatus</a> Bare-rumped Sheath-tailed Bat, Bare-rumped Sheath-tail Bat [66889]	Vulnerable	Species or species habitat may occur within area
<b>PLANT</b>		
<a href="#">Cycas platyphylla</a> a cycad [55796]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
<a href="#">Dichanthium setosum</a> bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phaius australis</a> Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
<a href="#">Tephrosia leveillei</a> [16946]	Vulnerable	Species or species habitat may occur within area

## REPTILE

<a href="#">Egernia rugosa</a> Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
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## Listed Migratory Species [\[ Resource Information \]](#)

Scientific Name	Threatened Category	Presence Text
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area

## Migratory Terrestrial Species

<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat may occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat likely to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat likely to occur within area
<a href="#">Symposiachrus trivirgatus as Monarcha trivirgatus</a> Spectacled Monarch [83946]		Species or species habitat likely to occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species		[ Resource Information ]
Scientific Name	Threatened Category	Presence Text
Bird		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Anseranas semipalmata</a> Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area



Scientific Name	Threatened Category	Presence Text
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area overfly marine area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
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<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area
<a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
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## Extra Information

State and Territory Reserves			[ <a href="#">Resource Information</a> ]
Protected Area Name	Reserve Type	State	
Girringun	National Park	QLD	

EPBC Act Referrals				[ <a href="#">Resource Information</a> ]
Title of referral	Reference	Referral Outcome	Assessment Status	
Not controlled action				
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	

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The report contains the mapped locations of:

- World and National Heritage properties;
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- distribution of listed threatened, migratory and marine species;
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Department of Climate Change, Energy,  
the Environment and Water

# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Jul-2023

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

# Summary

## Matters of National Environment Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	28
<a href="#">Listed Migratory Species:</a>	16

## 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 <https://www.dcceew.gov.au/parks-heritage/heritage>

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

<a href="#">Commonwealth Lands:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	21
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">EPBC Act Referrals:</a>	2
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	None
<a href="#">Geological and Bioregional Assessments:</a>	None

# Details

## Matters of National Environmental Significance

### Listed Threatened Species

[ [Resource Information](#) ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.  
Number is the current name ID.

Scientific Name

Threatened Category

Presence Text

#### BIRD

[Calidris ferruginea](#)

Curlew Sandpiper [856]

Critically Endangered

Species or species habitat may occur within area

[Erythrotriorchis radiatus](#)

Red Goshawk [942]

Endangered

Species or species habitat likely to occur within area

[Falco hypoleucos](#)

Grey Falcon [929]

Vulnerable

Species or species habitat may occur within area

[Hirundapus caudacutus](#)

White-throated Needletail [682]

Vulnerable

Species or species habitat may occur within area

[Numenius madagascariensis](#)

Eastern Curlew, Far Eastern Curlew [847]

Critically Endangered

Species or species habitat may occur within area

[Poephila cincta cincta](#)

Southern Black-throated Finch [64447]

Endangered

Species or species habitat likely to occur within area

[Rostratula australis](#)

Australian Painted Snipe [77037]

Endangered

Species or species habitat likely to occur within area

[Tyto novaehollandiae kimberli](#)

Masked Owl (northern) [26048]

Vulnerable

Species or species habitat likely to occur within area

#### FROG



Scientific Name	Threatened Category	Presence Text
<a href="#">Litoria dayi</a> Australian Lace-lid, Lace-eyed Tree Frog, Day's Big-eyed Treefrog [86707]	Vulnerable	Species or species habitat may occur within area
<b>MAMMAL</b>		
<a href="#">Dasyurus hallucatus</a> Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
<a href="#">Hipposideros semoni</a> Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area
<a href="#">Macroderma gigas</a> Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Mesembriomys gouldii rattoides</a> Black-footed Tree-rat (north Queensland), Shaggy Rabbit-rat [87620]	Vulnerable	Species or species habitat may occur within area
<a href="#">Petauroides minor</a> Greater Glider (northern), Greater Glider (north-eastern Queensland) [92008]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Petrogale sharmani</a> Mount Claro Rock Wallaby, Sharman's Rock Wallaby [59281]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat likely to occur within area
<a href="#">Pteropus conspicillatus</a> Spectacled Flying-fox [185]	Endangered	Species or species habitat may occur within area
<a href="#">Pteropus poliocephalus</a> Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
<a href="#">Rhinolophus robertsi</a> Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Saccolaimus saccolaimus nudicluniatus</a> Bare-rumped Sheath-tailed Bat, Bare- rumped Sheath-tail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
<b>PLANT</b>		
<a href="#">Cycas platyphylla</a> a cycad [55796]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Dichanthium setosum</a> bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Leichhardtia araujacea</a> [91900]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Leichhardtia brevifolia listed as Marsdenia brevifolia</a> [91893]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Lindsaea pulchella var. blanda</a> [20842]	Vulnerable	Species or species habitat may occur within area
<a href="#">Phaius australis</a> Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
<a href="#">Tephrosia leveillei</a> [16946]	Vulnerable	Species or species habitat likely to occur within area
<b>REPTILE</b>		
<a href="#">Egernia rugosa</a> Yakka Skink [1420]	Vulnerable	Species or species habitat may occur within area
<b>Listed Migratory Species</b> [ <a href="#">Resource Information</a> ]		
Scientific Name	Threatened Category	Presence Text
<b>Migratory Marine Birds</b>		

Scientific Name	Threatened Category	Presence Text
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area
<a href="#">Hirundo rustica</a> Barn Swallow [662]		Species or species habitat may occur within area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat likely to occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat likely to occur within area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat likely to occur within area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat likely to occur within area
<a href="#">Symposiachrus trivirgatus as Monarcha trivirgatus</a> Spectacled Monarch [83946]		Species or species habitat likely to occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species		[ <a href="#">Resource Information</a> ]
Scientific Name	Threatened Category	Presence Text
Bird		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Anseranas semipalmata</a> Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area

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<a href="#">Chalcites osculans as Chrysococcyx osculans</a> Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area
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## 2.4.2 Habitat mapping

The assessment of occurrence of threatened and migratory species within the project area, as highlighted above, has been informed from desktop investigations and field surveys undertaken over a number of years (refer to Table 2-3). Desktop investigations include a literature review of species ecology /biology with respect to habitat requirements for MNES with potential to occur in the project area. An understanding of habitat requirements and an assessment of where these may be supported in the project area informed targeted field surveys for these species. Various mapping products were examined to identify landscape features that influence species habitats including:

- Hi-resolution aerial imagery
- Topography (contours and terrain)
- Watercourse mapping
- Geology and soils mapping
- State government Regional Ecosystem mapping.

Field surveys investigated the variety of landscape features present and the habitats they support. In particular, habitats present were ground-truthed through flora and fauna surveys; vegetation community vegetation condition, Regional Ecosystem and BioCondition surveys; general habitat assessments; and targeted searches for potential MNES. These surveys were used to produce ground-truthed broad habitat mapping and Regional Ecosystem mapping.

Habitats present were further ground-truthed through habitat quality assessments (refer to Section 2.2.1.5).

Generally, habitat mapping was undertaken following the using the following workflow for each species:

- Literature review of ecology / biology
- Identify which broad habitats in the project area provide habitat
- Of this sub-set of broad habitat types, further refine potential habitat map through identification of Regional Ecosystems in which the key features of the landscape meet habitat needs are located, inconsideration of:
  - Land Zones -underlying geology and soil type, association with micro-habitats, soil moisture and potential water availability (eg. Land Zone 3 and riparian zones)
  - Vegetation structure and condition
  - Vegetation communities
  - Dominant flora species
- Apply additional mapping rules where relevant based on ecology / biology of the species not specific to habitat features
- Review and refine with consideration of species records where available.

The habitat requirements (features and relevant ecology / biology), the broad habitats in the project area which support these features, and the REs in which they are found are outlined in Table 2-7 below.



## Appendix B Habitat mapping rules

Table 2-7: Habitat mapping

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
<i>Marsupials</i>			
Sharman's rock-wallaby	Occupies rocky habitats including outcrops, boulder piles, gorges and cliffs in open forest and grassy woodland. Breeding / shelter habitat associated with high density complex boulder stacks. Foraging habitat is within close proximity to breeding/shelter habitat (500m is the average maximum distance (Hayes 2019))	Key breeding and shelter habitat – Higher density of complex granite boulder stacks, rocky outcrops. Known habitat, species observed. <sup>2</sup>	
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses.	REs 9.12.1a, 9.12.22, 9.12.22/9.12.19, 9.12.1a/9.12.22, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22
		Large boulders and boulder stacks are common, occasionally forming steep rugged ranges and granite stacked cliff faces alongside valleys. Caves and crevices within granite cliff faces and jump ups. Ample entry and exit routes and basking opportunities.	
		Major riparian zones near complex boulder stacks	9.3.1 <sup>^</sup>
		Foraging habitat within less complex granite outcrops and boulder piles that are potential breeding and shelter habitat. Known habitat, species observed.	
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses where boulders and boulder piles are common.	REs - 7.12.34, 9.12.19, 9.12.2, 9.12.2/9.12.1a, 9.12.2/9.12.19, 9.12.19/9.12.2, 9.12.19/9.12.22, 9.12.19/9.12.22/9.12.2, 9.12.4c
Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Lophostemon suaveolens</i> , <i>Allocasuarina littoralis</i> , and <i>Acacia</i> spp. Grasses include <i>Themeda triandra</i> , <i>Arundinella nepalensis</i> and <i>Aristida</i> sp. Areas of complex stacked boulders with deep and abundant crevices.	REs - 7.12.65b/c		

<sup>2</sup> Where polygon has mixed RE the habitat type has been adopted from the dominant RE

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Mid dense to very sparse shrub layer of <i>Acacia</i> spp. Ground layer of native grasses and forbs with sparse exotics. Native groundcover near granite shelter sites provide potential foraging.	REs - 9.11.2a/9.11.4a, 9.11.2a, 9.11.4a, 9.11.2a/9.11.5
		Dense, low (5-10 m), species-rich vine thicket with tall emergent trees in fire protected gullies near major watercourses. Shelter areas with surrounded by potential foraging habitat.	REs - 9.12.8
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent. Ground layer consists of native grasses <i>Heteropogon contortus</i> and <i>Themeda triandra</i> provide potential foraging habitat.	REs - 9.8.4a
		Potential connecting habitats - Habitats where the species has not been observed, support open grassy woodlands with occasional boulder piles. Potentially provide linkage habitat between confirmed breeding/shelter and foraging habitat	
		Riparian zones	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.43a, 7.3.49a, 9.3.13, 9.3.6
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Ground layer is typically dense, made up of native grass species, and moist with litter but may vary in density.	RE - 7.12.24a, 7.12.29b
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent. Ground layer consists of native grasses <i>Heteropogon contortus</i> and <i>Themeda triandra</i> .	RE - 7.8.10, 9.8.1a, 9.8.1a/9.8.4c, 9.8.4b, 9.8.4c
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses where boulder piles are uncommon.	RE - 7.12.30a, 7.12.35, 7.12.35/7.12.24a, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b, 9.7.3b, 9.12.1e

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
		Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Lophostemon suaveolens</i> , <i>Allocasuarina littoralis</i> , and <i>Acacia</i> spp. Grasses include <i>Themeda triandra</i> , <i>Arundinella nepalensis</i> and <i>Aristida</i> sp.	RE - 7.12.66b
		Grassland to very open grassland of <i>Iseilema</i> spp. (flinders grass) with a mixture of other grass species such as <i>Dichanthium</i> spp., <i>Bothriochloa</i> spp., <i>Heteropogon contortus</i> and <i>Aristida</i> spp. Occurs in the project area on undulating basalt plains amongst open woodland and vine-thicket communities.	RE - 9.8.13
		Dense, low (5-10 m), species-rich vine thicket with tall emergent trees in fire protected gullies near major watercourses. Shelter areas with surrounded by potential foraging habitat.	REs - 9.8.7, 9.8.7x
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Mid dense to very sparse shrub layer of <i>Acacia</i> spp. Ground layer of native grasses and forbs with sparse exotics.	REs- 9.11.2, 9.11.2/9.8.4, 9.11.5/9.11.1a/9.11.2a, 9.11.9
		Woodland dominated by <i>Corymbia citriodora</i> and infrequent other eucalypts. Sparse shrub layer and moderately dense ground layer of native grass.	REs - 9.7.3b
Koala	Foraging, breeding, refuge and dispersal habitat are found across a mosaic of vegetation communities dominated by <i>Eucalyptus</i> species.  Food trees include canopy trees from genera <i>Angophora</i> , <i>Eucalyptus</i> ,	Foraging, breeding, refuge habitat	
		Open woodland dominated by <i>Eucalyptus platyphylla</i> with associated <i>Corymbia</i> species. Provides foraging habitat.	RF 9.3.6
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasuarina</i> which occupy the upper and sub-canopy. <i>Eucalyptus</i> and <i>Corymbia</i> species provide foraging and refuge habitat.	REs - 7.12.24a, 7.12.29a, 7.12.29b, 7.12.60a, 7.12.60b, 7.12.61a, 7.12.69b, 7.5.1a, 7.5.1b, 7.5.2, 7.5.2a, 7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, 7.5.3a, 7.5.4a, 7.5.4b, 7.5.4c, 7.5.4f

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	<p><i>Corymbia</i>, <i>Lophostemon</i> and <i>Melaleuca</i>.</p> <p>Riparian forest and open forest habitat in moist areas provide refuge habitat.</p> <p>In project area, observed in <i>Eucalyptus tereticornis</i>, <i>E. crebra</i>, <i>E. moluccana</i>, and <i>Corymbia citriodora</i>.</p>	Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i> . Foraging habitat.	REs - 7.8.18a, 7.8.18b, 7.8.18c
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent. Eucalypts provide foraging habitat.	REs - 7.8.10, 9.8.1a, 9.8.1a/9.8.4c, 9.8.4a, 9.8.4b, 9.8.4c
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . <i>Eucalyptus</i> and <i>Corymbia</i> species provide foraging habitat.	RE - 7.12.30a, 7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.19, 9.12.19/9.12.2, 9.12.19/9.12.22, 9.12.19/9.12.22/9.12.2, 9.12.1a, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22, 9.12.1a/9.12.22, 9.12.1e, 9.12.2, 9.12.2/9.12.19, 9.12.2/9.12.1a, 9.12.22, 9.12.22/9.12.19, 9.12.4c, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provide foraging and refuge habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
		Marginal habitat - Dry habitat types such as open or very open woodlands dominated by ironbarks, such as <i>Eucalyptus crebra</i> . Provide lower density foraging and dispersal habitat for koala	
		Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Lophostemon suaveolens</i> , <i>Allocasuarina littoralis</i> , and <i>Acacia</i> spp.	REs - 7.12.65, 7.12.65b, 7.12.65c, 7.12.65k, 7.12.66b
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species	RF - 9.8.4a
		Woodland dominated by <i>Corymbia citriodora</i> and infrequent other eucalypts.	RE - 9.7.3b
Greater glider	Eucalypt forest and woodlands	Foraging and breeding / denning. Higher density of den trees and higher quality food resources (greater tree trunk girth and canopy cover) and Regional Ecosystems with confirmed greater glider records (Eyre et al. 2022)	



Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	Old growth forest with abundance (> 2 – 5 ha) of large tree hollows (min. entrance size of 6cm) Large, connected habitats.	Open woodland dominated by <i>Eucalyptus platyphylla</i> with associated <i>Corymbia</i> species. Provides foraging habitat.	RE 9.3.6
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Canopy species have large hollows, provide denning habitat.	REs - 7.12.24a, 7.12.29a, 7.12.29b, 7.12.60a, 7.12.60b, 7.12.61a, 7.12.69b, 7.5.1a, 7.5.1b, 7.5.2, 7.5.2a, 7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, 7.5.3a, 7.5.4a, 7.5.4b, 7.5.4c, 7.5.4f
		Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i> . Large, hollowing <i>Eucalyptus</i> and <i>Corymbia</i> provide denning habitat for greater glider.	REs - 7.8.18a, 7.8.18b, 7.8.18c
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provide foraging habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Large hollows located near riparian vegetation provide den sites.	REs - 7.12.30a, 7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.19, 9.12.19/9.12.2, 9.12.19/9.12.22, 9.12.19/9.12.22/9.12.2, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22, 9.12.1a/9.12.22, 9.12.1e, 9.12.2, 9.12.2/9.12.19, 9.12.2/9.12.1a, 9.12.22, 9.12.22/9.12.19, 9.12.4c, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Provides denning and foraging habitat.	9.11.2a, 9.11.2a/9.11.4a, 9.11.2a/9.11.5, 9.11.4a, 9.11.5/9.11.1a/9.11.2a, 9.11.9
		Marginal habitat – Dispersal habitat and lower quality forage habitat. Due to species’ reliance on tree hollows, dry eucalypt habitat dominated by ironbarks such as <i>E. crebra</i> are mapped as marginal as they did not contain suitable hollows and Regional Ecosystems with confirmed greater glider records (Eyre et al. 2022).	

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent.	RE - 9.8.1a, 9.8.1a/9.8.4c, 9.8.4a, 9.8.4b, 9.8.4c
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Mid-dense to very sparse shrub layer of <i>Acacia</i> spp. Provides foraging and dispersal habitat.	REs - 9.11.2, 9.11.2/9.8.4, 9.11.2a/9.11.4a
		Woodland dominated by <i>Corymbia citriodora</i> and infrequent other eucalypts	REs - 9.7.3b
<i>Flying-foxes</i>			
Spectacled flying-fox	Breeding habitat (colonies) usually within or near rainforest  Forages on a range of flowering and fruiting flora, including Eucalyptus, Melaleuca, Burdekin plum and fig species	Foraging habitat	
		Open woodland dominated by <i>Eucalyptus platyphylla</i> with associated <i>Corymbia</i> species.	RE 9.3.6
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species.	REs - 7.12.24a, 7.12.29a, 7.12.29b, 7.12.60a, 7.12.60b, 7.12.61a, 7.12.69b, 7.5.1a, 7.5.1b, 7.5.2, 7.5.2a, 7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, 7.5.3a, 7.5.4a, 7.5.4b, 7.5.4c, 7.5.4f
		Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i>	REs - 7.8.18a, 7.8.18b, 7.8.18c
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species	RE - 7.8.10, 9.8.1a, 9.8.1a/9.8.4c, 9.8.4a, 9.8.4b, 9.8.4c
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> .	RE - 7.12.30a, 7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.19, 9.12.19/9.12.2, 9.12.19/9.12.22, 9.12.19/9.12.22/9.12.2, 9.12.1a, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22, 9.12.1a/9.12.22, 9.12.1e, 9.12.2, 9.12.2/9.12.19,

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
			9.12.2/9.12.1a, 9.12.22, 9.12.22/9.12.19, 9.12.4c, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
		Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Lophostemon suaveolens</i> , <i>Allocasuarina littoralis</i> , and <i>Acacia</i> spp	REs - 7.12.65, 7.12.65b, 7.12.65c, 7.12.65k, 7.12.66b
		Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus</i> spp., <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium</i> spp. Provides foraging habitat (and breeding habitat, no camp detected)	REs- 7.12.16a, 7.12.2e
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Mid dense to very sparse shrub layer of <i>Acacia</i> spp.	REs - 9.11.2, 9.11.2/9.8.4, 9.11.2a, 9.11.2a/9.11.4a, 9.11.2a/9.11.5, 9.11.4a, 9.11.5/9.11.1a/9.11.2a, 9.11.9
		Dense, low (5-10 m), species-rich vine thicket with tall emergent trees in fire protected gullies near major watercourses	REs - 9.12.8, 9.8.7, 9.8.7x
		Woodland dominated by <i>Corymbia citriodora</i> and infrequent other eucalypts.	REs - 9.7.3b
Grey-headed flying-fox	Typically camps/breeds in closed forests dominated by rainforest, broad-leaved paper, mangrove or <i>Casuarina</i> species. potential breeding habitat limited to isolated simple notophyll	Potential foraging habitat	
		Foraging habitat present in open forest to woodlands to very open woodlands, vine forest and vine thicket across the project area.	All REs, excluding tussock grasslands RF 9.8.13

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	<p>vine forest and small areas of paperbark or Casuarina species fringing riparian areas. Species and camp not recorded in project area, and limited breeding habitat not separated from foraging.</p> <p>Foraging habitat occurs across a variety of forest and woodland communities.</p>		
<i>Microbats</i>			
Greater large-eared horseshoe bat	<p>Forage mainly in open forest (prefer thicker vegetation in gullies/creeks) and wattle-dominated ridges in rainforest.</p> <p>Daytime roosts include caves, underground mines, suspected basal hollows of large trees, dense vegetation, rockpiles and areas beneath creekbanks.</p>	Foraging habitat with potential roosting opportunities	
		<p>Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasurina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i>, <i>A. calyculata</i>. Dense <i>Allocasurina</i> understory provides flyways and foraging opportunities. Hollow bearing trees provide potential roosting habitat.</p> <p>Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i>, <i>Elaeocarpus</i> spp., <i>Buckinghamia celsissima</i>, <i>Cardwellia sublimis</i> and <i>Syzygium</i> spp. Dense vegetation provides foraging habitat and potential roost habitat.</p>	<p>REs – 7.12.24a, 7.12.29a, 7.12.29b, 7.12.60a, 7.12.60b, 7.12.61a, 7.12.69b, 7.5.1a, 7.5.1b, 7.5.2, 7.5.2a, 7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, 7.5.3a, 7.5.4a, 7.5.4b,v 7.5.4c, 7.5.4f</p> <p>7.12.16a, 7.12.2e</p>

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules	
	Roost locations assumed to be located within foraging habitat.	Dense, low (5-10 m), species-rich vine thicket with tall emergent trees in fire protected gullies near major watercourses. Dense vegetation provides foraging habitat and potential roost habitat.	9.12.8, 9.8.7, 9.8.7x	
	Observed in wetter portions of the project area.	Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i> . Dense vegetation provides foraging habitat and hollow-bearing trees potential roost habitat.	REs - 7.8.18a, 7.8.18b, 7.8.18c	
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provide foraging habitat and steep banks potential roost habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13	
		Potential roosting habitat		
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent. Ground layer consists of native grasses <i>Heteropogon contortus</i> and <i>Themeda triandra</i> . Hollow bearing trees provide potential roost habitat.	7.8.10, 9.8.1a, 9.8.1a/9.8.4c, 9.8.4a, 9.8.4b, 9.8.4c	
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses. Boulder stacks and caves provide potential roost sites.	7.12.30a, 7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.19, 9.12.19/9.12.2, 9.12.19/9.12.22, 9.12.19/9.12.22/9.12.2, 9.12.1a, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22, 9.12.1a/9.12.22, 9.12.1e, 9.12.2, 9.12.2/9.12.19, 9.12.2/9.12.1a, 9.12.22, 9.12.22/9.12.19, 9.12.4c, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b	
Bare-rumped sheath-tail bat	Roosting, including maternity roosts recorded long deep tree hollows in <i>Eucalyptus platyphylla</i> ,	Foraging, breeding and roost habitat		
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasuarina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i> , A.	REs - 7.12.24a, 7.12.29a, 7.12.29b, 7.12.60a, 7.12.60b, 7.12.61a, 7.12.69b, 7.5.1a, 7.5.1b, 7.5.2, 7.5.2a,	

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
<i>E. miniata</i> and <i>E. tetradonta</i> . <i>E. platyphylla</i> recorded in project area. Forages not well understood, but observed foraging over <i>Eucalyptus platyphylla</i> , <i>Corymbia tessellaris</i> and <i>E. papuana</i> woodlands at Ayr, <i>E. tetradonta</i> with <i>Corymbia clarksoniana</i> and <i>C. tessellaris</i> , gallery forest and rainforest at Iron Range; and at riverine vine forest with adjacent open forest/woodland at Coen. It may also forage at the edge of such habitat. It is assumed roosting and foraging habitat is co-located.		<i>calyculata</i> . Dense <i>Allocasuarina</i> understory provides flyways and foraging opportunities.	7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, 7.5.3a, 7.5.4a, 7.5.4b, 7.5.4c, 7.5.4f
		Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i> . Foraging habitat.	REs - 7.8.18a, 7.8.18b, 7.8.18c
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent. Ground layer consists of native grasses <i>Heteropogon contortus</i> and <i>Themeda triandra</i> . Foraging habitat.	7.8.10, 9.8.1a, 9.8.1a/9.8.4c, 9.8.4a, 9.8.4b, 9.8.4c
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses.	7.12.30a, 7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.19, 9.12.19/9.12.2, 9.12.19/9.12.22, 9.12.19/9.12.22/9.12.2, 9.12.1a, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22, 9.12.1a/9.12.22, 9.12.1e, 9.12.2, 9.12.2/9.12.19, 9.12.2/9.12.1a, 9.12.22, 9.12.22/9.12.19, 9.12.4c, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provide foraging habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
		Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus</i> spp., <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium</i> spp. Provides foraging habitat.	7.12.16a, 7.12.2e
		Dense, low (5-10 m), species-rich vine thicket with tall emergent trees in fire protected gullies near major watercourses. Provides foraging habitat and potential roost habitat.	9.12.8, 9.8.7, 9.8.7x
	Open woodland dominated by <i>Eucalyptus platyphylla</i> with associated <i>Corymbia</i> species.	RE 9.3.6	

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules	
<i>Frogs</i>				
Magnificent brood frog <sup>3</sup>	<p>Known breeding habitat is at or above 800m a.s.l., associated with 1<sup>st</sup> order streams, in grassy woodland/forest on volcanic geologies. Potential for breeding and foraging habitat to occur below 800m to 700m a.s.l.</p> <p>Breeding habitat within these areas is found in seepages dependant on micro relief and cross-section profile of invert. The entire project area is below 800m a.s.l. and no known breeding habitat is present.</p>	Potential breeding, foraging and dispersal habitat		
		Seepages on volcanic geologies, above 700m a.s.l, associated with 1 <sup>st</sup> order streams	Area that is: <ul style="list-style-type: none"> <li>• Land Zone 12 and</li> <li>• ≥700m a.s.l and</li> <li>• 1st order streams (mapped waterway buffered to 50m)</li> </ul>	
		<b>AND</b>		
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasurina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i> , <i>A. calyculata</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca viridiflora</i> , and <i>Xanthorrhoea johnsonii</i> . Ground layer is typically dense, made up of native grass species, and moist with litter but may vary in density.	7.12.24a, 7.12.29a, 7.12.29b	
<b>OR</b>				
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses.	7.12.30a, 7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.1a, 9.12.2, 9.12.2/9.12.1a	
<i>Birds</i>				
Red goshawk	Forages widely over a mosaic of all open forest, woodland, lightly treed	Potential nesting habitat		
		All areas with potential to support tall trees within 1km of water	1 km buffer to stream order 2 and above Exclude ground-truthed areas showing: <ul style="list-style-type: none"> <li>• Ephemeral streams</li> </ul>	

<sup>3</sup> For further information on magnificent broodfrog, refer to Appendix I

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	savannah and the edge of rainforest. In partly cleared parts of eastern Queensland, it is associated with gorge and escarpment country Nests in tall trees (mean – 31m) within 1km of water		<ul style="list-style-type: none"> <li>• No tall emergent trees including                             <ul style="list-style-type: none"> <li>○ Rock pavements</li> <li>○ Sparsely structured open woodlands</li> <li>○ Tussock grasslands</li> </ul> </li> </ul>
		Foraging habitat	
		All habitats within project area	Map extent of project area
Masked owl <sup>4</sup>	Known to occupy rainforest, riparian forest, open forest, Melaleuca swamps. Requires habitat with large mature hollow bearing trees in heavy forest for breeding/denning. Areas with more open shrub layer with woody debris, hollow logs and support small to medium sized terrestrial mammals provide more suitable habitat for hunting/foraging.	Breeding/denning and foraging habitat	
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasuarina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i> , <i>A. calyculata</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca viridiflora</i> , and <i>Xanthorrhoea johnsonii</i> . Ground layer is typically dense, made up of native grass species, and moist with litter but may vary in density. Provides breeding/denning and foraging habitat.	REs – 7.12.24a, 7.12.29a, 7.12.29b, 7.12.60a, 7.12.60b, 7.12.61a, 7.12.69b, 7.5.1a, 7.5.1b, 7.5.2, 7.5.2a, 7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, REs – 7.5.3a, 7.5.4a, 7.5.4b, 7.5.4c, 7.5.4f
		Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i> . Shrub layer of <i>Acacia flavescens</i> and <i>A. torulosa</i> . Large, hollowing <i>Eucalyptus</i> and <i>Corymbia</i> provide breeding/denning habitat.	REs – 7.8.18a, 7.8.18b, 7.8.18c
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses. Provides foraging habitat.	REs – 7.12.30a, 7.12.34, 7.12.35, 9.12.1a, 9.12.2, 9.12.2/9.12.1a, 9.5.5a, 9.5.5e, 9.5.5f/9.7.3b
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provides foraging habitat.	REs – 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13

<sup>4</sup> Masked owl habitat mapping was further ground-truthed during the 2022 dry season targeted masked owl survey. New sightings of masked owl were within habitat mapping for the species.



Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
		Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Lophostemon suaveolens</i> , <i>Allocasuarina littoralis</i> , and <i>Acacia</i> spp. Grasses include <i>Themeda triandra</i> , <i>Arundinella nepalensis</i> and <i>Aristida</i> sp. Foraging habitat.	RE 7.12.65b
		Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Mid-dense to very sparse shrub layer of <i>Acacia</i> spp. Ground layer of native grasses and forbs with sparse exotics. Foraging habitat.	RE- 9.11.4a
		Woodland dominated by <i>Corymbia citriodora</i> and infrequent other eucalypts. Sparse shrub layer and moderately dense ground layer of native grass. Foraging habitat.	RE 9.7.3b
White-throated needletail	Aerial feeder, forages over a range of habitats. Non-breeding visitor to Australia	Foraging and dispersal habitat	
		Whole project area potential foraging and dispersal habitat for this species	Map extent of project area
Southern cassowary	Preferred habitat is rainforest. Requires a high diversity of fruiting trees to provide a year-round supply of fleshy fruits.	Potential foraging habitat – Variety of fruiting trees to provide a food source at various time of the year	
		Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus</i> spp., <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium</i> spp. The ground layer comprised tree and vine seedlings.	REs - 7.12.16a
		Potential marginal foraging and movement habitat – Some fruiting species, may provide movement opportunities between Wet Tropics and core habitat	
		Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i> , <i>Eucalyptus crebra</i> , and <i>Eucalyptus portuensis</i> . Shrub layer of <i>Acacia flavescens</i> and <i>A. torulosa</i> .	REs - 7.5.4a, 7.5.4b, 7.5.4c, 7.5.4f, 7.8.18a

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provides potential foraging habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39c, 7.3.43a
		Rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus</i> spp., <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium</i> spp. The ground layer comprised tree and vine seedlings.	REs - 7.12.2e, 7.3.49a
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasurina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i> , <i>A. calyculata</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca viridiflora</i> , and <i>Xanthorrhoea johnsonii</i> .	REs - 7.12.24a, 7.12.29, 7.12.29a, 7.12.29b, 7.12.29c, 7.12.66b, 7.12.69b, 7.5.2, 7.5.2a, 7.5.2a/7.5.2d, 7.5.2b, 7.5.2c, 7.5.2e, 7.5.3, 7.5.3a, 7.8.10, 7.8.18c

Plants

<i>Corymbia leptoloma</i>	Variable habitat – wet rainfall zones across mixed open woodlands on uplands and granite rock pavement communities typically dominated by <i>Eucalyptus</i> and <i>Corymbia</i> . Known to co-occur with <i>E. portuensis</i> , <i>Lophostemon suaveolens</i> , and <i>C. intermedia</i> and shrubs <i>Acacia flavescens</i> and <i>Melaleuca viridiflora</i> . Groundlayer typically includes <i>Themeda triandra</i>	Potential habitat	
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasurina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i> , <i>A. calyculata</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca viridiflora</i> , and <i>Xanthorrhoea johnsonii</i> . Ground layer is typically dense, made up of native grass species, and moist with litter but may vary in density	RE - 7.12.24a, RE - 7.12.29a
		Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses.	RE - 7.12.30a
		Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i> , <i>C. intermedia</i> , <i>Lophostemon suaveolens</i> , <i>Allocasuarina littoralis</i> , and <i>Acacia</i> spp. Grasses include <i>Themeda triandra</i> , <i>Arundinella nepalensis</i> and <i>Aristida</i> sp	REs - 7.12.65, 7.12.65b, 7.12.65c, 7.12.65k, 7.12.66b

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
<i>Cycas platyphylla</i>	Occurs in sparse woodland of <i>Eucalyptus sideroxylon</i> with a grassy understorey, often on rocky slopes in shallow red stony loamy soil.	<p>Potential habitat</p> <p>Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species. Mid dense to very sparse shrub layer of <i>Acacia</i> spp. Ground layer of native grasses and forbs with sparse exotics.</p>	REs - 9.11.2, 9.11.2a, 9.11.2a/9.11.4a, 9.11.2a/9.11.5
<i>Homoranthus porteri</i>	Variable habitat – wet and dry rainfall zones across mixed open woodlands on uplands and granite rock pavement communities typically dominated by <i>Eucalyptus</i> and <i>Corymbia</i> . Has the potential to occur where soils are shallow on exposed slope ridges and edges of rock pavements.	<p>Potential habitat</p> <p>Sparse shrubby and grassy vegetation around the margins of rock pavements. Low tree and shrub cover includes <i>Eucalyptus portuensis</i>, <i>C. intermedia</i>, <i>Lophostemon suaveolens</i>, <i>Allocasuarina littoralis</i>, and <i>Acacia</i> spp. Grasses include <i>Themeda triandra</i>, <i>Arundinella nepalensis</i> and <i>Aristida</i> sp.</p>	REs - 7.12.65, 7.12.65b, 7.12.65c, 7.12.65k
<i>Marsdenia brevifolia</i>	Distinct habitat characterised by very open woodlands communities on basalt plains. Sparse canopy and mid layer dominated by <i>E. crebra</i> and <i>Corymbia tessellaris</i> . Dense ground layer of native grasses <i>Heteropogon contortus</i> , and <i>H. triticeus</i> .	<p>Potential habitat</p> <p>Open <i>Allocasuarina littoralis</i> forest with a mixture of <i>Corymbia intermedia</i>, <i>Eucalyptus crebra</i>, and <i>Eucalyptus portuensis</i>. Shrub layer of <i>Acacia flavescens</i> and <i>A. torulosa</i>.</p> <p>Open woodland dominated by <i>Eucalyptus crebra</i> or other ironbark species with shrub layer absent. Ground layer consists of native grasses <i>Heteropogon contortus</i> and <i>Themeda triandra</i>.</p>	REs - 7.8.18a, 7.8.18b, 7.8.18c  REs - 7.8.10, 9.8.1a, 9.8.4a, 9.8.4b, 9.8.4c
<i>Solanum graniticum</i>		Potential habitat	

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	Habitat occurs on granite uplands in mixed open woodland communities of <i>Eucalyptus</i> and <i>Corymbia</i> , dominated by <i>E. crebra</i> , <i>E. tereticornis</i> , <i>E. persistens</i> , and <i>C. intermedia</i> . Shrub layer is sparse to absent. Variable density ground layer of predominantly native grasses <i>Heteropogon triticeus</i> , <i>Themeda triandra</i> , and <i>Heteropogon contortus</i> .	Sparsely structured open woodland to open forest of <i>Eucalyptus</i> and <i>Corymbia</i> . Shrub layer of <i>Acacia</i> and <i>Melaleuca</i> . Open ground cover of predominantly native grasses.	7.12.34, 7.12.35, 7.12.35/7.12.24a, 9.12.1a, 9.12.1a/9.12.2, 9.12.1a/9.12.2/9.12.22, 9.12.1a/9.12.22, 9.12.1e
<i>Migratory birds</i>			
Fork-tailed swift	Aerial feeder, forages over a range of habitats. Non-breeding visitor to Australia	Foraging and dispersal habitat	
		Whole project area potential foraging habitat for this species.	Map extent of project area
Latham's snipe	Permanent and ephemeral wetlands up to 2000m above sea level. Non-breeding visitor to Australia.	Potential foraging and dispersal habitat	
		Vegetated swamps dominated by <i>Melaleuca</i> spp. with sedge dominated ground layers. Sparse shrub layer contains <i>Acacia</i> spp., <i>Banksia aquilonia</i> , <i>Melastoma malabathricum</i> and <i>Xanthorrhoea johnsonii</i> . Foraging habitat.	RF 7.3.8x
Oriental cuckoo	Foraging habitat monsoon forest, rainforest edges, leafy trees in paddocks, river flats, riverside trees, roadsides, mangroves, islands.	Foraging and dispersal habitat	
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provides foraging habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	Non-breeding visitor to Australia.		
Barn swallow	Open country in coastal lowlands, often near water, towns and cities. Freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub species thickets and tussock grassland. Non-breeding visitor to Australia.	Potential foraging and dispersal habitat	
		Vegetated swamps dominated by <i>Melaleuca</i> spp. with sedge dominated ground layers. Sparse shrub layer contains <i>Acacia</i> spp., <i>Banksia aquilonia</i> , <i>Melastoma malabathricum</i> and <i>Xanthorrhoea johnsonii</i> . Foraging habitat.	RE 7.3.8x
		Grassland to very open grassland of <i>Iseilema</i> spp. (flinders grass) with a mixture of other grass species such as <i>Dichanthium</i> spp., <i>Bothriochloa</i> spp., <i>Heteropogon contortus</i> and <i>Aristida</i> spp. Occurs in the project area on undulating basalt plains amongst open woodland and vine-thicket communities.	9.8.13
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks. Provides foraging habitat.	REs - 7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
Black-faced monarch	Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs. Breeds in rainforest.	Potential breeding, foraging and dispersal habitat	
		Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus</i> spp., <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium</i> spp. The ground layer comprised tree and vine seedlings.	7.12.16a, 7.12.2e
		Potential foraging and dispersal habitat	
		Dense, low (5-10 m), species rich vine thicket with tall emergent trees in fire protected gullies near major watercourses.	9.12.8, 9.8.7, 9.8.7x
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks.	7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c, 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
Spectacled monarch		Potential breeding, foraging and dispersal habitat	

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	Dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation including thick understorey such as wet gullies, rainforests and mangroves.	Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks.	7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus spp.</i> , <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium spp.</i> The ground layer comprised tree and vine seedlings.		7.12.16a, 7.12.2e	
Dense, low (5-10 m), species-rich vine thicket with tall emergent trees in fire protected gullies near major watercourses.		9.12.8, 9.8.7, 9.8.7x	
Satin flycatcher	Winter foraging habitat in north Queensland includes rainforest, but mainly found in eucalypt forests, especially wet sclerophyll forests, often along gullies and water courses. Non-breeding visitor to north Queensland.	Foraging and dispersal habitat	
		Tall forest (20-25 m) of <i>Casuarina</i> , <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks.	7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13
		Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i> , <i>Elaeocarpus spp.</i> , <i>Buckinghamia celsissima</i> , <i>Cardwellia sublimis</i> and <i>Syzygium spp.</i> The ground layer comprised tree and vine seedlings.	7.12.16a, 7.12.2e
		Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasuarina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i> , <i>A. calyculata</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca viridiflora</i> , and <i>Xanthorrhoea johnsonii</i> . Ground layer is typically dense, made up of native grass species, and moist with litter but may vary in density.	7.12.24a, 7.12.29a, 7.12.29b
Rufous fantail		Foraging and dispersal habitat	

Species	Habitat requirements and utilisation	Project area habitats supporting habitat requirements and utilisation	Habitat mapping rules
	<p>Wet sclerophyll forests usually with dense shrubby understorey often with ferns. During migration can also be found in rainforests and drier open forests. Non-breeding visitor to north Queensland.</p>	<p>Tall forest (20-25 m) of <i>Casuarina</i>, <i>Melaleuca</i> and eucalypts growing along major watercourses, narrow alluvial flats, and benches constrained by steep banks.</p>	<p>7.3.19a, 7.3.26a, 7.3.28d, 7.3.39a, 7.3.39c 7.3.43a, 7.3.49a, 7.3.8x, 9.3.1, 9.3.13</p>
<p>Species-rich rainforest with well-developed structure, dominated by <i>Archontophoenix alexandrae</i>, <i>Elaeocarpus spp.</i>, <i>Buckinghamia celsissima</i>, <i>Cardwellia sublimis</i> and <i>Syzygium spp.</i> The ground layer comprised tree and vine seedlings.</p>		<p>7.12.16a, 7.12.2e</p>	
<p>Open forest to tall open forest and woodland of <i>Eucalyptus</i> and <i>Corymbia</i> species. Some areas include <i>Allocasuarina</i> which occupy the upper and sub-canopy. Shrub layer is variable and may include <i>Acacia flavescens</i>, <i>A. calyculata</i>, <i>Laphosteman suaveolens</i>, <i>Melaleuca viridiflora</i>, and <i>Xanthorrhoea johnsonii</i>. Ground layer is typically dense, made up of native grass species, and moist with litter but may vary in density.</p>		<p>7.12.24a, 7.12.29a, 7.12.29b</p>	



## Appendix C Anabat analysis





## Microbat Call Identification Report

<b>Prepared for (“Client”):</b>	E2M Pty Ltd
<b>Survey location/project name:</b>	██
<b>Survey dates:</b>	4 May – 1 June 2023
<b>Client project reference:</b>	
<b>Job no.:</b>	E2M-2302
<b>Report date:</b>	10 June 2023

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## Methods

### Data received

*Balance! Environmental* received 10,224 full-spectrum ultrasonic acoustic files (WAV files), recorded on Anabat Swift detectors (Titley Scientific, Brisbane) over two sampling periods (see Table 1). Six detectors were deployed on the nights of 4<sup>th</sup> and 5<sup>th</sup> May 2023; and eight units were deployed between 23<sup>rd</sup> May and 1<sup>st</sup> June 2023.

Table 1 Bat detector deployment schedule for the [REDACTED], May 2023.

Dataset	Detector code	Nights deployed
Tranche 1	E2M-009	04-05 May
	E2M-010	04-05 May
	E2M-011	04-05 May
	E2M-012	04-05 May
	E2M-013	04-05 May
	E2M-014	04-05 May
Tranche 2	E2M-009	24 May - 1 Jun
	E2M-010	23-29 May
	E2M-011	23-29 May
	E2M-012	24 May - 1 Jun
	E2M-013	24 May - 1 Jun
	E2M-014	23-29 May
	E2M-016	24 May - 1 Jun
	E2M-017	23-29 May

### Bat-call analysis

The brief for this analysis was to ascertain the presence and number of calls attributable to the following threatened species:

- Greater Large-eared Horseshoe Bat *Rhinolophus robertsi*
- Bare-rumped Sheath-tailed Bat *Saccolaimus saccolaimus*

Analyses were performed in several steps with *Anabat Insight* (Version 2.0.7; Titley Scientific).

1. Two species-specific Search filters were developed to find potential calls from the target species within the dataset:
  - a. *R. robertsi* filter search criteria
    - i. Characteristic frequency (Fc) 28-34 kHz
    - ii. Pulse duration (Dur) >20 ms
    - iii. Slope of characteristic section (Sc) minimum -5 OPS, maximum +5 OPS
    - iv. Accept minimum of one pulse meeting search metrics

- b. *S. saccolaimus* filter search criteria
  - i. Fc 18-26 kHz
  - ii. Dur 3-30 ms
  - iii. Accept minimum of three pulses meeting search metrics.
2. The Search filters were run separately on all WAV files in the dataset. Each Search was run on a "Per Pulse" basis (i.e. every pulse in each file was screened against the Search criteria, rather than searching for average metrics across the whole file) and the Analysis Settings (zero-crossing trigger threshold and smoothness filter) were both set to "Auto" to optimise .
3. All WAV files that passed the two Searches (i.e., contained at least one potential *R. robertsi* call or three potential *S. saccolaimus* calls) were automatically labelled and set aside for later manual review.
4. Manual species confirmation was achieved by comparing call spectrograms and derived metrics with those of reference calls for the target species (G. Ford/Balance! Environmental bat-call library) and published call descriptions (e.g., Armstrong *et al.* 2021, McKenzie *et al.* 2018, Milne 2004,).

A Decision Tree analysis was also run on the complete dataset to group and label files according to broad species/frequency groups. This process allowed for additional manual searches to be made on a subset of files with average frequencies in the relevant ranges of the target species. Although not strictly necessary, given the above Search process, the manual search ensured a higher level of confidence in the presence/absence of target species' calls.

#### Reporting standard

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

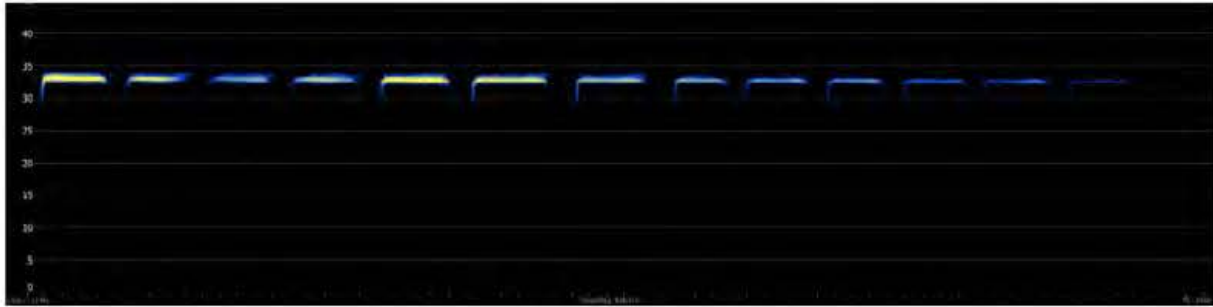
Species nomenclature follows Armstrong *et al.* (2020).

## Results & Discussion

### *Rhinolophus robertsi*

Just one call (**Figure 1**) – recorded by E2M-011 of 23<sup>rd</sup> May – was found to belong to *R. robertsi*.

Several additional Search iterations were run for this species, using slightly looser criteria (e.g., with the Sc limitations removed), but all those Searches found only non-target species (e.g., *Ozimops ridei*) that call in the same frequency range.



**Figure 1** Spectrogram of *Rhinolophus robertsi* call detected by E2M-011 on 23/05/2023. Time-scale (x-axis) = 25 ms per tick-mark

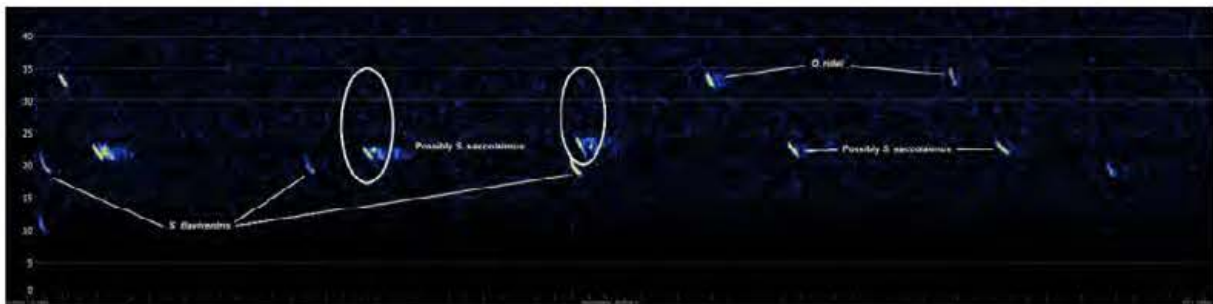
### *Saccolaimus saccolaimus*

Some 277 WAV files were found to contain calls that met the search criteria for *S. saccolaimus*; however, manual review confirmed all but one of those calls belonged to other species (*Chaerephon jobensis*, *Ozimops lumsdenae* and *Saccolaimus flaviventris*).

The single exception is a poor-quality call that cannot be confirmed as belonging to *S. saccolaimus*, but which shows some features of the target species (see **Figure 2**). The call consists of five pulses, but it is too weak for reliable metrics to be derived by *Anabat Insight*. The pulses consist of a more-or-less straight, narrow bandwidth (~3 kHz) FM body with Fc ~21-22 kHz (estimated manually). Two pulses have very weak evidence of a harmonic at ~32-33 kHz, consistent with *S. saccolaimus* third harmonic, but there is no evidence of a first harmonic at ~10-12 kHz.

Two other species' calls are present (*Ozimops ridei* and *Saccolaimus flaviventris*); and it is possible that the unresolved call belongs to *O. lumsdenae*, rather than *S. saccolaimus*.

The sequence was recorded on 25<sup>th</sup> May at the same site as the *R. robertsi* call.

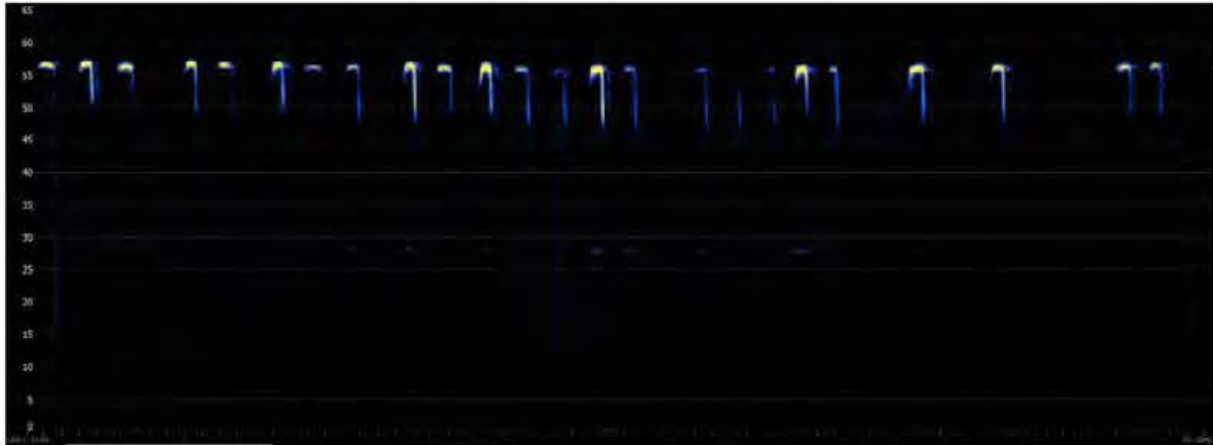


**Figure 2** Spectrogram of possible *Saccolaimus saccolaimus* call detected by E2M-011 on 25/05/2023. Pulses with possible weak 3<sup>rd</sup> harmonic are circled. Time-scale (x-axis) = 25 ms per tick-mark

### Additional observations

At least 10 other species were evident in the reviewed files; however, more may be present because the complete range of frequency groups was not analysed.

A chance observation of a call from *Hipposideros diadema* (Near Threatened, *Nature Conservation Act 1992*) led to a Search being run for other calls from that species. It was detected at two sites: by detector E2M-011 on 4<sup>th</sup> May (193 calls); and by detector E2M-013 on 31<sup>st</sup> May (1 call).



**Figure 2** Spectrogram of *Hipposideros diadema* call detected by E2M-011 on 04/05/2023.  
Time-scale (x-axis) = 25 ms per tick-mark

### Conclusion

*Rhinolophus robertsi* is definitely present in the study area, but was only detected once at one site.

The presence of *Saccolaimus saccolaimus* remains inconclusive. On balance of probability, the “possible” call detected by E2M-011 is more likely from *Ozimops lumsdenae*, given that species’ prevalence among other calls in the relevant frequency range.

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